How to record a video SWISSTRAFFIC.ai DRONE?

The key aspects are optimal drone position, resolution, framerate, bitrate and scene acuity.

If you have a nice, sharp and stable footage of your favourite roundabout, you can probably just **upload it straight away to the SWISSTRAFFIC.ai DRONE service**. A simple rule of thumb: if you feel comfortable telling a bus from a truck on the footage, then our AI will probably feel the same way… and reward you with accurate results.

When thinking about the **design** of your **traffic survey**, here are a few points to observe:

- **Legislation and safety**. First things first – it is always a good idea to fly your drone responsibly.
- **Acquisition geometry** – position and elevation of the drone, lens used
- **Scene acuity and exposure** – make sure the footage is as crisp as possible
- **Resolution, framerate and bitrate** of the video footage

Legislation & safety

Before the recording itself, always check the legal constraints for the planned mission. Legislation differs from country to country and sometimes it is required to use services of a professional pilot with the necessary permissions. There is a predefined maximum flight altitude for drones in many countries (usually 120 meters), as well as a minimum safety distance (usually 50–120 meters away from objects). If the recording is carried out by a professional pilot, it is possible to gain permission for different conditions. Always take the possible risks of technical failure into consideration.

- Make sure you observe the maximum allowed altitude of flight in your country and don't breach any safety zones around the part of the infrastructure you are going to study.
- It is a good practise to check active airspaces around your study area before setting off from your office.
- You might need to coordinate with Air Traffic Control or other responsible bodies.

If you do not want to carry out the recording yourself, do not hesitate to **contact us.** We have a network of experienced and certified pilots within the SWISSTRAFFIC.ai PILOT program. We will provide you with consultations of your project and its requirements to find the most suitable solution. We can also carry out the recording for you.

Angle of recording / drone position

In terms of accuracy of vehicle localization, the ideal camera position is directly above the analysed intersection — so-called nadir or TOP-DOWN view. At this position, the camera is the most sensitive to position changes of objects in the scene. At the same time, dynamic occlusions between individual objects are minimized. Unfortunately, drone flight above a traffic node is not always possible due to safety regulations and applicable legislation. In a situation like this, a simple rule applies — go as close and as high as possible.

The procedure is as follows:

1. Fly with the drone to the **nearest possible** place to the middle of the intersection.
2. Ascend to the **maximum possible elevation** while making sure pixel resolution of monitored objects is more than 20x20 pixels. You can use longer focal length lens (zoom in) – this way you reduce optical distortions of the lens and more importantly the perspective distortion.
3. Check the **incidence angle** – the lower the better:

   - 0 degrees means that the drone is directly above the intersection. This is the **most desired nadir** or top-down view.
   - 45 degrees means that the drone altitude is the same as its distance from the centre of the intersection. This is still a suitable configuration.
   - >55 degrees – expect a notable drop of the vehicle localization accuracy (please note that this does NOT hold for DETECTION or for CLASSIFICATION)
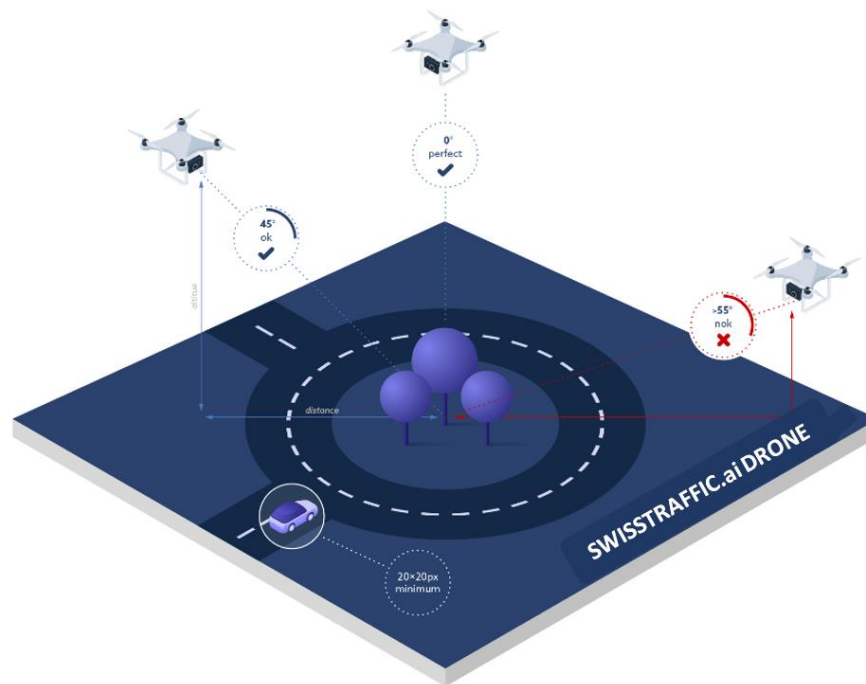
Figure: Three situations: 0° = ideal position, 45° = ok, altitude is the same as distance from the centre of the intersection, 55° = drone should be higher.

Further recommendations:

Position the drone so that dynamic and static occlusions are avoided. Occlusions increase the probability of failure of object tracking and of disengagement of continuous trajectories - in other words, one object would have a higher number of shorter trajectories. The SWISSTRAFFIC.ai system is robust against short occlusions, but long occlusions can cause the disengagement of continuous trajectories into more parts.
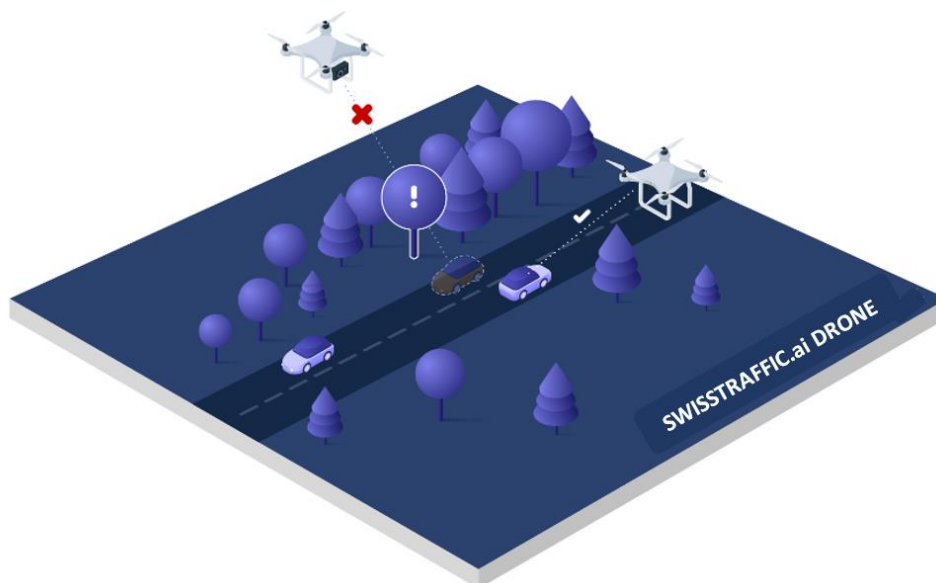

Figure: Two situations — long occlusions are problematic, but system is robust against short occlusions.

Try to **keep the drone stable during recording.** Do not change the drone position or camera attitude and zoom when recording. All **parameters should be fixed** before the start of recording. Ideally, use a gimballed camera. If you have the option, select lens with lower distortion. A rule of thumb here is that the higher the focal length, the lower the distortion. In other words, try to **avoid fish-eye lenses** where possible. At least if you are looking for precise speed and acceleration data.
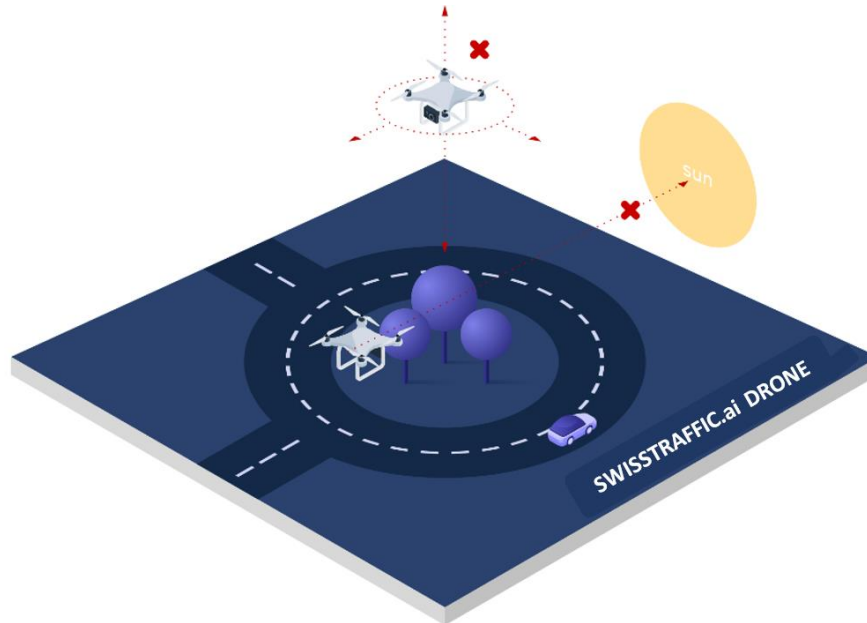

Figure: Two situations — try to avoid changing the drone's position when recording, and also avoid recording against a strong source of light.

Scene acuity and exposure

Try to **capture a clear scene with good contrast and brightness.** Try to avoid parasitic optical phenomena in camera take. These may be caused by sun or another strong source of light. Always orient the camera to keep strong light sources away from the frame. Takes of scenes with the sky should be avoided.

Figure: Three situations — nok: too bright (left), ok: ideal (center), nok: dark, blurred due to long exposure time (right).

Focusing and exposure control should ensure the vehicles / objects are **not blurred** in a take. Objects should be contrasting but not overexposed nor too dark. This should be considered even at the expense of other parts of the shot. In case of night recordings or recordings at low light conditions, it is important to ensure that traffic elements are visibly identifiable besides vehicles.

Camera footage should be stable and free of vibrations or image deformation (so called "jello"). These artefacts produced by a combination of drone vibrations and rolling shutter of many cameras decrease the accuracy of our results by a significant margin. Try to use gimballed cameras, damping elements and other means to avoid these parasitic artefacts.

Important - do not add your logos or timestamps into your video, as this could negatively impact subsequent video stabilization.

Resolution, FPS and bitrate

Resolution is a key attribute for detection and classification of objects. The minimum size of an object within the image (for its detection) is **15x15 pixels**, while for its correct classification, a resolution of 30x30 pixels is needed. A recommended size for objects within the image is **between 30x30 pixels and up to 150x150 pixels** in the whole monitored area within the intersection. Object size depends on the following parameters:

- Image resolution
- Drone's position — altitude / angle
- Mutual position of a monitored object and a drone/camera

A common rule is that if you record the video with maximum resolution used by modern cameras (e.g. 4K or even 8K), it will be sufficient, as it is always possible to reduce the quality, but not the other way around. The following is a simple guide for resolution and the most common wide-angle cameras:

- For distances between the camera and the scene center shorter than 120 meters, FULL HD (1920x1200) resolution will be sufficient, but it is better to use a higher resolution (2k/4k)
- For distances between 120 meters up to 300 meters, use 4K video resolution

Framerate represents the sampling frequency of measurements. For vehicle speed up to 70 km/h, it is possible to use a framerate of 15 FPS. For vehicle speed over 50 km/h, it is better to use sampling frequency around 25 FPS. Sampling frequency over 35fps has no further positive effect on the quality of measurement, but only makes the video and its size unnecessarily large.

The final quality of the video is also greatly influenced by bitrate settings. At FULL HD videos, coded with the H.264 coding format, the bitrate should be at least 10 Mbit/s. At 4K videos, coded with H.264, a minimum of 20 Mbit/s is necessary. The video must not be blurry, pixelated, or with any signs of damage caused by compression algorithms.

Tip for beginners: record your video with 4K resolution, 25 FPS and standard bitrate (approx. 20 Mbit/s)

By following these rules, you will get suitable videos for automatic processing to extract super-accurate data for your traffic study. Before the final recording, we recommend carrying out a test flight or make a few sample recordings in order to get acquainted with the basic principles. If you have any questions, do not hesitate to **contact us.**

Do not have your own video? Try SWISSTRAFFIC.ai for free with one of our examples for DRONE.