Technical sheet: what are the constraints for installing an automatic cyclist computer?

1. Context :

Once you have carefully chosen a survey and counting point on your route (*see Data Sheet: how to choose the location of a counting point)*. You will need to consider the technical constraints of installing the automatic counter. This sheet gives you the elements to keep in mind when choosing an efficient system and installing it so that it counts optimally.

In all cases, it is important to carefully analyze the installation location chosen with the counting system provider to benefit from his expertise and ensure that the installation is optimal.

Reminder of the key elements of the "Choose the location of a reporting point" sheet

- The **typical spacing** between two counting points on a route is in the order of 10 to 50 km depending on the population and accommodation density
- Mix the points by type of **environment** (urban/peri urban and rural)
- Mix the points by type of **infrastucture** (greenway / shared road)
- Consider **various types of attendance**
- Prioritize locations on **homogeneous sections**
- Anticipate according to an **expected volume**: above 50 passages/day for permanent counts, possibly to be completed by temporary counting campaigns in areas with lower traffic.
- **Avoid** the proximity of very **localized round-trip centers** (schools, colleges, between the beach and a campsite...)
- **Avoid** setting up at a **stopping place** (traffic lights, stop...), **slowing down** (hill) or near car parks, rest areas or picnic areas.

2. What is an automatic counter?

An automatic counter is a system whose purpose is to count the number of users passing through a portion of the road (path, street, road, square, etc.). The system must be continuous 24 hours a day, 7 days a week and allow the data collected to be stored and transmitted for analysis.

Automatic counter are electronic systems that can be based on different physical principles to ensure their measurements (detection of inductive effects, detection of pressure variation, heat detection, analysis of a video signal, etc.)

There are a variety of technologies and sensors that allow automatic counting.
It is always advisable to study the context of the counting location to choose the system that will best meet the constraints to count with the best efficiency.

3. Permanent or temporary system?

Some counting systems are adapted for permanent counts (continuous counting, all year round), others are adapted for temporary counts (continuous counting, from a few hours to about fifteen days or few months).

Important: it is necessary to start with the installation of permanent measuring points because only a complete and continuous measurement of the counts throughout the year makes it possible to establish the hourly, daily and seasonal frequentation profiles required for frequentation studies. Permanent counters are also essential to establish consistent frequentation statistics over the long term (several years).

NB. When the observatory has enough permanent points with a history allowing a detailed knowledge of the behaviours, it becomes possible to use temporary counters in addition. Permanent data are then useful for extrapolating the data collected temporarily.

3.1 Permanent counters

Inductive loops

This sensor is based on the analysis of the inductive effect generated by an object that passes over a loop composed of a conductive cable. The loop can take various shapes depending on the technology and the supplier.

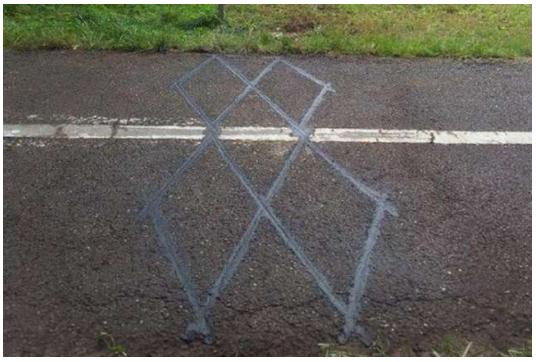

Figure 1 Inductive loops on asphalt, source: Eco-Counter

The inductive loop is buried or integrated into the ground by sawing the pavement

Its installation requires sawing in the case of asphalt or concrete floors.

In the case of loose soil, it is possible to bury loops preformed by a plastic frame and then compact the soil over them.

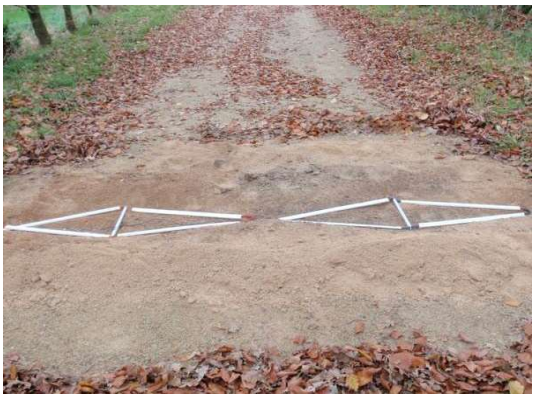

Figure 2 Inductive loops on natural soil, source: Eco-counter

If it is a paved floor (with bricks, stones, ...), it is possible to integrate the same type of preformed loops under the paving.

Figure 3 Inductive loops under paving, source: Eco-Counter

It is an energy-efficient sensor that generally operates on batteries (replaced every year or every two years depending on the size of the system). It can be powered by an external source if electricity is readily available at the installation site.

Piezoelectric strips

This sensor is based on a measurement of the pressure resulting from the cyclist's passage over two piezoelectric bands.

Figure 4 Piezoelectric strips on asphalt, source: MetroCount

The piezoelectric strips are integrated by trimming the ground and pouring them into a suitable asphalt.

It is necessary to have a sufficient surface quality to guarantee operation.

3.2 Temporary counters

Pneumatic tubes

The measurement is made by detecting an overpressure generated in a pneumatic tube that crosses the pavement.

It is preferable to use the tube only for temporary use because it expands as the users pass.

The appropriate duration of use varies from a few days to about 15 days. On a cycle path without maintenance or cleaning vehicles, the tubes can be taped to the ground to increase the counting time (1 to 2 months).

It is a very energy-efficient sensor that runs on batteries.

Figure 5 Temporary pneumatic tubes, source: Eco-Counter

Inductive loops glued to the floor

This is the same technology as permanent inductive loops, here the loop is simply glued to the floor using butyl adhesive strips. The lifetime of such an assembly is approximately 6 months and cannot be installed in areas with car traffic.

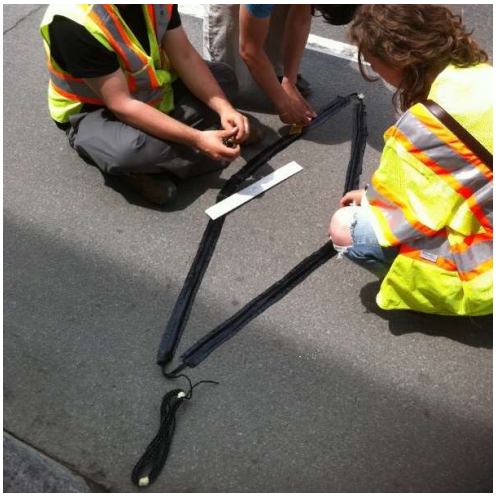

Figure 6 Temporary inductive loop glued, source: Eco-Counter

3.3 Temporary or permanent counters

Radar

The measurement is made by sending electromagnetic waves and analyzing the echo of these waves on objects moving towards the radar.

The radar can be easily moved and installed. The autonomy is short if the meter is not powered by the grid or solar panel. The detection of groups of cyclists is limited. These counters are generally intended for infrastructures dedicated solely to bicycles because they do not differentiate between pedestrians and cyclists.

Figure 7 Radar installed at the pole, source: CA Traffic

4. Counter power supply

Automatic counting technologies are based on electronic systems composed of sensors and modules to interpret, process and transmit measurements.

These systems require an energy supply that varies according to the products.

Be sure to check the power constraints on the desired location.

In most cases, there is no easily accessible power source. Connection to the electricity grid can also generate significant costs (trenching for cable entry, electrical safety, waterproofing).

Many systems are based on the use of batteries, counters must be designed to be energy efficient. Check the battery life with the counter manufacturer. The battery life depends on the complexity of the system. The state of the art today is batteries that change from once a year to once every 10 years for permanent counting systems.

Another option is to embed the energy production with the collector, usually using a solar panel. Warning: this type of solution may require more extensive maintenance, requires checking the sunlight and orientation of the panel and may be subject to vandalism.
If there is a power source, it becomes possible to power the system directly. Be sure to check that the system has temporary backup batteries. This type of small batteries makes it possible to overcome power cuts from the grid while the power is restored. Some power sources such as connection to a public lighting network necessarily require the use of additional batteries because the lighting is only powered at night.

5. Type of infrastructure and width

The type of infrastructure (greenway, cycle path, cycle lane, lane shared with motorized traffic, lane shared between bus and bicycle, ...) is an important parameter for the choice of system.

The configurations of the automatic counters may vary depending on whether:

- the system is installed in a dedicated site: only cyclists and pedestrians use the infrastructure. The sensor must separate cyclist traffic from pedestrian.
- the system is installed in a mixed site: the sensor must separate cyclist traffic from other types of traffic (cars, trucks, buses, scooters, motorcycles, etc.)

The width of the infrastructure will also affect the choice and configuration of the counting system. The narrowest cases are generally bicycle lanes, up to the widest case where counting is carried out on several mixed traffic lanes.

Figure 7 Inductive loops on greenways (pedestrians, bicycles), source: Eco-Counter

Figure 8 Inductive loops on shared lanes (bicycles and buses), source: Eco-Counter

6. Type of coating

The type and quality of the coating are important parameters.

Some technologies are particularly sensitive to this:

- Piezoelectric strips that require a very flat surface do not adapt well to natural or non-planar surfaces (ageing pavement).

- Pneumatic tubes that can reach their limit if:

    - the soil is loose (some types of gravel)
    - the surface is very rough / chaotic: asphalt or aging concrete with cracks and bumps

Other technologies are less sensitive, or even not at all sensitive to the quality of the coating:

- The radars
- Inductive loops

7. Water and weather resistance

Counting systems must last over time and maintain all their capabilities even in difficult weather conditions (snow, rain, floods, etc.)

It is essential that the chosen counter has very good resistance capacities in wet or flooded environments. This case is common on greenways along rivers, for example.

If possible, avoid installing the counter in an area that will be flooded regularly.

8. Electromagnetic interferences

Automatic counters are electronic systems (sensors, memory, data transmission modules, etc.) that can be disturbed in the event of intense electromagnetic interference.

It is important to avoid installing a counter under or in the immediate vicinity of a High Voltage power line.

9. Vandalism

Automatic counters are generally installed in public areas, they may be subject to vandalism depending on their appearance and location:

- sensors buried or integrated into the coating are not sensitive to vandalism because they are almost invisible. The electronic system is also usually buried in the immediate vicinity of the sensor in an almost invisible view (batteries, memory, data transmission modules, etc.)

- radar sensors can be damaged if they are visible. It is important to ensure that the system is "melted" into the landscape to make it as discreet as possible.

- the pneumatic tubes and the associated electronic system are visible on the road and may be subject to vandalism. It is advisable to lock the system to a fixed element (street furniture, pole, etc.). The rubber tubes themselves can be damaged, causing the counting to stop, but no damage to the counter itself.

10. Position the counter correctly on the infrastructure: avoid trap locations

The purpose of the counter is to measure the passage of cyclists (or pedestrians, ...). It is important to position the computer at a place where cyclists are in a straight line, at an established speed and where their trajectory necessarily passes over the computer.

Here are some pitfalls to avoid:

- avoid an area where cyclists stop or slow down (traffic lights, stop, picnic area, bicycle parking)
- avoid a steeply sloping area where cyclists can be very slow, or even stop to walk
- avoid an area in a curve where cyclists may cross the counter sensor at an angle

11. Data transmission

To store and analyze counting data, it is necessary to have a database and software tools.

Between the on-field measurement and the arrival of the data on a storage server (cloud), it is necessary to transmit the data.

Several options may exist:

- **regular data transmission via the cellular network (GSM):** if the chosen sensor offers this technique, it must be checked that the network coverage is sufficient at the location where the counter is installed. For example, by looking at the "network bars" displayed on a mobile phone. If the automatic counter is to be installed in an isolated location (countryside, mountain...), this can be an important parameter

- **transmission via Ethernet or wifi connection:** if the automatic counter can be directly connected to the network via an Ethernet connection (it is necessary to pull a cable and connect the system) this solution allows data transfer. Unfortunately, it is rarely possible outside special cases in the city and requires network expertise within the organization managing automatic counters.

- **manual reading transmission:** if the automatic counter is placed in a very isolated location, the two previous cases are sometimes simply impossible. In this case, it may be necessary to take data readings by going on site to the counter and retrieving the data from a smartphone or tablet for later transfer to the cloud as soon as a connection is available. It is important in this case to ensure that the automatic counter has sufficient memory to store data between two on-field readings.

It is important to define the best option for data transmission. The GSM or Ethernet modes also have the advantage of being able to monitor the health of the automatic counter in real time in order to act quickly in the event of an anomaly on the system (vandalism, failure, empty battery, abnormal data, etc.)

To remember

- Make sure that your automatic counter is suitable for **permanent counts** (24 hours a day, 7 days a week, all year round)
- Check which **power supply** mode is possible (direct connection or batteries)
- Check that the automatic counter is adapted to the **traffic** and the **size of the infrastructure** (counting in dedicated or mixed traffic road)
- Check that the counter is suitable for the **type of pavement** (asphalt, concrete, soft ground, paving stones, gravel, etc.)
- Make sure that the **waterproofing** is guaranteed and avoid areas that are regularly **flooded**.
- Check that no **underground High Voltage power lines** pass in the immediate vicinity of the counter installation site
- Check the **network coverage** and plan in advance the **transmission mode** of your data (GSM, Ethernet, manual reading directly on the counter, ...)
- Keep in mind that automatic transmission modes (GSM, Ethernet, ...) allow you to monitor the health of the counter remotely
- Arrange for as discreet an installation as possible to **prevent vandalism**
- Avoid **curves** and **steep slopes**
- Avoid areas where cyclists are forced to **slow down** or **stop** (traffic lights, stops, parking, picnic area)