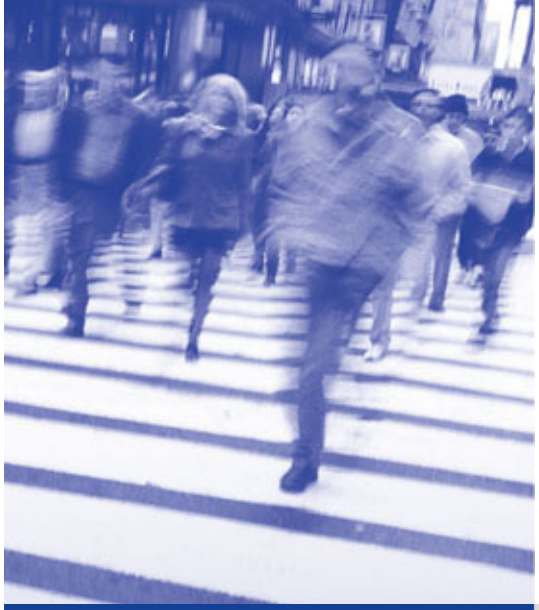

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Measure Evaluation Results Template

FUN 3.1 – Control of Limited Traffic Zone in the Historical Centre

Armando Ribeiro

Augusto Vieira

Lívia Silva (Municipality of Funchal)

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Executive Summary

Funchal's economy is mainly based on services and commerce, including tourism and public administration, which is mainly located in the City Centre. This concentration in the city centre has resulted in attracting huge traffic, generating a large flow of cars and pedestrians. Funchal is also a tourist city that is visited all around the year by thousands of tourists. Since 1996, several streets in the City Centre have been restricted to traffic in an attempt to reduce pollution, noise and congestion. Nowadays, almost all streets are controlled through a manual bollard release system which required owning a key. Due to the high amount of illegal key replications, the deficiency of the current release system leads to illegal entrances in the Low Traffic Zone (LTZ).

The goal of this measure is to change the current LTZ access system to a more efficient and modern system which consists of retractable bollards, a license plate recognition system, and a software management system. The measure aims at reducing the traffic in the city core and increasing the quality of life of citizens. Additionally, this measure focuses on protecting and enhancing the historical inheritance and improving the urban image.

The target group of this measure comprises several levels. At a higher level, there are the residents, local shoppers and people who have their own activities in these areas. On a second level, there are the providers of services to establishments located in these areas. At a third level, it includes all citizens who visit these areas.

The measure was implemented in the following stages:

Stage 1: Definition of the Access control system requirements (January 2010) The system infrastructures should fit within the urban landscape and enable pedestrian circulation in a safe and comfortable way; the entrance of all authorized vehicles should be fast in order to avoid traffic problems and monitored in order to allow the identification of all vehicles, their time of entry, and length of stay in the LTZ.

Stage 2: Identification of pilot zones (June 2011) Two zones with different characteristics were selected: a zone formed by a single road, and another zone that covers five roads. Both zones cover commercial and residential areas and already had traffic restrictions, such as a specific entrance period controlled by removable bollards.

Stage 3: Implementation of the system (February 2012) Following the tender process and the subsequent choice of the company to implement the automatic control system, during the first months of 2012, the company proceeded to deploy the devices. The new system is comprised of an automatic retractable bollard, a camera, an intercommunication device and a database in which all the allowed vehicles are registered. The camera is used for identification of the car plates of registered users.

Stage 4: Software (June 2012) The database that feeds the system was established including vehicles for emergency, service monitoring and registered residents. The software allows the opening/closing of the bollards and records the number of entries and length of stay for each registered vehicle, among other indicators.

Stage 5: Access control system regulation and communication campaign (June 2012) A preliminary document has already been completed, regarding the study for the management of restricted areas, including legal issues and registration procedures. Following the regulation approval, a communication campaign was carried out in the pilot zone, in which a leaflet was given to all commercial occupiers and residents explaining in detail the new access control system.

As for the **evaluation process**, it was partially achieved through surveys to assess whether citizens consider the access control system relevant. Additionally, data were collected such as the number of entries in the LTZ, estimation of parking time, and noise assessment. The **key-results** proved that the system has caused a positive impact. The number of entries has decreased: after the system implementation, in September 219 vehicles entered the LTZ, which is an average of 8,76 vehicles per day as opposed to the 20 vehicles prior to the system implementation. As for the noise assessment, the measurements conducted revealed a decrease of 4,1 Db during the day in the LTZ. Also, there was an increase of 8,3 percentage points in the percentage of people that consider the automatic control system very useful (2011 and 2012). The evaluation also included a traffic count that was carried out before and after the implementation. This revealed a reduction in the number of cars entering streets covered by the access system: before the implementation, a daily entrances of 20 cars was registered, afterwards an average of 8,75 vehicles was registered. Furthermore, the new access control system has contributed to a better management of the LTZ, since it allows the Municipality to control the access remotely and prevent any sort of abuse. Additionally, the software collects a lot of data, such as the number of entries, parking time and vehicle classification, among other indicators and contributes to collect relevant data for the evaluation itself.

The **main barrier** found referred to the complexity of the system and the components that would comprise the whole system, due to the spatial qualities of the streets selected for the test pilot. The lack of expertise in the Municipality led to delays in the choice of the most suitable system. This led to some delays in the launch of the tender process. Additionally, the lack of tradition in data collection made it difficult to establish comparative scenarios, causing some difficulties in the evaluation process.

The database created through the system was **a driver** for the implementation since it allowed a better monitoring/management of the system, which was missing before the implementation.

The measure **could be easily replicated** in other city streets, since is it is a very flexible system that enables dynamic management of access control. The control system with license plate recognition is more effective than other solutions (magnetic card, for example) since it enables a very efficient control of access. A more effective control of access prevents unauthorized users who become unhappy with the new system. Therefore, in order to prevent the spread of this discontentment, it is necessary to explain in political terms (the reasons and goals), and in technical terms (who has the right to access and how to use it). It is therefore recommended to involve all citizens, not only those directly targeted (residents, merchants and service providers in the pilot areas).

This system is innovative, since at regional level, it was the first time that this type of system was implemented in public space. The pilot project implemented during the MIMOSA measure has proven to be successful, making it possible to control vehicle entries in a more efficient way. Given the efficiency of the system, this system will gradually replace the old system. Nevertheless, this replacement is dependent on the availability of financial resources in the next years.

A Introduction

A1 Objectives

The measure objectives are:

(A) High level / longer term:

● Improve access, safety and security in the limited traffic zones (LTZ);

● Traffic reduction in the central area;

● Improve the quality and image of urban life, especially in the central area.

(B) Strategic level:

● Provide better access restriction in the city core, thus tackling the unauthorized utilization of private vehicles in limited traffic areas.

(C) Measure level:

● Reduce traffic levels in the city centre;

● Reduce noise levels in the city´s LTZ;

A2 Description

The Municipality of Funchal has been restricting accesses in the last 20 years in the city center. The purpose of the restriction is to reduce the traffic levels on these streets (which are narrow and with intense pedestrian traffic) in order to allow a more pleasant, more fluid and more safely pedestrian circulation. The goal is also to improve air quality and reduce noise levels in these streets. Given the traditional disregard for road signs and poor supervision, the Municipality was forced to deploy physical obstacles to make this access restriction possible. Such obstacles are bollards, planters and others. The need to ensure the loading and unloading operations and access to housing within restricted areas obliged the Municipality to put bollards and chains with padlocks, in which they are opened in certain hours by Municipality employees. Due to various reasons (load and unload operations, safety reasons), the padlocks are opened at 17:00 and closed at 10:00, in which it´s access is possible between this time period. It is important to note that due to safety reasons, the padlock keys were handed to police, firefighters and other rescue organizations. during the hours of closure of streets, including medical clinics. It should be noted that for operational reasons the key to all the locks is identical. This proliferation of keys, without being possible to control it properly, has lead to its replication, with a lack of control.

Therefore, the measure's goal was to implement a different and more innovative system within MIMOSA in order to reinforce the access control and reduce the traffic. The new system is comprised of retractable bollards, video cameras used to read car plates and surveillance,intercommunication devices, and a software that includes the collection of data.

Since this is a pilot test, theimplementation took place in two streets located in the city centre. Following the system´s implementation, a communication campaign was oriented towards local shoppers and residents, and the publication of the regulation that manages the system.

B Measure implementation

B1 Innovative aspects

The measure comprises innovative aspects, since prior to CIVITAS, there wasn´t any automatic control system. The participation in MIMOSA allowed the implementation of an innovative approach, based on new technology and a new physical infrastructure solution, in opposition to the old one that comprised of manual bollards that are opened using a key that is easily replicated, allowing vehicles to enter outside authorized periods.

The most innovative aspect is that the system allows access only to vehicles whose registration is recorded on the database. This registration is made in advance on request by the owner, and after an analysis by the municipality's as to the real need to access the LTZ, the maximum number of entries per day and the maximum parking time is established. The previous system allowed access to all cars (when the bollard was down) or to any vehicle (when raised) regardless of their actual need for access. This recognition system has the advantage to prevent abuse, because only cars are allowed and not cardholders. This is due to the access mechanism that is only activated through car plate reading.

Innovative Aspects:

- **New conceptual approach** – The new control system is innovative in the city, since the previous one had some limitations, such as the impossibility to control and count car entrances.
- **Use of new technology/ITS** – The system is comprised of a retractable bollard in which all the allowed vehicles are registered, according to the trader needs. Additionally, the system also has a surveillance system and software that manages all the clients. The use of a camera is also an innovative aspect, since the car entries is made through number plate recognition.
- **New physical infrastructure solutions** - The control system includes a retractable bollard, a surveillance system and a intercommunication device which represents an innovative solution in Madeira.

B2 Research and Technology Development

Much research was conducted to identify the most suitable technology. In 2008, an early consultation was carried out with numerous companies, in which the technical requirements

consisted of retractable bollards that allow the recognition of authorized vehicles. In January 2010, a more detailed study was conducted by the Municipality, including the various possible locations in which the control system would be implemented, the main equipment components and a brief description of the solutions used in other cities (Lisbon, Vila Nova de Gaia, Rome and Bologna). Of all the examples studied, the system used in Lisbon was considered the most suitable for Funchal, since it relies on the existence of physical barriers such as bollards, and a number plate recognition system.

The study also lists the services in the streets in which the system will be tested, and some regulation aspects to be taken in account, such as a time period where access is allowed, loading and unloading operations, type of vehicles that should be allowed in the LTZ, and other aspects. The study concluded that restricting access roads into pedestrian access is essential and very useful, since it allows pedestrian access in a safe and convenient way, but also allowing the entrance of vehicles on streets. The system used currently, a removable bollard secured with a lock, is inefficient because it is cumbersome and can be easily removed. Furthermore, this study sought to present the possible chances of implementing a system of restricting access in the streets located in the city centre, which enables an efficient and effective control of access for vehicles and restrict unauthorized entry. Following that, a more recent research study was conducted in October 2009 which describes in detail the LTZ (including demography, functional activities, noise, motorization rate) and an analysis of the traffic counts that were conducted in April 2009, in which the parking time, and type of vehicle was assessed.

The distribution of functional activities in the defined area reveals a predominance of tertiary activities, primarily located in the city centre, consisting of shopping centres, administrative functions, a health clinic, and some hotel units.This study allowed us to have a better perspective of the area in which the access system was implemented. The streets are located in a parish strongly marked by an administrative sector, including also the existence of historical monuments. More recently, following the tender process launch, a management regulation for the access system was published. The study for the regulation included several features, such asrestriction of accesses, type of vehicles, access identifier assignment per type of client (shop, resident, governmental entities), unload and unload operations, and others.

The implementation of this new access control system, entailed a total investment of 94.871 € broken down into: equipment (51.131,42 €), public works (36.313,3 €) and others, that also include training campaigns (5.504,22 €). The communication costs were of 7.504,22 €. From the point of view of the system, all personnel costs that previously proceeded to the opening and closing of bollards, as well as its willingness to open them in punctual emergency situations were eliminated, reducing costs around 500 € per month.

Another major benefit, and perhaps the main one, is related with the increase of the quality of life in these streets, security and reduction of the air pollution and noise, making these areas more commercially active.
Since they are situated in the city core and since Funchal is a city dedicated to tourism, the

increase in pedestrian zones preferably, makes these roads very attractive for tourists. Moreover, the proximity of the cruise port, which in 2011 accounted for more than 500,000 passenger entries, also contributed to revitalize this important commercial area. Previous studies have shown that on average each tourist cruise spends 75 € per day, so even if the level of tourist attraction is small, the numbers involved reach very interesting and fully justify the investment.

B3 Situation before CIVITAS

In the city of Funchal there are several roads intended only for pedestrian circulation. These streets that are mostly paved for pedestrians share a great commercial activity. The historic heritage that defines this part of the city requires a policy of greater restriction to traffic that allow the preservation of the city core. The security, improvement of life quality and traffic reduction in the downtown area are important elements in the historical heritage and city symbolism. For this reason, the Municipality of Funchal has created these pedestrian areas, in which car circulation is very restricted.

Due to the increase of automobiles in the city of Funchal, the Municipality has been closing some streets since the 1990´s. The first street closed for car traffic took place in 1992. Despite the initial controversy, this action proved to be a good solution to reduce vehicle access and to improve conditions for pedestrian circulation. Following the success of this intervention, the Municipality proceeded to close more streets in the City Centre. However, it is expected that more streets will be closed to traffic in the future. Currently, these zones are strongly characterized by the existence of retail services. On the other hand, there has been a decrease in the resident population.

These zones underwent in the last years through several urban improvements, such as infrastructures, urban equipment and others, which allowed the creation of quality areas, such as pedestrian areas that can be enjoyed by the community. The reorganization of the public space also allowed the development of several activities such as exhibitions and other events.




Images 1, 2, 3 and 4 –Photos of the streets after vehicle restriction

As previously mentioned, the current access system in the LTZ is inefficient. In the implementation area, the restricted areas have access points for emergency procedures or other exceptional cases. In these places, there are removable bollards that can only be removed, if properly authorized by the Municipality, or in case of an emergency. All the local authorities and emergency vehicles had this key, which being the same for all bollards, can be easily replicated.



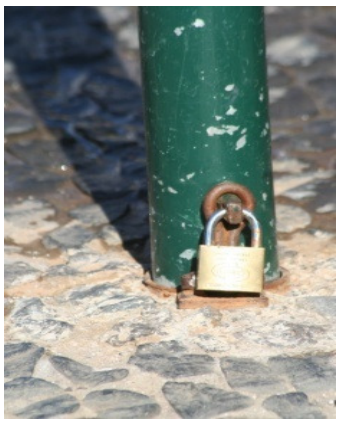


Image 5,6 and 7 – Images of the old access control system

Besides these access points, other locals are allowed to access the LTZ, following an established period of time. Therefore, the entrance is permitted for freight operations or other kind of services in some cases from 08:00 to 10:00, and in other cases from 20:00 to 10:00. During the weekends and holidays, these streets are opened from Friday, 20:00 to

10:00, Monday. The access to these streets is mainly controlled by bollards and a chain system that is secured by padlocks. This limits the operation of these streets, since:

- Access can be made only through a defined timetable and is not flexible;
- The operation of lock opening and closing is done manually by an employee;
- For operational reasons, it was necessary to provide the key to some companies, and also to emergency vehicles which led to the duplication of keys with a subsequent lack of control by users;
- It discourages the housing function in these streets;

Therefore, it was necessary to implement a more efficient system.

B4 Actual implementation of the measure

Stage 1 – Definition of the Access control system requirements (January, 2010)

Following the conclusions extracted from the previous studies, it was established that the system should have the following features:

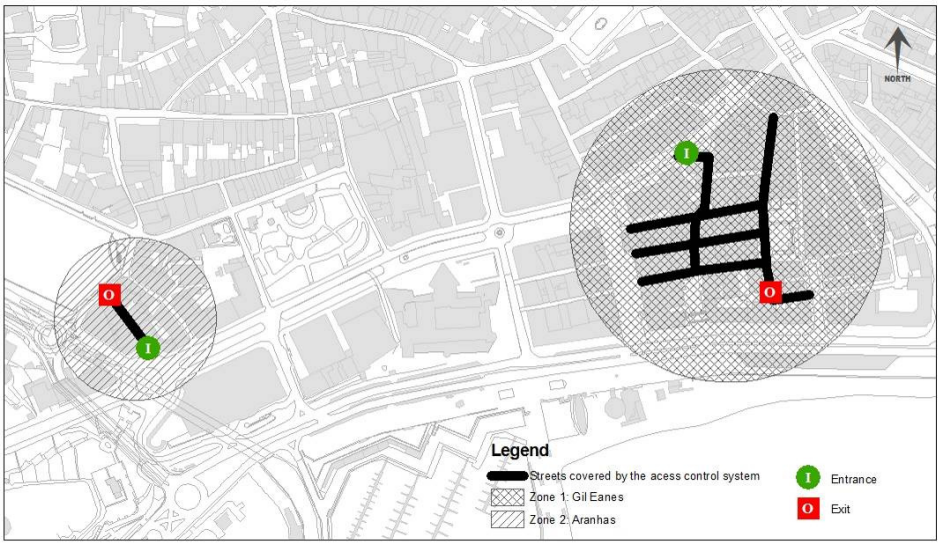
•The system infrastructures should be discreet and be in tune with the urban area, so that it allows pedestrian circulation in a safe and comfortable way.

• The entrance of all authorized vehicles should be fast in order to avoid traffic problems, such as traffic overcrowdings.

• The entry of all authorized vehicles should be monitored, allowing the identification of all vehicles, its time of entry, and the vehicle´s length of stay in the LTZ.

Stage 2 – Identification of pilot zones (June, 2011)

Two streets were selected for the implementation of the new access system. For the zone definition, a study was made, regarding all restricted areas. The study included a detailed characterization of the area, namely the service and commerce distribution. As stated previously, the streets are located in an area marked by administration buildings and several services. The following map shows the area where the system was implemented.



Map 1 – Location of the access control system

Located in the City Core, zone 2(Aranhas), presents some diversity, namely the existence of several restaurant establishments that implies frequent loading and unloading operations.

As for the zone 1(Lg. Gil Eanes), there are various services distributed throughout this area, namely a health clinic, administrative buildings, a guesthouse, among other services that influences the access restriction regulation in this zone. Besides this, there are several authorized parking spots in this area, making it an interesting pilot zone to assess its impact.

Some delays have occurred but the implementation and the subsequent evaluation of this measure was never at risk. The delays were due to some difficulties in defining the most suitable technology. The adjustment of public works began in February, and the implementation was completed in June, namely the deployment of retractable bollards and the installation of the telecommunications network. The system was officially launched on the 18th of June, following a communication campaign that was aimed at local shoppers and residents located within the areas in which the retractable bollards were deployed.

Stage 3 – Implementation of the system (February, 2012)

Following the tender process and the subsequent choice of the company that implemented the automatic control system, during the first months of 2012, the company proceeded to deploy the devices. The system is operated by the following procedure: When a vehicle reaches the entrance of the street it will be barried by a bollard. When the vehicle stops, the system will read the number plate through a camera. This camera is connected to an online database that allows (or not) the access to the street. If the car is included in the registration database, the bollard goes down, and after its retraction, a green light turns on, allowing the entry. If the car plate is not included in the database, the bollard remains high with a glowing red light. In this case the driver has the possibility to connect to a voice system that is located at the Central Fire Station in which he asks the operator for permission. The operator can

remotely raise the bollard, allowing the entry of the vehicle, if the driver has a valid reason (medical emergency, for example). The operator sees through the monitor what type of vehicle intends to access the LTZ.

The exit is open to all vehicles, regardless of their registration in the database. However, the reading of number plates is made prior to the exit for purposes of registration and control of time to prevent abuses.

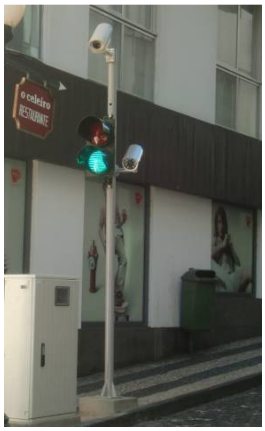


Image 8 – Intercomunication device

Image 9 – Camera and traffic light

Image 10 – Retractable bollard

Image 11 – Vehicle entry management software

Image 12 – Leaflet that was handed out to local shoppers and residents

Since the retractable bollards were implemented (June, 2012), 255 vehicles were added to the database.The predominant group is constituted of local authorities, fire department, cleaning vehicles and emergency vehicles. Since there are some administration buildings in the LTZ, 18 vehicles were also included in the database. As for local shoppers, so far, the Municipality received 5 requests, in which 11 vehicles were included. The remaining vehicle (other services) is a request made by a laboratory. Most of the vehicles have unlimited accesses per day, even though their maximum length of time cannot exceed 30 minutes.

Stage 4 – Software

The database that feeds the system has been established based on the following clients:

a) Emergency (local authorities, Fire Department, hospital, etc.).
b) Monitoring (local authorities and Municipality.).
c) Loading and unloading, residents, etc. (the registration is made following a request according to the regulation guidelines).
Each client is created under a specific category. Additionally, the software allows the opening/closing of the bollards and records the number of entries and length of stay for each vehicle, among other indicators.

Stage 5 – Access control system regulation and communication campaign (June 2012)

A preliminary document has already been completed, regarding the study for the management of restricted areas. This document establishes the LTZ Access conditions and the legal framework. The regulation also includes the form in which clients can request entry to the streets. The form is then submitted to the Traffic Department where it is subjected to further evaluation. Following approval, the number plate is added to the database.

Following the regulation approval, a communication campaign was carried out in the pilot zone, in which a leaflet was given to all commercial occupiers and residents explaining in detail the new access control system.

B5 Inter-relationships with other measures

- **Measure 4.1** – Awareness Raising Campaign for Sustainable Mobility - At project level, this measure is connected to measure 4.1 that aims to foster pedestrian circulation.

Sustainable Energy Action Plan (SEAP)
Beyond MIMOSA, at the local level, this measure tightly fits into local policy actions which aims to create conditions to reduce traffic in the city throught the closure of streets that began in 1992, and improve the quality of life among citizens. The Sustainable Energy Action Plan also plays an important role regarding that. The realization of this plan resulted from experience gained through MIMOSA, by technicians and especially politicians who are committed in improving the quality of life through the implementation of measures aimed at increasing energy efficiency and investment in renewable energies. By signing the Covenant of Mayors, the City has committed to reduce CO2 levels by 20% until 2020.

C Impact Evaluation Findings

C1 Measurement methodology

C1.1 Impacts and Indicators

Table C1.1: Indicators.

No.	Impact	Indicator	Data Used	Baseline Data
1	Noise	Average and peak noise (city specific indicator)	This data was collected by a subcontractor (first measurement) and by the Municipality (second measurement). The data was collected before and after the access system´s implementation.	Collected in June of 2011. The air quality measurements were conducted in two periods: day, and night during one day.
2		Noise perception (core indicator – no. 12)	This data was collected by the Municipality and consisted of surveys that were conducted before and after the system´s implementation. The survey was oriented towards residents and local shoppers located in the street, which are the measure´s target group.	Collected in June of 2011 with a sample size of 64, namely 30 local shoppers and 34 residents. The approach used consisted of Face-to-face surveys.
3	Acceptance	Usefulness of the access control system (core indicator – no. 14)	This data was collected through a survey carried on during the Expo-Madeira event and on the street (face-to-face survey)	Collected in July of 2011. The surveys collected in 2011 were conducted before the measure´s implementation, with a sample size of 510.
4	Traffic Levels	Number of entries per month (city specific indicator)	Information collected by the Municipality, obtained through the management software that registers vehicle entry.	No baseline data, because the data collected before was not collected in a comparable way..
5		Estimated Parking time (city specific indicator)	Information collected by the Municipality	Collected in April 2009 for one working day, through manually observed countings.

Some adjustments were made in the evaluation process. The air quality indicators were removed. Other indicators were added such as the estimation of parking time of vehicles that are parked within the streets in which the automatic system was implemented. Also, the number of entries per month was included in the evaluation process.

Below are detailed descriptions of the indicator methodologies:

- **Indicator 1** (Average and peak noise) – This indicator aims at assessing the noise values in the implementation zone. The data available is from 2011 and was also collected in September 2012, which makes it possible to assess this indicator before and after the measure implementation and its impact. Two periods were measured (daytime and night time). The sound meter was deployed at a height of 1,5 m (mounted on a tripod) at least 3.5 m away from any reflective structure (excluding soil), located at the entrance of one location. Each measurement took at least 15 minutes. This indicator refers to measure level, goal 2.
- **Indicator 2** (Noise perception) – This indicator aims at assessing the noise perception among local shoppers and residents. This data has been collected through two surveys conducted in June of 2011 (sample size of 64, namely 30 local shoppers and 34 residents) and September of 2012 (sample size of 64, namely 30 local shoppers and 34 residents). This indicator is related to high level (A), goal 3.
- **Indicator 3** (Usefulness of the access control system) – This indicator aims at assessing the level of acceptance among citizens. The data has been collected through a survey carried on during Expo-Madeira 2011 (sample size of 510) and in September of 2012 in the city, during the Mobility Week. (sample size of 515) This indicator is related to Strategic Level (B), goal 1.
- **Indicator 4** (Number of entries per month) – This indicator aims to measure the number of vehicles entering the LTZ per month. The data was obtained by the management software, since it registers all the entries. The data were collected from June to October of 2012. This indicator refers to High level (A), measure specific objective 2.
- **Indicator 5** (Estimation of parking time) – This indicator aims to decrease the duration of parking of vehicles in the implementation zone. To evaluate this, data was collected at two occasions, namely in April 2009 and September 2012. During the first collection, the Municipality manually registered all the vehicles that were parked in the implementation zone for one working day by observations. In September of 2012, this data was obtained by the management software. This indicator refers to High level (A), goal 2.

List of potential effects that were not assessed

The following indicators were not measured:

No.	Indicator	How does it impact?	Why it was not been assessed?
1	Air quality	NO2 levels measured in specific spots in the city centre	This indicator was removed, since the street was not closed, but its restriction was reinforced. Therefore, the impacts would have been practically insignificant
2		CO levels measured in specific spots in the city centre	
3		PM10 levels measured in specific spots in the city centre	
6	Public Awareness	Number of events, news on traffic control issues and visits to Municipality webpage	Although the Municipality had a specific page describing the access system, we consider more important to have an indicator that refers to the number of requests

C1.3 Building the Business-as-Usual scenario

If the system was not implemented, no significant changes were expected at the level of noise in the area, given that currently, there is a stabilization in both the number of vehicles accessing the area and in the number of pedestrians (stable commercial activity). The noise increase is only noticed in days when cruises dock (usually 2 or 3) in the bay, which means that 5, 6, or 7 thousand tourists explore the city by foot then.

Indicator	BAU assumptions
Average and peak noise	Even if the measure was not implemented, the noise values would remain the same.
Noise perception	
Usefulness of the access control system	This indicator is based upon surveys; therefore it was not possible to elaborate a BaU analysis.
Number of entries per month	The data collected is insufficient to establish a BaU scenario.
Estimated parking time	The data collected is insufficient to establish a BaU scenario.

C2 Measure results

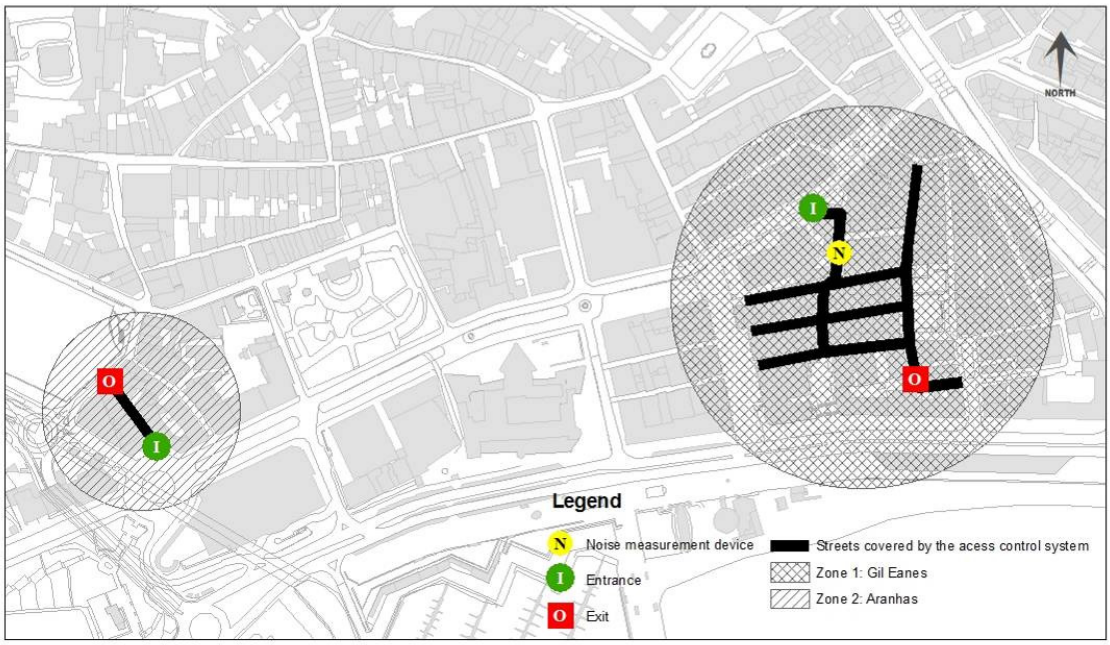
C2.1 Economy

C2.2 Energy

C2.3 Environment

1 - Average and peak noise

The noise meter was deployed in Largo Gil Eanes, in the entrance area of a street near the automatic control system. The other location in which the access control system was deployed was not measured, since it doesn´t have the same traffic flow as zone 1. The noise was not measured in Zone 2, because the length of the street is so small that the implementation of the measure would have no influence on the noise levels given that the circulation in the surrounding area causes significant noise levels. The following map shows the exact location in which the noise measurement was deployed.



Map 2 – Location of the access control system

The table below refers to the noise values obtained. According to the measurements, the values obtained in 2011 do not exceed acceptable limits. The values obtained for the daytime period were 57 Db, while at night, the sound meter registered 43 db. After the automatic control system implementation, new measurements were conducted revealing a decrease in the daytime period of 4,1 Db, which is in agreement with the noise perception surveys and the traffic reduction. At dusk and at night the values remained the same.

		2011			2012			Comparision	
Limit values [dB(A)]		Values obtained [dB(A)]		Analysis	Values obtained [dB(A)]		Analysis	Values obtained [dB(A)]	
Ld	Ln	Ld	Ln		Ld	Ln		Ld	Ln
63	**53**	57	43	Does not exceed	53,1	43,2	Does not exceed	-4,1	0,2

Table 1 - Noise values evaluation

C2.4 Transport

4 - Number of entries per month

Before the implementation of the system, the municipality undertook manual counts to assess the number of entries and the parking time. These counts were carried on in a single day, in which 20 entries were identified. Following the system implementation, the data was collected systematically by the management software. Extracting the data allowed us to realize that per day, the average number of entries is 8,75 vehicles, which shows that the automatic control system contributed for a significant reduction in the number of entries, especially if we take into account that before the automatic control system deployment, the number of entries was significantly higher.

Car entries per month (after implementation)			
June*	July	August	September
34	224	265	219

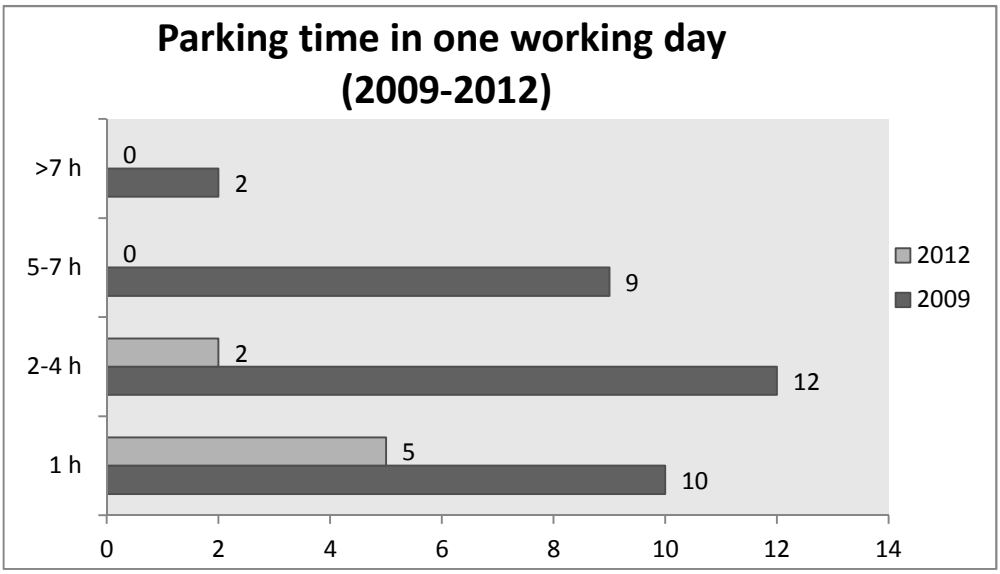
*- The system was only launched on 18 of June 2012

Table 3 – Number of car entries per month

Taking into consideration the counts, the access control system contributed for a daily reduction of 56% in car entries.

5- Parking time (City specific indicator)

The parking time data was obtained in the same day as the number of accesses in the restricted area. The data was collected before the access system implementation (April, 2009) and after the implementation (September, 2012), in which the data was extracted from the access system. The traffic counts were made between 10:00 am and 17:00 pm, the period in which the automatic control system is activated. The aim of this collection was to identify the number of vehicles parked inside the LTZ.



Graph 1 – Vehicles parking time in the LTZ

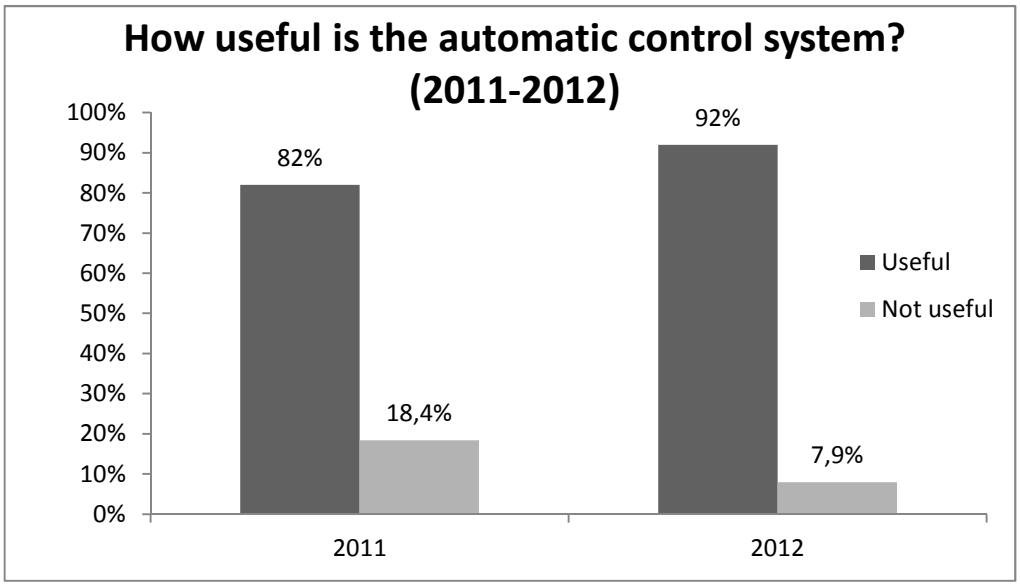
In 2009, 10 vehicles were parked for an hour, while 12 vehicles were parked for 2-4 hours. Furthermore, 9 vehicles were parked for 5-7 hours, while 2 vehicles parked for more than 7 hours. Overall, 33 vehicles were parked for more than an hour which proves the lack of surveillance and control in the LTZ. Moreover, it also proved the necessity of implementing an automatic access. During the first data collection, there were already vehicles parked inside the LTZ, even before 10:00 am.

In 2012 new traffic counts were analysed (data collected by the automatic control system), to test the impact of the access system. The results obtained revealed a significant decrease in the length of stay, which is explained by the restrictions that were imposed by the system, that limits the time to half an hour in most cases. Therefore, only 7 vehicles were parked less than one hour while two parked between 2-4 hours. As for the vehicle classification, most of the vehicles are light duty vehicles while the rest were passenger vehicles. Therefore the new system contributed to a decrease in illegal parking in the LTZ.

C2.5 Society

3 - Measure acceptance level

To assess the measure acceptance among the population, a survey was conducted in the Expo-Madeira event (in 2011) and another one carried out following the system´s implementation during the European Mobility Week in September 2012. The majority of the participants (in both years) welcomed the implementation of an automatic control system. According to the graph, the majority of participants considered the access control system useful or very useful (about 82% in 2011). In 2012, there has been an increase in the percentage of people that consider the access control system useful or very useful (92%).

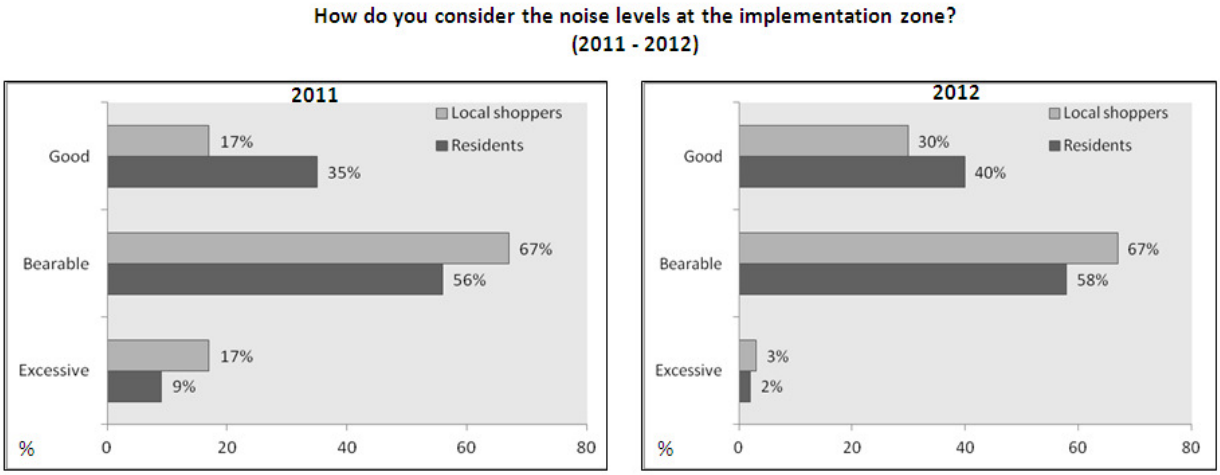


Graph 2 – Usefulness of the access control system

The chi square value gives a score of 45,4 with a significance level of 5%, the critical value is 7.81. So there is a significant change of acceptance level between 2011 and 2012.

2 - Noise perception (core indicator)

To assess the noise, a survey was oriented towards tourists, local shoppers and residents in the streets in which measure 3.1 was implemented. The survey was conducted to 30 local shoppers to assess how they perceived the level of noise in the streets. Furthermore 34 residents in the area were also included in the survey. According to the survey the majority of the shoppers consider the noise levels bearable (67%) andmore than half of the residents (56%) consider the noise bearable. Nevertheless, 17% of the local shoppers perceived the noise as being excessive.



Graph 3 and 4 - Noise perception

All respondents indicated the road traffic as the main source of noise in the area. Shoppers also mentioned the noise caused by the public works carried on in the area as well as audible alarms (and horns). In 2012, following the implementation of the automatic system, a new survey was conducted. The results shows a positive improvement over 2011 results.

	2011		2012		Variation	
	Residents (N=34)	Local shoppers (N=30)	Residents	Local shoppers	Residents	Local shoppers
Good	35%	17%	40%	30%	+5 p.p	+13 p.p
Bearable	56%	67%	58%	67%	+2 p.p	-
Excessive	9%	16%	2%	3%	-7 p.p	-13 p.p

Table 4 – Noise comparision

There has been an increase in the percentage of people who consider that the noise level is good, especially among local shoppers (a raise of 13 p.p in the people who perceive the noise as being good and a decrease of 13 p.p in the people who perceive noise as being excessive). As for residents, the results also revealed some increase, although on a smaller scale, of people who perceive the noise level as being bearable and good. Interestingly, this result also matchesthe noise assessment, in which noise values decreased from 2011 to 2012.

C3 Achievement of quantifiable targets and objectives

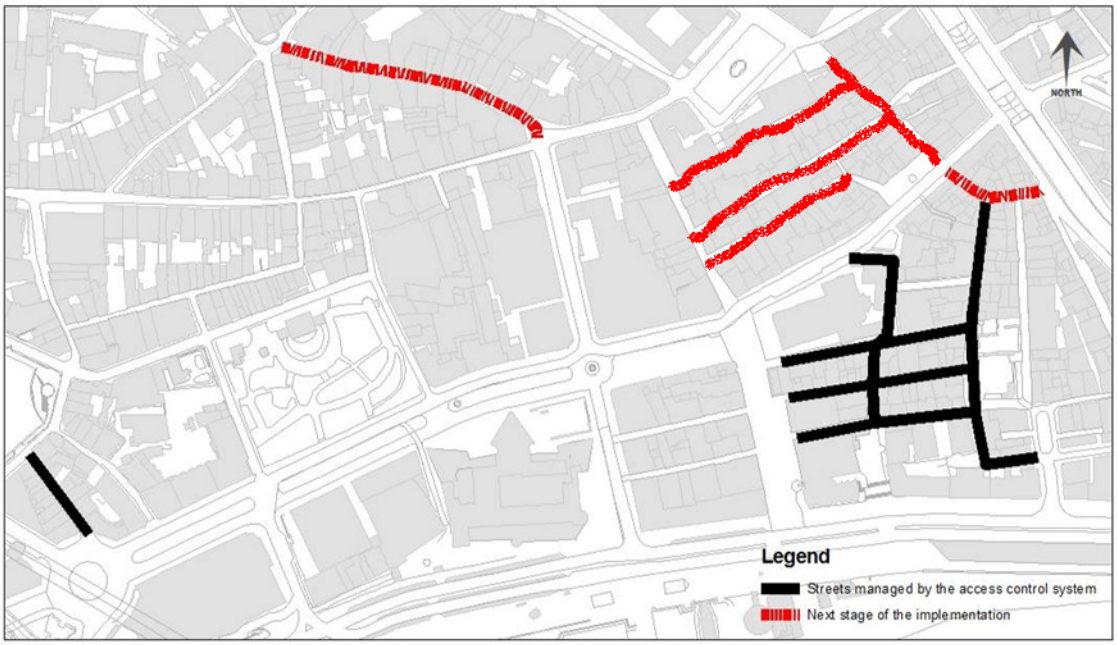
No.	Target	Rating
1	**Objective:** Traffic reduction in the central area **Result:** According to the counts, the access control system contributed to a reduction of 56% in car entries.	**
2	**Objective:** Improve access, safety and security in the limited traffic zones (LTZ) **Result:** The access control was successfully implemented. Two automatic control systems were deployed in two streets.	**
3	**Objective:** Provide a better access restriction in the city core, thus tackling the unauthorized use of private vehicles in limited traffic areas. **Result:** The access control system contributed to reduce the length of stay in the LTZ, since the maximum time allowed per vehicle is 30 minutes.	**
NA = Not Assessed O = Not Achieved * = Substantially achieved (at least 50%) ** = Achieved in full * = Exceeded**		

While it not possible to measure some outputs established in the DoW, most tangible results were achieved, namely the acquisition of the control system, including cameras, an intercomunication device, and a management software. The automatic control system also led to traffic and noise reduction, and was positively accepted by the target group. Through the results, the system has proven its efficiency in the management of the LTZ, contributing greatly to the reduction of vehicles in areas closed to motorized traffic. By reducing the

volume of traffic movement in these areas the safety has increased for pedesrians. As for the time restrictions , this has also been achieved, taking into account that the system only allows 30 minutes of parking time, preventing vehicles from being parked for longer, as happened before the implementation of the access control system. According to the results, the system has proven its efficiency contributing greatly to the reduction of vehicles in areas closed to traffic.

C4 Up-scaling of results

In the future we will try to get political approval so that the system could be active 24 hours a day, 7 days a week. Everything indicates that, given the success of the system, it will be replicated in other streets. In a first step we are going to study the possibility of implement the system on the streets depicted in the map below . As previously stated, the installation of automatic retractable bollards, with license plate recognition in two areas of the city is a pilot project that was successful, so the municipality intends to gradually extend this type of equipment to other areas of the city. Given the financial constraints and the high cost of installing equipment that will be gradual, the system will be implemented in 2014.In 2013 a feasibility study will be conducted to study the possibility to restrict traffic on another city street. It appears therefore that the conditions for pedestrian traffic need to be improved, but given the activities in this street, its closure must be made with the support of a flexible management system.



Map 3 – Future locations in which the access control system will be implemented

In addition, we are also studying the feasibility of closing one of the streets that is currently opened to traffic. Considering the narrowness of the street, less than 1 meter, it is expected that this street will have an access system similar to this.

While the effective implementation of the automatic control system suffered some delays, due to technical requirements that had to be tailored to the streets' characteristics, the measure has been successfully achieved. The retractable bollards were purchased, along with a surveillance system, and specific software that manages the system, which allows an efficient control of all the vehicles that enter the area. Additionally, a management regulation was published and applications form which local shoppers and residents must submit to the traffic department in order to access these streets. The system was also positively received by citizens. As for the noise values, they also suffered a decrease, which shows that the access control system had a positive impact, in several respects. Due to its effectiveness, the measure should be further expanded on a bigger scale, in order to have better control of vehicle entry in the LTZ.

C5 Appraisal of evaluation approach

Comparing the original evaluation process, some indicators had to be dropped, since their impact was practically irrelevant. The current evaluation approach was the most suitable since it includes not only how the population perceives the access control system but also its external impact, two components that we consider crucial for the process evaluation. At a measure level, there were some delays that also hampered the data collection. Since the automatic control system was only deployed at a later stage, it was not possible to collect more reliable data after implementation. Unfortunately the data collected prior to implementation is not sufficient to establish a comparison.

C6 Summary of evaluation results

The key results are as follows:

- **Reduce the traffic in the area** – According to traffic counts, there was a decrease. In one working day, before the system implementation, 20 vehicles entered the LTZ. Afterwards 8, 75 vehicles enter in average per day in the LTZ.

- **Provide a better access restriction in the city core, thus tackling the unauthorized use of private vehicles in limited traffic areas –** The parking time has been reduced.

- **Improve access, safety and security in the limited traffic zones (LTZ) -** The access control was successfully implemented. Two automatic control systems were deployed in two streets.

- **Improve usefulness regarding the automatic control system -** According to a survey conducted in Expo-Madeira (of a sample size of 510 people), most respondents consider the system useful (56,9% in 2011). In the survey carried on in 2012, there has been an increase of 8.3 pp in the percentage of respondents that considered the service very useful.

C7 Future activities relating to the measure

The implementation of the access control system was a pilot test that proved in a short time that it could contribute to reducing the traffic volume in the LTZ. It is expected that in the future, the whole LTZ will be accessed through this innovative system. As for the communication campaign, it will be carried out in order to promote pedestrian mobility and the access control system as a way to improve the image and quality of the city, and to reduce the pollutant emissions, and noise.

Given the fact that the system is only activated on working days (from 10 am to 5 pm), and Saturdays (10 am to noon), It seems more suitable now that the bollards should be always in the raised position, thus creating two types of users: those who can access anytime and those that could only access the LTZ outside the time period indicated above. This would allow an even greater control of the system, and a better analysis of the dynamics.

As stated above, the implementation of automatic retractable bollards in 2 areas of the city is a test pilot, if the goals are achieved; it will be replicated in other areas so that in all areas of restricted access, only authorized vehicles can access them, pre-defining the number of entries per day, week or month, and parking time.

D Process Evaluation Findings

D.1 Deviations from the original plan

The deviations from the original plan comprised:

- **Delayed Implementation and ajustment of the evaluation process** – The original evaluation process had to be adjusted in which some indicators were dropped. Taking into account that the measure was implemented in a very late stage, it was necessary to readjust the evaluation process. The choice of indicators was not the most appropriate initially. This flaw has been detected at a late stage of the implementation process of the system.

- **Infrastructures** – Although four automatic bollards were acquired, there is still one bollard that was not deployed, in one of the exits due to the infrastructures that makes the installation difficult (namely sewer, water network and telecommunications). Nevertheless, the area is properly signed with a lighting sign and a stop sign. When the infrastructure network is changed, the additional bollard will be implemented.

D.2 Barriers and drivers

D.2.1 Barriers

Overall barriers

- **Technical aspects (10 - Technological)**: The complexity of the system and definition of the components that lead to delays in launching the tender process. This was due to a lack of technical expertise in the municipality to assess the most suitable system.

- **Lack of tradition in gathering data (7 – Planning):** The lack of tradition in collecting data hampered the evaluation process to a certain extent, making it impossible to draw BaU scenarios based on data prior to MIMOSA. Before CIVITAS, there wasn´t a systematic process of data collection which hampered evaluation of the measure. Additionally, the technical inexperience also contributed to increased difficulties in defining which indicators were best suited to properly evaluate the impact of the measure.

Preparation phase

- **Delays (7 - Planning):** Delays in launching the tender process. This was due to difficulties in defining the technical specifications.

Implementation phase

- **System´s operational problems (10 - Technological)**: Some operational problems were found a few days after implementation, , particularly in the closing and opening of bollards, and there have been failures of communication. These faults were quickly overcome, given that the problems were reported by users, and remotely, or manually opening operations were carried out to properly activate the system. The problems were also corrected in terms of software and communication.

D.2.2 Drivers

Overall Drivers

- **Better management (10 - Technological)**: Previous to this measure, there was a lack of a proper management of loading and unloading operations. This, of course, would lead to frequent abuses and unauthorized entry. Additionally, the fact that the entrances are controlled through car plate recognition, guarantees a better control.
- **Replication of the measure in other streets (10 - Technological)**: The technological features are very efficient preventing vehicle entrances in the LTZ.

Preparation phase

- **Detailed research (7 – Planning):** A throughout research was conducted to identify the most suitable system, taking in account the specificities of the streets in which the automatic bollards were implemented. This research proved to be crucial in outlining the specifications.

Implementation phase

- **Awareness campaign (5 – Involvement/Communication):** During the implementation, a communication campaign was carried on among local shoppers and citizens who live within the areas. This campaign proved to be important to promote the measure.

Operation phase

- **User satisfaction (5 – Involvement/Communication)**: After implementing the system, it was found that the Municipality met the user´s expectations to enter during the period, given that there was only one complaint by an unauthorized user, since he did not meet the conditions to access the system.

- **Data Collection (2 – Institutional):** The automatic access system brought together a wide range of indicators that allow the municipality to analyze the dynamics of entry and exit of permitted vehicles, allowing a better optimization of the system.
- **Reducing the volume of traffic in the area (12 – Increase of public space)**: This system allowed, as can be seen in the evaluation phase, a reduction in the number of entries of vehicles in the area.

D.2.3 Activities

Preparation phase

- **Cross-sectional study (10 - Technological)**: The selection of the streets followed a research that ranged from demographic features, noise, traffic and distribution of services and commerce in the area.

Implementation phase

- **Awareness campaign (5 – Involvement/Communication):** During the implementation, a communication campaign was carried on among local shoppers and citizens who live within the areas. This campaign proved to be important to promote the measure.

Operation phase

- **Training campaign (10 - Technological)**: A training campaign was conducted among the technicians that manages the access control software.

D.3 Participation

D.3.1. Measure Partners

- **Measure partner 1 –**The Municipality of Funchal has a leading role in this measure (level of activity 1).
- **Measure partner 2 -** Madeira Tecnopolo – MT supports the Municipality in all stages, except in dissemination. The type of organization is 3 (knowledge institution) with a level of activity 3 (occasional participant).

D.3.2 Stakeholders

- **Soltráfego -** This private company was assigned to implement an access control system and provides the Municipality with maintenance support.
- **Local authorities (PSP, Fire Department, Civil Protection) –** These entities manage the LTZ. The system is remotely controlled by the fire department.

D.4 Recommendations

D.4.1 Recommendations: measure replication

In the city of Funchal, deploying a prohibition parking sign or restricted access sign to avoid parking or access to not authorized vehicles is not sufficient. Indeed, given the cultural issues and the ineffectiveness of surveillance (with responsibility of a national entity), it became necessary to place physical objects to prevent parking and access by unauthorized vehicles.

This problem is common not only in other Portuguese cities, but also in the cities of other countries. A solution composed of bollards associated with recognition systems registration is very effective because it allows access only to vehicles to which the grantor (the city) determines.

The control system via license plate recognition is very effective because it enables a very efficient control of accesses. It is advantageous not only in relation to the system that is currently installed in the city of Funchal, but is also more advantageous than automated systems controlled by card (magnetic or other) that allow you to be transported from car to car. Overall, this is a system which allows flexible management system.

The system implemented in Funchal has no impediment to be replicated in other cities that have the same kind of problems, because the technology is developed and no special conditions are required.

D.4.2 Recommendations: process

In implementing this measure it was essential to involve citizens, especially residents, traders and people who their daily activities in the area have controlled by the system. Thus, making an exhaustive collection of all activities, with their specificities and needs is crucial for the success of the measure.
It is also important to explain not only to the people directly involved, but to the general public what are the goals and the operation details of the system.

Having a backup service controllable by intercoms that activates remotely the bollards is also important to allow access during unforeseen situations.
Furthermore, making a survey of the existent underground infrastructures is also important to assess the availability of space for mounting the system (it is necessary to build a foundation buried with a volume of 1m3).

In any case, it is also recommended to engage politics and media as facilitating agents to pass on information about the virtues of the system.