

2020  
**CiViTAS**  
Cleaner and better transport in cities

**DESTINATIONS**



## Measure Evaluation Result

### LIM 6.4 - Smart parking guidance system

|                           |                                       |
|---------------------------|---------------------------------------|
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## Executive Summary

In the centre of Limassol, a considerable number of parking spaces exist. There are more than 10 municipally owned parking spaces with their capacity exceeding 2.000 cars, and about the same number of places of private ownership. The majority of parking spaces can be reached through the narrow roads within the city centre.

Before DESTINATIONS, the cars would move around the city centre trying to locate a free empty space, something that caused unnecessary traffic congestion and consequently high levels of pollution, increased traffic noise, and low road safety.

Under such a context, the present measure aimed to reduce those negative impacts in the city centre of Limassol. This was achieved through the implementation of a **parking guidance system** that was made available to the drivers before reaching the parking spaces, by providing information of real-time parking availability, visually displayed on mobile phones/computer devices through a smart application, as well as on variable message systems that were located around the city centre.

Smart sensors were installed in 6 municipally owned parking spaces, which transfer real time data regarding space availability to a central server. The server collects all the data, and through appropriate software, forwards the data to the installed information boards and to a smart application (Δημότης Λεμεσού) available for public use through the internet.

Moreover, Limassol Municipality was in constant contact with Cyprus Public Works Department of the Cypriot Ministry of Transport, Communication and Works, in order to incorporate the live update of the information from the parking sensors from the 6 Limassol Parking spaces into the “Parking Spaces” Tab of the Diaylos Intelligent Transport System of the Ministry. The engagement and support of the Public Works Department and the support of the Limassol Tourism Board helped the measure to be implemented on time. Limassol Municipality enhanced its relations with the Ministry of Transport, Communications and Works, and its collaboration with the Municipal traffic police department facilitated the provision of all necessary information for the measure impact evaluation. During the implementation, the infrastructure within the municipal parking places was challenging but the engagement of municipal engineers solved the issue.

This measure has significantly reduced unnecessary traffic congestion in Limassol city centre, resulting in lower levels of noise pollution to 47,8 dB. Additionally, the measure significantly reduced unnecessary driving for searching for free parking spaces in the 6 municipal parking spaces, resulting in a decrease of 29,2 t of CO<sub>2</sub> emissions. As a consequence, the savings in fuel reached 8.640L and fuel cost savings reached 10.713€.

Data was successfully collected, allowing the evaluation for this measure to be completed on time. The process for collecting the data and fulfilling the measure requirements was achieved without facing significant barriers. After the completion of this measure and the successful management of the electric displays which were installed during the project, an additional number of electric displays will be installed in additional parking spaces throughout Limassol. Moreover, further improvement of the system will be undertaken.

## A Description

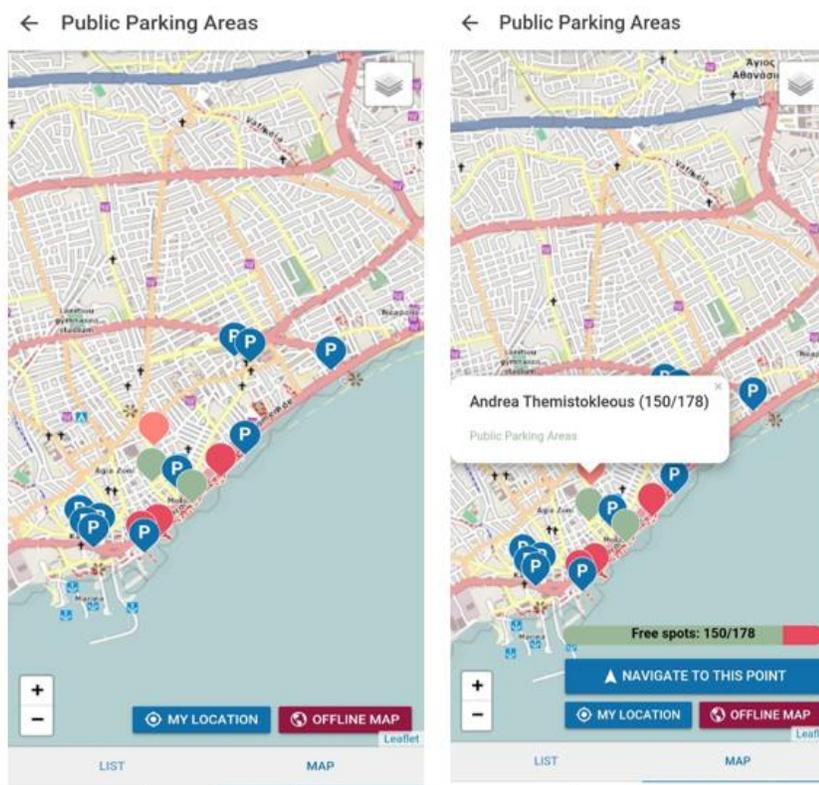
This measure allowed the Municipality of Limassol to significantly reduce unnecessary traffic congestion in the city centre. A parking guidance system including smart sensors and further smart electronic devices were installed in 6 Municipal owned parking spaces. Information regarding free parking slots in these parking spaces was made available to the car drivers through mobile applications and message systems, informing drivers about parking availability before reaching the parking places, by providing real-time information.

The smart sensors installed in 6 municipally owned parking spaces transferred real time data regarding space availability to a central server. The server collected all the data, and through appropriate software, forwarded the data to the installed information boards and to a smart application (Δημότης Λεμεσού) available for public use through the internet (Figure 1).

The new mobile application “Δημότης Λεμεσού”, provided information about type of parking (public/private, covered/uncovered), parking rates, and proximity of parking to areas of interest, in addition to real time availability. For immediate use, availability is presented on a map with distinct colours and GPS navigator instructions will be at hand for users.

Also, 7 guidance signs were installed in key boulevards in Limassol indicating parking place availability, in order to help drivers to decide in which parking place they should focus while entering the city centre and, in addition, to guide them for finding easily an available parking slot (see Figure 2 below).

The measure improved the mobility system, not only for tourists travelling by car but also for local citizens. It also improved leisure level of tourists visiting city centre due to lower traffic, lower traffic noise, fewer CO<sub>2</sub> emissions, and a higher road safety level. The application has been generalized in order to be able to be implemented in other tourist cities/places in the future.



**Figure 1:** Smart Parking Application “Δημότης Λεμεσού”

## A1 Objectives and outputs

### City policy level objectives

The measure is in line with Limassol Municipality's Strategy aimed to promote the sustainable mobility of tourists and residents in the Region of Limassol, contributing to the below objectives:

- Improved urban accessibility
- Reduced energy consumption
- Better and smarter mobility management of the city
- Reduced emissions
- Increased road safety

### Measure Specific objectives

- Reduce unnecessary traffic congestion in the city centre
- Improve the whole mobility system
- Improve the leisure level of tourists visiting the city centre due to lower traffic congestion, lower traffic noise, fewer CO<sub>2</sub> emissions, and a higher road safety level
- Improve road efficiency through reduced cruising traffic

### Outputs

The following outputs funded exclusively within the DESTINATIONS budget have been released:

- Leaflets and brochures for the communication campaign
- Dissemination through media and social networks
- Smart parking guidance system technology installed in 6 public parking spaces in Limassol city centre
- Serve the largest possible number of cars searching for a free parking places in the centre
- Implementation of 7 info signs at the main entrances of the centre
- A mobile information application about traffic in general (Δημότης Λεμεσού)
- Encourage the owners of private parking spaces to participate in the info platform by financing their own equipment and their involvement in the software
- Influence citizens traffic culture and ethics

### Supporting activities

During this period, Limassol Municipality held several meetings with the Police Traffic Department and Electricity Authority of Cyprus to provide information and services for the implementation of the measure. Also, this measure was particularly important for the implementation and application of Limassol SUMP.

Moreover, Limassol Municipality is in constant contact with Cyprus Public Works Department of the Cypriot Ministry of Transport, Communication and Works, in order to incorporate the live update of the information from the parking sensors from the 6 Limassol Parking spaces into the "Parking Spaces" Tab of the Diaylos Intelligent Trasport System of the Ministry

(<http://www.traffic4cyprus.org.cy/trafficapp/?wp=parkingplaces-en> ).

## A2 Inter-relationship with other measures

The measure shares some synergies and has a strong interaction with the CIVITAS DESTINATIONS measure as follows:

- **LIM 3.4:** *Attractive and accessible public spaces to promote intermodal leisure trips*, as the leisure level of tourists visiting the city centre was improved due to lower traffic congestion, lower traffic noise, fewer CO<sub>2</sub> emissions, and a higher road safety level. Also, this measure provided more information to the tourists, making the central public spaces more attractive and accessible.
- **LIM 2.1:** *Sustainable mobility tourist action plan*, as the satisfaction level of tourists and residents moving across Limassol city centre was improved. The traffic congestion, noise pollution, increase of free spaces, and a healthier and safer environment have been achieved. The “Δημότης Λεμεσού” application and the sign boards satisfied the mobility needs for both tourists and residents.

## A3 Target groups and/or affected part of the city or region

Tourists and residents moving across Limassol region were influenced by this measure.

## A4 Stakeholders: CIVITAS project partners and other important actors

| Stakeholder name   | Activities description      |
|--|-----------------------------|
| Chamber of Commerce  | Promotion of the measure    |
| Tourist Organization   | Promotion of the measure    |
| Parking owners   | Collaboration and promotion |
| Police Traffic Department  | Collaboration and promotion |
| Cyprus Public Works Department, Ministry of Transport, Communication and Works | Collaboration and promotion |

**Table 1:** Stakeholders: CIVITAS project partners and other important actors

## B Measure implementation

### B1 Situation before CIVITAS

Before the CIVITAS DESTINATIONS project, parking in the city of Limassol was a challenging issue. Limassol city centre had limited parking space availability and drivers needed to drive all around the centre in order to find somewhere to park, causing various problems such as traffic jams, noise pollution, and more CO<sub>2</sub> emissions, as well as frustration for the drivers. With the implementation of this measure, drivers have the opportunity to check the availability of each parking space before entering the parking area and move more conveniently around the centre.

### B2 Innovative aspects

The innovation in this measure was that it was the first time that parking places counted the availability and made it visible to the public in Limassol. More specifically, smart sensors and further smart electronic devices were available to car drivers through mobile applications and variable message systems, providing crucial information regarding parking space availability.

- **New conceptual approach** – With new installations and the application a solution was given to solve the issue of drivers lacking information about available parking slots in the Municipal parking spaces, resulting in drivers making extra Kms searching for free parking spaces.
- **Targeting specific user groups** – The signalization systems as well as the application offers the opportunity to drivers to save time, fuel, and money as their free parking slot research becomes easier and more targeted.

### B3 Technology development

This measure used upgraded electronic information signs on each main entrance of the city centre, so that the drivers get the information early and can choose which direction to follow to the near free parking space. Moreover, the information from the smart sensors is used also from the Application (Δημότης Λεμεσού) so the driver can have access to information regarding free parking slots in public parking spaces from anywhere.

### B4 Actual implementation of the measure

Limassol Municipality performed a site visit to determine the parking spaces which could be included for the implementation of the measure. Efforts have been made to encourage the owners of private parking spaces to participate in the info platform by financing their own equipment and their involvement in the software. The procurement process for the system started on 8/8/2017, tenders were received on 22/9/2017 for the implementation of the parking guidance system, and it has since been awarded to VIP Technologies Ltd.

The solution of parking guidance made available to the drivers provided real time information for parking availability, visually displayed on mobile phones and computer devices through a smart application (“Δημότης Λεμεσού”), as well as on variable message systems (signs) that were located around the city centre. During September 2019, smart sensors have been successfully installed in 6 municipality-owned parking spaces which transferred in real time the parking space availability to a central server and by extension to smart applications. These sensors provide the real-time availability also at the parking entrance, so that people know if they should enter the specific parking or drive to the next one.

The smart application “Δημότης Λεμεσού” includes information like type of parking (public/private, covered/uncovered), parking rates, and proximity of parking to areas of interest, in addition to real time availability. For immediate use, availability is presented on a map with distinct colours and GPS navigator instructions will be at hand for users

<http://www.traffic4cyprus.org.cy/trafficapp/?wp=parkingplaces-en>.

Also, 7 guidance signs were installed in key boulevards in Limassol indicating the parking place availability, in order to help drivers to decide in which parking place they should focus while entering the city centre and in addition to guide them for easily finding available parking.



**Figure 2:** Smart Parking Guidance System (Signs)

For the measure’s dissemination and communication purposes, leaflets and brochures have been developed and disseminated for the communication campaign, as well as relevant posts on social media platforms and website to inform the public about the new parking guidance solution. The citizens traffic culture and ethics have been significantly influenced.

# C Impact evaluation

## C1 Evaluation approach

### Expected impacts and indicators

| Impact category | Impact indicator                                      | Unit of measure |
|-----------------|---|-----------------|
| Environment     | 1 - CO <sub>2</sub> emissions                         | ton             |
| Environment     | 2 - Traffic noise                                     | dB              |
| Energy          | 3 - Fuel consumption                                  | L               |
| Economy         | 4 - Fuel costs  | €               |
| Society         | 5 - Awareness Level about the smart parking solution  | %               |
| Society         | 6 - Acceptance Level about the smart parking solution | %               |

**Table 2:** Expected impact and indicators

### Method of measurement

| Impact indicator                                      | Method* | Frequency |       |       | Target Group   | Domain (demonstration area/city) |
|---|---------|-----------|-------|-------|--|----------------------------------|
|   |         | Bef.      | Dur.  | Aft.  |  |                                  |
| 1 - CO <sub>2</sub> emissions                         | DC/E    | 12        | 26    | 45    | Vehicles in demonstration area                                   | demonstration area               |
| 2 - Traffic noise                                     | DC/E    | 12        | 26    | 45    | Inhabitants and visitors   | demonstration area               |
| 3 - Fuel consumption                                  | E       | 12        | 26    | 45    | Vehicles in the area   | demonstration area               |
| 4 – Fuel costs  | E       | 12        | 26    | 45    | Transport service providers                                      | demonstration area               |
| 5 - Awareness Level about the smart parking solution  | S       | n.a.      | 21-26 | 34-41 | General public, operators (residents and visitors), PT customers | demonstration area               |
| 6 - Acceptance Level about the smart parking solution | S       | n.a.      | 21-26 | 34-41 | General public, operators (residents and visitors), PT customers | demonstration area               |

\*(Data collection (DC), Estimation (E), Survey (S))

**Table 3:** Method of measurement

## Detailed description of the indicator methodologies

**1 CO<sub>2</sub> emissions** – This indicator was estimated using the data extracted by the environmental sensors which collected data from the 6 areas in the city centre where the parking system was installed.

**2 Traffic Noise** – This indicator was obtained from the environmental sensors, which collected data from the 6 areas in the city centre where the parking system was installed.

**3 Fuel consumption and 4 Fuel costs** – These indicators were obtained based on estimations that made in cooperation with the Cyprus Public Works Department of the Cypriot Ministry of Transport, Communication and Works. Therefore, it was estimated that with the application of the smart parking guidance system, drivers avoid on average 3 km of useless driving in Limassol city centre per trip. It was also estimated that each user will use the application for 12 trips per year on average, and the approximate consumption of an average car was 8 L/100 Km. Also, the average fuel price in Cyprus for the period of the implementation of the measure and the evaluation was set at 1,24 €/L.

**5 Awareness level and 6 Accessibility level about the smart parking solution** – These indicators were calculated based on surveys applied to assess the understanding, usefulness, and willingness regarding the actions related to the smart parking solution. Survey findings were related to questions about the current situation of the available free parking spaces, parking guidance, and how accessible the city centre was. The questions specifically were: “Are you aware of the current situation of the available free parking spaces”, “Do you know that the mobility application “Δημότης Λεμεσού” is available? If yes: Did you use the application? If yes: How often did you use it? If yes: How was your experience with this service?” The survey was applied to 350 people, in 2018 (172 tourists; 3 locals) and 2019 (175 tourists) in Limassol city centre.

## The Business-as-Usual scenario

Not applicable for the indicator evaluated, as this was a new initiative.

## C2 Measure results

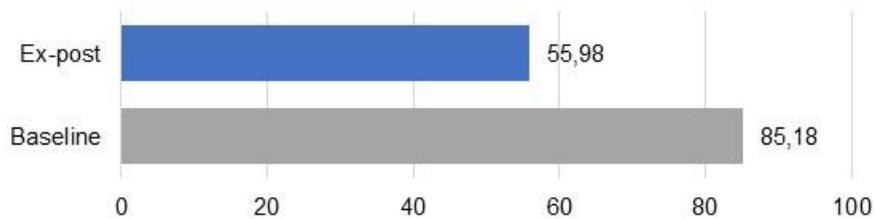
| Impact category | Impact indicator                                      | Unit of measure | Baseline | Ex-Ante | Ex-Post |
|-----------------|---|-----------------|----------|---------|---------|
| Environment     | 1 - CO <sub>2</sub> emissions                         | ton             | 85,18    | 43,06   | 55,98   |
| Environment     | 2 - Traffic noise                                     | dB              | 93,9     | 73,9    | 47,8    |
| Energy          | 3 - Fuel consumption savings                          | L               | 0        | 7.770   | 8.640   |
| Economy         | 4 - Fuel costs savings                                | €               | 0        | 9.635   | 10.713  |
| Society         | 5 - Awareness level about the smart parking solution  | %               | 0        | 50      | 80      |
| Society         | 6 - Acceptance level about the smart parking solution | %               | 0        | 50      | 80      |

**Table 4:** Measure results

## C2.1 Environment

### 1 - CO<sub>2</sub> Emissions

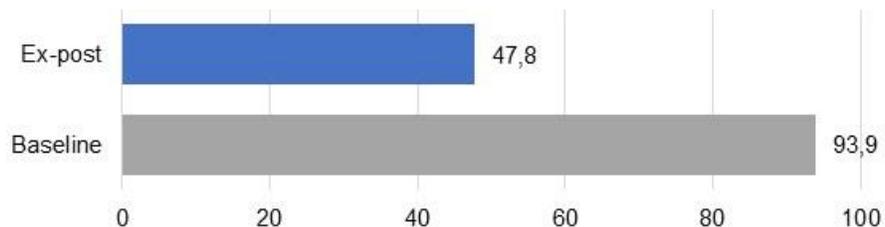
The smart parking guidance system significantly reduced unnecessary traffic congestion and decreased unnecessary driving when searching for a free parking space in the 6 municipal parking spaces, resulting in a decrease of 29,2 tCO<sub>2</sub>, to 55,98 tCO<sub>2</sub> compared to the baseline scenario (85,18 tCO<sub>2</sub>).



**Figure 3:** Levels of CO<sub>2</sub> Emissions (tCO<sub>2</sub>)

### 2 - Traffic Noise

This measure significantly reduced the unnecessary traffic congestion in Limassol city centre, resulting in lower levels of noise pollution. A decrease of 46,1 dB was achieved, which was a reduction of 49% in traffic noise compared to the baseline situation.



**Figure 4:** Levels of Traffic Noise (dB)

## C2.1 Energy

### 3 - Fuel consumption

Under the conditions detailed in section C1, the local partners estimated that the implementation of the measure lead to 8.640 L of fuel savings, since the real time parking information improved mobility in the area. People have the chance to check for available free parking spaces close to their location, thereby avoiding useless driving.

## C2.1 Economy

### 4 - Fuel costs

The implementation of the measure allowed fuel savings of 10.713 € to be achieved, since the real time parking information improved mobility in the area,. People have the chance to check for available free parking spaces close to their location, thereby avoiding useless driving.

## C2.1 Society

### 5 and 6 - Awareness and Acceptance levels about the smart parking solution

The surveys aimed to understand the levels of acceptance, awareness, and usefulness of the application from approximately 350 tourists and residents. The results revealed that in 2019, 80% of the surveyed population were aware of the need for information regarding available free parking spaces to address the parking issues. In 2018, 92% of people answered that they were aware of the problem.

Additionally, 80% of people in 2019 were aware of the application and had already used it. The acceptance of its use came very quickly, as the application was accepted and adopted very fast from Limassol tourists and residents.

## C3 Quantifiable targets

| No.  | Target  | Rating |
|--|---|--------|
| 1  | Less CO <sub>2</sub> emissions: 42,11t                          | ★      |
| 2  | Less traffic noise in the city centre 20dB                      | ★★★    |
| 3  | * Increase the awareness and acceptance levels of people by 50% | ★★★    |
| 4  | Save fuel costs 9.635€  | ★★     |
| 5  | Save fuel consumption 7.770 L                                   | ★★     |
| 6  | Less energy consumption: 69,93 MWh                              | ★      |
| <p><b>N/A = Not Assessed   0 = Not Achieved   ★ = Substantially achieved (at least 50%)</b><br/> <b>★★ = Achieved in full   ★★★ = Exceeded</b></p> |   |        |

\*New target, not in GA

**Table 5:** Assessment of quantifiable targets

All of the targets have been achieved compared with the initial ones stated in the Grant Agreement, either fully or substantially, allowing data to be collected and analysed on time.

Target 2 was Exceeded. With the measure implementation, it was possible to achieve a decrease of 46,1dB in the city centre – a reduction of 49% of noise pollution compared to the baseline.

The reduction of unnecessary traffic congestion and unnecessary driving while searching for a free parking space allowed Targets 4 and 5 to be Achieved in Full. The smart parking solution allowed savings of 8.640L, and consequently, savings on fuel costs by 10.713€.

Target 3 was a new target adapted to the scope of the measure and was Achieved in Full. During the surveys, it was possible to understand that 80% of the residents and tourists surveyed were aware of and had used the mobile app.

Target 1 was only Substantially Achieved. After the implementation of the measure, the evaluation results revealed that the CO2 savings reached 29,2t, compared to the expected 42,11t. The target was only Substantially Achieved because the evaluation was planned to occur during more months, however due to the delayed implementation, it was only possible to collect data for around 1 year. Also, initially there was an adaptation and acceptance period among the drivers for them to get used to it and apply it in their everyday life.

Target 6 was not possible to be assessed due to a lack of collecting data regarding the energy consumption from cars that was avoided due to the parking guidance system. However, it is expected that the target is substantially achieved as Targets 1, 2, and 5 were achieved. Additionally, this target was achieved through the implementation of the other interrelated measures referred in section A2.

## C4 Up-scaling of results

Not applicable.

# D Process Evaluation Findings

## D1 Drivers

The engagement and support of the Public Works Department (part of the Ministry of Transport, Communication and Works), as well as the support of Limassol Tourism Board, which agreed to show parking availability on their website and application respectively, helped the measure to be implemented on time. Limassol Municipality has enhanced its relations with the Ministry of Transport, Communications and Works, and its collaboration with the Municipal traffic police department enabled the provision of all necessary information needed for the evaluation impact of the measure.

## D2 Barriers

The main barrier faced during this implementation was the infrastructure of the municipal parking places. Apparently, the decisive point was the engagement of municipal engineers, which led to the actions for upgrading the existing parking places and fixed the infrastructure, making the spaces ready for the installation of the sensors and enabled the correct counting of parking spaces. With the completion of the installation of the smart parking guidance system, the evaluation of this measure has been successful, collecting enough data for analysis.

## D3 Main Lessons Learned

The measure improved the whole mobility system due to lower traffic, noise, CO<sub>2</sub> emissions, and higher safety levels. It is the first attempt in Limassol where such infrastructure provided the availability to the public to choose where to park their cars, so it could be used as a pilot for more parking places to be engaged and support the whole Limassol district. This initiative allowed citizens and tourists of Limassol to identify available parking spaces before reaching the city centre, and therefore know where to head.

## E Evaluation conclusions

Visitors and residents now have at their disposal an intelligent parking system that allows them to move around more efficiently, saving time on driving and improving their quality of life. From an environmental perspective, the smart parking guidance system provide benefits for the urban centre, contributing to reduced congestion and noise pollution. The fuel savings is also an important benefit not only for residents but tourists as well.

## F Additional information

### F1 Appraisal of evaluation approach

The evaluation of this measure has been successfully completed in full. The parking system in Limassol has improved resident's quality of life and daily life as well as tourist's mobility. A series of surveys, estimations, and data collection took place since the beginning of the project and during the whole duration of the project.

A third survey was planned to occur between M44 and M47 to assess the impact of the measure in 2020 and how it evolved from 2018 and 2019. Unfortunately, the arrival of tourists in Limassol decreased dramatically and even the resident moves throughout the region decreased due to COVID-19. Therefore, the data resulting from surveys in 2020 would not have been representative and it was decided to consider the results from the survey applied in 2019 for the impact evaluation approach.

Additionally, the energy consumption (Target 6) was not assessed due to the impossibility of collecting data for the energy consumption avoided due to the parking guidance system. However, it is expected that the target is substantially achieved through Targets 1, 2, and 5 of the studied measure as well as the interrelated measures in section A2.

### F2 Future activities relating to the measure

After the completion of this measure and the successful management of the electric displays which were installed during the project, there is the will to install additional electric displays in

additional parking spaces throughout Limassol. Moreover, further improvements of the system will be undertaken.

Moreover, Limassol Municipality is in constant contact with Cyprus Public Works Department of the Cypriot Ministry of Transport, Communication and Works, in order to incorporate the live update of information from the parking sensors from the 6 Limassol Parking spaces into the “Parking Spaces” Tab of the Diaylos Intelligent Transport System of the Ministry

(<http://www.traffic4cyprus.org.cy/trafficapp/?wp=parkingplaces-en>).