# Implementation status report on access control system

# ELAN Deliverable No. 3.4 – D1

**Project acronym:**     **ELAN**
**Project full title:**     **Mobilising citizens for vital cities**

**Grant Agreement No.: ELAN TREN/FP7TR/218954/"ELAN"**

**Workpackage:**     **WP3 Demand management**

**Measure:**     **3.4-GEN Pedestrian area enforcement with automatic number plate recognition**

**Author:**     **Brecht Vekeman**

Final

30/7/2012

| ELAN deliverable no. | 3.4-D1 |
|---|---|
| Date / Version | 30/7/2012 / Final |
| Dissemination level | public |
| Work Package | WP3 |
| Author | Brecht Vekeman |
| File Name | 3.4 - D1 - Implementation status report on access control system.pdf |

## Keywords

| | General | | | | Work package links | | | |
|---|---|---|---|---|---|---|---|---|
| x | CIVITAS | | | | | WP1 Alternative fuels & clean vehicles | | WP7 Energy-efficient freight logistics |
| x | ELAN Project | | | | | WP2 Collective transport & intermodal integration | | WP8 Transport telematics |
| | | | | | x | WP3 Demand management | | WP9 Project coordination |
| | | | | | | WP4 Influencing travel behaviour | | WP10 Project management |
| | | | | | | WP5 Safety, security & health | | WP11 Research and Technological Development |
| | | | | | | WP6 Innovative mobility services | | WP12 Impact and process evaluation |
| | | | | | | | | WP13 Dissemination, citizens' engagement, training and knowledge transfer |

## Document history

| Date | Person | Action | Status [1] | Circulation [2] |
|---|---|---|---|---|
| 26/7/2012 | Brecht Vekeman | Draft | Draft | SC |
| 27/7/2012 | Brecht Vekeman | Final | Final | PM |
| 30/7/2012 | Marcel Braun | Proof-reading final version | Final | PC |

---

[1] *Status:* Draft, Final, Approved, Submitted

[2] *Circulation*: PC = Project Coordinator; PM = Project Manager; SC = Site Coordinators; EM = Evaluation Manager; DM = Dissemination Manager; SEM = Site Evaluation Managers; SDM = Site Dissemination Managers; SCo = Scientific Coordinator, P = partners, ML = Measure Leaders

# CONTENT

# 1. Access control with ANPR-cameras for the pedestrian area: concept

## 1.1. Context

Annually the City of Ghent Mobility Company issues several thousands of licenses for the pedestrian area. The many licensed vehicles create traffic and parking nuisance and a decline in the perception and feeling of safety in the zone.

The pedestrian area is all too often used as an easy way to shorten travel time and distances (i.e. as a shortcut). The rules and laws that apply within the pedestrian area are often not followed nor respected:

- Driving in the area without a (valid) permit;
- Ignoring access restrictions ('access prohibited');
- Cut-through traffic, i.e. a license is used to drive through the area without having a destination located within the zone;
- Not respecting the speed limit, i.e. actual traffic speed should be at a 'footpace';
- The weight limit of 10 tonnes is not complied with;
- Pedestrian area permits are used as permits for parking in the area (which is not allowed, at any time).

Factors that do not help in reducing the number of infringements are the substantial size of the pedestrian zone, the wide variety of functions it houses and the very low probability of actually being fined.

To re-establish the pedestrian area as a place where pedestrians and cyclists feel at home, within measure 3.4-GEN of the CIVITAS-ELAN project we are revising the licensing scheme and installing an automatic access control system based on the use of ANPR[3]-cameras.

## 1.2. Intended results

By overhauling the licensing scheme and introducing an ANPR-camera access control system, we will:

- issue permits more efficiently;
- ensure the correct use of permits;
- reduce the number of (traffic) infringements;
- decrease the number of kilometres driven by motorized vehicles in the pedestrian area;
- reduce the amount of vehicles parking within the area.

Ultimately, our goal is to make the pedestrian area safer and more liveable. We want to monitor, limit and enforce access to the area and at the same time keep it accessible for the delivery and collection of goods.

## 1.3. Practical use of an automatic access control system

The automated access control system based on the use of ANPR-cameras, is used to serve two purposes:

- The City of Ghent wants to gather information on the use of all permits: what are the most-used shortcuts, how many unlicensed vehicles are driving around in the area, how fast do people drive through the area, etc. By installing a traffic monitoring system based on ANPR, the city has an instrument similar to a continuous license plate survey which can be used to continually improve its licensing policy;

---

[3] ANPR: Automatic Number Plate Recognition

- Ghent's local police uses the system to enforce statutory regulations for vehicular access to the pedestrian area and certain roads within the area.[4]

Our ANPR-camera access control mechanism performs two types of access control:

- ignoring a C3 access prohibition : the license plate is read and two sets photos are taken of every vehicle that drives past a C3 road sign: one set of photos before it drives past the road sign, and one set of photos when it has driven past the road sign. The two consecutive sets of photos prove that the vehicle drove past the C3 road sign.



*Figure: road sign C3*

- the possession of a valid license for the pedestrian zone: the license plate is read of every vehicle that drives into the area and compared to a whitelist containing all valid permits.

Both ignoring a C3 access prohibition and driving in the pedestrian zone without a valid permit are criminally sanctioned. They are violations of the first degree for which a 50 € fine will be issued.

At locations where an access prohibition coincides with the start of the pedestrian zone, we will enforce access prohibition.

However, even at these locations, we will control whether or not a vehicle is licensed to drive in the pedestrian area. This data will not be used for criminal prosecution, but to complement the statistics on the use of Ghent's pedestrian zone.

# 2. Realization

## 2.1. Locations where an automatic access control mechanism is most useful

### 2.1.1. A focus on busy roads and most commonly used shortcuts

Because the Ghent pedestrian area extends over a 35 ha large territory, there are numerous locations where anyone can enter or leave the area. Several factors (e.g. shopping streets, presence of buses and trams, certain access prohibitions, very narrow roads, etc.) make it practically impossible to use certain roads as access roads. We want to focus on the busiest roads, roads that are part of frequently used shortcuts and roads that are used by public transportation.

In 2006 and 2009 the City of Ghent Mobility Company investigated all traffic driving into and driving out of the zone as well as the traffic passing through the zone, by means of license plate surveys. Conclusions were drawn at three levels:

1. Traffic within the area: 300 movements per hour[5] were recorded in the morning, 30% of which were categorized as through traffic. In the afternoon, the intensities were lower, but there was a higher proportion of through traffic, namely 44%.

---

[4] Currently, access is controlled daily by two traffic policemen at two strategic locations. They control whether an incoming vehicle has a valid license or not. All vehicles without a valid license are instructed to leave the area. They do not receive a fine, nor are they criminally sanctioned.

[5] At this level, we counted in *'movements'*. A continuous car movement was registered two times: once at an ingoing location and once at an outgoing location. In calculating the number of movements caused by through traffic compared to all traffic in the pedestrian area, every cut-through movement was counted just once.

2. Through traffic on street level[6]: the St-Michielsplein was the busiest access route to the area: in the morning 105 vehicles per hour drove into or out of the zone, in the afternoon that figure came down to 65. The St-Veerlplein, Emile Braunplein and St-Baafsplein complete the top 4.

3. Through traffic on axis level: the axes with the most through traffic were St-Michielsplein - Botermarkt, Botermarkt - St-Baafsplein and St-Michielsplein - St-Baafsplein.

Two of the busiest through traffic axes (i.e. St-Michielsplein - Botermarkt and St-Michielsplein - St-Baafsplein) are cut off by an access prohibition in both directions in the Cataloniëstreet. This access prohibition is often ignored.
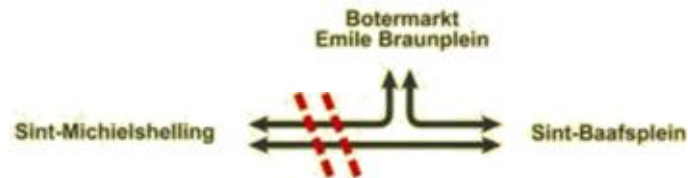


*Figure: Schematic representation of the most frequently used through traffic axes*

Together with Ghent's local police, the Traffic Engineering Office of the Local Police, the Department of Urban Planning and the Department of Economy, the City of Ghent Mobility Company thoroughly evaluated every single access location on site from May to August 2011. Out of all the major access points a top ten was defined in August 2011. These locations were labelled as ideal locations where a system of automatic access control would initially be most useful:

1. St-Michielsplein;

2. Jan Breydelstraat;

3. St-Veerleplein/Kleine Vismarkt;

4. Hoogpoort (ingoing and outgoing traffic);

5. Botermarkt;

6. St-Baafsplein;

7. St-Niklaasstraat;

8. a. Cataloniëstraat – St-Niklaasstraat side;

8. b. Cataloniëstraat – Veldstraat side;

9. Predikherenlei.

The decision on which control points will be equipped with ANPR-cameras was formalized by the Board of Mayor and Aldermen on 19 April 2012.

---

[6] Unlike the calculations of through traffic, on street level all passing vehicles are counted, e.g. the movement of a vehicle which is registered at St-Michielsplein and subsequently within five minutes also at the St-Baafsplein counts as a passing vehicle at the St-Michielsplein and at the St-Baafsplein.
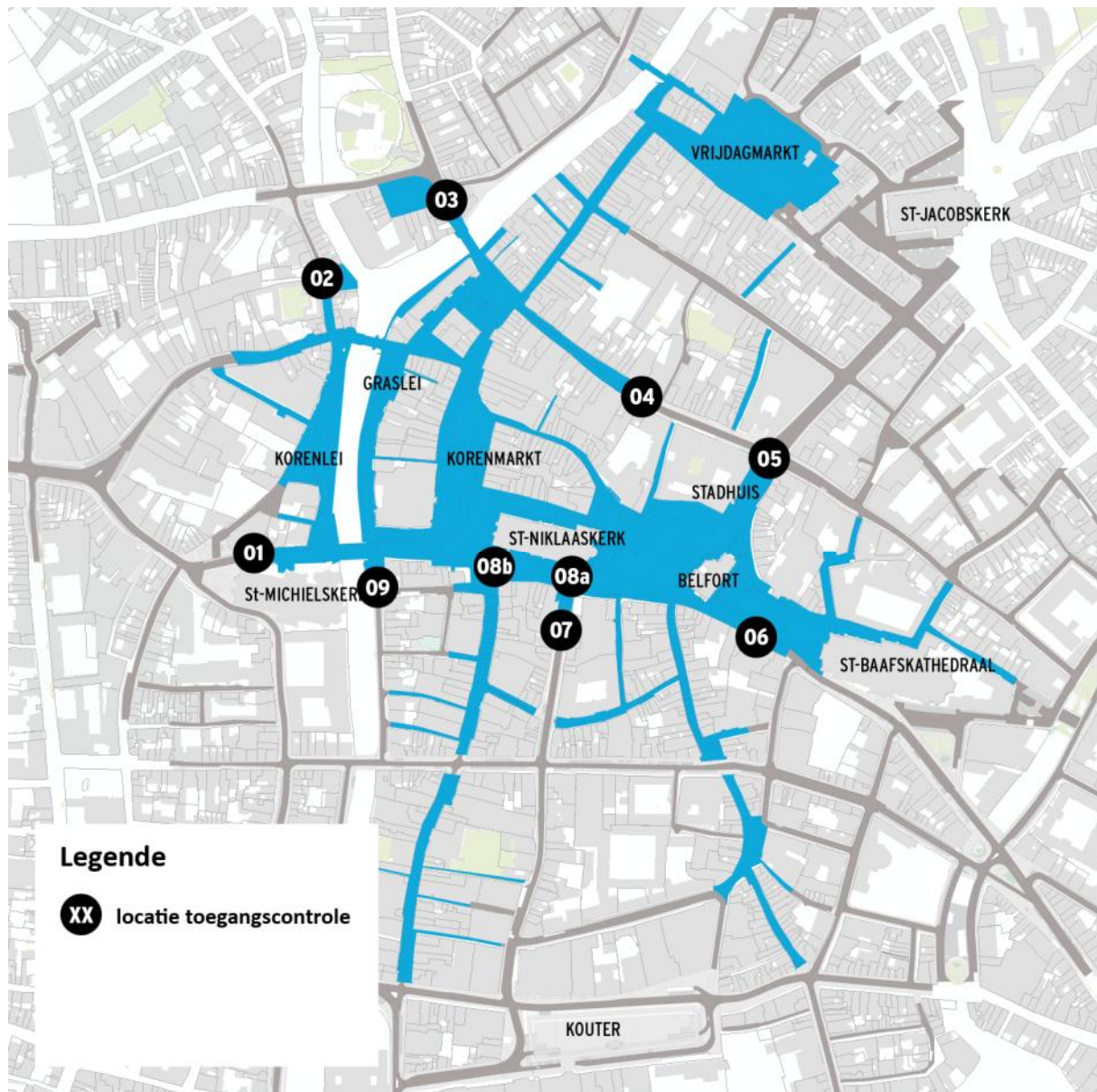
*Figure: Locations where an automatic access control mechanism will be installed*

## 2.1.2. External advice with regard to the chosen locations

We organised several site visits to the chosen locations. During these visits the opinions of various municipal services, Ghent's local police, the optical fibre company, and some technical experts were gathered. Based on their suggestions, camera installation points for all ten locations were carefully selected.

A preliminary dossier documenting the installation options for each location was submitted to various departments and agencies with a request for comments and advice:

- The Heritage Agency for Eastern Flanders;

- The Architectural Conservation Service;

- The Department of Urban Planning, the Department of Roads, Bridges and Waterways, the Coordination Service and Administration Service of the Department of Urban Planning, Transport and Public Domain.

Through consultation and participation, we want to ensure that the final placement of the ANPR-cameras (i.e. mounting on a pole or on to a facade) is in line with the vision and policies of these official bodies.

## 2.1.3. Two types of access control

Both sides of the Cataloniëstraat (08a and 08b), the entrances to the zone via the St-Niklaasstraat (07), Jan Breydelstraat (02) and Hoogpoort (04) are closed off to (most) vehicular traffic by means of an access prohibition. Where an access prohibition coincides with the start of the pedestrian zone (i.e. St-Niklaasstraat, Jan Breydelstraat and Hoogpoort), we want to enforce the access prohibition. Everyone who ignores the access prohibition will be fined.

At the borders of the pedestrian zone without a strict access prohibition, we will enforce our licensing scheme. Everyone who drives into the zone without a valid permit will be fined.

The map below gives an overview of the type of access control that will be realized at each location:
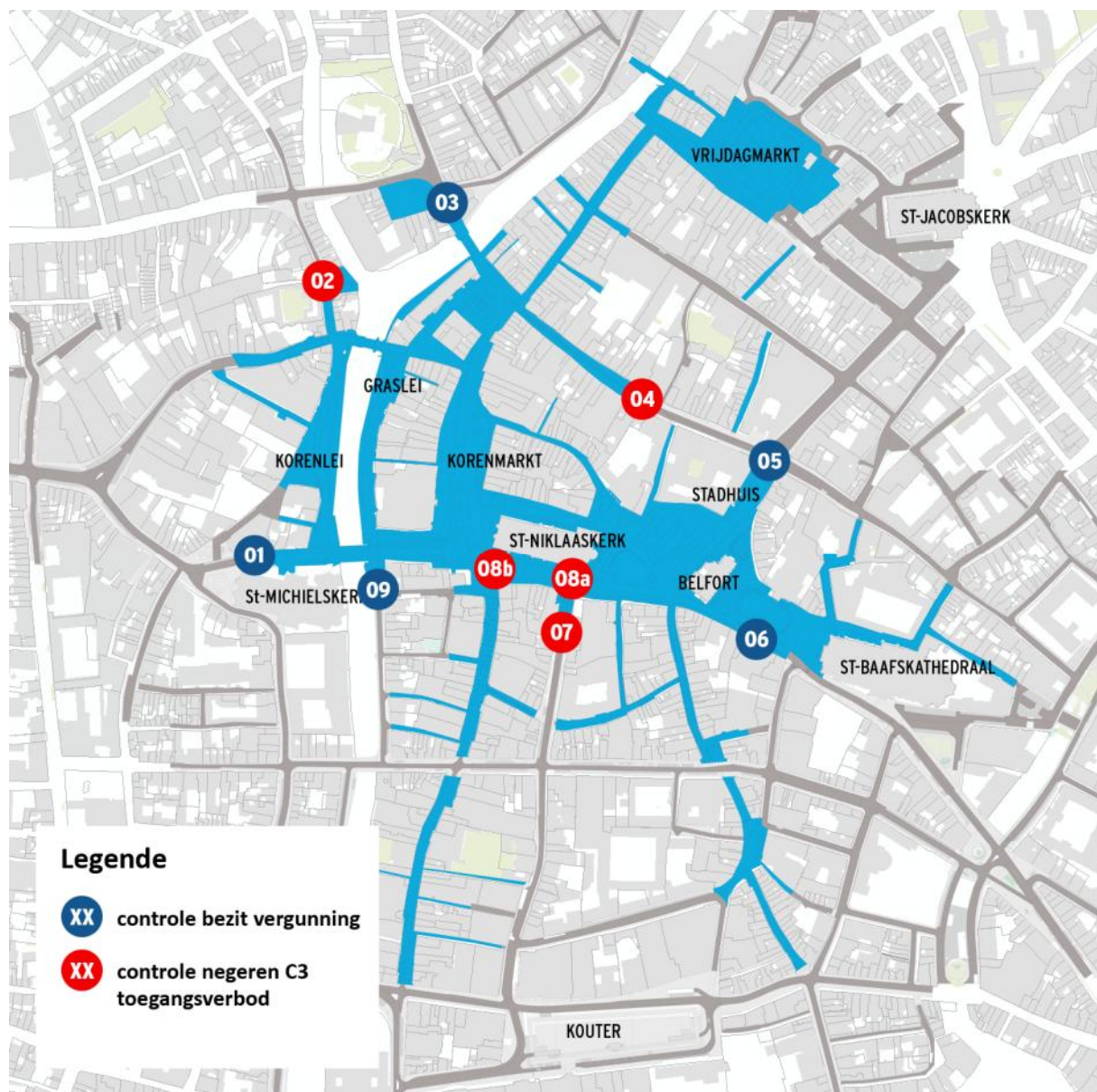


*Figure: Type of access control for each location, blue being the enforcement of our licensing scheme, red the enforcement of an access prohibition*

## 2.1.4. Controlling inbound traffic

The rear license plate of a vehicle registered in Belgium is the only official license plate. The validity of an automatic detection of an offense based on a photograph of the rear license plate is not debatable. When the front plate is used, that is not the case.

For both types of offences, we will limit ourselves to reading rear license plates, i.e. our cameras focuses on inbound traffic.[7]
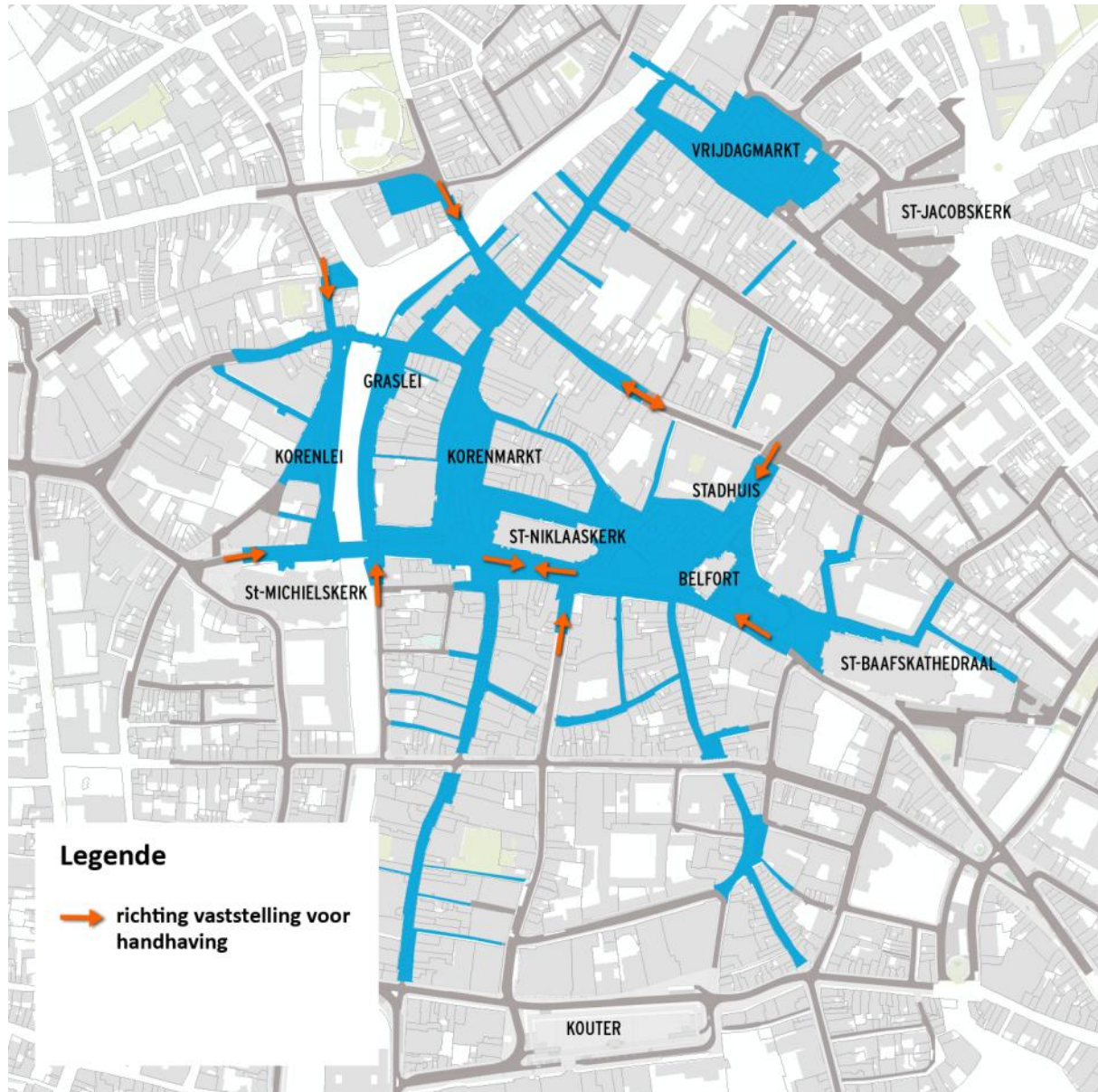


*Figure: Direction of access control at each location*

Technically, the same camera (no matter in what direction it is pointed) can read both the front and rear license plate of a passing vehicle. At all locations we will read the front license plate of outbound vehicles. This data will be used merely for statistics on traffic in and through the pedestrian area.

---

[7] At location 04 Hoogpoort we will also control outbound traffic. At this border location there is an access prohibition in both directions.

## 2.2. Legal basis for the use of automatic control systems

### 2.2.1. Law on Security Cameras

The question to what purpose the cameras are used is of particular importance. When the cameras are used only to detect traffic offences (as described in the previous chapters) the Law on Security Cameras[8] does not apply.

Therefore, an advance notice of the cameras by means of an appropriate road sign is not obligatory.

When cameras are used for example to maintain public order or to track down criminals, the Law on Security Cameras does apply.

### 2.2.2. Model approval

In October 2010 a new Royal Decree[9] was accepted that describes how the certification, calibration and installation of measuring devices used to monitor and detect road traffic offences must be handled. This law applies to devices that directly or indirectly perform a measurement.

When enforcing our licensing scheme, we read license plates and compare them to a whitelist of permits. We do not perform a measurement. Therefore this type of detection is not covered by the above Royal Decree.

When detecting access prohibition offences (i.e. driving past a C3 road sign), we take two sets of pictures of a vehicle just before and just after the road sign. These two consecutive sets of pictures prove that the vehicle has ignored the access prohibition. Both sets of pictures contain a time stamp that irrefutably establishes a sequence for the sets. Strictly speaking, we perform a measurement, but this may be open to interpretation.

To be on the safe side we asked the camera supplier to start the model approval process for the cameras we are using. They must be fully approved before we start prosecuting traffic offences.

### 2.2.3. Privacy and Data Protection Act

The Privacy and Data Protection Act[10] is undoubtedly applicable as personal data is being processed. The processing of personal data in the cases described below is justified under Article 5 e) of the Privacy Act: the processing of personal data is necessary for the performance of an activity that is carried out in the public interest or in the exercise of official authority.

Our databases are declared to the Privacy Commission. Our declaration contains a description of the personal data we store and to what purpose we use it.

One single declaration is sufficient for all locations where cameras are installed. The databases are all part of a separate declaration. This allows us to add cameras in the future without having to adjust the declaration.

There are three types of data storage that require a separate declaration to the Privacy Commission:

1. The City of Ghent is responsible for creating, managing and maintaining a whitelist consisting of license plates. A whitelist contains license plates belonging to three different categories:

   - vehicles that are required to have a valid permit in order to be allowed access to the pedestrian zone;

---

[8] 21 MAART 2007. — Wet tot regeling van de plaatsingen het gebruik van bewakingscamera's.
[9] 12 OKTOBER 2010. — Koninklijk besluit betreffende de goedkeuring, de ijking en de installatie van de meettoestellen gebruikt om toezicht te houden op de naleving van de wet betreffende de politie over het wegverkeer en haar uitvoeringsbesluiten.
[10] 8 DECEMBER 1992. — Wet tot bescherming van de persoonlijke levenssfeer ten opzichte van de verwerking van persoonsgegevens.

- vehicles that, according to Federal Traffic Laws[11], do not need a permit to access the pedestrian area: e.g. garbage trucks, emergency vehicles or public transport vehicles. These vehicles are called *exempt vehicles'*;

- vehicles used to pick up or drop off people with disabilities in the pedestrian area[12].

The retention period for the data in a whitelist should not exceed the maximum validity of a license, i.e. one year. The whitelist is constantly being updated: the plates of expired licenses are removed, new ones are added.

2. The City of Ghent collects data on the use of permits to further improve its licensing policy. To this end, the City of Ghent Mobility Company receives a copy of the database holding all (processed) data collected by the ANPR-cameras. This database is managed by the local police. With regard to the exchange of data, the following restrictions apply:

- The Mobility Company does not receive photographs;

- When a dataset is part of a criminal prosecution (i.e. an actual offense has been established) we receive only anonymous data.

To allow for a complete analysis of all traffic within and through the pedestrian area, the retention period is aligned with the maximum validity period of a permit, i.e. one year, with an added margin of one additional year. This means that data on the use of permits is kept up to two years. This way we can compare the use of permits for the current year to that of the previous year.

Older data is stored in anonymous reports.

3. The local police manages a database holding all data collected by the ANPR-cameras. Each detection comprises the following data:

- a license plate number;

- a country code for the license plate number;

- an indication of the reliability of the automatic recognition algorithm;

- an infrared image[13];

- the location of the license plate cut-out on the infrared image;

- 1 or 2 overview images[14];

- 1 or 2 timestamps[14];

- the direction of traffic for the detected vehicle;

- identification data of the camera.

When a dataset is gathered that doesn't potentially lead to a criminal investigation, all graphical data is immediately removed.

All data belonging to a dataset that is potentially part of a criminal investigation, is stored no longer than absolutely necessary:

- The retention period of a dataset marked as the detection of a potential violation is 120 days, i.e. police personnel must visually inspect and officially validate a violation

---

[11] 1 DECEMBER 1975. — Koninklijk besluit houdende algemeen reglement op de politie van het wegverkeer en van het gebruik van de openbare weg — Artikel 22sexies. Verkeer in de voetgangerszones.

[12] Currently, the City of Ghent website states that persons with disabilities are allowed access to the pedestrian area 24/7. The only condition is that they own a special parking card for people with disabilities. When the automatic access control system is in force, the number plates of vehicles used to pick up or drop off people with disabilities in the pedestrian area, must be registered and added to the whitelist.

[13] An infrared photograph is used to locate license plates. On an infrared photograph reflective objects and surfaces, such as license plate plaques, are clearly distinguishable from other objects.

[14] Two overview images for the detection of an access prohibition offence and one for the detection of driving in the pedestrian area without a valid permit.

within 120 days. All graphical data is removed from a dataset after 120 days when it is not confirmed as part of a criminal investigation.

- Datasets that register an actual violation become part of a criminal charge that is formatted in ISLP[15]. By law, these have to be stored for at least five years.

- All datasets that are not a part of the detection of a potential offense are stored in a database maintained by the local police. The retention period for this data is the same as for the copy that is maintained by the City of Ghent, i.e. up to two years. These datasets do not contain graphical data.

## 2.3. How do our ANPR-cameras gather data?

Our automatic access control system based on the use of ANPR-cameras gathers a lot of data. Not all of it is treated in the same way:

1. An ANPR-camera is continuously looking for reflective surfaces. When it encounters a reflective object, it captures a series of infrared images:

   - an infrared image is used to locate a license plate;

   - the ANPR-camera has a built-in OCR-engine[16] that recognizes the license plate number characters;

2. at the same time, a colour context photo is taken (two when dealing with the detection of a C3 access prohibition offence[17]);

3. the ANPR-camera puts together a data package (containing all images, one or two timestamps, identification data of the camera, etc.) and sends it to a central server maintained by Ghent's local police;

4. at the central server, the license plate number is compared to a whitelist[18] containing license plate numbers;

   - the license plate number matches to one in the whitelist: no hit: all graphical data is immediately deleted;

   - the license plate number doesn't match to one in the whitelist: hit: the full data packet is stored on a server at the local police and marked as a *'potential violation'*;

5. Local Police personnel visually inspects and officially validates the results of the data packets marked as *'potential violation'*;

   - the detection is validated: a violation was correctly identified. The license plate data and graphical data are imported into ISLP, where a criminal charge is drafted;

   - the license plate number was correctly read, but the vehicle does not need a valid permit to enter the area (e.g. a taxi or ambulance). It should have been part of the list of exempt vehicles and thus should have been included in the whitelist. The license plate number is added to the whitelist and the graphic data is removed;

   - the automatically recognized license plate number is not correct. Police personnel adjusts the license plate number and verifies whether the corrected plate is part of the whitelist. The above process is repeated.

6. the City of Ghent Mobility Company receives a copy of the database holding all data collected by the ANPR-cameras after it has been processed by the local police;

---

[15] ISLP: Integrated System of Local Police
[16] OCR: Optical Character Recognition
[17] One with the rear license plate of the vehicle before it passes the C3 road sign and one after the vehicle has driven passed the C3 road sign.
[18] The whitelist is composed of the license plate numbers of vehicles with a valid permit allowing access to the pedestrian area, exempt vehicles and vehicles used to pick up or drop off people with disabilities in the pedestrian area.

- all datasets have been stripped of graphical data and contain no license plate information when the dataset is part of an actual offense.

## 2.4. Infrastructure for an ANPR-camera system

### 2.4.1. Technical limitations of ANPR cameras

Each of the ten chosen locations was thoroughly screened. Depending on the properties of the ANPR-cameras used, they cannot be installed at any given location[19]. Factors that play a crucial role in the positioning of our cameras are the following:

- the angle at which a license plate can be read;
- the width of the road that a single ANPR-camera can scan;
- the height at which the ANPR-camera must be placed;
- the distance to the location where license plate numbers are scanned;
- the fact whether the front or rear license plate has to be read.

### 2.4.2. Components of our ANPR system setup

Our ANPR setup consists of:

- at least one ANPR-camera;
- a pole with mounting bracket or brackets for mounting on a facade;
- network connections:
    - a telecommunications interface that enables data transfer between all different sites and the back office system;
    - a telecommunications network;
    - a connection to the electricity grid;
- a technical cabinet in which the cameras are connected to the various networks, preferably an underground technical cabinet;
- a back office system where all data coming from the ANPR-cameras is stored and processed (manually and automatically).

#### 2.4.2.1. ANPR-cameras

We chose an ANPR-camera model that is capable of detecting license plates of crossing cars or cars overtaking each other: i.e. capturing license plates over one to two lanes in both directions.

A combination of the following elements can be found within the housing of an ANPR-camera:

- an infrared camera;
- an invisible infrared light illuminator for lighting up reflective surfaces on an infrared image;
- a colour camera for taking context images;
- a built-in processing unit performing the actual optical character recognition;
- an internal clock which generates timestamps;
- an internal memory for storing detected plate data as a buffer in case the telecommunications network is temporarily unavailable.

---

[19] ANPR-cameras can read license plates at a distance of 12 to 35 meters and at a width of 3 to 6 meters. They are usually hung up 4 to 6 meters high and at an angle in the horizontal plane which is smaller than 30°. Plates can be read from vehicles driving at speeds of up to 250 km/h.

### 2.4.2.2.    Mounting on poles or on walls

Wherever possible, we do not install new poles with the sole purpose of having something to mount an ANPR-camera to. Mostly, we replace existing poles with new ones that are better suited for mounting ANPR-cameras to.

The poles are coloured in the standard colours used for signal poles.

At locations where no useful poles are present, we mount the cameras on a facade.

Cameras are always spray-painted in the colour of the pole or the wall to which they are attached.

### 2.4.2.3.    Network connections and technical cabinet

All cameras are connected to the City of Ghent optical fibre network. Making use of the optical fibre network has some remarkable advantages:

- very high data rates are possible;
- a very robust network;
- easily extendable[20];
- full in-house management[21];
- no subscription fees.

The main disadvantages are the higher costs for building and upgrading the optical fibre communications network and the fact that extending the network is more manual labour intensive.

The network interfaces to connect the ANPR-cameras to the optical fibre network and the electricity grid, as well as various network peripheral hardware (e.g. network adapters, switches, power supply adapters, etc.), are located in an on-site underground technical cabinet. The lids of these cabinets can be tiled.

### 2.4.2.4.    Back office system

Each dataset sent out by the ANPR-camera is stored in a database managed by Ghent's local police.

Each dataset is automatically marked as a '*potential violation*' when the license plate contained in the dataset does not match to any of the plates in the whitelist. These potential violations are visually inspected by police personnel. When confirmed, the dataset is copied into ISLP, where an official criminal charge is drafted.

All the images are immediately deleted from all datasets not marked as potential violations.

## 2.5. Realization in several phases

The measure is implemented in three separate phases:

- Phase 1: implementation of a pilot project to:

  - ensure that the technical system meets our requirements. There isn't a single existing commercial product available that can simply be purchased and installed that meets our specific needs. To monitor access to the pedestrian area and enforce C3 access prohibitions, adapting the standard ANPR-camera hardware is absolutely necessary and specific software must be developed.

  - gather detailed data about the actual traffic in the pedestrian zone (e.g. the actual use of permits, the number of potential violations, etc.) before we go *'live'*, i.e. we start with criminal prosecutions. That way we can estimate the future workload for Ghent's local police and the public prosecutor.

---

[20] E.g. connecting additional ANPR-cameras.
[21] Management of the optical fibre network is a responsibility of Digipolis who outsources this task through a framework contract with Telenet.

A suitable pilot project is at best a faithful but small-scale representation of the complete control system. As a pilot project we chose two locations with very different characteristics:

- different type of access control (one where permits are controlled and one where a C3 access prohibition is enforced);

- different road layout (e.g. narrow versus wide roads, levelled pedestrian walkways versus raised walkways);

- roads shared by different modes of transport (e.g. public transport or not).

Apart from technically equipping two locations with infrastructure for an ANPR-camera system, we are also developing a basic software application. This software application ensures that the ANPR-camera output is stored in a database and that each data packet can be visualized. This enables us to thoroughly evaluate the technical installation.

The ANPR-cameras for the pilot project (phase 1) were installed in June 2012.

- Phase 2: the implementation of two additional locations where permits will be controlled.

  This phase can start immediately after the pilot project has proven that the detection of the use of permits is technically sound. Currently, the start of phase 2 is foreseen for the end of 2012.

  In this phase, the complete software for visually controlling all potential violations will be developed. This software builds on the basic application that is developed in phase 1.

- Phase 3: implementing the other sites. Before we can realize this phase, we must first:

  a. make sure that the way we detect potential C3 access prohibition offences must be technically sound[22];

  b. make further agreements on the exact location where we can mount cameras on facades[23];

  c. be sure about the fact that certain existing boundaries of the pedestrian area will not be moved in the foreseeable future[24].

  In phase 3, reporting software will be developed. This software is used by the local police and the Mobility Company to generate reports about the traffic in and through the pedestrian area, which routes are frequented, what the busiest entry points are, etc. This software will also be used to create anonymous reports collecting data of which the retention period has passed. Phase 3 is foreseen to be completed by mid-2013.

The access control points to be realized in each phase are the following:

- Phase 1: 01 St-Michielsplein, 02 Jan Breydelstraat;

- Phase 2: 03 St-Veerleplein, 06 St-Baafsplein;

- Phase 3: 04 Hoogpoort, 05 Botermarkt, 07 St-Niklaasstraat, 08a Cataloniëstraat (side St-Niklaasstraat), 08b Cataloniëstraat (side Veldstraat) and 09 Predikherenlei.

---

[22] This applies to the installation of these locations 04 Hoogpoort, 07 St-Niklaasstraat, 08a Cataloniëstraat (side St-Niklaasstraat) and 08b Cataloniëstraat (side Veldstraat).

[23] For locations 04 Hoogpoort and 05 Botermarkt we need further preparations.

[24] The boundaries of the pedestrian zone can be adjusted by the next City of Ghent administration after the next elections in October 2012. It seems therefore better for some locations to wait until there is more certainty regarding the following sites: 04 Hoogpoort, 07 St-Niklaasstraat and 09 Predikherenlei.
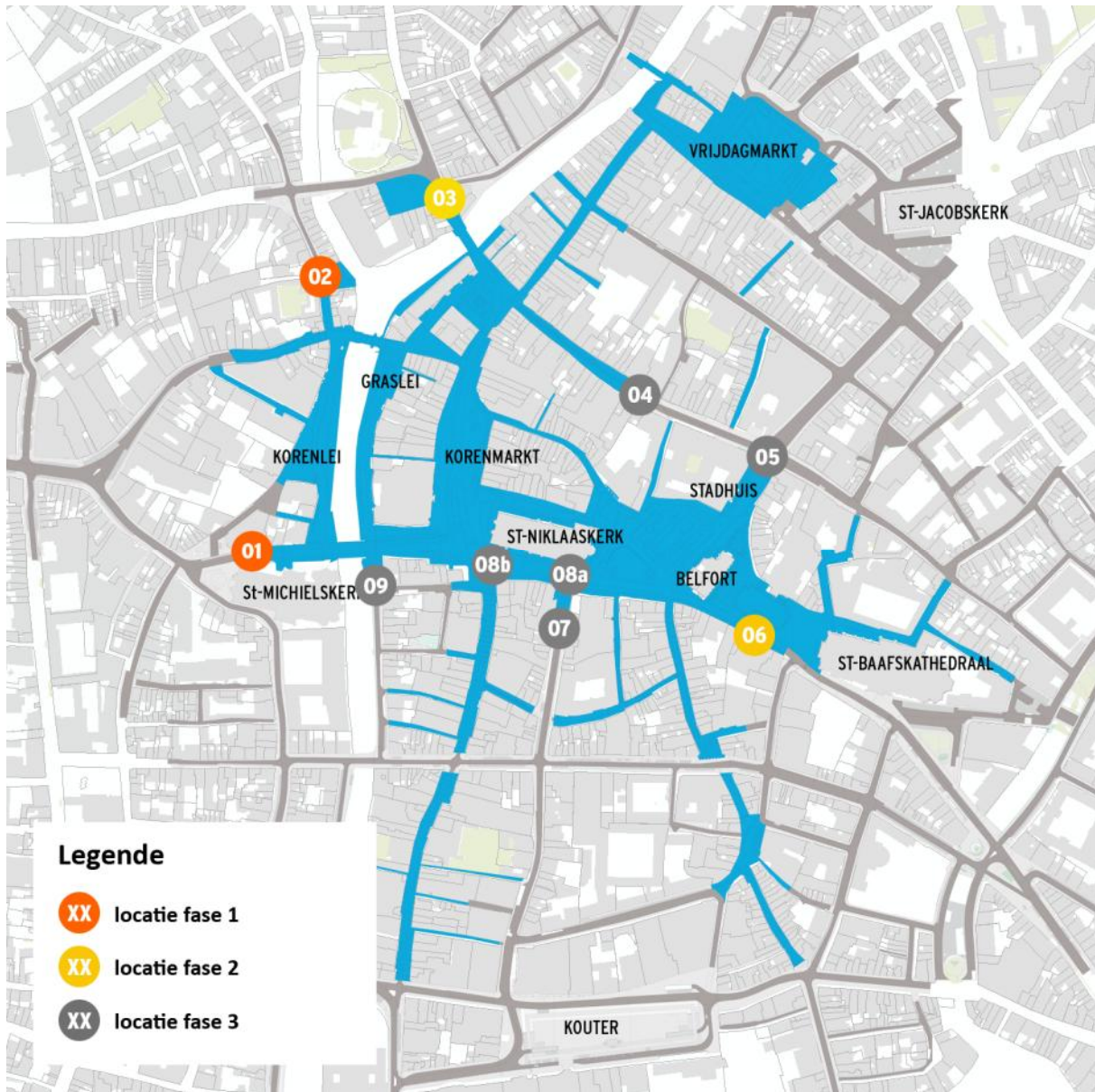
*Figure: Different phases in the project: orange: phase 1 (pilot project), yellow: phase 2 and grey: phase 3*

## 2.6. Current status

Each phase in itself consist of several steps.

- Creation of infrastructure necessary for an ANPR-system, excluding the actual ANPR-cameras: the replacement of existing poles by poles that are more suitable for mounting ANPR-cameras to, the assembly and installation of an underground technical cabinet containing all network interfaces, a switch and other network peripheral devices, excavation works, connections to the optical fibre network and the electricity grid, testing of the connections, etc.;

- Installing, adjusting and testing of ANPR-cameras;

- Developing software: in phase 1, this step consists of the development of a basic application for the visualization of ANPR datasets;

- Testing: evaluate the previous steps and the technical soundness of the installation before we order the equipment necessary to realize the next phase.

Details about the implementation of the above steps can be found in the next chapters. We are currently (July 2012) in the technical testing stage of phase 1, the realization of a pilot project.

## 2.6.1. The pilot project

We chose locations 01 St-Michielsplein and 02 Jan Breydelstraat to be realized as the pilot project because they are fundamentally different:

- 01 St-Michielsplein:
    - o Controlling the possession of a valid license for the pedestrian zone: the license plate of every vehicle that drives into the area is read and compared to a whitelist containing all valid permits;
    - o Very wide road;
    - o Part of a busy public transport axis.
- 02 Jan Breydelstraat:
    - o Enforcing a C3 access prohibition: the license plate is read and two sets photos are taken of every vehicle that drives past a C3 road sign: one set of photos before it drives past the road sign, and one set of photos when it has driven past the road sign.
    - o Fairly narrow road;
    - o Not part of a busy Public transport axis.

Other important differentiating technical factors:

- 01 St-Michielsplein:
    - o Two ANPR-cameras;
    - o Expansion of the optical fibre network;
    - o New connection to the electricity grid;
    - o A lot of excavation works;
    - o Need for an underground technical cabinet to house all network equipment;
    - o 6m high pole.
- 02 Jan Breydelstraat:
    - o One ANPR-camera;
    - o Very close to the Design Museum Ghent (run by the City of Ghent): no expansion of the optical fibre network necessary. We connected the ANPR-camera to the optical fibre network hub within the museum.
    - o The same goes for the connection to the electricity grid;
    - o Limited excavation works;
    - o No underground technical cabinet needed. All network equipment was installed in the basement of the museum.
    - o 4m high pole.

## 2.6.2. Infrastructure necessary for an ANPR-system

We thoroughly evaluated our partner Digipolis' framework contract with a firm that specializes in camera equipment and software (i.e. VCS with subcontractor Arvoo, a developer of imaging products). The fact that Digipolis had this framework contract meant that we did not have to follow the time consuming Call for Tender and Contract Award procedure.

In December 2011 we purchased all infrastructure necessary to realize the first two sites under this framework contract. All infrastructure (i.e. one sunken technical cabinet, two new poles, connection to

power and optical fibre communication networks, switches and other peripherals for network connections) was installed in May and June 2012.



*Photographs: 6m high pole at St-Michielsplein (left) and 4m high pole at Jan Breydelstraat (right)*



*Photographs: Extension of the optical fibre network at St-Michielsplein*

*Photographs: Excavations at the Jan Breydelstraat to physically connect the new pole (left) to the basement of the Design Museum Ghent (right)*



*Photographs: Sunken technical cabinet at St-Michielsplein with contents*



*Figure: Schematic representation of the components in the sunken technical cabinet at St-Michielsplein*

## 2.6.3. Installing, adjusting and testing of ANPR-cameras

The ANPR-cameras were ordered in April 2012 under the same framework contract. They were installed, set up and adjusted in June 2012.



*Photographs: Pole with two ANPR-cameras at St-Michielsplein (left) and pole with one ANPR-camera at Jan Breydelstraat (right)*



*Photographs: Close-ups of the ANPR-cameras at St-Michielsplein*

## 2.6.4. Developing software

Together with the ANPR-cameras, the phase 1 software application was ordered. The contractor developed a robust database structure (that will also be used by the phase 2 and phase 3 applications) and a basic web-based application for the visualization of ANPR datasets.
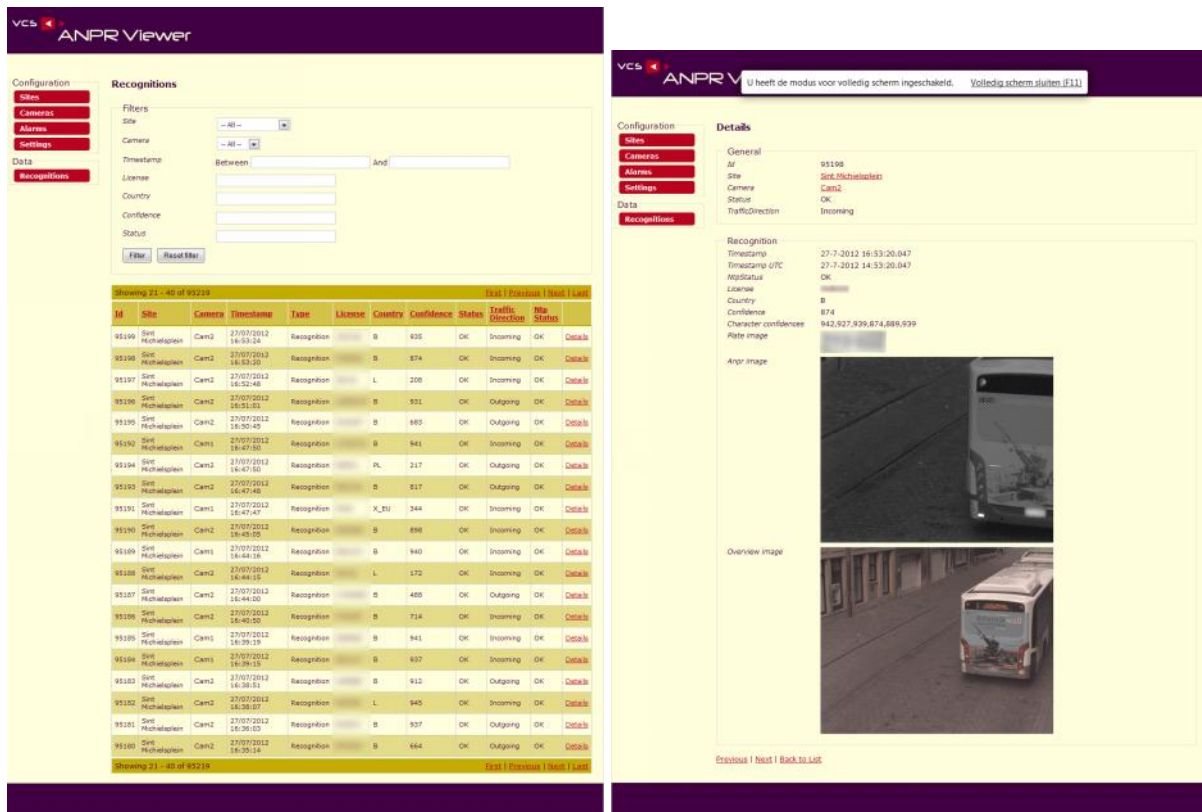


*Figure: Print screens of the ANPR Viewer application*

## 2.6.5. Testing stage

Currently (July 2012), tests are being conducted that will help to determine the technical soundness of the system. We are assessing the way the use of permits is captured, the way we detect potential C3 access prohibition offences, whether or not all vehicles driving past an access point are captured, what the error rate of the system is, how technologically robust the system is, amongst other things.

To determine the error rate we built an additional application that uses the same source date the ANPR Viewer application uses. This application allows us to visualize and correct data packets and as such assess the performance of the entire ANPR system.
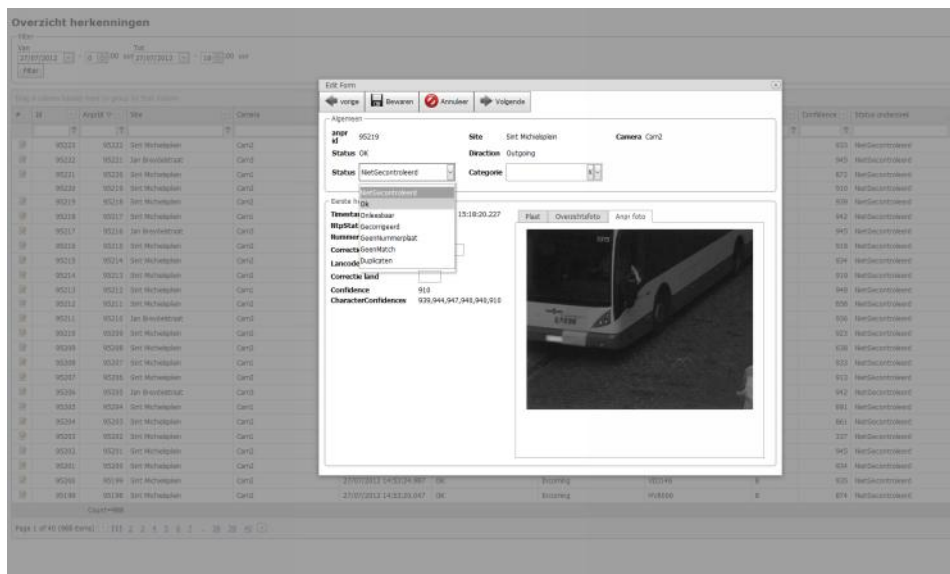
*Figure: Print screen of the application used for testing the performance of the ANPR-system*

## 2.7. Next steps

The first step will be a further assessment of the setup of the phase 1 pilot project. In August 2012 we will evaluate the performance of the ANPR-cameras and the OCR engine by comparing passing traffic at the two access control points with the detections that are collected in the ANPR Viewer application. Figures about the passing traffic will be collected by means of license plate surveys. They will be conducted at varying times and under different weather conditions (e.g. dark/light, day/night, dry/rainy, etc.).

Phase 2 of the project will start once the pilot project has shown us that the process of detecting the use of permits is technically sound. In this phase, two new locations will be equipped with ANPR-cameras and the complete software for visually controlling all potential violations will be developed. This software builds on the basic application that is developed in phase 1. It is currently foreseen that phase 2 of the project will be implemented by early 2013.

At the same time we will pursue the model approval for the cameras we are using to detect access prohibition offences and further fine-tune the positioning of the cameras for the phase 3 locations by consulting with various official bodies. In phase 3, reporting software will be developed. This software will be used to create anonymous reports collecting data of which the retention period has passed. Completion of phase 3, the final phase of the project, is foreseen for mid-2013.