SWISS TRAFFIC

we innovate mobility

SWISSTRAFFIC.AI VIEWER

USER GUIDE

For tomorrow's mobility

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INTRODUCTION

This is the **SWISSTRAFFIC.ai Viewer User Guide** which is part of SWISSTRAFFIC.ai Software Suite.

SWISSTRAFFIC.ai Viewer is unique software for further analysis, advanced interpretation and visualization of traffic data, capable of measuring macroscopic flow characteristics at any point or region required by analyzing all trajectories in that place. Discover anything you want from your trajectory data.

This user guide is for **DRONE** and **SCOUT** mode of this program.

DRONE mode is designed for video recording from a higher height, e.g. a drone above a roundabout at 150 meters. This means that the objects are smaller, and the viewing angle is larger. It is supposed to use georegistered data, i.e. the connection of the scene with the map. In this mode of viewer there are real units used (meters, feet, ...).

How to record the video for **SWISSTRAFFIC.AI DRONE**

SCOUT mode of viewer is designed for scenes shot from a smaller height, such as traffic cameras. Objects are much larger, it is not georegistered data i.e. individual trajectory positions are only in the image (expressed in pixels).

How to record the video for **SWISSTRAFFIC.AI SCOUT**

The application is currently in rapid development phase. We are working hard to improve the functionality and usability of the application to satisfy the needs of its users. If you encounter any application crash or unexpected behaviour, please, do not hesitate to contact us on info@SWISSTRAFFIC.ai

If you want to try **SWISSTRAFFIC.ai Viewer**, you can download it at this link.

Under this link you will be able to download any updates, which we always inform about on our website www.SWISSTRAFFIC.ai/news

If you have any questions or want help with something specific, please use our Help Desk & FAQ.

OVERVIEW

SWISSTRAFFIC.ai Viewer provides means to view, create, browse, inspect and edit vehicle tracking data in video sequences. The main functionality of the application is following:

- Inspect an existing Tracking Log files along with analyzed video sequences
- Export vehicle tracking data to CSV or Excel data files suitable for further analysis
- Add Overlay with velocity or acceleration visualization
- Export Visualization Video or Visualization Snapshot
- Visualization of annotated or detected vehicle Trajectories
- Create an Origin-Destination statistics and Flow Graphs

Available only in **SCOUT** mode:

- Display colours of vehicles in the flag

Available only in **DRONE** mode:

- Georegistered data
- Make Gap time and Time to Follow analysis
- Safety analysis (Time To Collision, Post Encroachment Time, Heavy Breaking)
- Export Trajectories to CSV
- Projection Offset Fix
- Calculate Headway Statistics

Attention!

Because in **SCOUT** mode of Viewer there are not georegistered data, actual velocity is expressed in thousands of pixels per hour (kilo-pixels - Kpx/h) and acceleration is in pxs^{-2}.

BASIC CONCEPTS AND TERMINOLOGY

The Viewer is an application that ties together the image data (video), annotation and trajectories of the tracked objects. A tracked vehicle can be understood either as an object having an immediate position at any time, or as a complete trajectory in time-space. Therefore, some information available via the Viewer is time-dependent where the user can set the viewing time, and some of the information is time-independent.

The items that form annotation of the scene are these:

- **Gates** – Virtual lines that register crossing vehicles, can be directional and selective according to object classification, can be designated as Entry, Exit and Other.
- **Lanes** – Areas within which vehicles are expected, can be designated as Entry, Exit and Other.
- **Traffic Region** – Regions used to define a Stationary vehicle and Stationary Time.
- **Action Region** – Regions used to detect the Presence and Speeding of objects.
- **Anonymization Region** – Regions used to anonymize a certain area in the scene view.

Available only in **DRONE** mode:

- **Analysis nodes** – Virtual objects that relate other annotations to each other.

TRACKING LOG

Tracking Log represents a data package containing information about traffic analysis scene and detected or annotated vehicle trajectory data. Tracking Log is stored in Tracking Log files (suffix ".tlg"). Each Tracking Log is closely tied to the video sequence file, as it itself does not contain image data. If you want to view or edit Tracking Log in SWISSTRAFFIC.ai Viewer, you have to provide original video sequence file as well.

USER INTERFACE

The application can be started by running executable file **SWISSTRAFFIC.ai Viewer.exe**. Upon the start of the application, welcome screen is shown. For more information about running the program, see the Welcome Screen - Running the Program section of the guide.

HELP MENU

The application offers classic Windows User Interface operable with mouse and keyboard. **User Guide** for the application can be invoked by selecting the **Help** item located at the top bar of the program or by pressing **F1**. In the **Help** menu you can also find information **About SWISSTRAFFIC.ai Viewer**. Here are the data about application version or build number. In this menu you will also find information about **User License**.

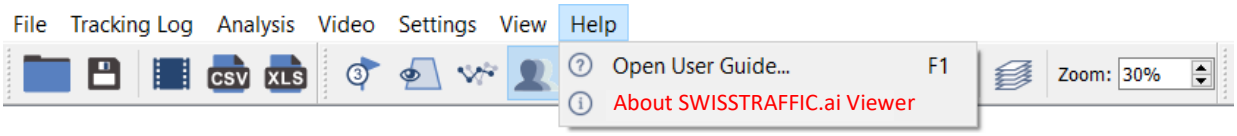


Figure 1: Help section

WELCOME SCREEN - RUNNING THE PROGRAM

First you need to download the program from the following link:

https://www.swisstraffic.com/en/assets/downloads/swisstraffic_ai/viewer/Viewer.exe

After downloading the program, run the installation file **SWISSTRAFFIC.ai Viewer**. Here you can choose where you want to install the program.

Figure 2: SWISSTRAFFIC.ai installation

After installation open the **SWISSTRAFFIC.AI Viewer** folder and click **SWISSTRAFFIC.ai Viewer** to start the program.

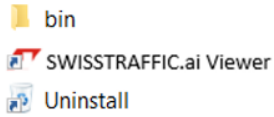


Figure 3: SWISSTRAFFIC.ai Viewer

The **SWISSTRAFFIC.ai Viewer** Welcome Screen appears.

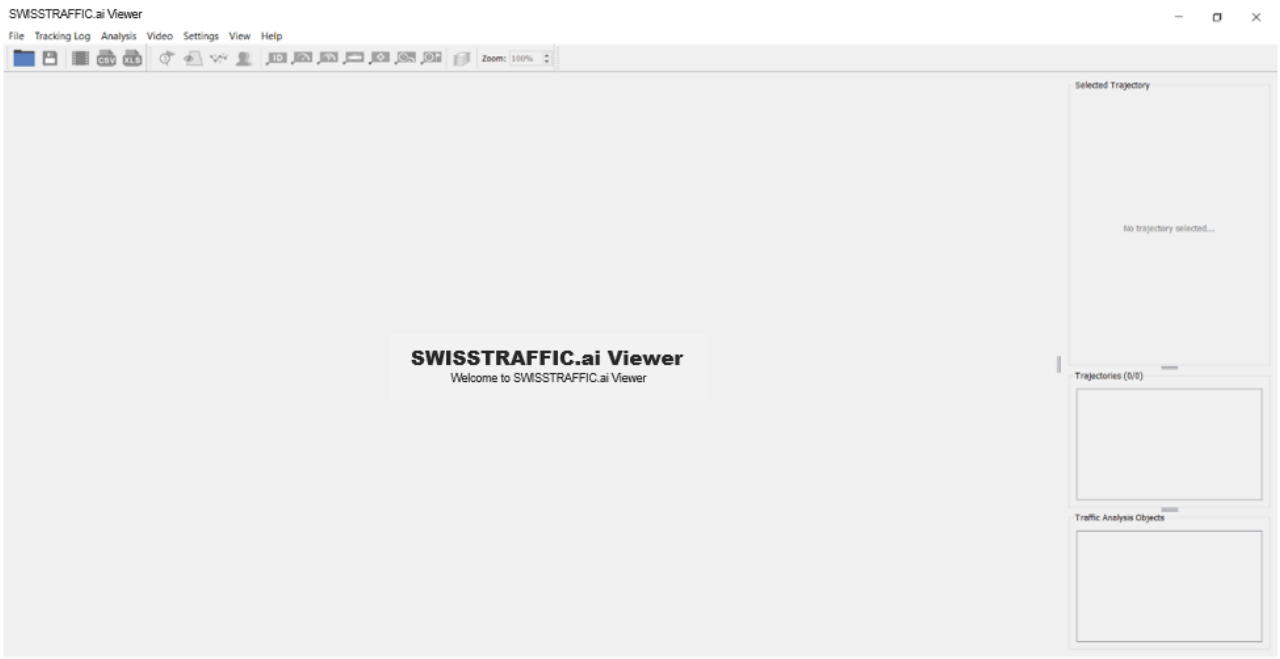


Figure 4: SWISSTRAFFIC.ai Viewer Welcome Screen

SCENE VIEW

Once the application holds a valid tracking log, the main area is switched to Scene View which is depicted in following image.

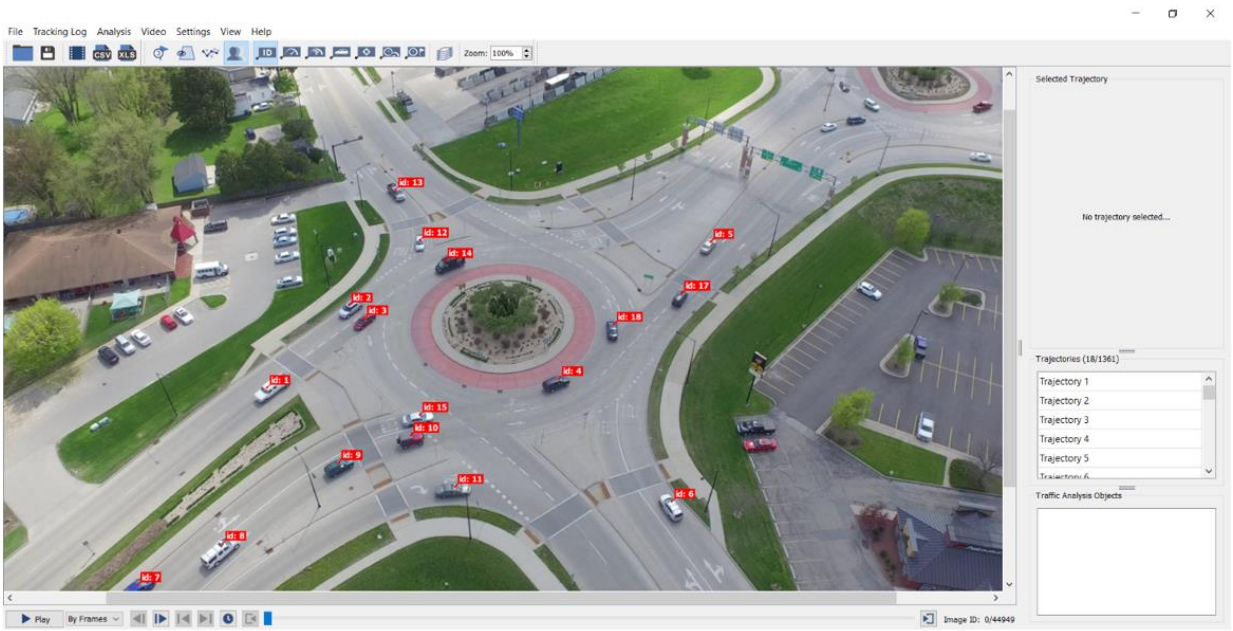


Figure 5: Scene view

The main part of Scene View is a video sequence with attached Annotations. At the top of the screen is Main toolbar. On the **Top bar** you can see the current mode of viewer. A player-like slider for video playback is available at the bottom of main window. List of all the Trajectories contained in the video sequence, is placed in the right side of the Viewer.

You can use the Mouse wheel to **zoom in or out** of the main image or you can set the desired zoom on the Main bar. To **move the image,** click and drag the mouse wheel.

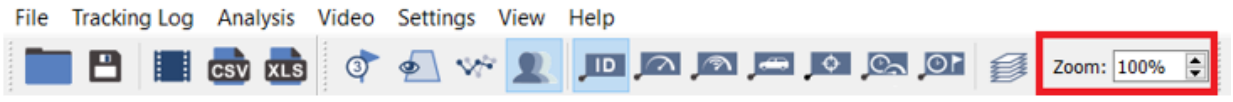


Figure 6: Zoom Setting

TRAJECTORIES

The **Trajectory line** represents the path of the tracked object, it is double coloured, green colour represents already travelled part of trajectory and blue colour represents the part of trajectory that is to be travelled.

Figure 7: Trajectory line

List of all the Trajectories contained in the video sequence, is placed in the right side of the Viewer, in the box called **Trajectories.**

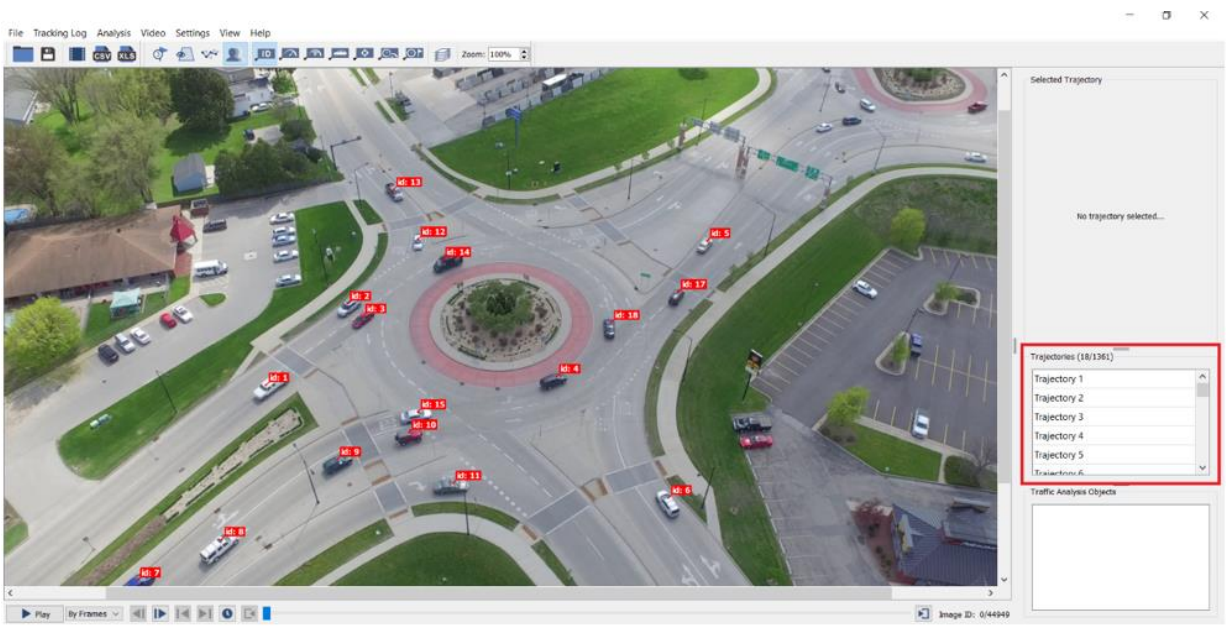


Figure 8: Trajectories

Scene View and right column are synchronized. Clicking on a tracked vehicle's Track Flags or selecting Trajectory in **Trajectories** list will highlight the marked Track and displays the following information in the **Selected Trajectory** list:

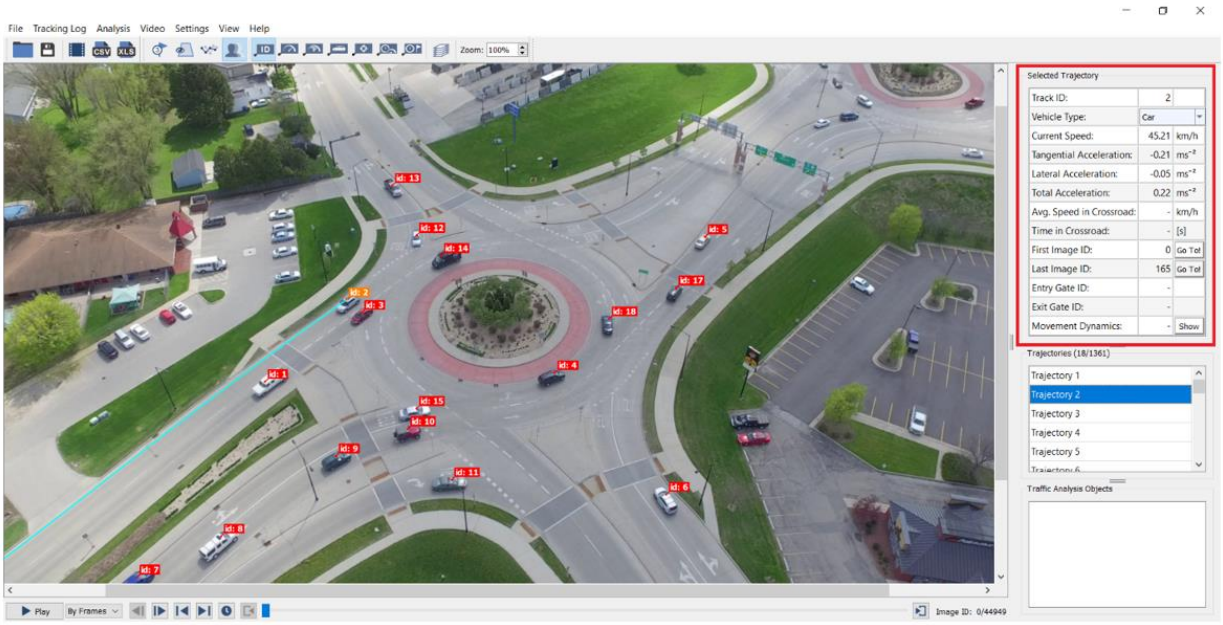


Figure 9: Selected Trajectory

Track ID – Unique identification number of each object.

Vehicle Type – Object classification, there are 7 object categories: Car, Medium Vehicle, Heavy Vehicle, Bus, Motorcycle, Bicycle, Pedestrian and Undefined.

Vehicle Colour – Only in **SCOUT** mode. Shows the estimated color of the vehicle (not for pedestrians).

Current Speed – Absolute size of object velocity vector. In **DRONE** mode of viewer is expressed in Kilometres per hour or miles per hour. In **SCOUT** expressed in kilo-pixels - Kpx/h.

Tangential Acceleration – Only in **DRONE** mode. Current Tangential Acceleration of the vehicle expressed in metres per squared second (ms^{-2}). Positive value means acceleration and negative value means deceleration.

Lateral Acceleration – Only in **DRONE** mode. Current lateral (normal) acceleration of the vehicle expressed in metres per squared second(ms^{-2}). Positive value means acceleration to the right and negative value means acceleration to the left.

Selected Trajectory

Track ID:	6	
Vehicle Type:	Car	
Current Speed:	24.95	km/h
Tangential Acceleration:	0.18	ms^{-2}
Lateral Acceleration:	0.37	ms^{-2}
Total Acceleration:	0.42	ms^{-2}
Avg. Speed in Crossroad:	26.13	km/h
Time in Crossroad:	1.43	[s]
First Image ID:	0	Go To!
Last Image ID:	785	Go To!
Entry Gate ID:	8	
Exit Gate ID:	9	
Movement Dynamics:	-	Show

Figure 10: Selected Trajectory list

Total Acceleration – Absolute size of immediate acceleration vector.

Average Speed in Crossroad – Average vehicle speed in crossroad area (between Entry and Exit Traffic Analysis Gates).

Time in crossroad – The time the object spent at the crossroad (between Entry and Exit Traffic Analysis Gates), expressed in seconds.

First image ID – Index of the image from beginning of the video sequence where the Track starts in. The **Go to!** button allows fast navigation to that moment.

Last image ID – Index of the last image where the displayed track ends. The **Go to!** button allows fast navigation to that moment.

Entry gate ID – Unique identification number of the Entry Traffic Analysis Gates the vehicle crossed when entering crossroad area.

Exit gate ID – Unique identification number of the Exit Traffic Analysis Gates the vehicle crossed when exiting crossroad area.

Movement dynamics – Displays a graph of speed and acceleration for each trajectory. Clicking the **Show** button will show you the **Speed and Accelerations graph**.

Speed and Accelerations graph

This graph shows the course of speed and acceleration of the tracked object.

At the bottom of the graph, you can choose whether you want the graph to show relative to the **Video time** or the **Travelled distance** of the object. On the left axis is the **Vehicle Speed** scale, the green line. The right axis is the **Accelerations** scale, the blue line for **Total acceleration**, orange for **Lateral acceleration** and purple for **Tangential acceleration**. Red and Green line in graph represents the moment when the vehicle crossed the Entry or Exit Traffic Analysis Gates.

Select Trajectory – By clicking the **Select Trajectory** button you can highlight the trajectory in the scene view.

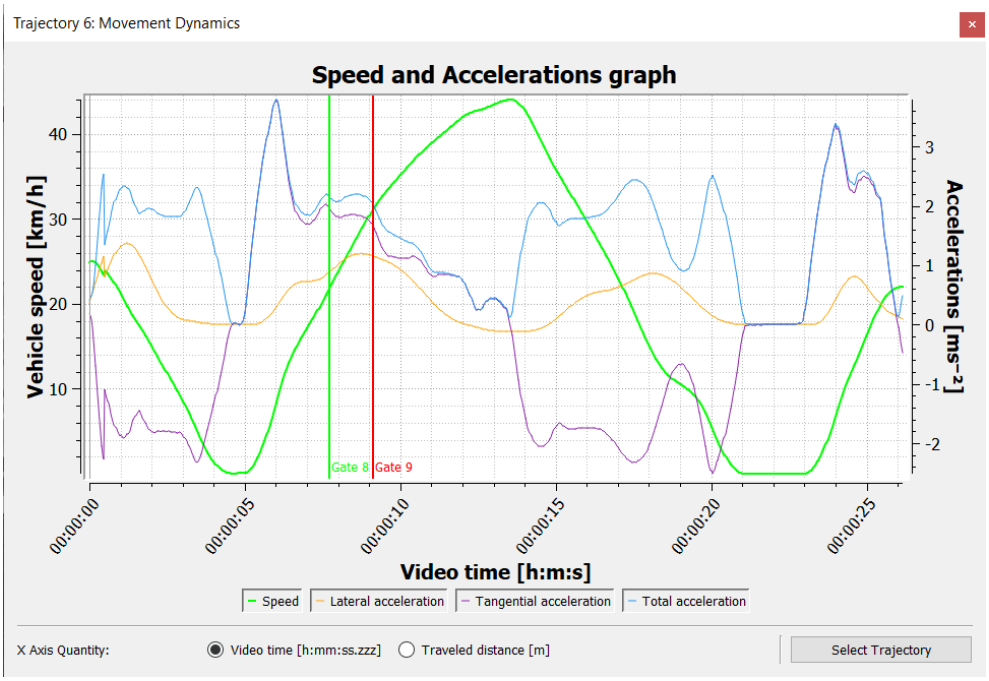


Figure 11: Speed and Acceleration graph

By double-clicking on the graph field, you can jump to a moment of the video sequence in the Scene View

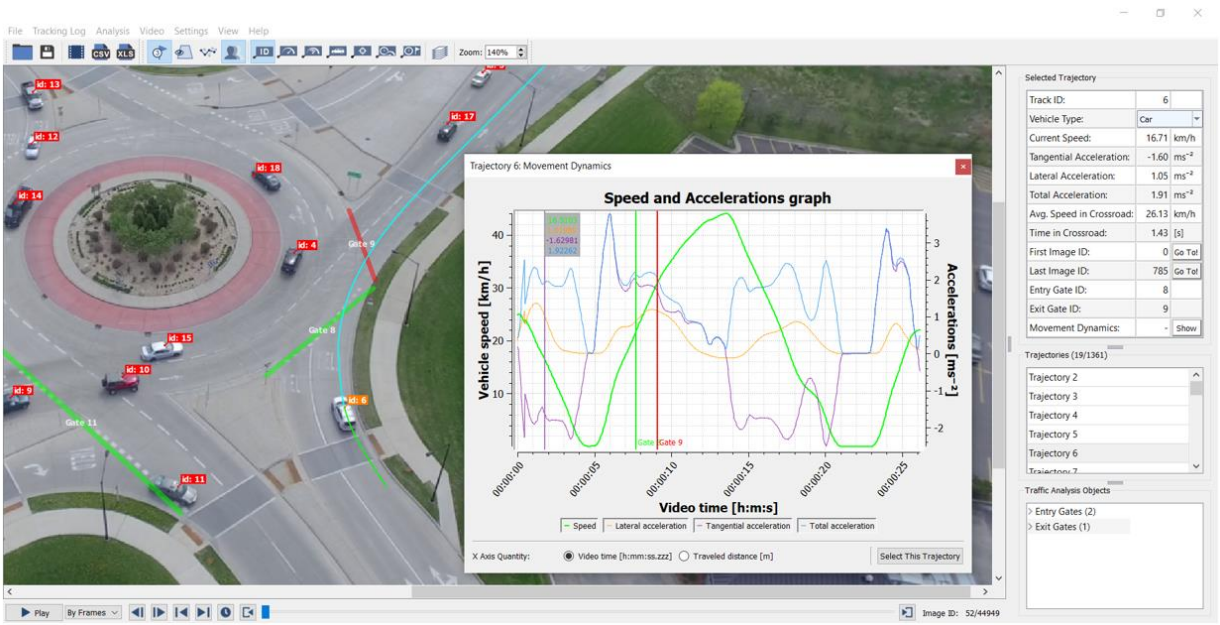


Figure 12: Speed and Acceleration graph

TRAFFIC ANALYSIS GATES

Gates are virtual lines that register crossing vehicles, can be directional and selective according to object classification. They are divided by their designated role for analysis into **Entry**, **Exit** and **Neutral**. They are used to generate a Origin-Destination , Export Gap-Time/Time-to-Follow Data and to Export Gate Crossing Events to CSV File. Learn more about Manage Annotation Configurations - Editing Annotation, Show Traffic Gates and inserting Gates.

As before with Trajectories, clicking a Gate in the scene brings it up in the **Traffic Analysis Gates** list.

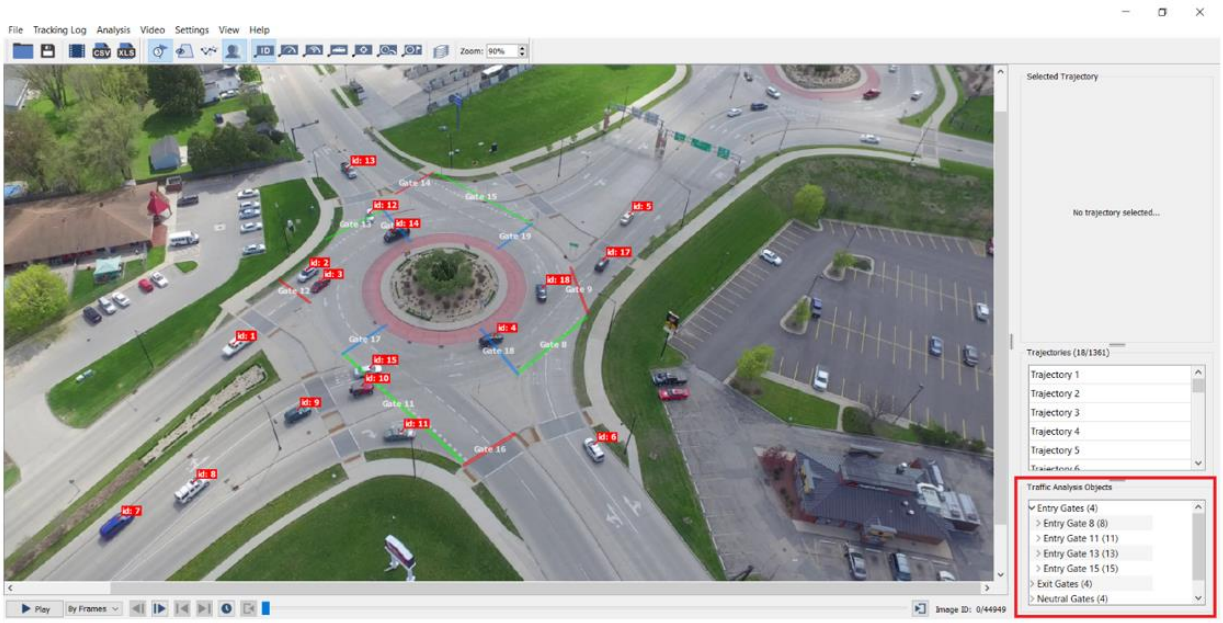


Figure 13: Traffic Analysis Gates list

If you click on the Gate you will see a table of all related information.

- **Gate Unique ID** – Each Gate has its own unique ID.
- **Gate Tag** – Lists the name of each Gate.
- **Passed Vehicles (Count)** – The number of vehicles that have passed through the Gate during the whole video sequence.
- **Vehicle Flow (per 15min)** – Recalculated flow of vehicles for 15 minutes.
- **Avg. Speed [Km/h]** – The average speed of the vehicle passing through the Gate. (In **SCOUT** mode expressed in thousand pixels per hour – Kpx/h)
- Detailed Info

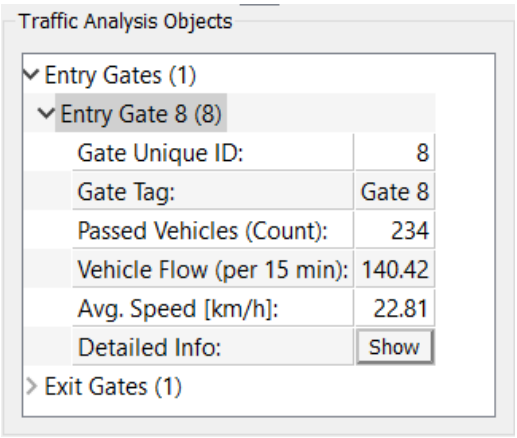


Figure 14: Traffic Analysis Gates

Detailed Info

If you click on **Show Detailed Info** you will see a table containing information about all the objects that passed through the Gate. In the **Types** field, you can check which types of objects you want to display. If you double-click a track row in the table, a track appears in the scene view. You can **Export** this table in **.csv** format for later analysis.

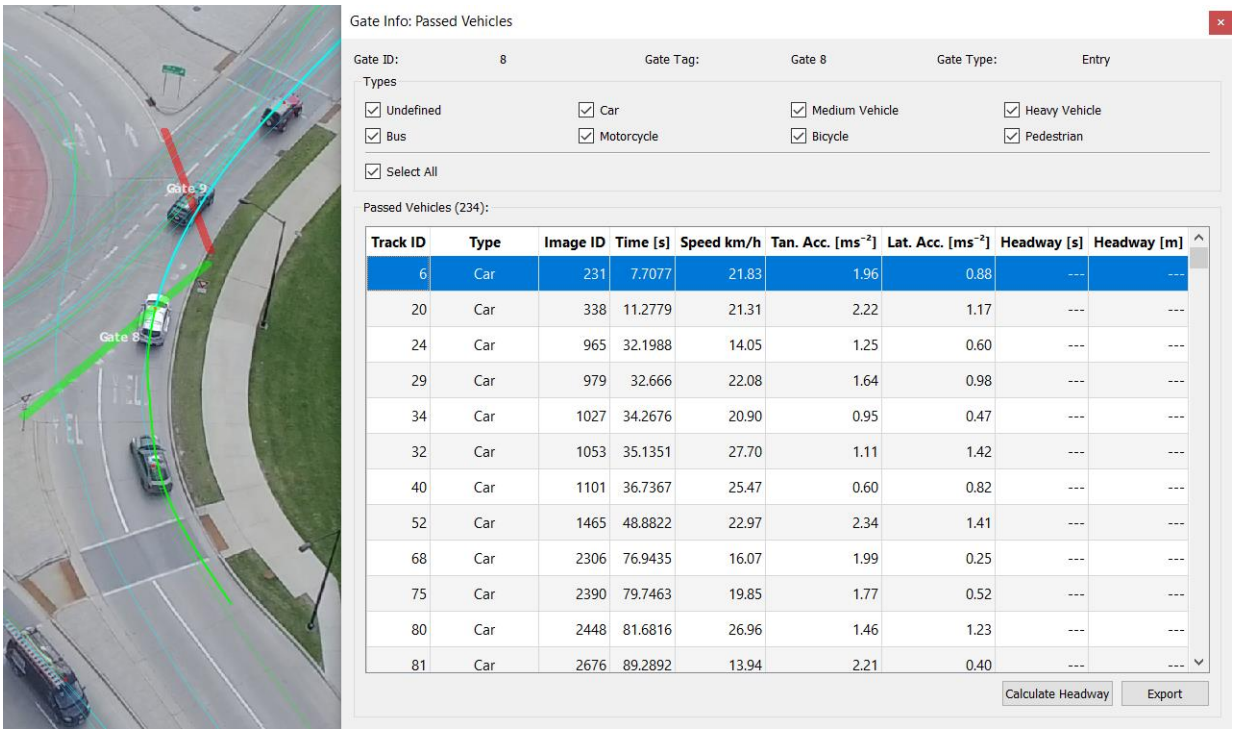
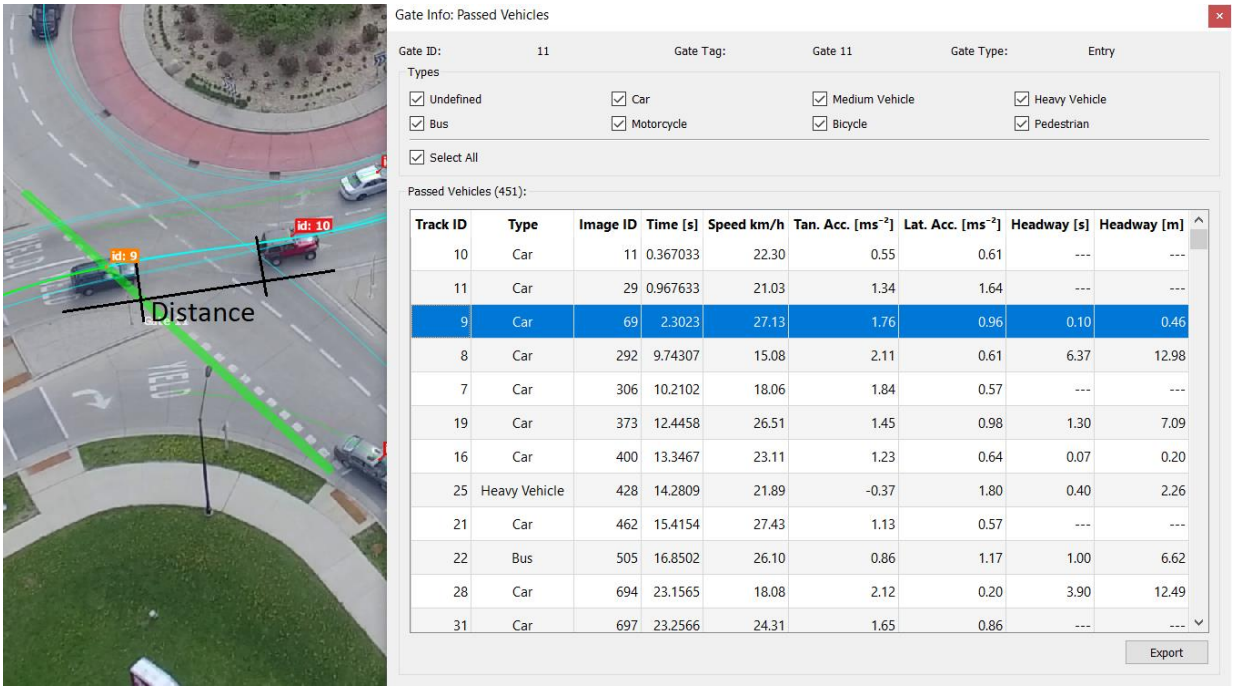


Figure 15: Gate Info

Calculate Headway – Only in **DRONE** mode.

Headway is a key input in calculating the overall route capacity of any transit system. It is the distance from the tip of the vehicle that passed through the given point (Gate) to the tail of the vehicle that passed before it.

- **Headway [s]** – The amount of **Time** between tip of one vehicle to tail of the next one passing through a given point (Gate) in transportation systems.
- **Headway [m]** – The **Distance** from the tail of one vehicle to the tip of the next one behind it.



Track ID	Type	Image ID	Time [s]	Speed km/h	Tan. Acc. [ms^{-2}]	Lat. Acc. [ms^{-2}]	Headway [s]	Headway [m]
10	Car	11	0.367033	22.30	0.55	0.61	---	---
11	Car	29	0.967633	21.03	1.34	1.64	---	---
9	Car	69	2.3023	27.13	1.76	0.96	0.10	0.46
8	Car	292	9.74307	15.08	2.11	0.61	6.37	12.98
7	Car	306	10.2102	18.06	1.84	0.57	---	---
19	Car	373	12.4458	26.51	1.45	0.98	1.30	7.09
16	Car	400	13.3467	23.11	1.23	0.64	0.07	0.20
25	Heavy Vehicle	428	14.2809	21.89	-0.37	1.80	0.40	2.26
21	Car	462	15.4154	27.43	1.13	0.57	---	---
22	Bus	505	16.8502	26.10	0.86	1.17	1.00	6.62
28	Car	694	23.1565	18.08	2.12	0.20	3.90	12.49
31	Car	697	23.2566	24.31	1.65	0.86	---	---

Figure 16: Headway

SHOW POSITION AND ADD LABEL

If you right-click in the scene view area a menu appears, here you can add a **Show position** marker or **Add label**.

Figure 17: Show position, Add label

Show position

If you select a **Show position** option, a blue marker showing the position of that point appears, left-click and drag to move the marker over the image. If you insert multiple markers, lines appear between them to indicate the distance between these points. In **SCOUT** mode of Viewer is the distance in pixels. Right-click on a marker and select **Hide position** to remove the marker. In Units Settings you can change the coordinate system from **UTM** to **WGS 84**, only in **DRONE** mode.

Figure 18: Show position

Add label

If you select a **Add label** option a **Add label** window appears. Here you can type the text you want. Left-click and drag to move the label over the image. If you right-click on a label, a menu appears, here you can **Edit** or **Remove** the label.

Figure 19: Add label window

Target Distance

This setting allows you to display the distance between individual vehicles, right-click on the vehicle or Track Flags to select this option.

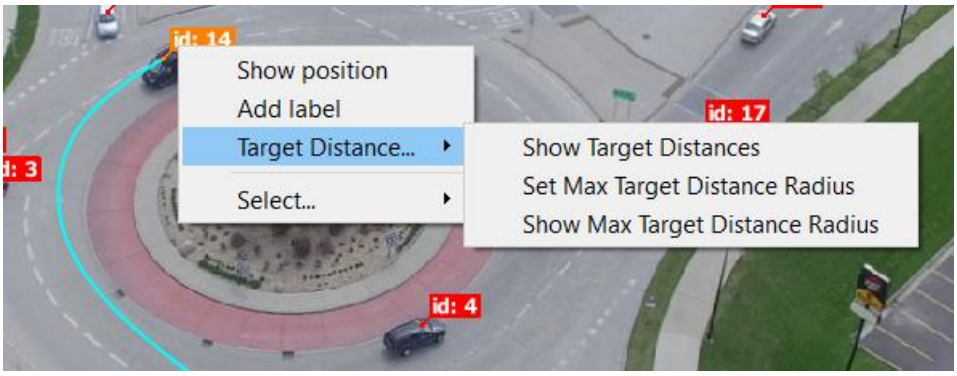


Figure 20: Target Distance

Show Target Distances – If you right-click on a vehicle and select this option you will see the distance of other objects from that vehicle.

Set Max Target Distance Radius – Sets the size of the circle at which distances from other objects will be displayed.

Show Max Target Distance Radius – Shows circle in which the distances from other objects are displayed. If you want to hide this circle, right click on the vehicle and select **Hide Max Target Distance Radius**.

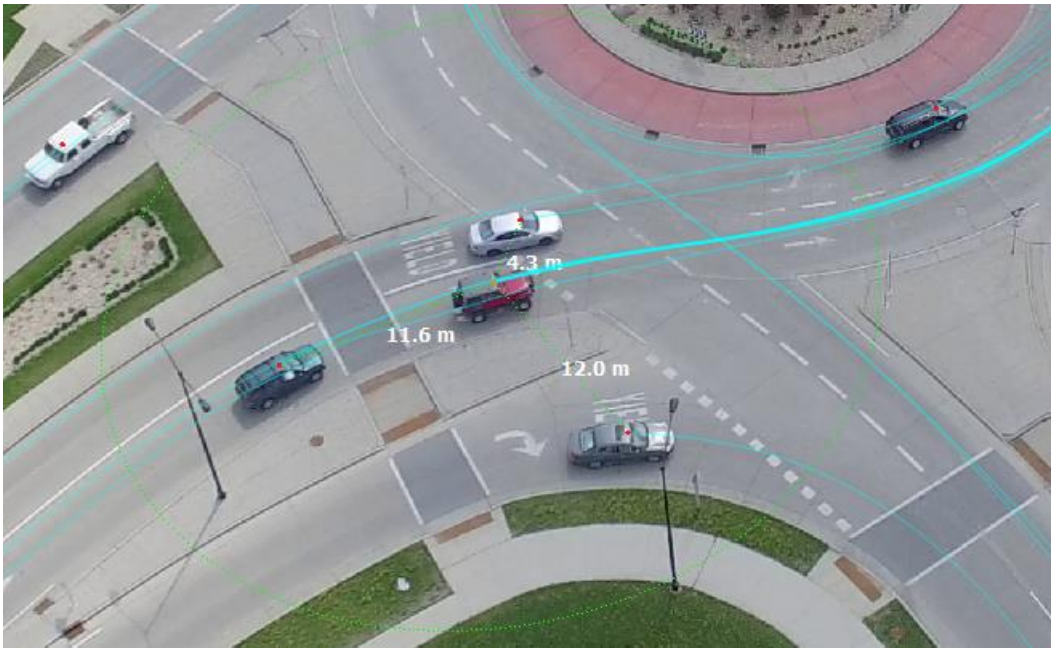


Figure 21: Show Target Distances and Show Max Target Distance Radius

FILE MENU

The File menu is used to control the basic functions of the program:

- Open Tracking log
- Import Input Video
- Save Tracking log
- Export Tracking Log
- Export Traffic Survey Video
- Export Traffic Survey Snapshot
- Export Trajectories to CSV File
- Change Application License

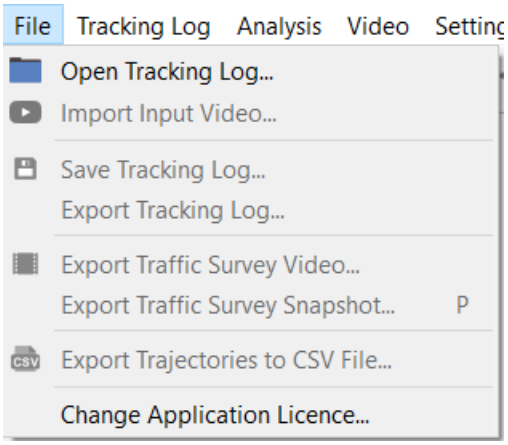


Figure 22: File Menu

Open Tracking log

To open the tracking log, you can directly open the .tlgx file in your computer or you can drag and drop the .tlgx file into an already running viewer. You can also use the **Open Tracking Log** button directly on the Main Toolbar.

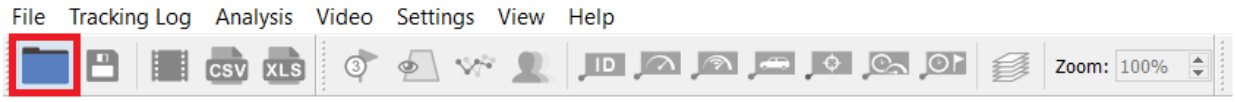


Figure 23: Open Tracking Log button

Or you can use the File Menu and click **Open Tracking Log**.

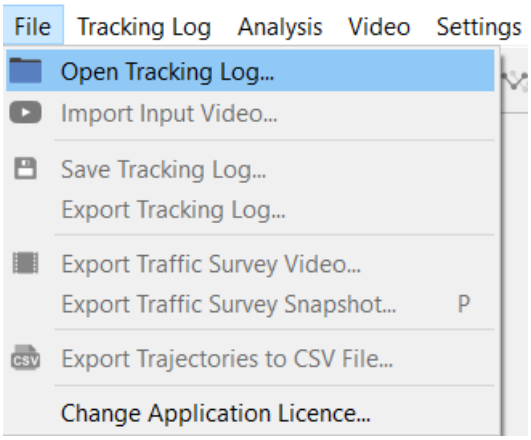


Figure 24: Open tracking log

In both cases, the **Open Tracking Log** window appears, then locate the **.tlgx** file you want to work with and open it. Reading of the tracking log and initializing the display are two steps that can take longer and display a progress bar.

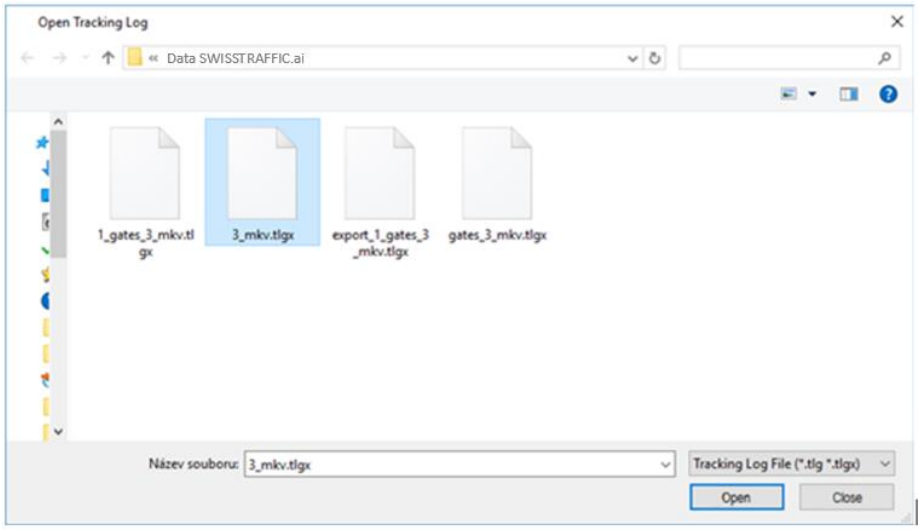


Figure 25: .tlgx file

When you open a valid tracking log, the main area switches to the scene view shown in the following figure.

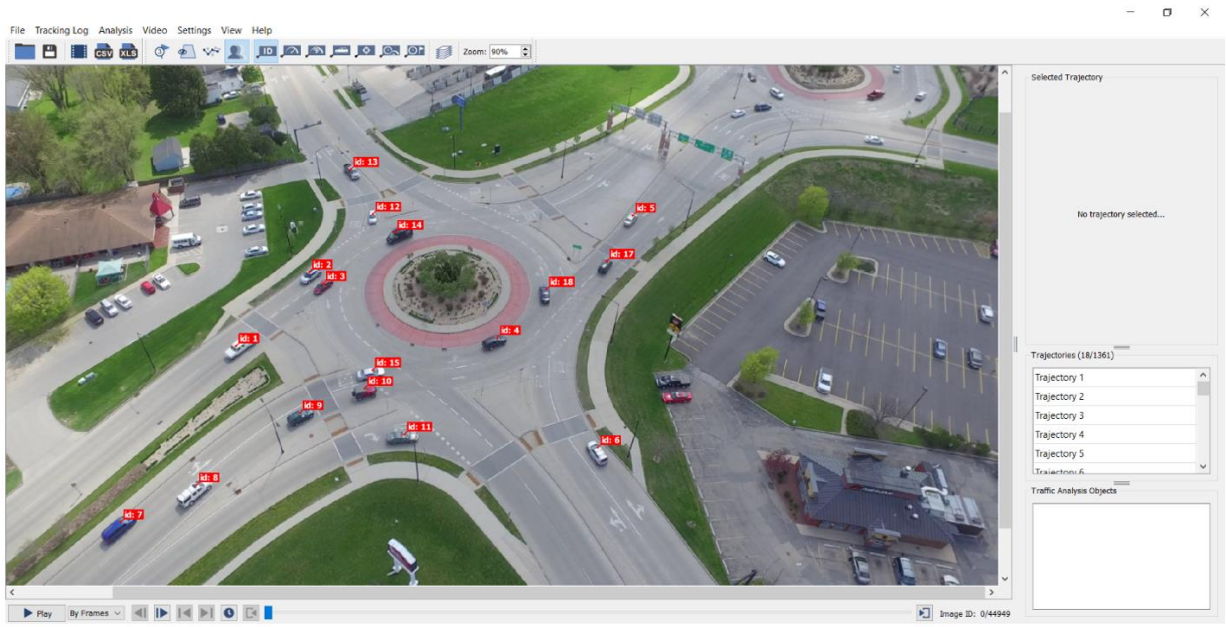


Figure 26: Tracking log

Import Input Video

After selecting **Import Input Video**, a window will open where you can find the desired video file. Importing another video will not affect existing Trajectories.

Save Tracking log

If you want to **Save Tracking Log** you can save it by clicking the **Save Tracking Log** button.

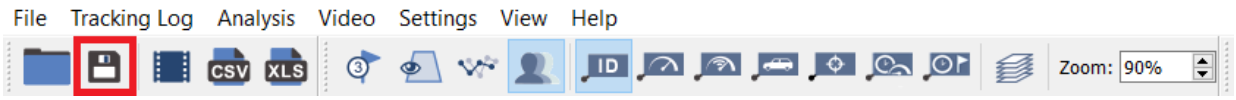


Figure 27: Save Tracking Log button

Or you can use the File Menu and click **Save Tracking Log…**

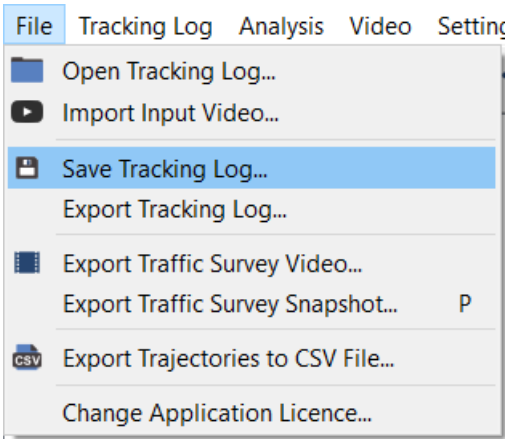


Figure 28: Save Tracking Log...

In both cases, the **Save tracking log** window appears, here you can select the file name and where you want to save it.

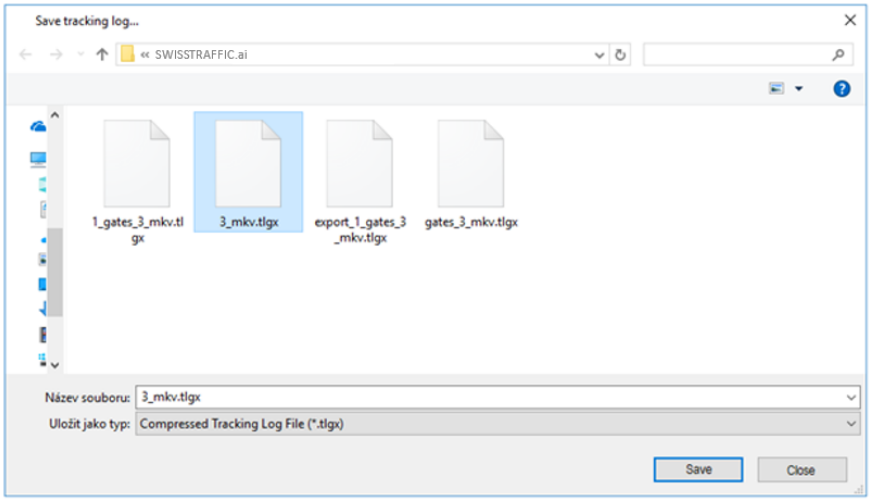


Figure 29: Save Tracking Log

Change Application License

Last field of File Menu is **Change Application Licence**, here you can **Activate** the application or **Register** for a **free evaluation licence**.

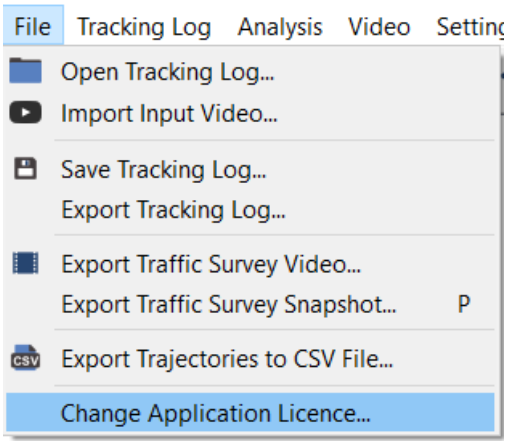


Figure 30: Save Tracking Log

To activate the application, the license has to be invoked. Please, fill in your license ID in the following field. License ID has been sent to you by an e-mail used in registration form or has been provided to you as part of a commercial licence.

If you have not obtained any licence ID, you can do so by registering this copy of the application to obtain free evaluation licence. Just click **Register** button bellow.

If you have lost your licence ID or have any other difficulties, please contact our support on web address: http://SWISSTRAFFIC.ai/contact-us

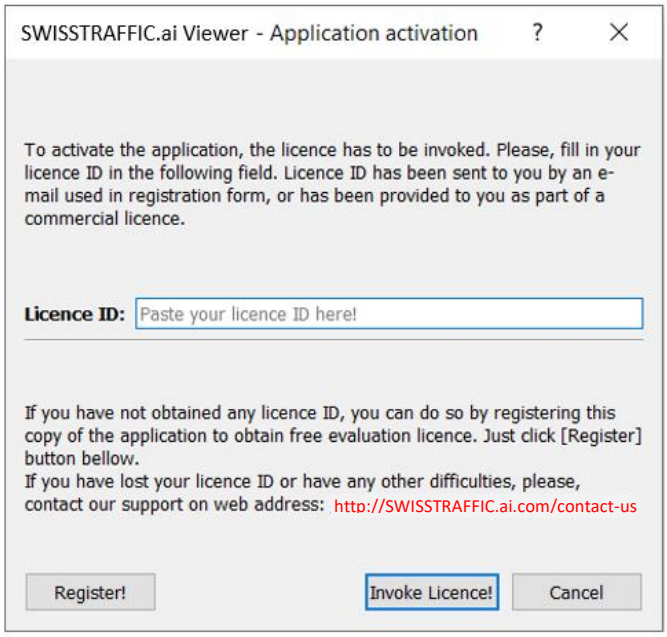


Figure 31: Save Tracking Log

TRACKING LOG MENU

You can find in this menu:

- Tracking Log Settings
- Manage Annotation Configurations - Editing Annotation
- Fix Offset Error
- Tracking log Information
- Tracking Log Statistics

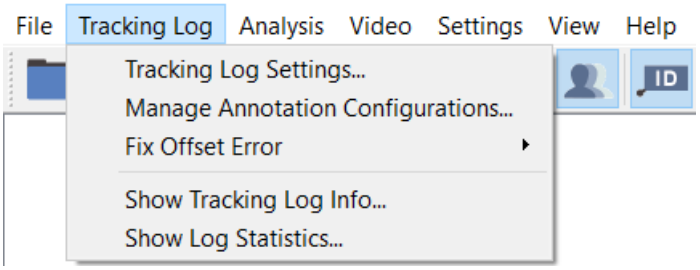


Figure 32: Tracking Log Menu

TRACKING LOG SETTINGS

Only in **DRONE** mode. Here you can set **Coordinate System** for georegistered log. You can change **UTM zone** and **Hemisphere**.

Bounding Box Settings – Sets whether a **Vehicle Position Pivot** (red dot on every object) is at the **Top** or **Bottom** of the Bounding Box.

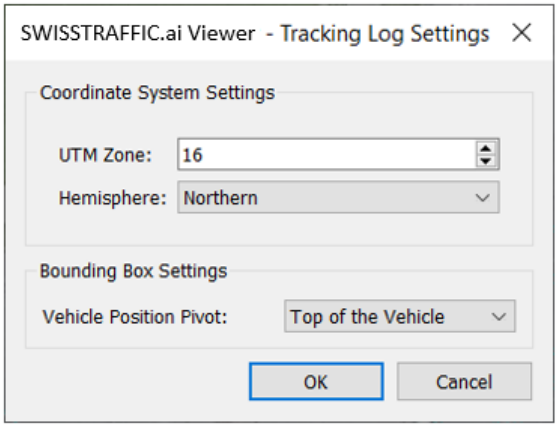


Figure 33: Tracking Log Settings

Select the **Tracking log** menu and click on **Manage Annotation Configurations** if you want to add:

- Gates
- Lanes
- Anonymization Region

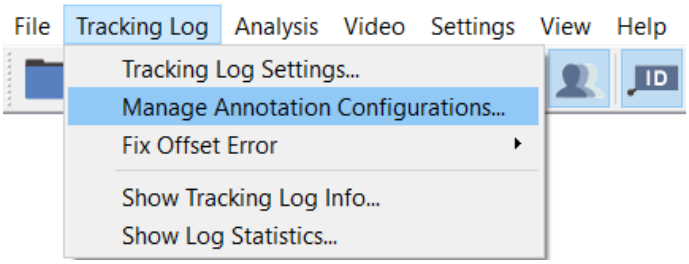


Figure 34: Manage Annotation Configurations

Anonymize everything outside current view

Clicking this option will anonymize everything except current view. Since Annotations are defined in Work Space (see Switch Coordinate Space) when you check the **Anonymize everything outside current view** option, it looks all the same in Workspace, but if you switch to Reference / Raw space, parts of the image that are not in the Workspace are then blurred.

To simplify the procedure:

- Open tracking log.
- Switch view to Workspace.
- Open Manage annotation configuration.
- Set the view you want to anonymize.
- Click **Anonymize everything outside current view**.
- Confirm.
- Then switch to Raw / Reference space and anonymous parts should be visible. The Show Anonymization regions must be checked.

Figure 49: Anonymize everything outside current view button

- Action Region
- Traffic Region
- Measurement Node

You will see the **Annotation Configuration Manager**. Original annotation configuration is pre-set and cannot be edited, so click on the **Clone** button.

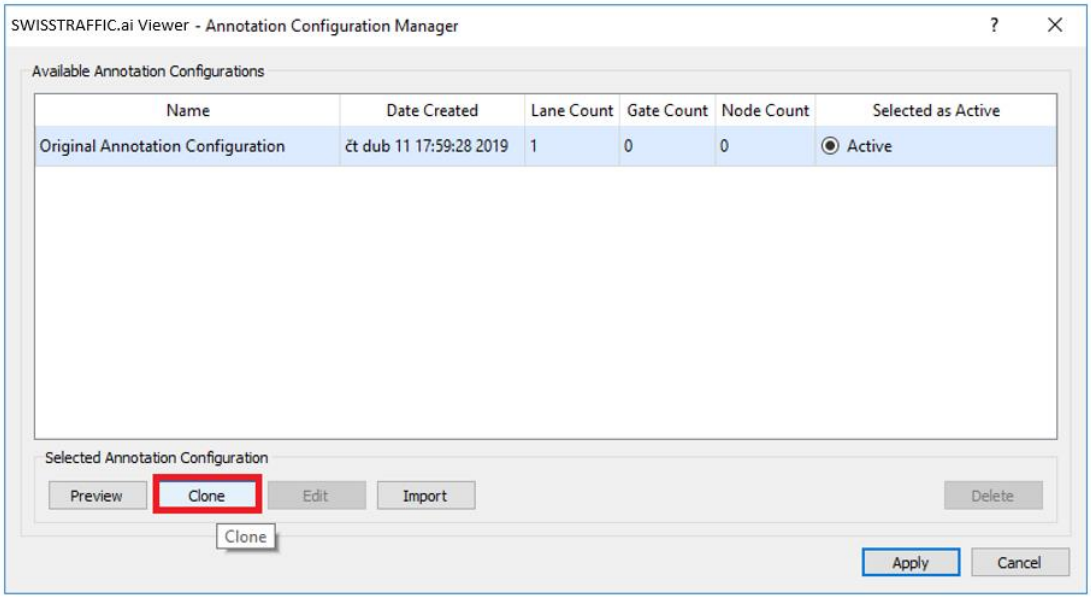


Figure 35: Annotation Configuration Manager, Clone

You have created a clone of the **Original Annotation Configuration** which can be edited, so click on the **Active** field and then click on the **Edit** button.

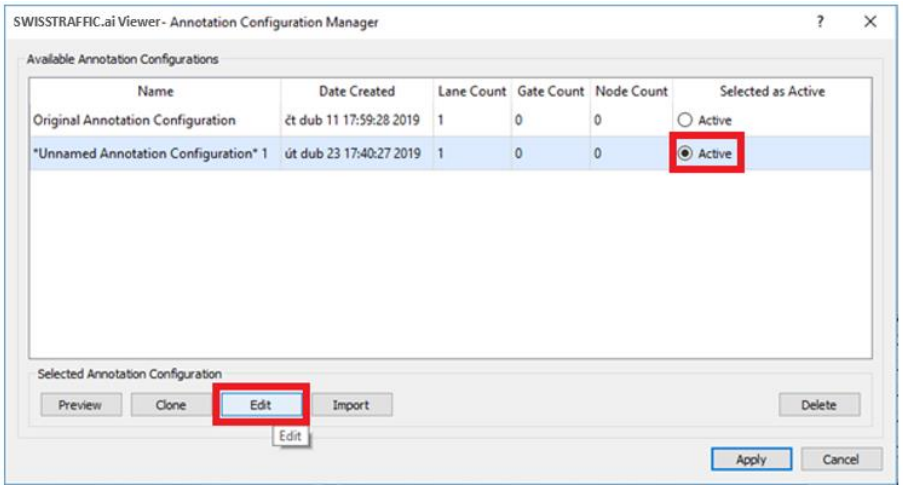


Figure 36: Annotation Configuration Manager, Edit

Then **Annotation Redefinition** opens, this editor allows you to insert and edit **Annotations**. To **zoom** in or out of the main image you can use the **mouse wheel**, click on the mouse wheel and drag to scroll the image. The key concepts are the following:

- The annotations visible in scene itself are Gates, Traffic Regions and Action Regions.
- The selected annotation is highlight in the **Annotation Object List** on the right side of the window, and its properties can be edited directly above.
- It is possible to define virtual **Traffic Measurement Nodes** (available in **DRONE** mode only) which connect various other annotations. These have their own editor on the right bottom side.

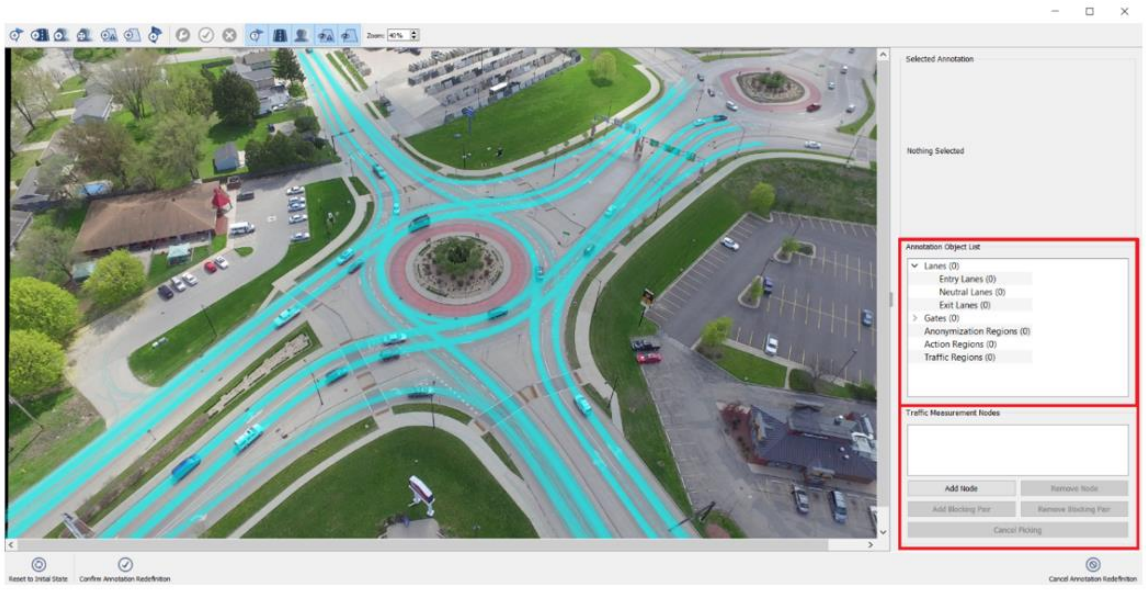


Figure 37: Annotation Redefinition

After setting all required **Annotations** confirm Editing by clicking the **Confirm Annotation Redefinition** button located on the bottom of the editor, you can also **Reset** the settings **to Initial state** or **Cancel Annotation Redefinition**.

Figure 38: Reset, Confirm or Cancel Annotation Redefinition

The editor window closes and then click on the **Apply** button.

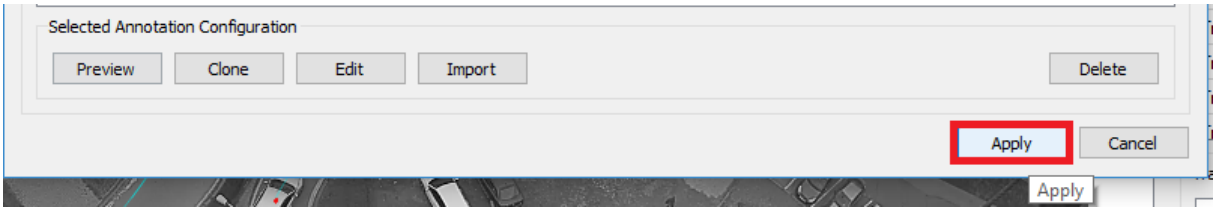


Figure 39: Apply button

Gates

The first button on the Main Toolbar is used for adding Gates. Gates are virtual lines which are crossed by vehicles and other tracked objects. They are in the form of a line consisting of straight segments connecting points, so you need at least 2 points to create them. To create a Gate, click on the button **Add Gate** or **right-click** in the scene view and select **Add Gate**. Then create at least two points between which you want to create a Gate, you can move the created point by clicking and dragging the mouse. Point can be removed by right-clicking and selecting **Remove Control Point**.

Figure 40: Create a Gate

Then you can set the desired properties of the created Gate in the right column **Selected Annotation**.

- **Gate Type –** Set whether the Gate is Entry, Exit, or Neutral
- **Gate Direction –** Sets the direction in which passing objects are to be tracked by the Gate.
- **Object detection mode –** Sets the method by which the object is to be detected, whether it will be based on **Trajectory** or on **Visual Detector**.
- **Object detection range –** If you select **Visual Detector**, you can set the size of the **detection range**.
- **Angular Sensitivity –** Adjusts the sensitivity of the Gate depending on the angle of the passing object.

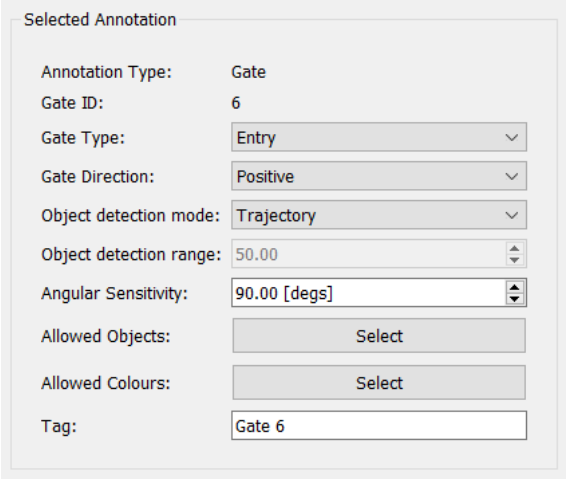


Figure 41: Example of annotation settings

- **Allowed Objects –** After clicking on this menu you can choose what kind of object the Gate will count. (Undefined, Car, Medium Vehicle, Heavy Vehicle, ...)
- **Allowed Colours –** Only in **SCOUT** mode. Sets which object colours the Gate will count.
- **Tag –** This field is used to set the Gate name.

After setting the desired properties, confirm the Gate settings with the **Finish Editing** button.

Figure 42: Finish Editing

If you want to modify the properties of the created Gate or move it, click it with the left mouse button, then you can change its settings in the Selected Annotation column, you can also move it by clicking and dragging with the left mouse button. If you want to change the location of the Control Points of the Gate, click on the Gate and then in the upper bar click **Edit Annotation** button, then you can change the position or number of points of the Gate. If you want to Delete whole Gate click **Delete Annotation** button. Or you can right-click on the Gate to select the desired option.

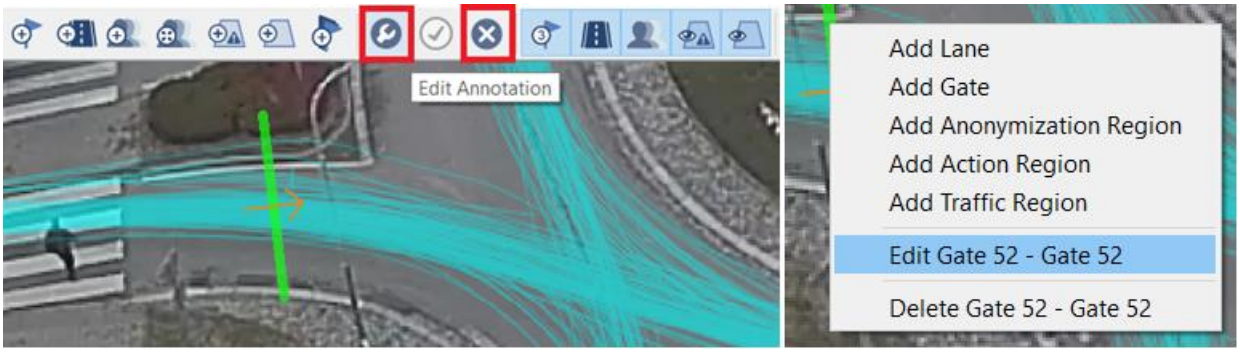


Figure 43: Edit Annotation

After making the desired adjustments, press **Finish Editing** button to confirm.

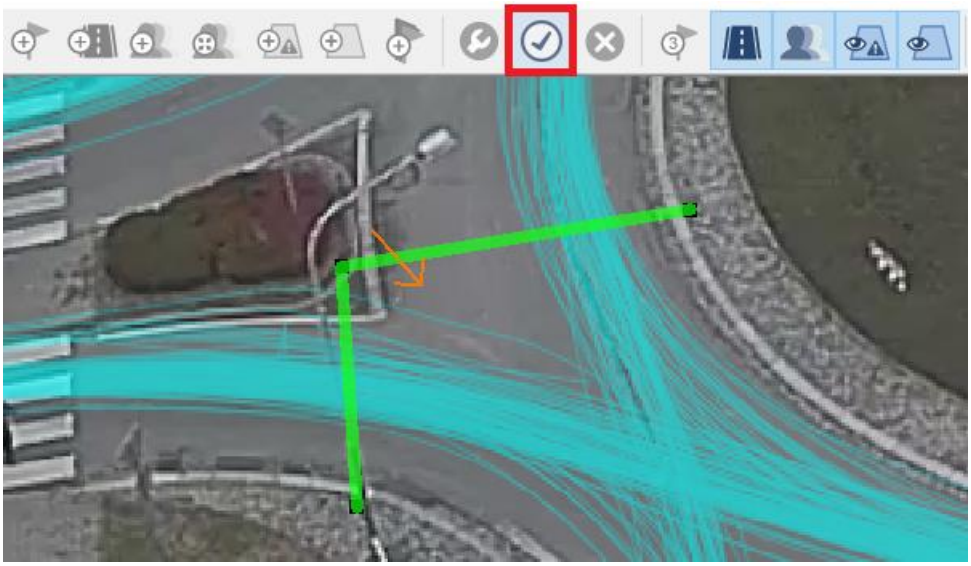


Figure 44: Finish Editing

For example, a roundabout with Entry and Exit Gates.

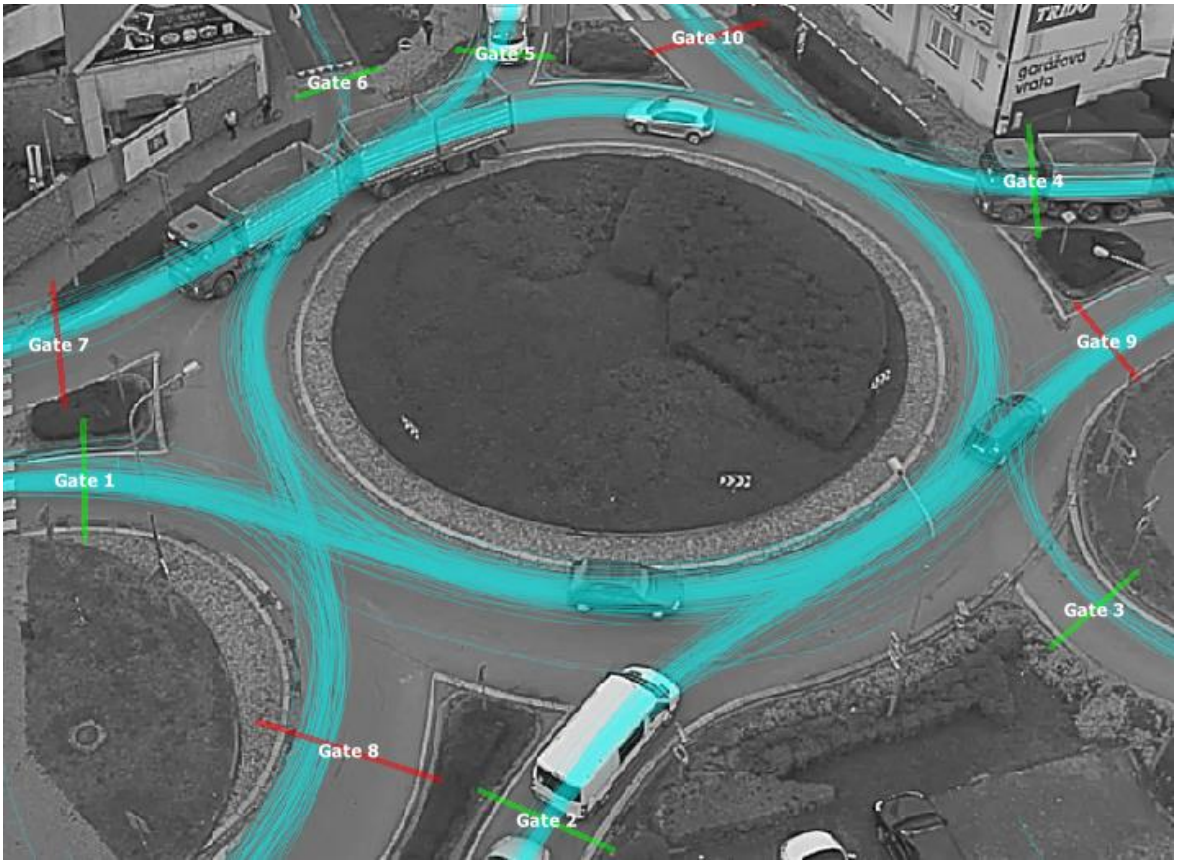


Figure 45: Roundabout with Entry and Exit Gates

Lanes

Lanes are areas where vehicles can be present. Their insertion is similar to the Gates and have the same colour coding **Entry**, **Exit** and **Neutral**. A Lane is drawn by pressing the **Add Lane** button, then clicking the points which form a polygonal border of the lane. The polygon is always closed, it is possible to display it only after three points are added. A Lane should cover the whole area, erring on the side of spreading out rather than shrinking. Ideally, a small overlapping of lanes is made, so that there is no space between lanes. Already placed points can be moved by dragging and removed by right click and select **Remove Control Point**. In right column you can also set **Lane Type** and **Tag**, setting is similar to Gates. Creating the Lane is done by pressing the **Finish Editing** button in Main Toolbar. You can also Edit or Delete Lanes by clicking **Edit** or **Delete** button on Main Toolbar.

Figure 46: Add Lane

For example, a roundabout with Lanes and Gates.

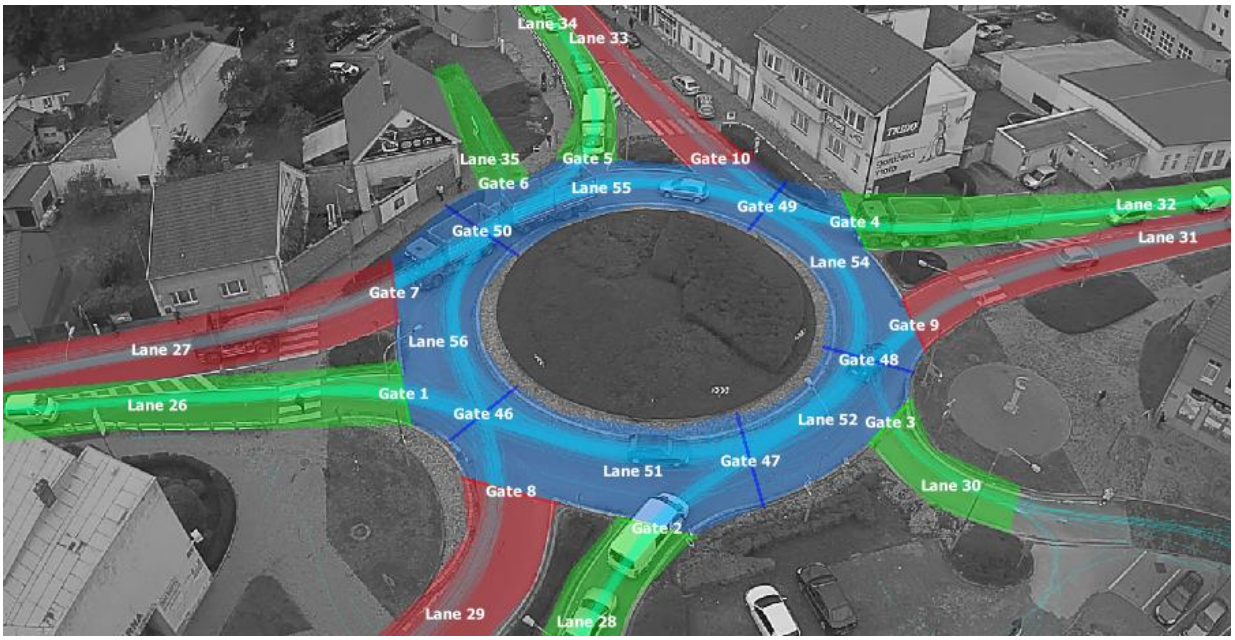


Figure 47: Roundabout with Lanes and Gates

Anonymization Region

Anonymization Region is used to anonymize a certain area in the scene view, it is inserted in the same way as the Lanes, you can set **Degree of blur** in the Selected Annotation column. More settings of anonymization regions Show Anonymization regions, Keep Anonymization regions up to date.

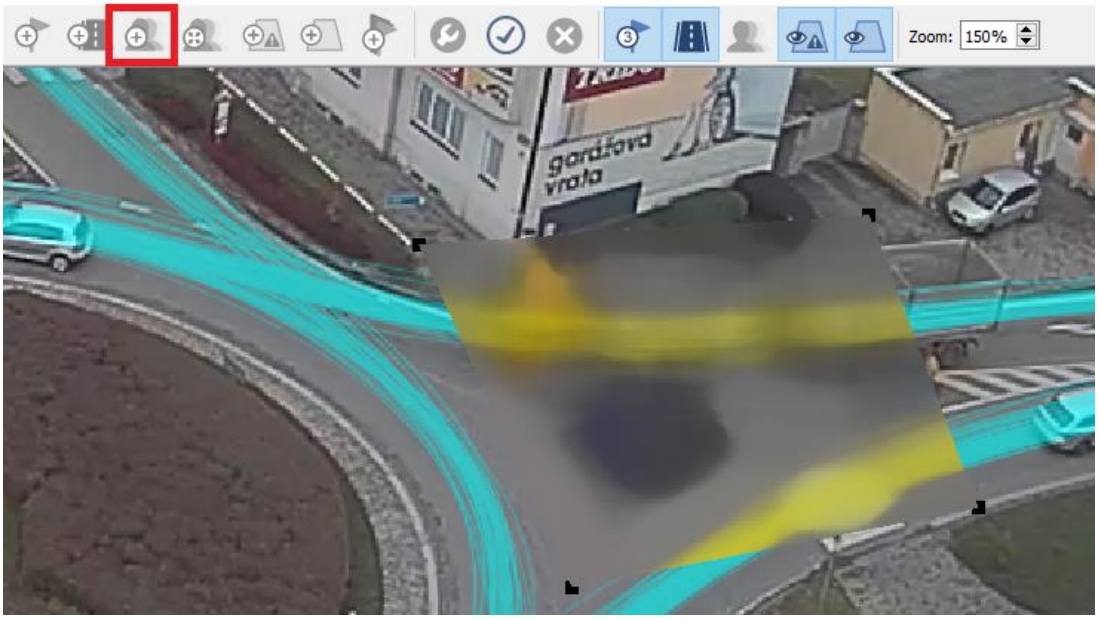


Figure 48: Anonymization Region

Anonymize everything outside current view

Clicking this option will anonymize everything except current view. Since Annotations are defined in Work Space (see Switch Coordinate Space) when you check the **Anonymize everything outside current view** option, it looks all the same in Workspace, but if you switch to Reference / Raw space, parts of the image that are not in the Workspace are then blurred.

To simplify the procedure:

- Open tracking log.
- Switch view to Workspace.
- Open Manage annotation configuration.
- Set the view you want to anonymize.
- Click **Anonymize everything outside current view**.
- Confirm.
- Then switch to Raw / Reference space and anonymous parts should be visible. The Show Anonymization regions must be checked.

Figure 49: Anonymize everything outside current view button

Action Region

Action Regions are used to detect the **Presence** and **Speeding** of objects in a certain area of the scene view. To create an Action Region, click on the button **Add Action Region** or **right-click** in the scene view and select **Add Action Region**. It is inserted in the same way as the Lanes.

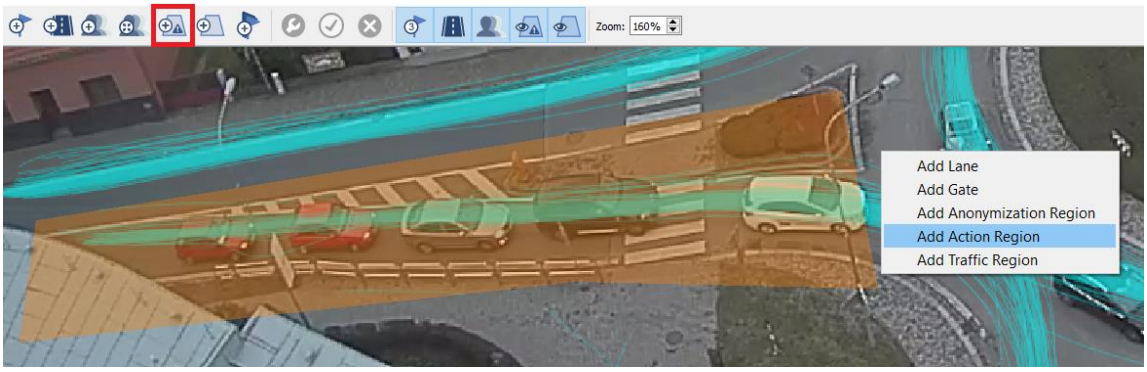


Figure 50: Add Action Region

In the Selected Annotation settings, you can find:

Annotation Type – The currently Selected Annotation Type.

Region ID – ID Annotation number.

Presence Alert – Enable the **Object Presence Alert**. You can then **Select Object Types** for which the Presence Alert will be displayed. If the desired type of object enters the Action Region an Alert is displayed and the Action Region where the event occurred is highlighted.

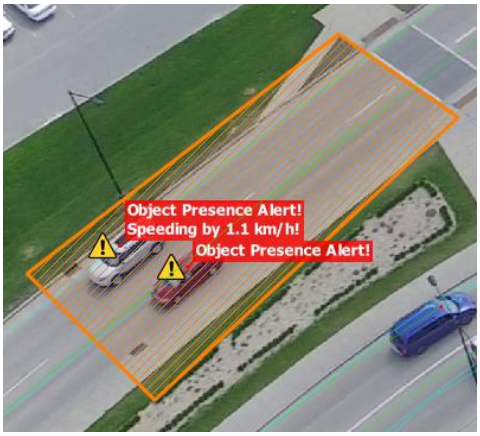


Figure 51: Presence and Speeding Alert

Speeding Alert – If the vehicle exceeds the set speed, an Speeding Alert is displayed in the scene view, the Action Region where the event occurred is highlighted and how much the maximum speed has been exceeded is displayed in the Flag above the object.

- **Select Max. Speeds** – Here you can set maximum speeds for individual objects.
- **Select Object Colours** – Only in **SCOUT** mode. Here you can set for which object colours the Alert will be displayed.

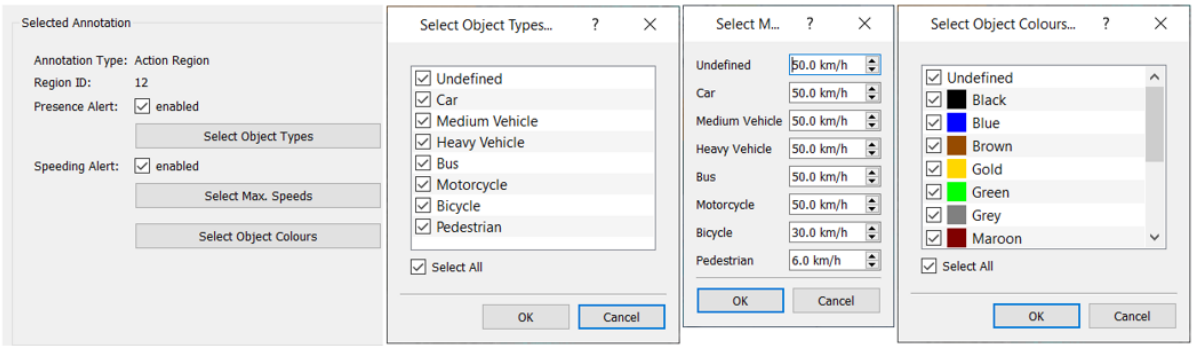


Figure 52: Action Region Settings

Traffic Region

Traffic Region work in a similar way to the Gates, but it is inserted in the same way as the Lanes. It is used to defining a stationary vehicle in a certain area in the scene view. Some vehicles that wait at the intersection do not stop completely but commute very slowly. Then they are not considered as stationary. If you want to Show Traffic Regions in the scene view you can use the button on the Main Toolbar.

In the Selected Annotation settings, you can find:

Annotation Type – The currently selected annotation type.

Region ID –ID Annotation number.

Tag – You can edit the Traffic Region name here.

Allowed Types – Here you can set which kinds of objects the Traffic Region will detect.

Allowed Colours – Only in **SCOUT** mode. Here you can set which object colours the Traffic Region will detect.

Max. Stationary Vehicle Speed – Sets the maximum speed at which the vehicle is considered stationary.

Min. Stationary Vehicle Spell – Sets how long at least the vehicle must be below **Max. Stationary Vehicle Speed** to be considered stationary.

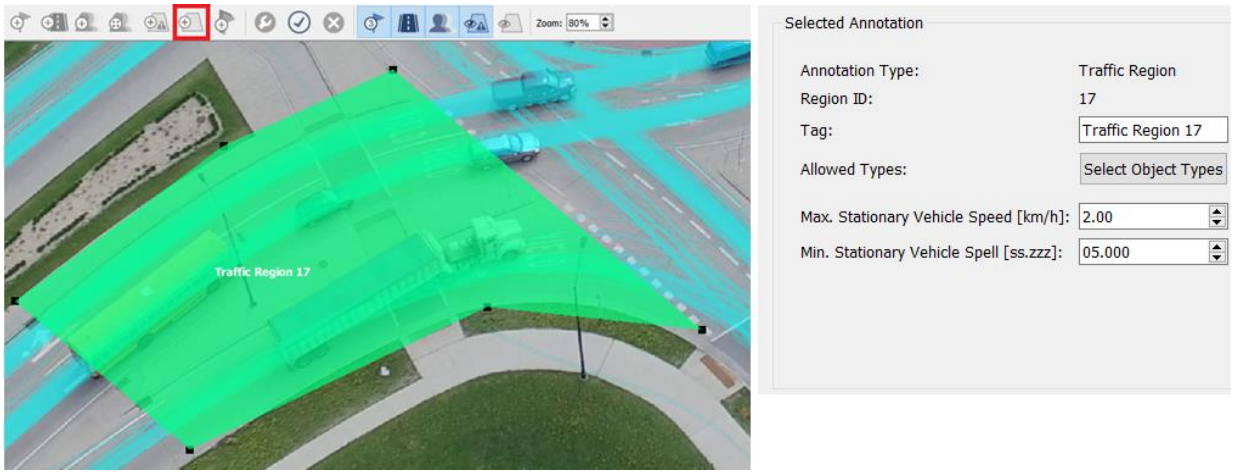


Figure 53: Traffic Region

Measurement Node – Gap Time and Time to Follow

Available in **DRONE** mode only. Measurement Nodes are used for calculation **Gap Time** and **Time to Follow** data, it is used to assess the capacity of a crossroad.

- **Gap time (Tg)** – Represents critical time gap between two successive cars in the main (major) lane that decides whether a car from the minor lane can enter/join the crossroad and fit into the gap. If the time difference between two successive cars is bigger than this critical value, then the waiting car on the minor lane (on average) enters the crossroad. If the difference is smaller than this critical value, the waiting car (on average) does not enter the crossroad.
- **Time to Follow (Tf)** – Represents the average time difference between two successive cars in the minor lane that enters the crossroad after a waiting. This time is measured at the entrance to the crossroad.

These values can be used to better estimate the actual capacity of given crossroad. Current approaches assume the general approximation of these values based on tabled values based on crossroad type and some of its geometry parameters. These may however be inaccurate/incorrect due to various other factors (field of view, road surface, signs, etc…). Thus, the data acquired by **SWISSTRAFFIC.ai** can be used to retrieve a better estimation based on traffic flow and driver's behaviour in the exact case.

To be able to export the post-process information, the following requirements have to be met:

- The traffic scene has to be properly annotated (see item Manage Annotation Configurations - Editing Annotation in Tracking Log Menu):
- Every entry point to the crossroad that we would like to analyse should be additionally annotated by **Traffic Measurement Node**. **Traffic Measurement Node** consist of **Waiting Gate** – **Lane** pair and non-empty list of **Blocking Gate** – **Lane** pairs.
- The **Waiting Gate** should be placed at the Entry of minor lane to the major lane. The waiting cars should all pass through this Waiting Gate when they enter the crossroad.
- The **Waiting Lane** is a lane where the waiting cars (that are waiting for major lane to be empty enough to enter the road) will be waiting. This should cover all the surface of road where these cars may be waiting.
- The **Blocking Lane** is the surface of the main Lane. If there are multiple main Lanes, all should be annotated separately and be part of blocking Gate-Lane pairs. For each Blocking Lane, there should be its pairing Blocking Gate.
- **Blocking Gate** is a Gate at which the blocking events will be detected. These are to assess the **Gap time (Tg)** and to detect the congestion of the main lane.
- The traffic must be congested enough for waiting of vehicles at the waiting lanes to happen. If there are no waiting vehicles, the application cannot estimate **Tg** and **Tf** values.

First, we must properly annotate the Traffic Scene. In the example in the following figure the **Waiting Pairs** are Gate 14 and Lane 15 and the **Blocking Pairs** are Gate 16 and Lane 17.

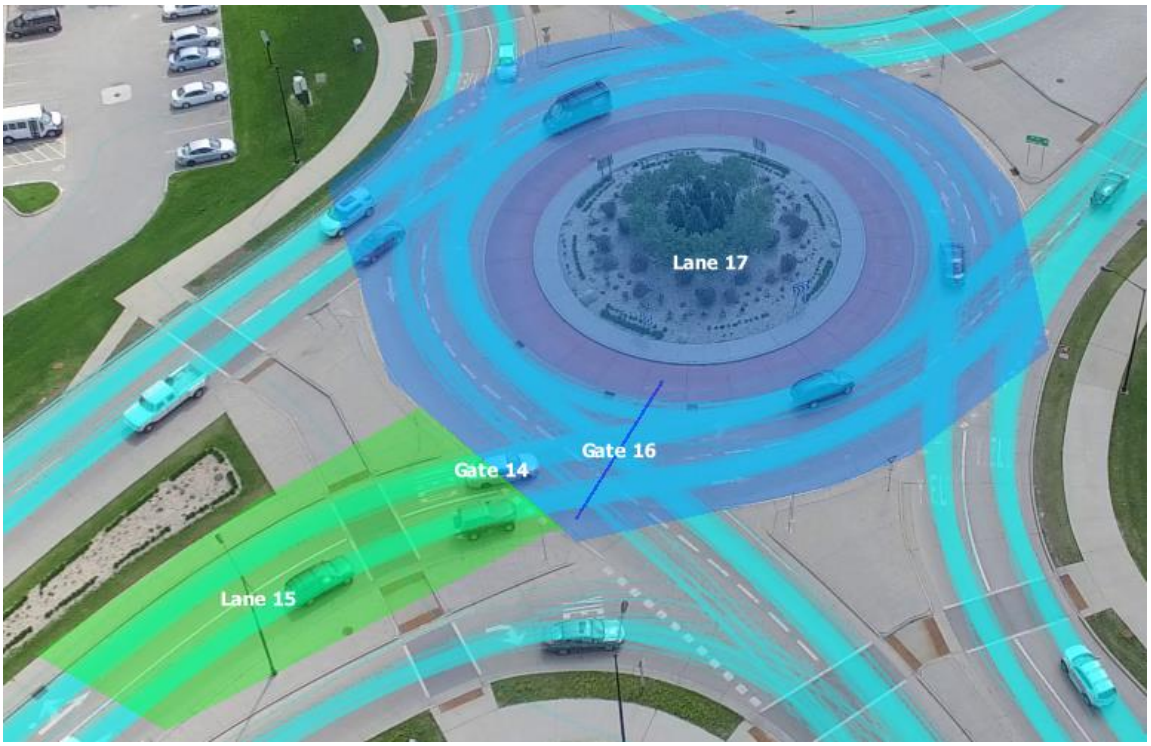


Figure 54: Measurement Node – example

Next, we have to set **Blocking** and **Waiting Pairs** with Measurement Node. We do this by clicking on the **Add Node** button, which can be found at the bottom of the right column. Then you need to specify **Blocking** and **Waiting Pairs**. You can do this by clicking the pick button and selecting the appropriate annotation. You can also **Remove Node** or **Blocking Pair.**

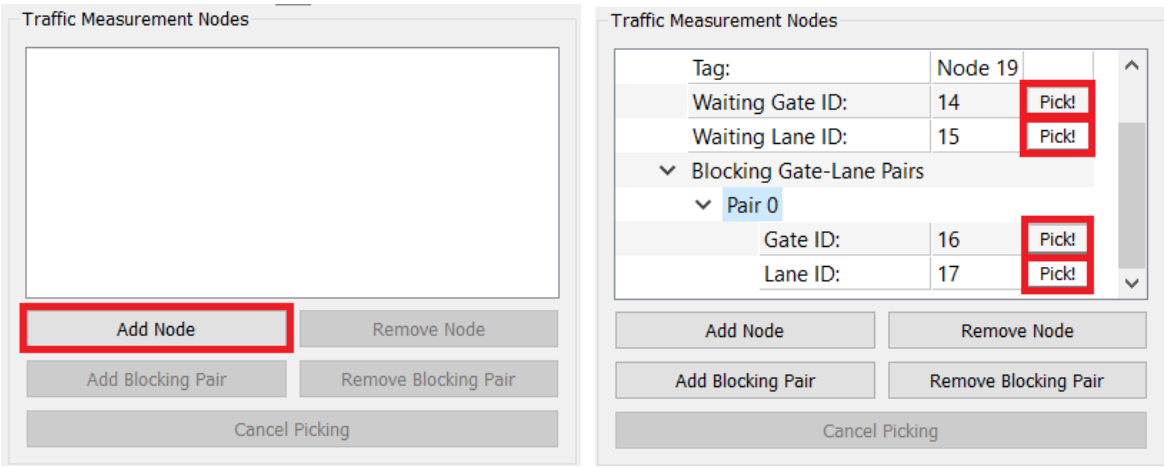


Figure 55: Add Node

If the traffic scene is properly annotated, we can proceed to Export Gap-Time/Time-to-Follow Data.

FIX OFFSET ERROR

Available only for **DRONE** mode. It is used to correct a projection error or to shift trajectories.

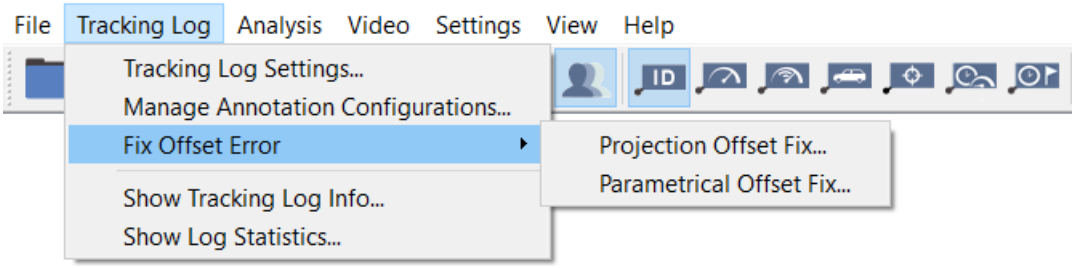


Figure 56: Tracking Log Menu

Projection Offset Fix

Available only for **DRONE** mode. It is used to correct a projection error, for example, if the trajectories in the image are on the hood of the vehicle, this function moves the trajectories to the ground according to the specified object heights. If you want to make this correction only for a single trajectory, mark it first in the scene view.

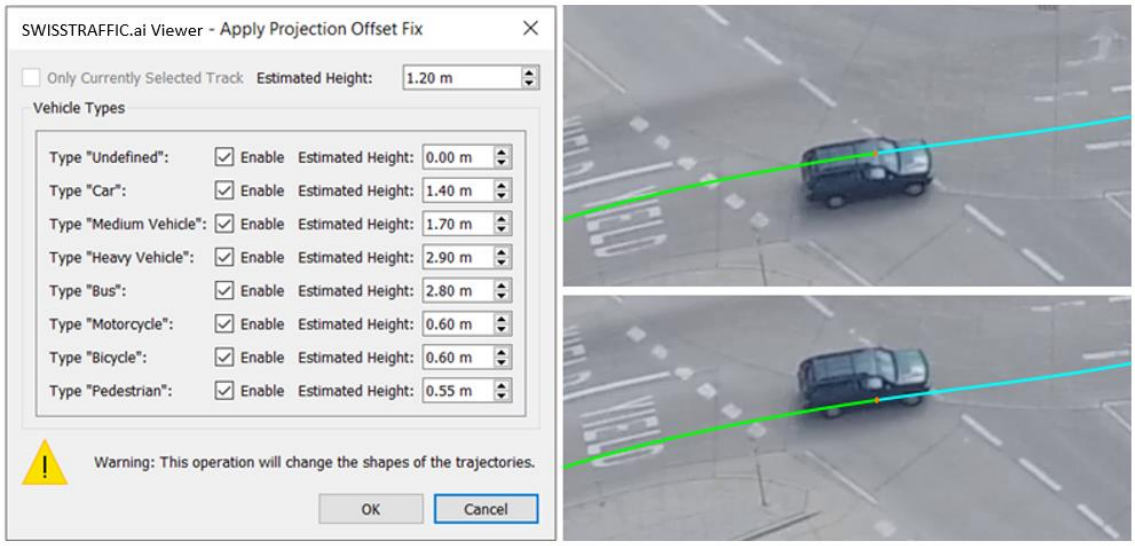


Figure 57: Projection Offset Fix window

Parametrical Offset Fix

Used to shift trajectories. Parametrical offset is adjusted to given parameters based on these equations:

$$x' = x + cx0 + (cxx * x) + (cxy * y)$$

$$y' = y + cy0 + (cyx * x) + (cyy * y)$$

Where (x, y) is the trajectory position and (x ’, y’) is the position after using this feature.

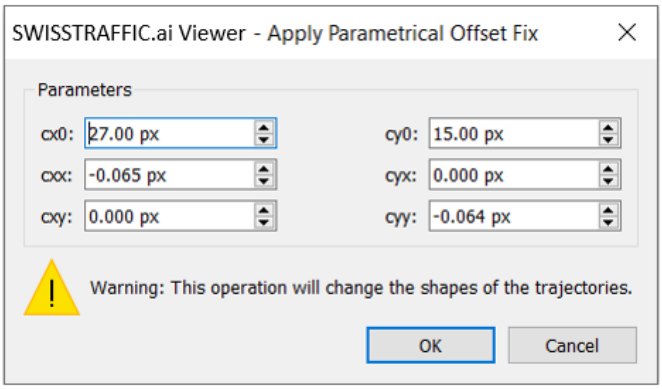


Figure 58: Parametrical Offset Fix window

TRACKING LOG INFORMATION

Shows table containing information about:

Survey ID – File name.

Date and Time – Here you can set the date and time the video was shot.

Location – Here you can enter the location where the video was taken.

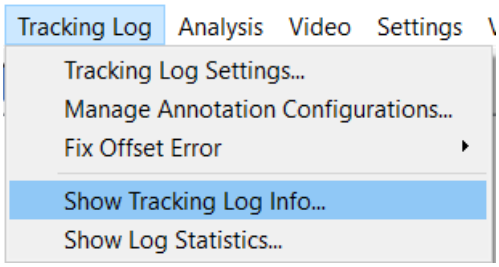


Figure 59: Show Tracking Log Info

Analysis Period Length – Sets the length of the period for which Vehicle Flow is calculated, e.g. at Traffic Analysis Gates and Origin-Destination Flow Graphs.

Scene Type – Signalized intersection, Two-Way Stop-Controlled intersection, etc.

Description – Here you can enter a description of the intersection or traffic situation.

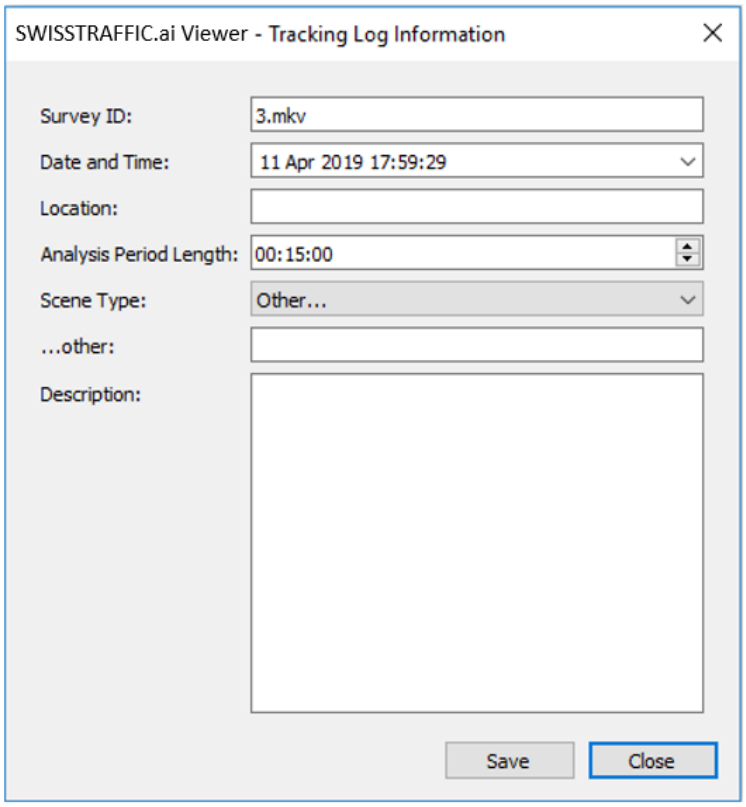


Figure 60: Tracking Log Information window

TRACKING LOG STATISTICS

Displays a table containing information about **Total number of tracks**, numbers of individual types of objects and **Other Statistics**.

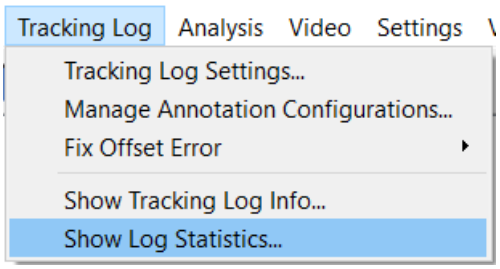


Figure 61: Log Statistics

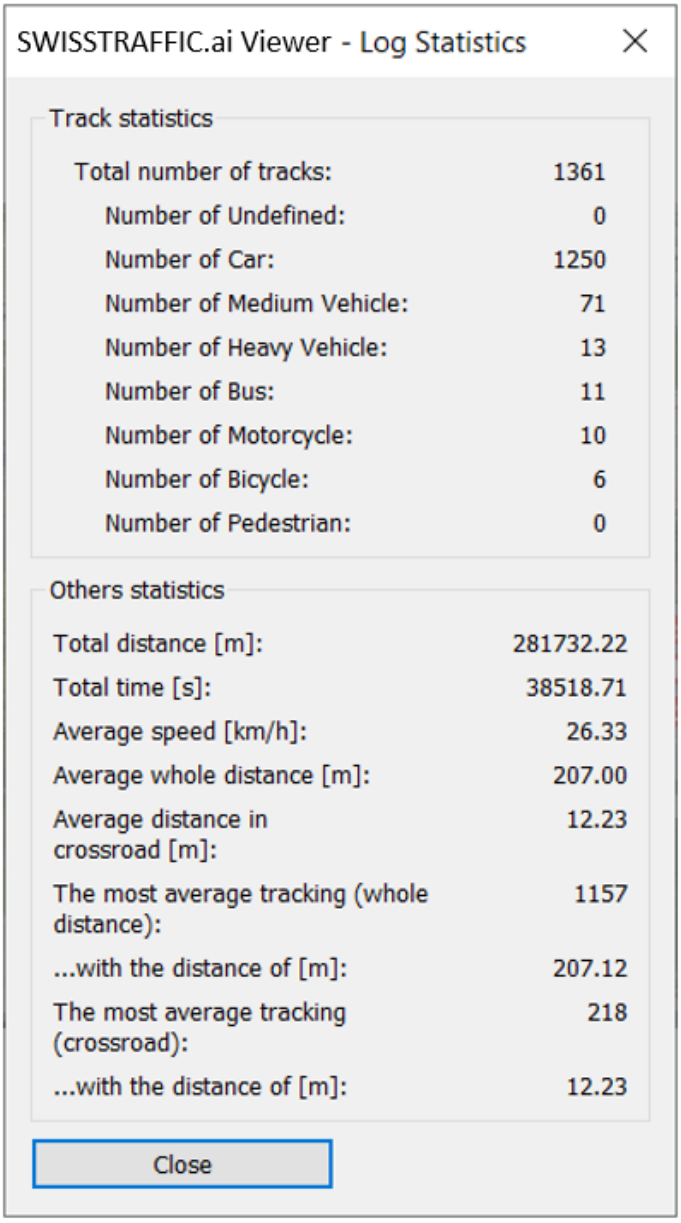


Figure 62: Log Statistics window

ANALYSIS MENU

A very important feature of **SWISSTRAFFIC.ai Viewer** is exporting Traffic Analysis:

- Export Trajectories Movement Dynamics to CSV File
- Export Gate Crossing Events to CSV File
- Export Traffic Analysis to Excel File
- Export Gap-Time/Time to Follow Data
- Origin-Destination Statistics
- Origin-Destination Flow Graphs
- Calculate Headway Statistics

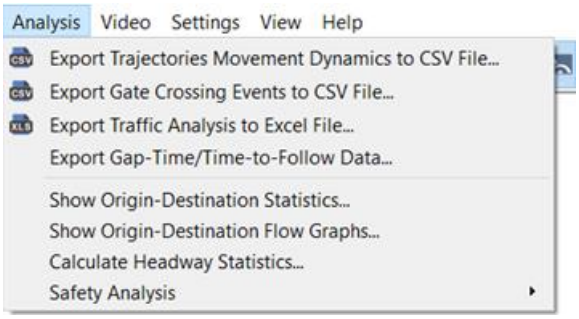


Figure 63: Analysis Menu

ORIGIN-DESTINATION STATISTICS

If you want to Export **Origin-Destination Matrix** click on the **Analysis** menu and select **Show Origin-Destination Statistics**.

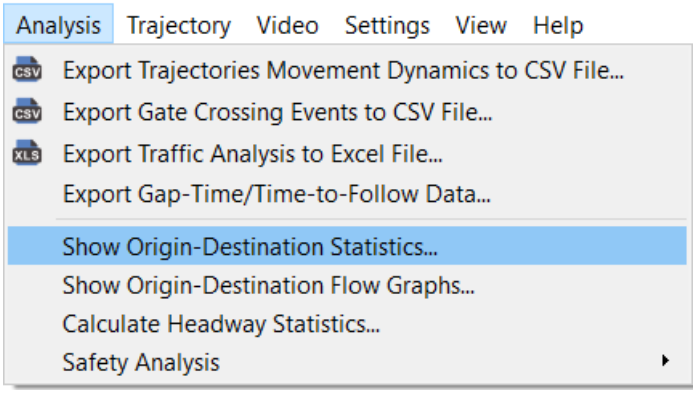


Figure 64: Show Origin-Destination Statistics

The **Origin-Destination Statistic Matrix** menu appears. Here you can set the required parameters for the exported Origin-Destination Matrix.

- **Check box "Whole video sequence"** – By unchecking this option, you can select a specific part of the video by setting specific time or ID of image, and the statistics will only be made for that portion of the video.

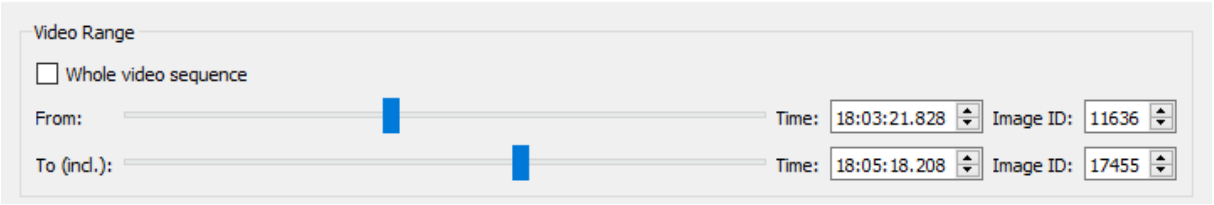


Figure 65: Video Range

- On the **Types** menu, select the objects for which you want to perform statistics.

And now the **Statistics Matrix**, here you can choose what data you want to export:

- **Vehicles count** this option has additional sub-options:

  Normalisation Type:
  - **Show Counts (no normalisation)** – Only the numbers of objects passed from each Entry Gate to each Exit Gate are listed in the Matrix.
  - **Divide by maximum value** – The numbers in the Matrix indicate the ratio between the maximum number of objects and the number of objects that have passed through the given pair of Gates listed.
  - **Divide by sum of values** – The numbers in the Matrix indicate the ratio between the total number of objects and the number of objects that have passed through the pair of Gates listed.

These options have additional sub-options:

- **Across whole matrix** – In this case, the ratio will be applied to the entire matrix.
- **For each Entry gate** – In this case, the ratio will be relative to each Entry Gate separately.
- **For each Exit gate** – In this case, the ratio will be relative to each Exit Gate separately.

- **Average Time** – The average driving times from the Entry gate to the Exit gate will be entered in the matrix.

The other times will be listed with other options like **Minimal Time**, **Maximal Time**, **Median Time** and **Standard Deviation**.

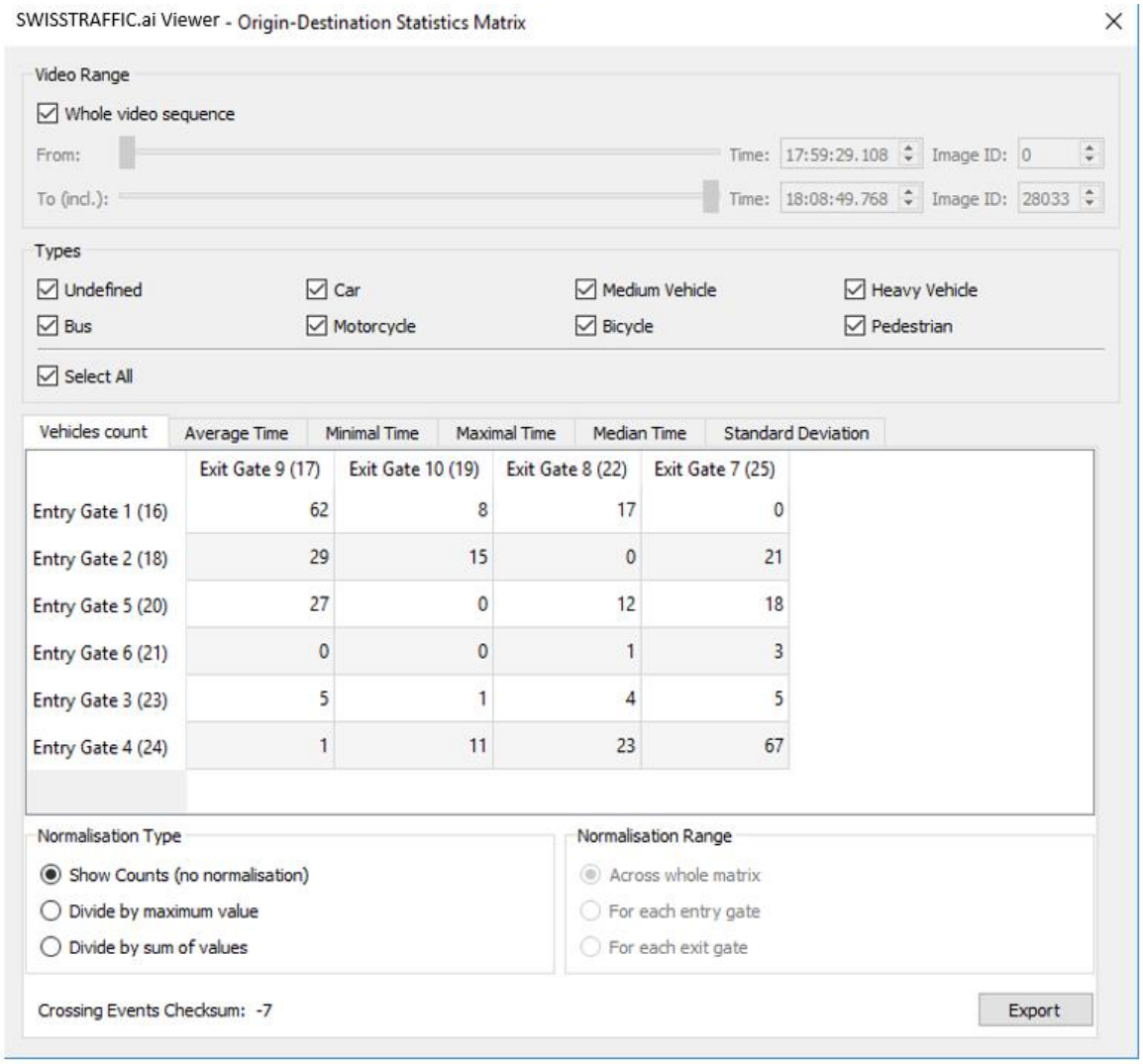


Figure 66: Origin Destination Statistics Matrix

If you click on a field in the **Origin-Destination Matrix** that displays a specific route from the input to the output Gate, you will see a table that contains all the path parameters between these Gates (object counts, average times, etc.). You can scroll the table by clicking and dragging the left mouse button.

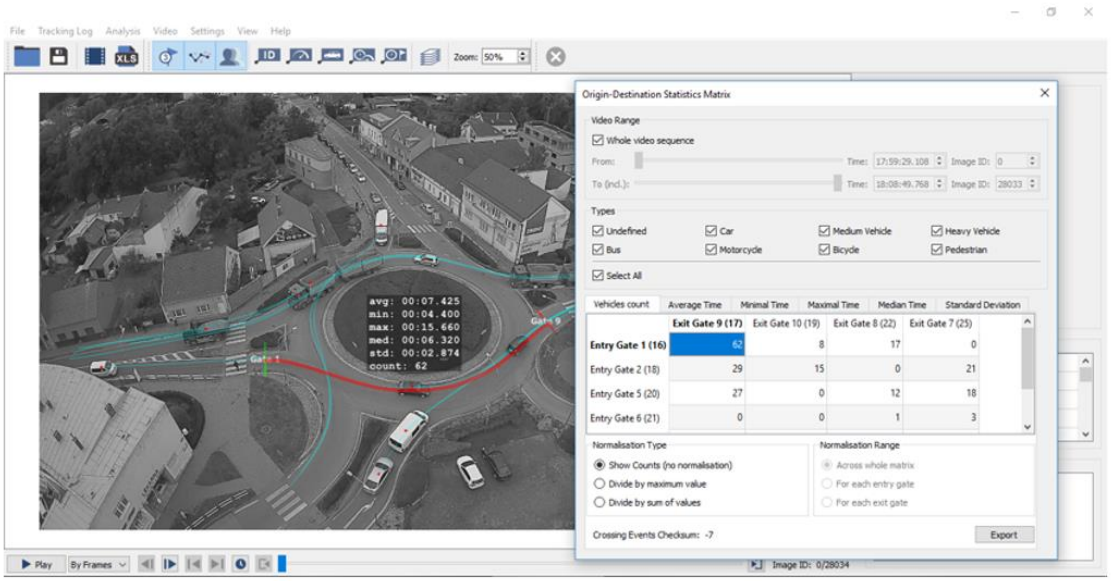


Figure 67: Path Information

You can also view multiple paths at once by pressing **ctrl** button and clicking on other paths.

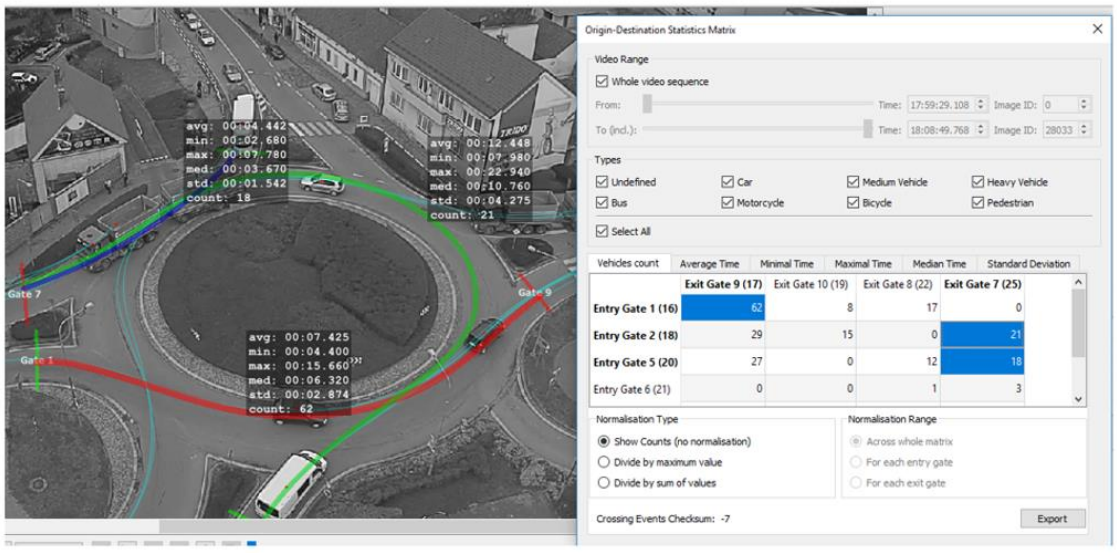


Figure 68: Multiple paths view

Click the **Export** button to export to **.csv** format. This is a simple file format intended for table data exchange, for example, it can be run in Microsoft Excel.

You can also create a snapshot of the current view by clicking the **File** menu and selecting Export Traffic Survey Snapshot or by pressing the **P** key on the keyboard.

ORIGIN-DESTINATION FLOW GRAPHS

Flow Graphs are used to display the number of objects passed through the Gates over time.

By default, the **Flow Graph** displays the total number of objects that passed between the Gates in the entire video sequence. In the **Add O/D Flow Graph** field you can mark a specific pair of Gates for which you want to generate a Flow Graph. Click on the appropriate field of the pair of Gates and then on the **Add Graph to the Chart** button to view the graph. You can remove the displayed graph by clicking on the **Remove** button or you can delete all displayed graphs by clicking on the **Remove All Graphs** button.

In the **Parameters** field you can set:

- **Time window width [h:m:s]** - Adjust the vertical axis sensitivity.
- **Reference Event** - Based on what event the graph will be displayed. (Entry, Exit)
- **Graph Fill** - Graph fill appearance.

Figure 69: Origin-Destination Flow

You can also display a graph for multiple pairs of Gates at once. Press **ctrl** and click on the desired pair of Gates, then click **Add Graph to the Chart**.

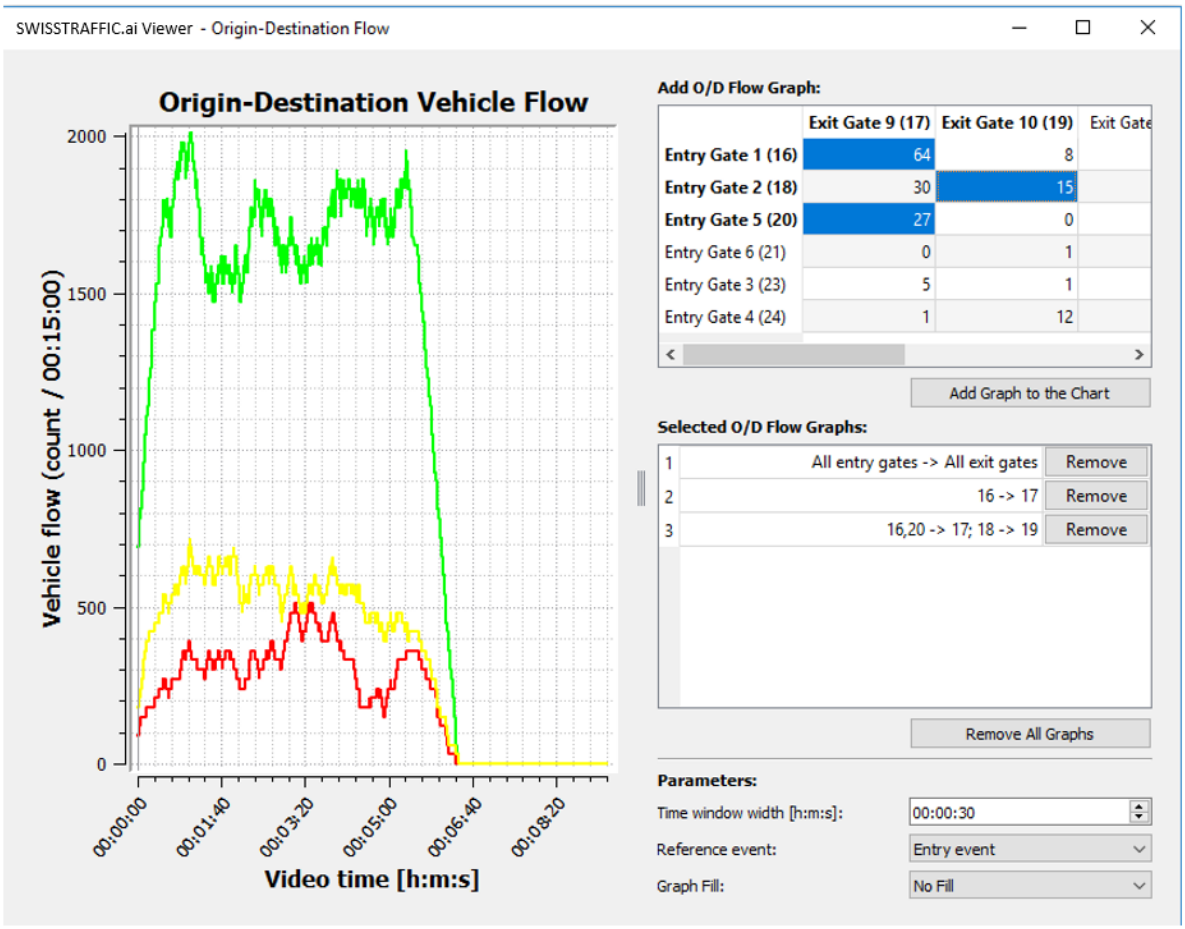


Figure 70: Origin-Destination Flow - Multiple Gates

CALCULATE HEADWAY STATISTICS

This feature generates the **Headway Statistics Report**. The calculation is performed in the same way as for Traffic Analysis Gates, but in this case displays the summary values.

Maximum headway time settings is used to filter too long time period between passed vehicles to get more accurate values.

For individual Gate Passing Events you can view this statistic in Detailed Info of each Gate or Export Gate Crossing Events to CSV File.

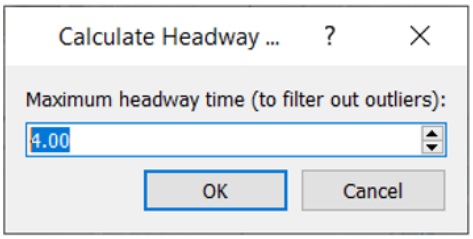


Figure 71: Maximum headway time

In the **Headway Statistics Report** you can find these values:

Overall –Average Headway value.

Sigma – The Standard Deviation of this value.

Num of samples – Number of Gate Passing Events used for calculation.

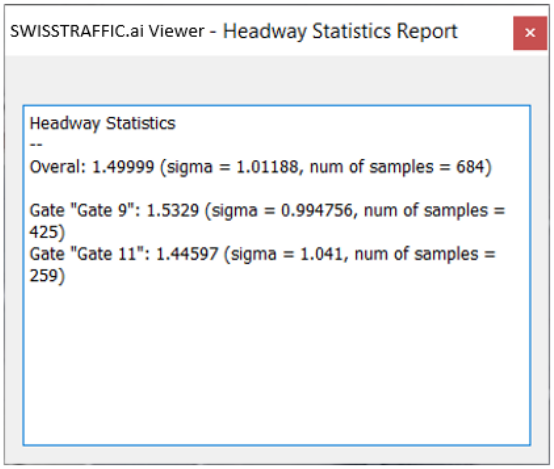


Figure 72: Headway Statistics Report

SAFETY ANALYSIS

Safety Analysis is used for creating a **Conflict List** which can be exported for further analysis and the detected conflicts are visualized in the scene view. You can find it in the Analysis Menu.

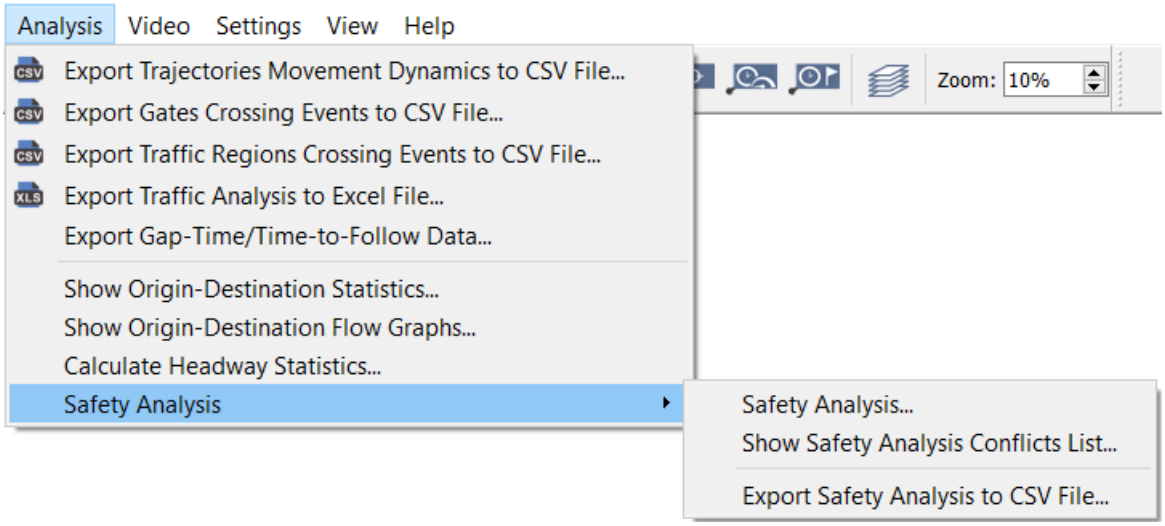


Figure 73: Safety Analysis

First it is necessary to set the Safety Analysis parameters, so click **Safety Analysis**. A window with two tabs will appear. In the **Analysis Parameters** tab, you can find:

Video Range settings, by unchecking box **Whole video sequence** you can select a specific part of the video by setting specific time or ID of image, and the statistics will only be made for that portion of the video.

In **Types** settings you can set for which object types the statistics will be calculated.

In **Simulation** settings you can set **Movement prediction** model:

- **Speed Vector** – This is a simpler calculation where the movement of the vehicle is considered straightforward. For this reason, the calculation of collisions in a curve is not entirely accurate, but the calculation is less demanding.
- **Ackerman Steer Model** – This is a more precisely defined vehicle model, the calculation is based on the angle of the wheels, but for this reason the calculation is more demanding and takes more time.
- **Use Traffic Object Acceleration** – By checking this box, not only the speed but also the acceleration of the vehicle are used in the calculation.

Select Traffic Conflict Type:

- **Time To Collision** –Calculates in how many seconds the vehicles would collide if they were moving at a constant speed and direction. **Min. Speed Difference** sets the minimum speed difference between two vehicles, if this difference is less than the specified value, the calculation will not be performed for this pair of vehicles. **Threshold Value** sets how many seconds the speed difference must be at least equal to the minimum value. The detected conflicts are visualized as arrows, which show the location and angle at which a collision would occur, rectangles indicate the position of vehicles. If you click on the marker of visualized conflict, the video sequence will set to the point when the conflict occurred. If there is any

conflict while playing the video, the alarm and the monitored value will be displayed over the vehicle.

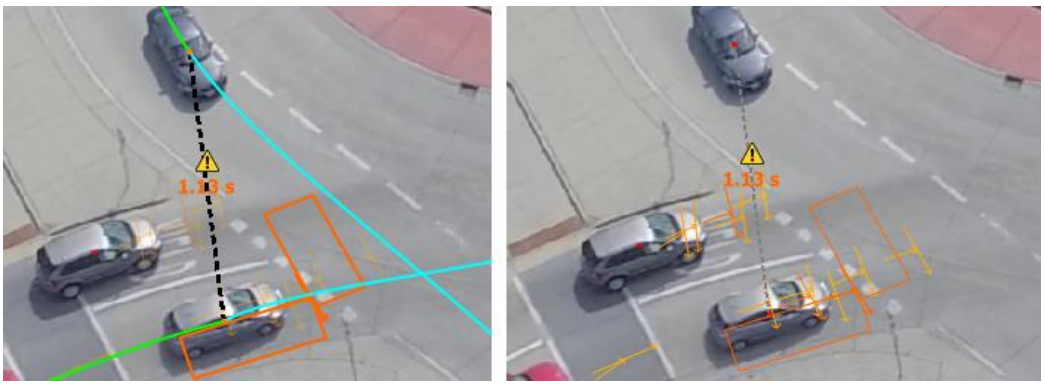


Figure 74: Safety Analysis – Time To Collision – selected and unselected conflict

- **Post Encroachment Time** – Post-encroachment time is the difference between the time a vehicle enters a conflict point until the time another vehicle arrives to this point, **Threshold Value** filter data by maximum time. The detected conflicts are visualized as arrows, which show the location and angle at which a collision would occur. If you click on the marker of visualized conflict, the video sequence will set to the point when the conflict occurred.

Figure 75: Safety Analysis – Post Encroachment Time – selected and unselected conflict

- **Heavy Braking** – This is a detection of rapid deceleration, used to detect collisions or dangerous situations. **Threshold Value** sets how strongly the vehicle must brake to be included in the analysis. The detected conflict is visualized as a line that shows the path where the vehicle deceleration exceeded the threshold value. If you click on the marker of visualized conflict, the video sequence will set to the point when the conflict occurred. If there is any conflict while playing the video, the alarm and the monitored value will be displayed over the vehicle.

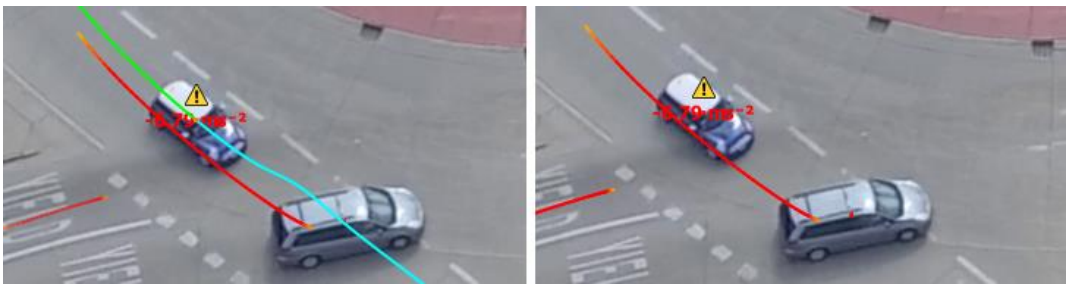


Figure 76: Safety Analysis – Heavy Braking – selected and unselected conflict

In the **Visualisation Parameters** tab, you can set the appearance of the visualized conflicts:

Conflict Font Size – When displaying a conflict, the value is displayed between vehicles, here you can set its font size.

Conflict Line Width – Sets the line size of visualized conflicts.

Trajectory Pair Line Width – Sets the line width between vehicles if there is a conflict where two vehicles interact.

The Most / Least Critical Conflict Colour – Here you can set different colours according to the severity of the conflicts.

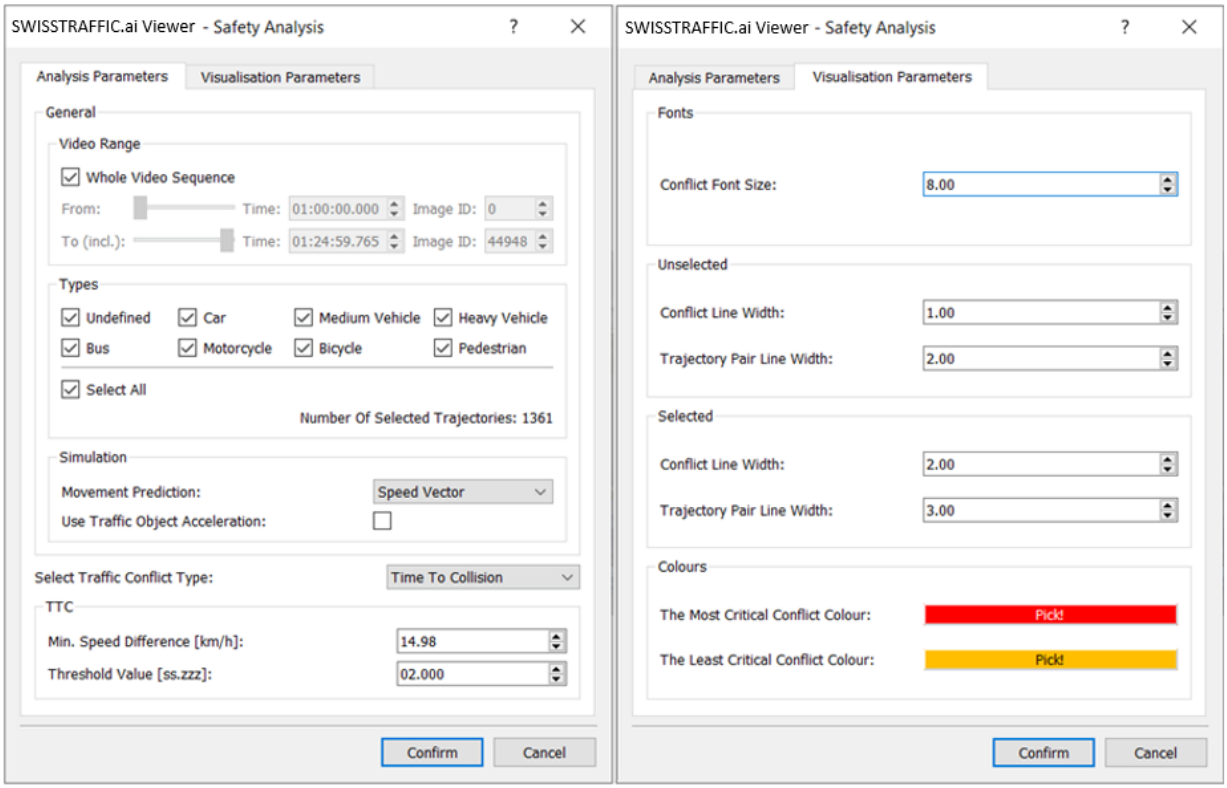


Figure 77: Safety Analysis – Analysis and Visualisation Parameters

After the Safety Analysis has been calculated, the **Conflict List** appears. Here you can find information about all detected conflicts, they are ranked from most critical to least critical. All detected conflicts are also visualised in the scene view. If you click on the marker of visualized conflict, the video sequence will set to the point when the conflict occurred, and the marked conflict appears in the Conflict List.

Conflict ID –ID of the marked conflict.

Conflict Type – Type of marked conflict.

First Track ID – The first track ID related to the conflict. If you click **Select!** the track is highlighted in Selected Trajectory list.

Second Track ID – The second track ID related to the conflict. If you click **Select!** the track is highlighted in Selected Trajectory list.

First Track Angle – Shows the angle of the first track at the time the conflict occurred.

Second Track Angle – Displays the angle of the second track at the time the conflict occurred.

Time Exposed TTC – Shows the amount of time the TTC value is below the threshold value.

Time Integrated TTC – It is the area of the TTC below the threshold value.

Worst Time to Collision – Shows the smallest Time to Collision of the conflict.

TTC progression – If you click the **Show** button, you will see a graph of Time to Collision progress, horizontal axis is video time, vertical axis is Time to Collision.

Post Encroachment Time – Shows the Post Encroachment Time for the conflict.

Breaking Time – Shows how long the deceleration rate was higher than the set value.

Deceleration Rate – Displays the maximum deceleration value for the conflict.

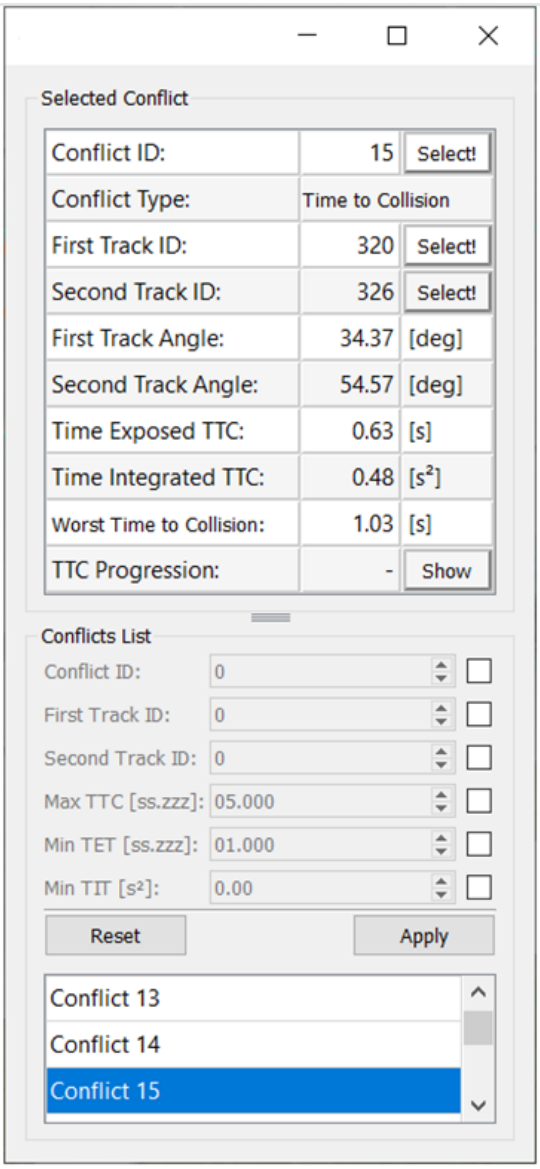


Figure 78: Conflict List

Conflicts List – Here you can filter individual conflicts, check the box for the parameter and enter the searched value.

You can set the display of detected conflicts in the View menu – Safety Analysis

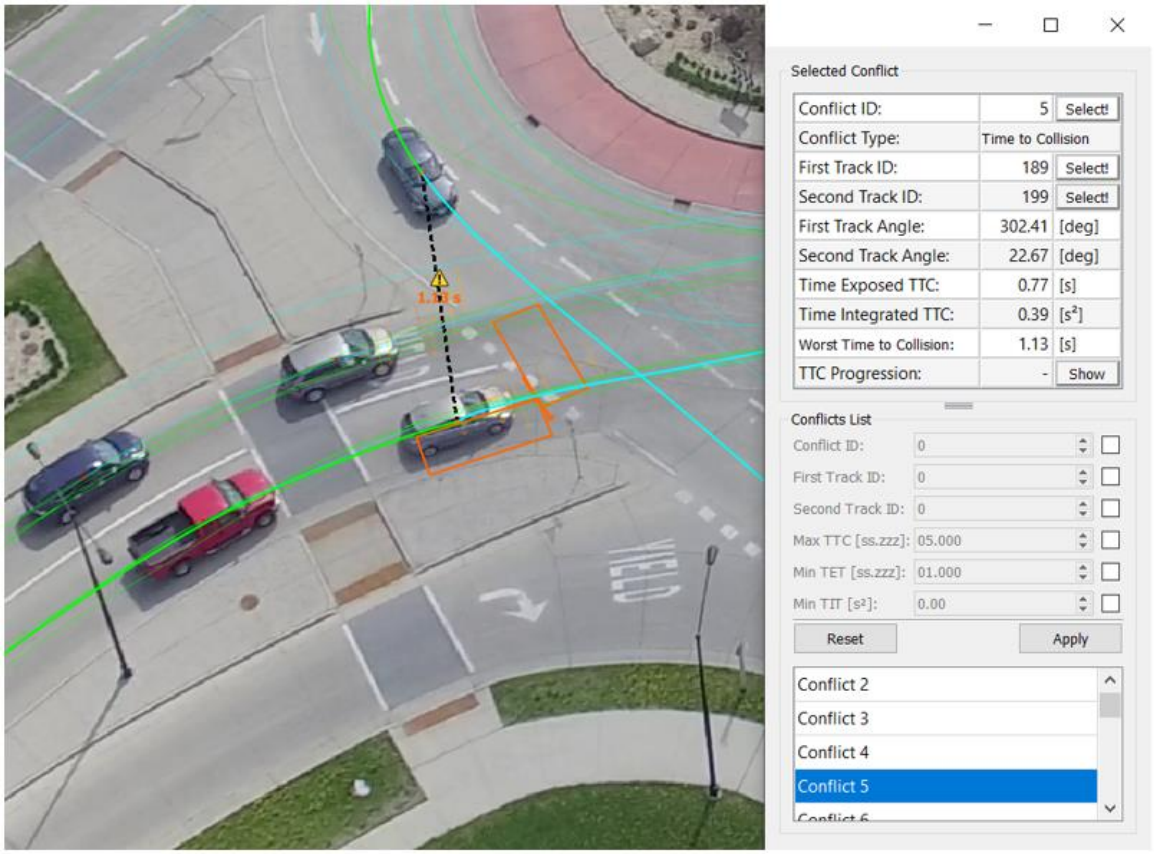


Figure 79: Selected Conflict

Time Exposed TTC – Shows the amount of time the TTC value is below the threshold value.

Time Integrated TTC – It is the area of the TTC below the threshold value.

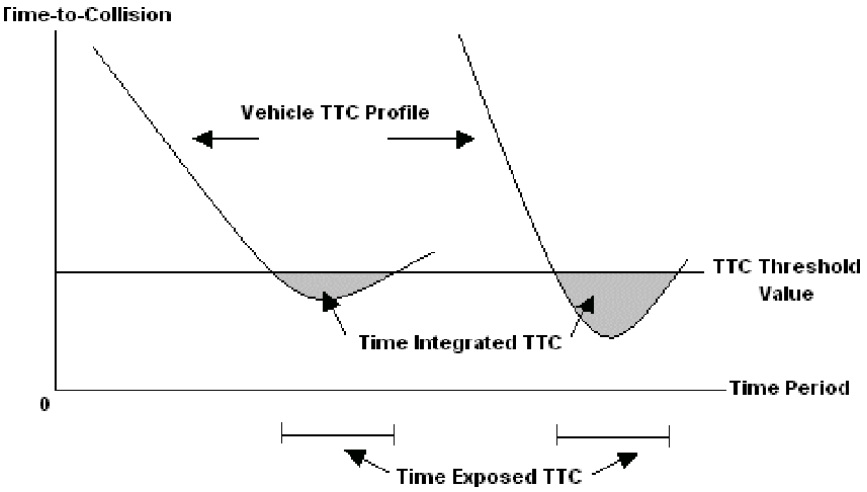


Figure 80: Time Exposed TTC and Time Integrated TTC explanation

NAVIGATING THE TIME AXIS – VIDEO MENU

To move coarsely through the video sequence, a player-like slider is available at the bottom of main window. To its right, the current position is displayed – in terms of video frames (current Image ID/total Image IDs). If you click on **Image ID** you can switch between the **current video time / total video length**, **video time relative to the time it was taken** (you can set this time in Tracking log Information), and **expired video milliseconds**.

Figure 81: Video Time

The play/pause button functions similarly to a video/audio player. Playback speed is not real-time, as its speed is bound by several operations performed by Viewer on the video. Default speed of the video is defined **By Frames**, various playback speed options are also available – from 0,25x speed up to 8x speed.

Figure 82: Time slider

Here you can jump one second Forward / Backward in the video sequence or you can use the keyboard shortcut **E** to jump forward and **Q** to jump back.

Figure 83: Jump Forward/Backward

Or you can jump to the Start / End of the highlighted Track.

Figure 84: Jump to the Start / End of track

You can also jump to the desired time or video frame by clicking on **Jump in Video** icon or you can use the keyboard shortcut **Ctrl + J**.

Figure 85: Jump in Video

After clicking on the **Jump in Video** icon you will see a table **Jump in Video Sequence**, here you can set the desired **Frame**, **time**, or **millisecond** of the video sequence. Click the **Jump!** button to perform the operation.

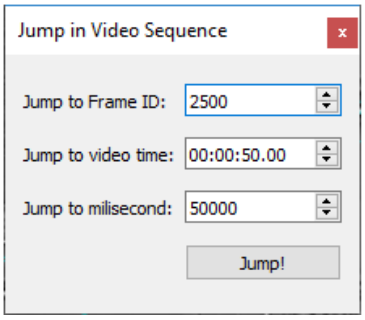


Figure 86: Jump in Video Sequence

You can also skip video **Frame by Frame** by clicking on the icons on the sides of the video slider or you can use the **Left** or **Right** arrow on the keyboard.

Figure 87: Next / Previous frame

Fine movement in time also can be performed by Navigating the Time Axis – Video Menu and associated keyboard shortcuts.

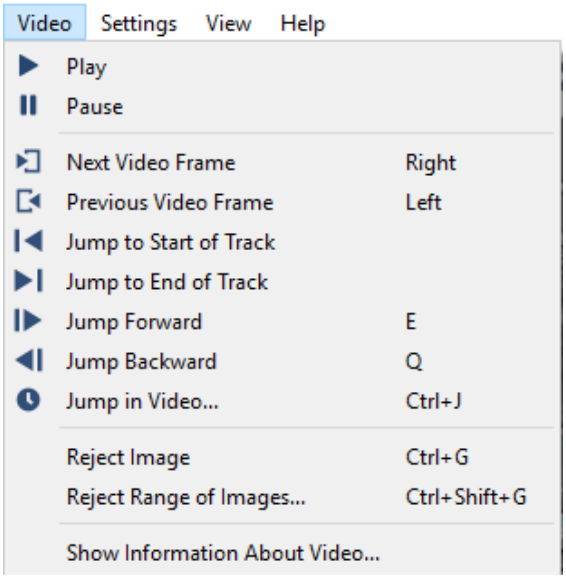


Figure 88: Video Menu

There are also other options such as:

- **Reject image** (shortcut **Ctrl + G**) – Selecting this option will delete the current video image, deleting the image does not affect the Trajectories.
- **Reject Range of Images...** (**Ctrl + Shift + G**). After clicking on this option, the **Reject Range of Images** menu appears, here you can select the range of images you want to delete deleting the image does not affect the Trajectories.

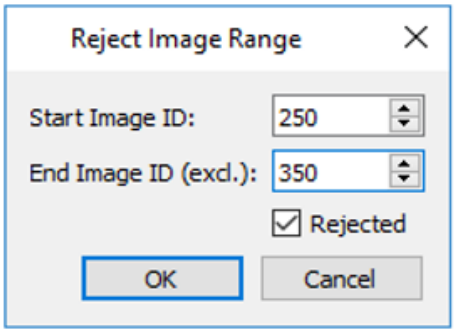


Figure 89: Reject Image Range

Show Information About Video – Opens new window with detailed information about the video:

- Framerate
- Video frame count
- Frame range
- Resolution
- Camera information.

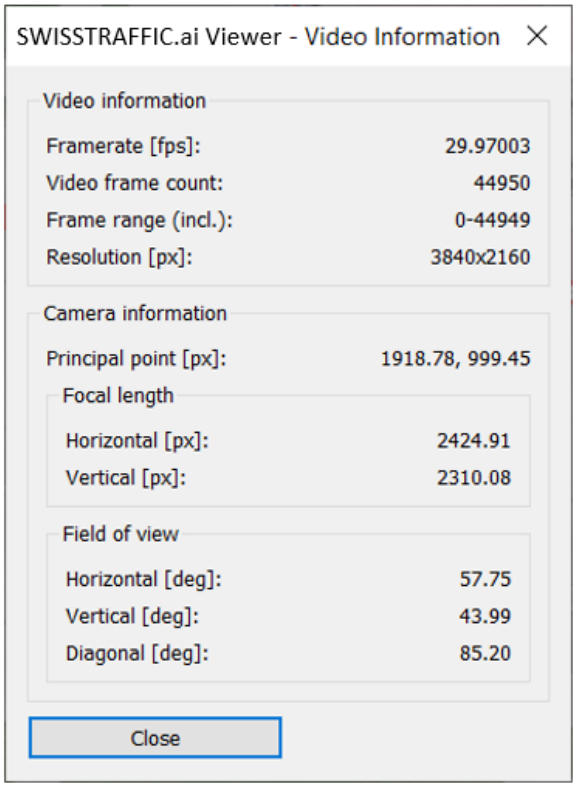


Figure 90: Video Information

SETTINGS MENU

In this menu you will find Application Settings and Visualization Settings.

APPLICATION SETTINGS

Here you can **Enable Video Buffering** or **Change Units Settings**.

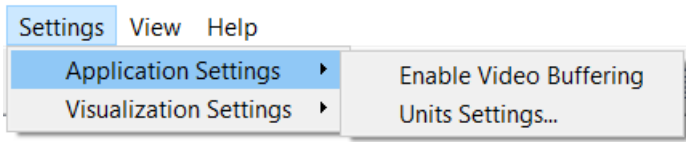


Figure 91: Application Settings

Enable Video Buffering

Turn this setting on for better playback of a video sequence but it increases the computer's RAM memory usage.

Units Settings

Only in **DRONE** mode. Here you can set what units you want to use for:

- **Position** – UTM / WGS-84
- **Length** – meters / feet,
- **Speed** – kilometres per hour / miles per hour
- **Acceleration** – meters per second square / feet per second square

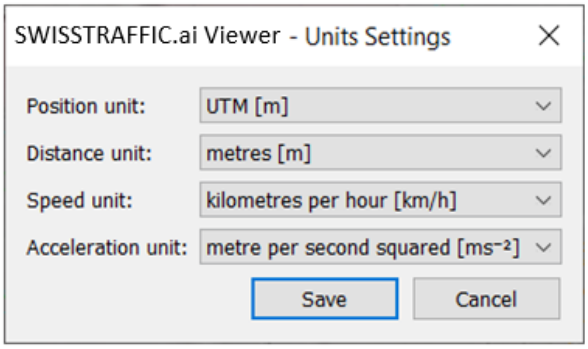


Figure 92: Units settings

VISUALIZATION SETTINGS

In this section you will find information about setting:

- Scene Visualisation Settings
- Rounding Properties Settings
- Flag Dynamics Settings
- Visibility Settings
- Set Video Background Colour
- Settings Presets
- Quality

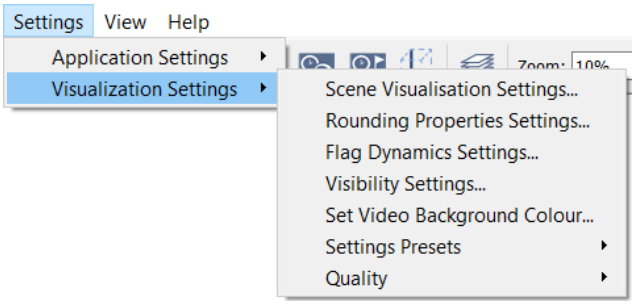


Figure 93: Scene Visualisation Settings…

Scene Visualisation Settings

If you choose this option, the following window will appear. Here you can control the **Font Size** of the displayed values and **Width** of the Track, Flow, Distance or Gate lines. You can change the values in the fields by clicking the arrows or typing the desired value in the field. Confirm your changes by clicking the Save button. All changes to the visualization settings are shown in the corresponding image. If you want to restore the changes to their original state, click **Reset to Defaults** box.

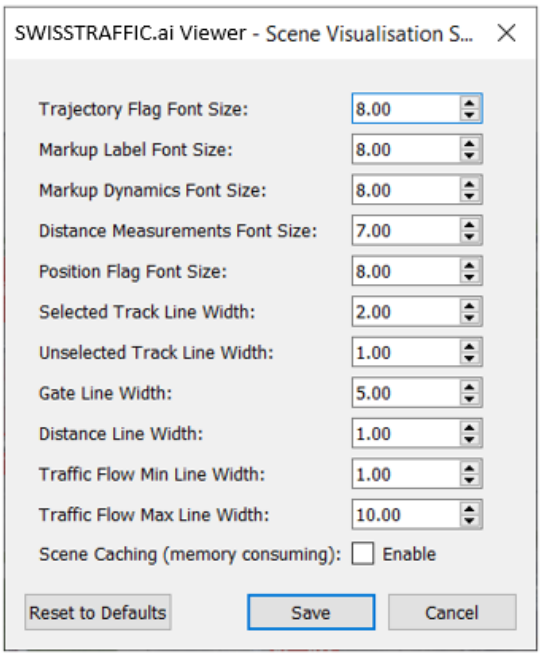


Figure 94: Scene Visualisation Settings window

Trajectory Flag Font Size

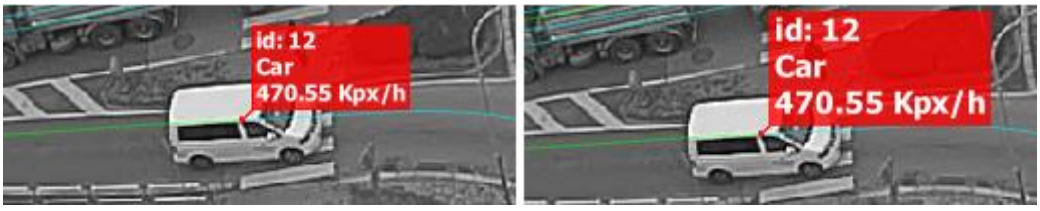


Figure 95: Trajectory Flag Font Size

Markup Label Font Size

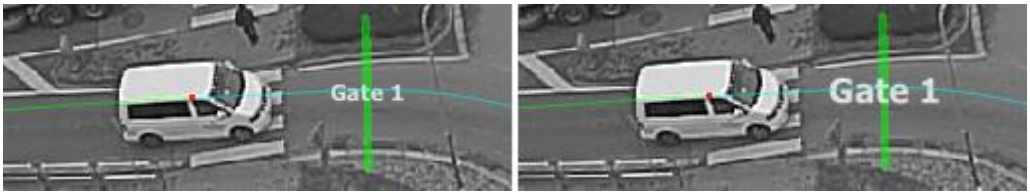


Figure 96: Gate Label Font Size

Mark-up dynamic Font size

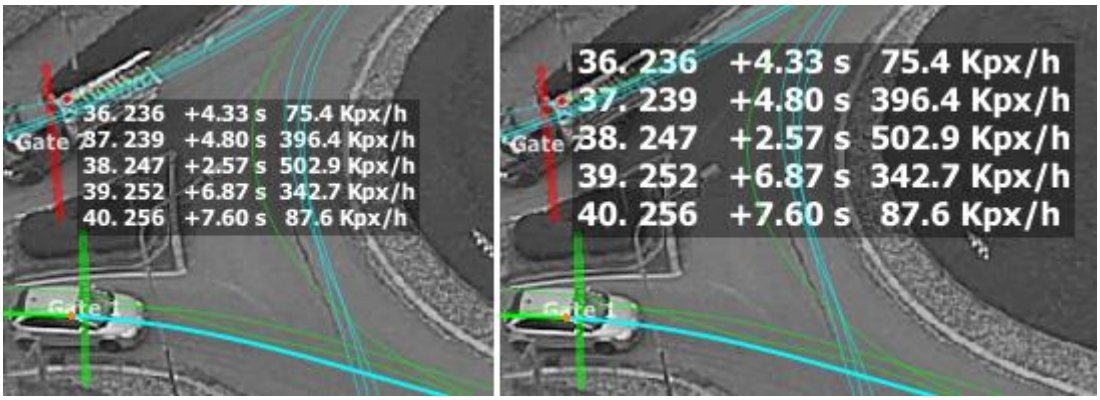


Figure 97: Gate dynamic Font size

Distance Measurements Font Size – Changes font size of distance between Position Flags.

Figure 98: Distance Measurements Font Size

Position Flag Font Size – Changes font size of Position Flags.

Figure 99: Position Flag Font Size

Selected Track Line Width

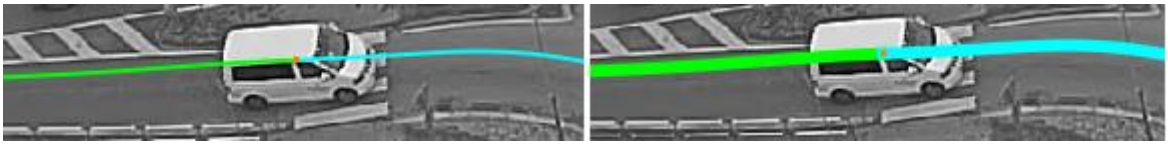


Figure 100: Selected Track Line Width

Unselected Track Line Width

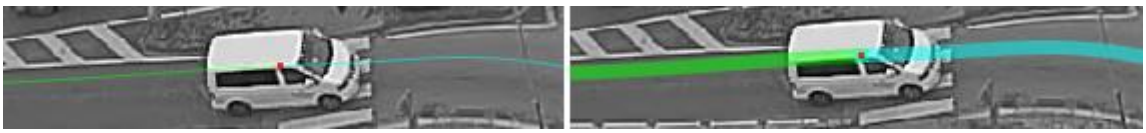


Figure 101: Unselected Track Line Width

Traffic Flow Min Line Width and **Traffic Flow Max Line Width** – Here you can set the minimum and maximum line width when viewing Origin-Destination statistics. The **Max** and **Min** line widths depend on the flow volume.

Figure 102: Traffic Flow Min-Max Line Width

Scene Caching (memory consuming) – Check this box to enable Scene Caching.

Rounding Properties Settings

Here you can set how many decimals the **Speed** or **Acceleration** of the object will be rounded. If you select the Object or Trajectory you can find both values in the **Selected Trajectory** table or you can display them in the scene view clicking the **Show Target Speeds** flag.

Velocity / Acceleration Smooth Window Width specifies the time over which the speed will be calculated at that time, for example, the video is in time 00:05 (mm: ss), if you select a 1 second smooth window, the instantaneous speed will be calculated as the average of the values from 00:04 to 00:06.

You can change the values in the fields by clicking the arrows or typing the desired value in the field. Confirm your changes by clicking the Save button. If you want to restore the changes to their original state, click **Reset to Defaults**.

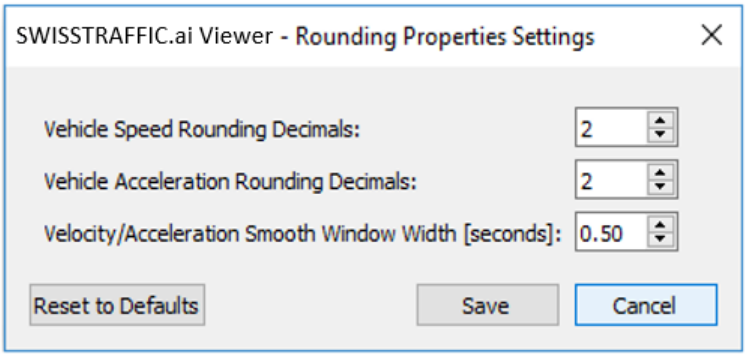


Figure 103: Rounding Properties Setting window

Flag Dynamics Settings

Here you can set the Track Flags behaviour dynamics. This setting is important for defining a stationary vehicle. Some vehicles that wait at the intersection do not stop completely but commute very slowly. Then they are not considered as stationary.

- **Max. Stationary Vehicle Speed [Km/h]** – Sets at what speed the vehicle is still considered as stationary.
- **Min. Stationary Vehicle Spell [seconds]** – Sets the minimum time the vehicle must stand to be considered as stationary.
- **Min. Time from the Last Gate [seconds]** – Sets the minimum time that is displayed when the vehicle travels between two Traffic Analysis Gates.

You can change the values in the fields by clicking the arrows or typing the desired value in the field. Confirm your changes by clicking the Save button. If you want to restore the changes to their original state, click **Reset to Defaults** box.

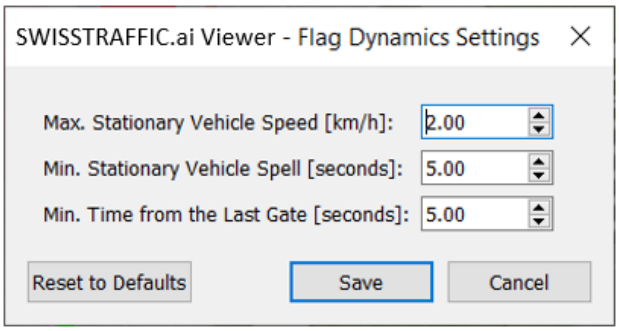


Figure 104: Flag Dynamics Settings window

Visibility Settings

Types - This setting allows you to show or hide **Trajectory** and **Info Flags** of specific object types, click **Overall Visibility** to hide both. If you want to restore the changes to their original state, click **Reset to Defaults** box.

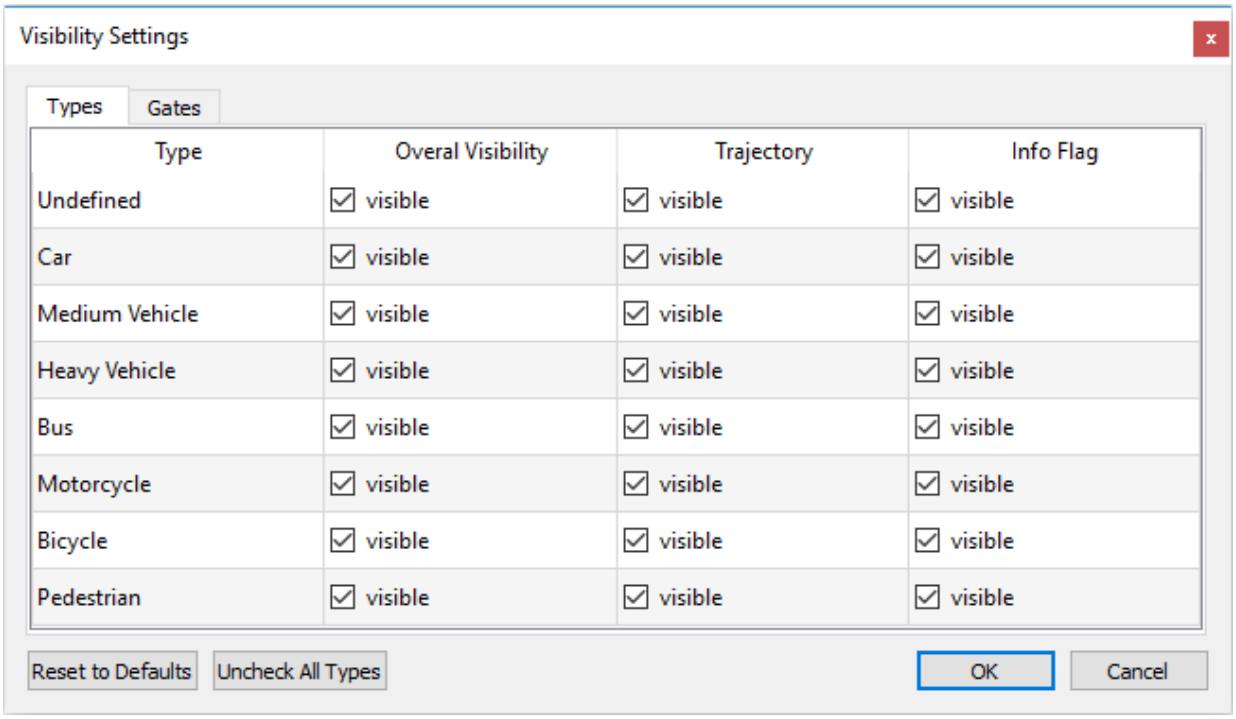


Figure 105: Visibility Settings window

Gates - Here you can show or hide Tracks for specific Gates If you want to restore the changes to their original state, click **Reset to Defaults** box.

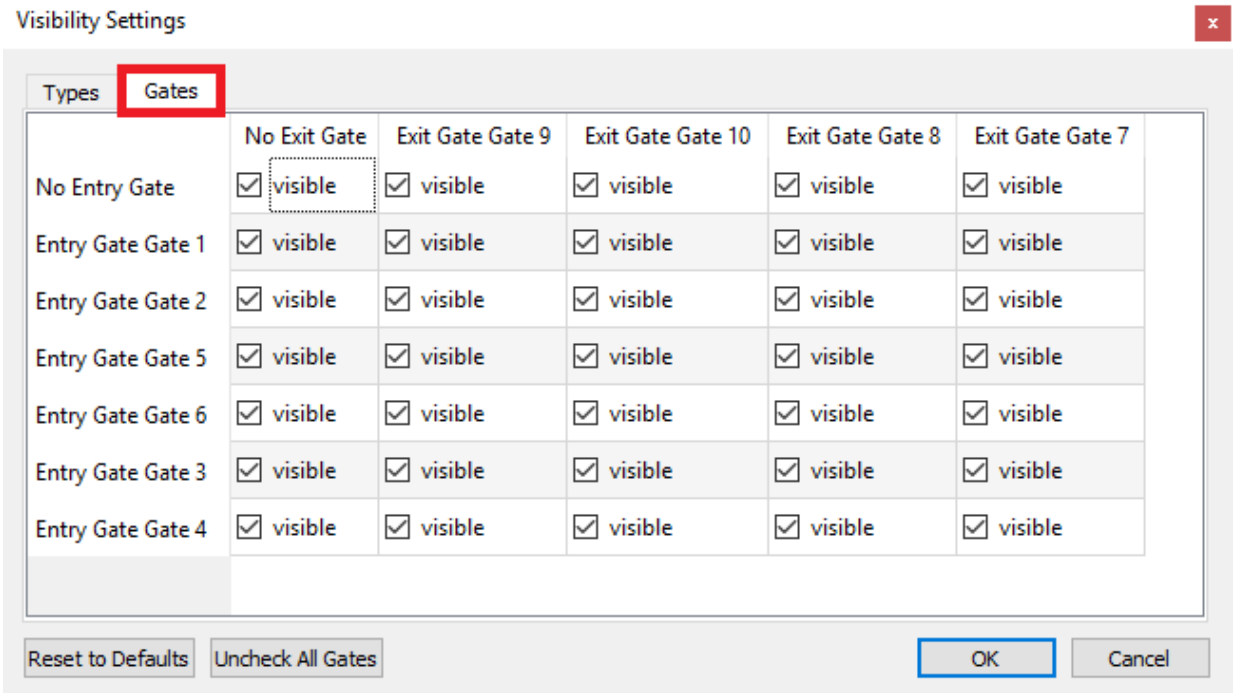


Figure 106: Gates Visibility Settings

For example, if you set in View Menu **Show Non-Present Track** and check only one pair of Gates, you will see all the object Tracks between a specific pair of Gates.

Figure 107: Gates Visibility Example

Set Video Background Colour

If a stabilized video is playing, or if the video display is turned off, it is the background colour below the video.

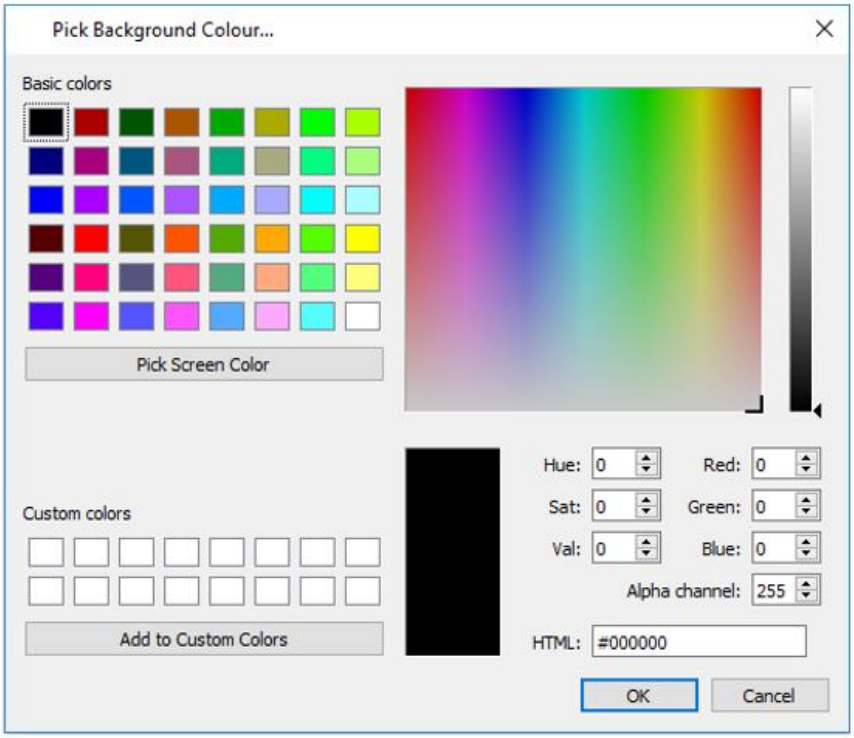


Figure 108: Set Video Background Colour window

Settings Presets

Here you can select the Preset Video Sequence quality.

- HD Preset
- FullHD Preset
- 4K Preset
- Custom Preset

Quality

Here you can set the Quality of the displayed video relative to the original video:

sets the quality of: “Best” - same size, “Good” - original resolution scale 0.5, “Low” - original resolution scale 0.25, the resolution affects the quality and speed of video playback.

- Best – The same quality as the original video.
- Good – Half quality of the original resolution.
- Low – Quarter quality of the original resolution.

VIEW MENU

The main window view can be configured to a great extent, using the **View** menu items.

You can find here:

- Visualise Data Outside View
- Show Text under Toolbar Icons
- Show Unselected Tracks
- *Show Non* - Present TracksShow Non - Present Tracks
- Show Anonymization regions
- Keep Anonymization regions up to date
- Show Traffic Gates
- Show Traffic Regions
- Show Video
- Manage Overlay…
- Safety Analysis
- Track Flags
- Track Colouring
- Switch Gate LabelSwitch Gate Label
- Zoom
- Switch Coordinate Space
- Switch Scene Colouring

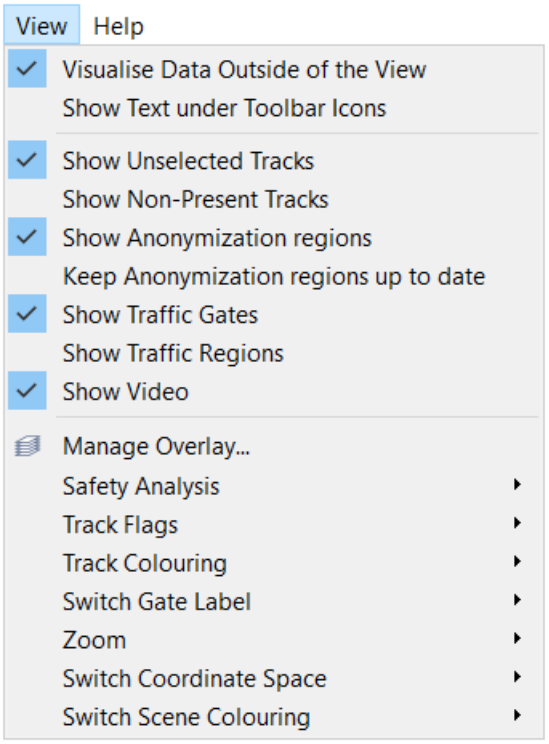


Figure 109: View menu

Visualise Data Outside View

Only for **DRONE** mode. Due to stabilization and georegistration, there are black corners in the video sequence. If you check this option, the Trajectories will be displayed in these black corners too.

Figure 110: Visualise Data Outside View

Show Text under Toolbar Icons

Checking this box will display a description of the buttons on the Main toolbar.

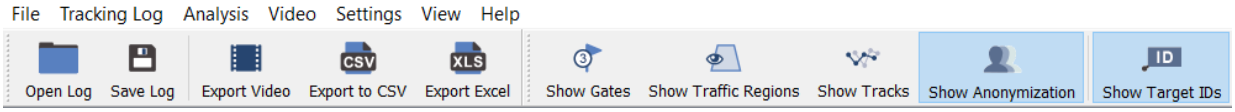


Figure 111: Text under Toolbar Icons

Show Unselected Tracks

If this box is checked (Default), only the Trajectories of the objects currently in the image are displayed, the button for this function is also located on the Main Toolbar.

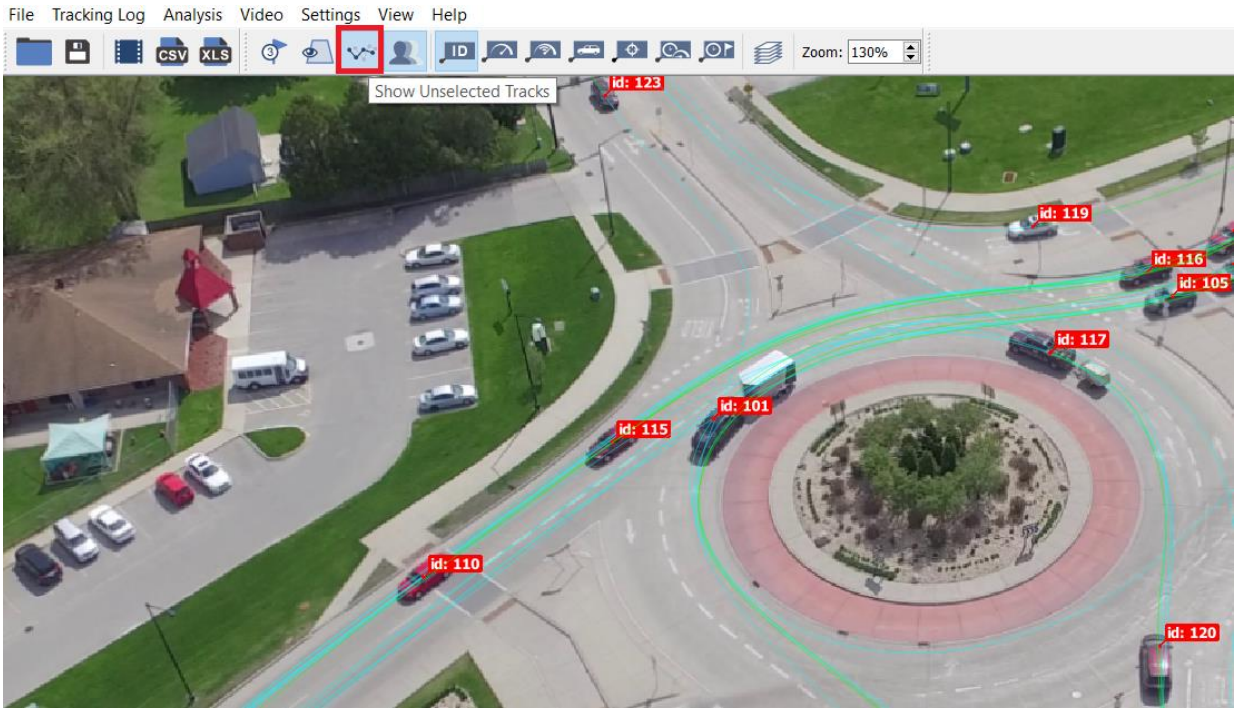


Figure 112: Show Unselected Tracks Button

Show Non - Present Tracks

If this field is checked, all Trajectories in the video sequence are displayed.

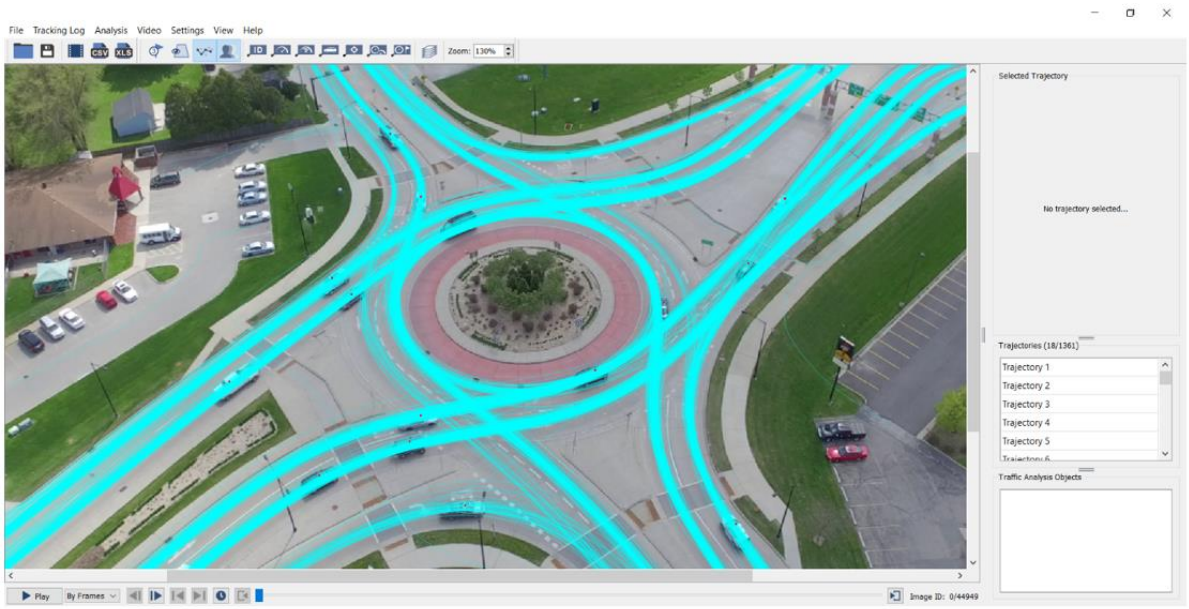


Figure 113: Show Non - Present Tracks

Show Anonymization regions

If this box is checked, it displays Anonymization regions, the button for this function is also located on the Main bar. (More about the Anonymization Regions)

Figure 114: Show Anonymization regions

Keep Anonymization regions up to date

If this field is unchecked (Default), the Anonymization region field will not be refreshed and will display only the still image. If this field is checked, the Anonymization region field will be refreshed and will display a blurred image. (More about the Anonymization Region)

Show Traffic Gates

Check this box to view the Traffic Gates, the button for this function is also located on the Main bar. (More about the Traffic Analysis Gates)

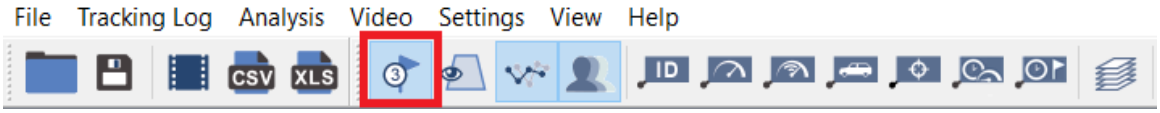


Figure 115: Show Traffic Gates Button

Show Traffic Regions

Traffic Region is used to defining a stationary vehicle in a certain area in the scene view.

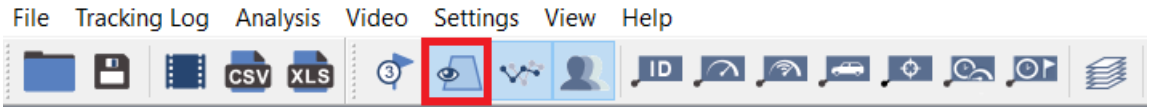


Figure 116: Show Traffic Regions Button

Show Video

Check this box to show or hide the video sequence.

Manage Overlay…

Select this option to display the **Overlay Visuals** window. The button for this function is also located on the Main bar.

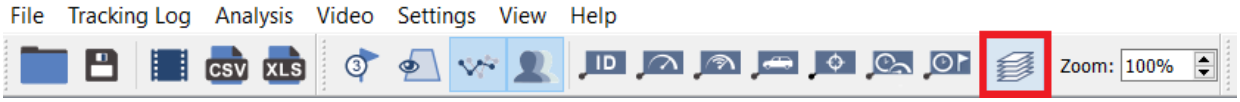


Figure 117: Overlay Manager Button

The **Overlay Visuals** setting is used to graphically display:

Velocity – Absolute size of object velocity vector.

Total Acceleration – Absolute size of immediate acceleration vector

Tangential Acceleration – Only in **DRONE** mode. Positive value means acceleration and negative value means deceleration.

Lateral Acceleration – Only in **DRONE** mode. Positive value means acceleration to the right and negative value means acceleration to the left.

Total Stationary Time – Visualizes areas where vehicles are considered stationary. For defining a stationary vehicle check Flag Dynamics Settings.

Object Density – Visualizes the density of occurring objects.

Safety Analysis – To view this overlay, you must first perform a Safety Analysis. Visualizes the conflict density of the selected type of Safety Analysis.

Attention! Since there are no georegistered data in **SCOUT mode**, the velocity and acceleration values will be distorted due to perspective (distant objects move seemingly slower). Even though the speed in **SCOUT mode** is in kilo-pixels you can easily find out which parts of the roundabout the tracked objects pass at the highest speed.

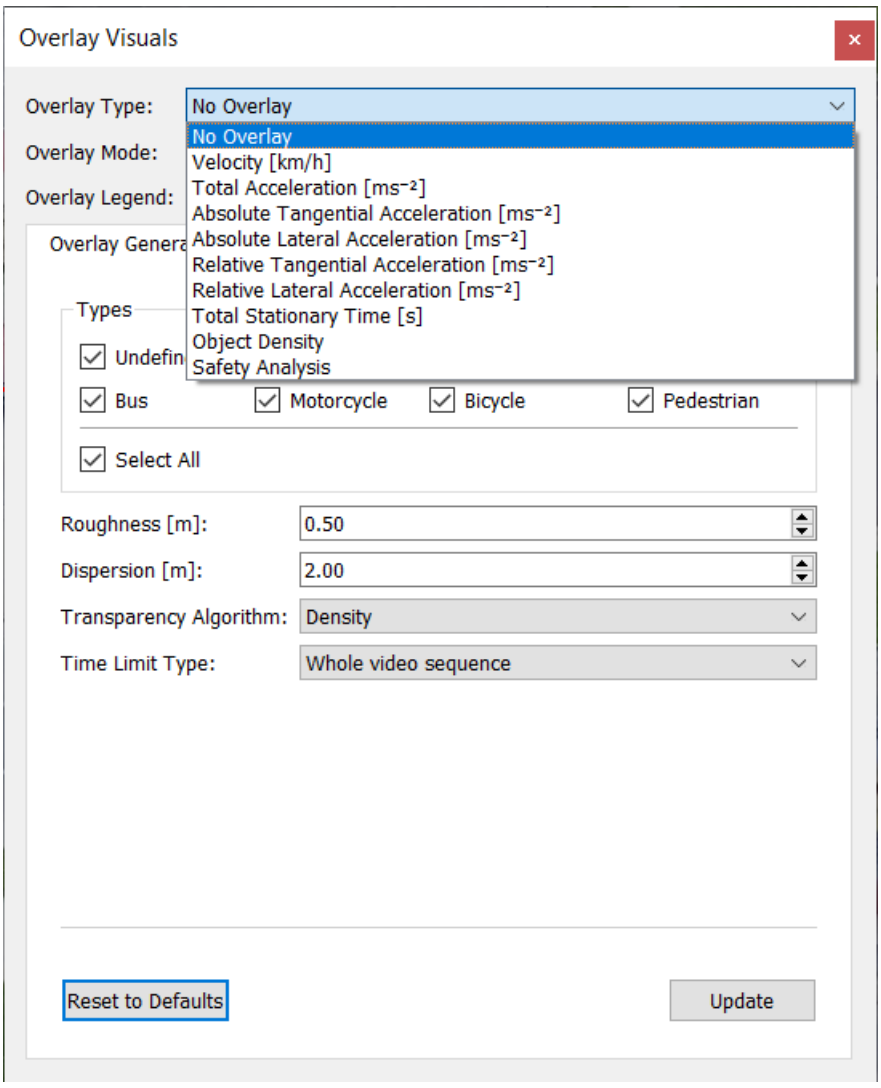


Figure 118: Overlay Visuals

Overlay Generation Settings:

- **Overlay Type** – Sets whether to display **Velocity**, **Acceleration**, **Total Stationary Time**, **Object Density**, **Safety Analysis**.
- **Overlay Mode** – Sets whether to display **Heat Map** or **Grid Map**.
- If you want to display the **Legend** check the **Overlay Legend** box.

- To select the object Types for which the Overlay is to be generated check required boxes in the **Overlay Generation Settings**. By default, the checkbox **Select All** is checked.
- **Roughness** – Sets the density of the displayed points.
- **Dispersion** – Sets the size of the displayed points.
- **Transparency Algorithm**
    - **Density** – The transparency level is set according to the sample density for that point in the image. This means that where there is a higher density of values, the transparency is less, and with a lower density of values, the transparency increases
    - **Presence** – All samples in the heatmap are equal (in terms of transparency). This means that the same transparency value is set for greater and lesser density of values in the heatmap.
- Then you can set if you want Overlay for **Whole video sequence**, **Fixed interval** or for **Floating time window.**

All changes in **Overlay Generation Settings** must be confirmed by clicking the **Update** button or you can undo all changes by clicking the **Reset to Default** button.

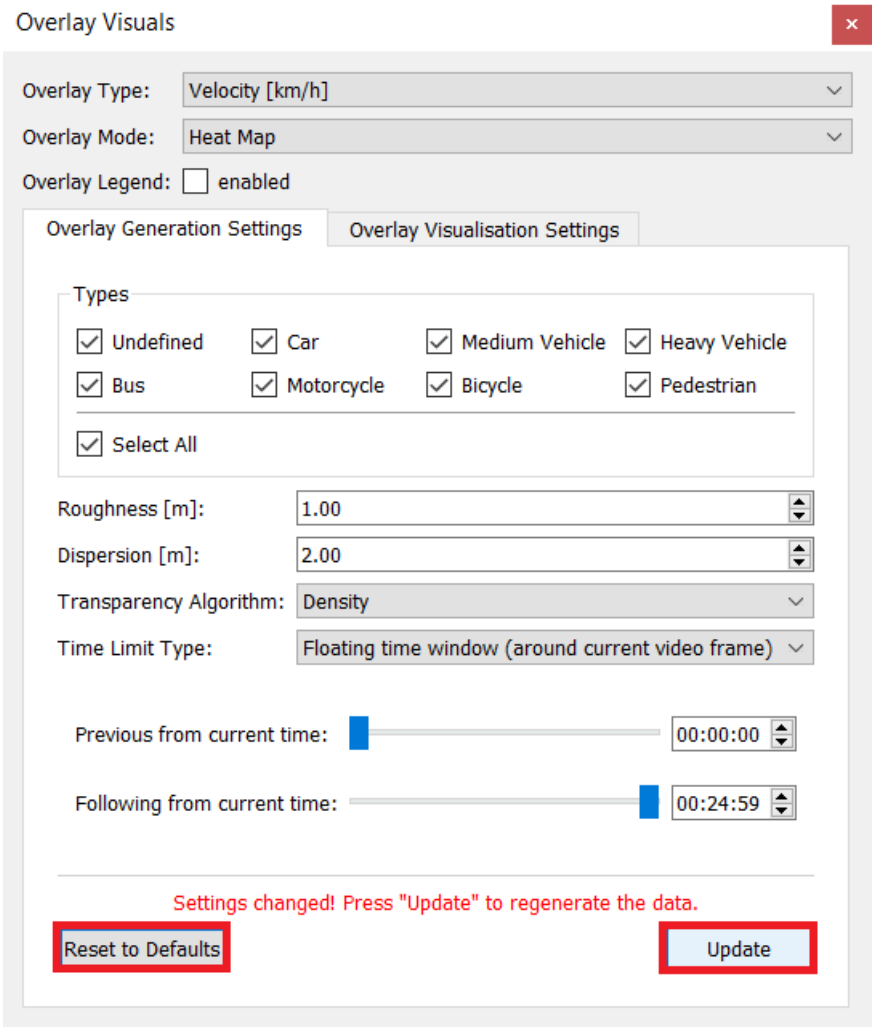


Figure 119: Overlay Visuals – Update

In **Overlay Visualisation Settings** you can find **Generic Settings** and **Grid Map Settings**.

In **Generic Settings** you can set what **Colour Map** of displayed overlay you want, **Transparency** of displayed trajectories and **Heat map value range**, that allows you to change the sensitivity of the displayed overlay.

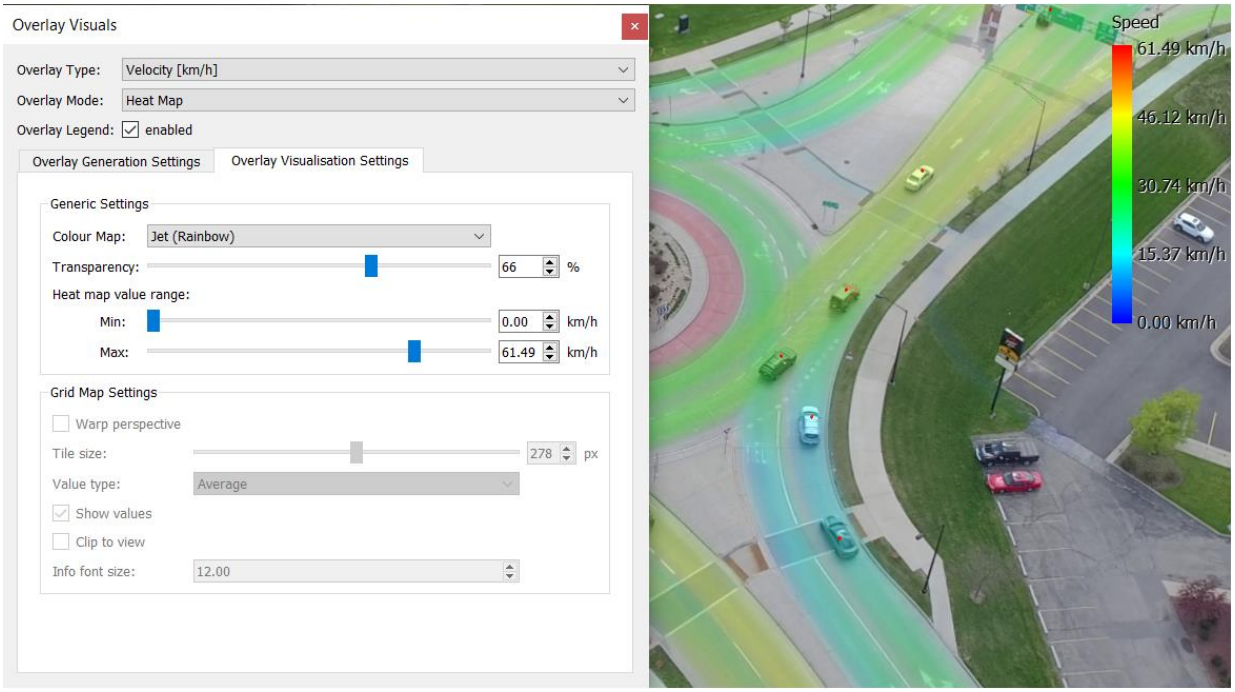


Figure 120: Overlay Visualisation Settings

If you select a **Grid Map** as the **Overlay Mode**, the **Grid Map Settings** become available:

Warp perspective – Only in **DRONE** mode. Requires georegistration, sets the Grid Map projection to the Earth plane.

Title size – Sets the size of each square of the map, by default in pixels. If checked **Warp perspective**, expressed in meters.

Value type – Sets which value to display in squares (Average, Median, Minimum, Maximum).

Show values – Sets whether to display values in squares.

Clip to view – If some squares extend beyond the image, check this box to crop them according to the image size.

Info font size – Sets the font size of the displayed information.

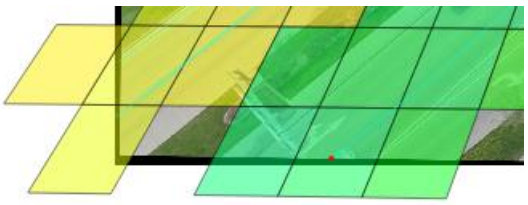


Figure 121: Clip to view

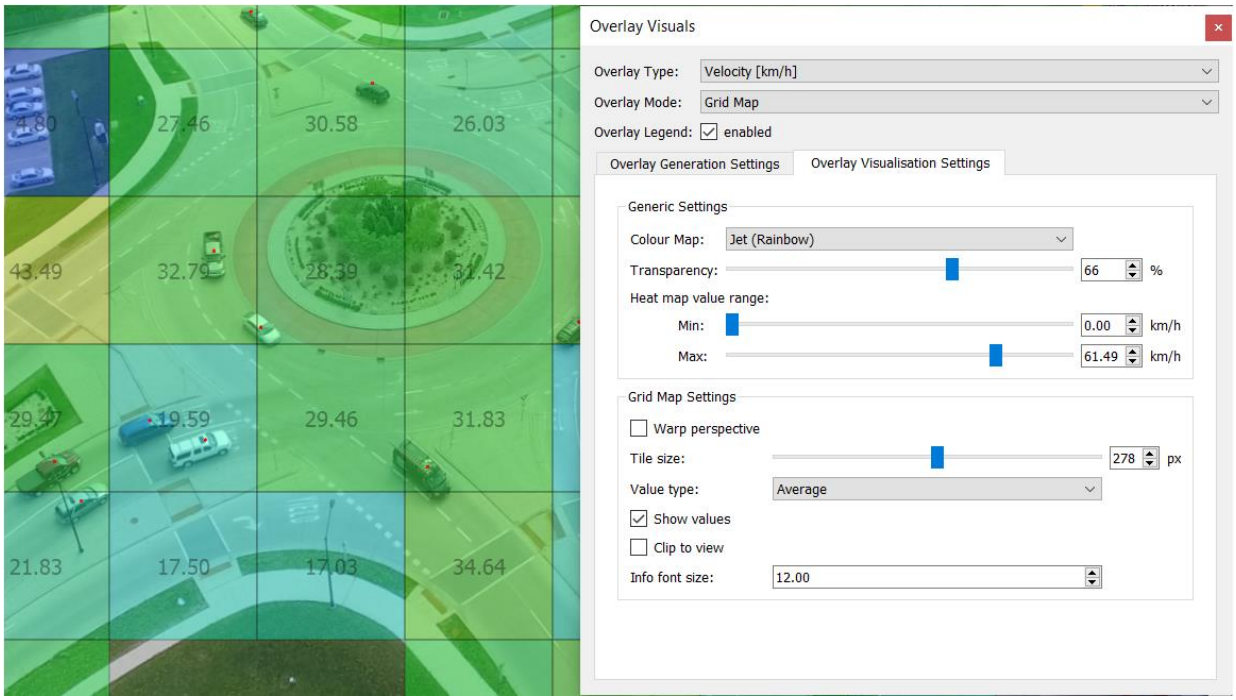


Figure 122: Overlay Visualisation Settings – Grid Map

Safety Analysis

Here you can set whether to display detected conflicts in the scene view. In order to display conflicts, the Safety Analysis must be performed first, after the analysis the **traffic conflicts** and the **traffic conflicts statistics** are displayed automatically. Check **Show traffic conflicts live** to show or hide alert of detected conflicts. Check the **Show traffic conflicts statistics** box to display marks of detected conflicts. See more about Safety Analysis.

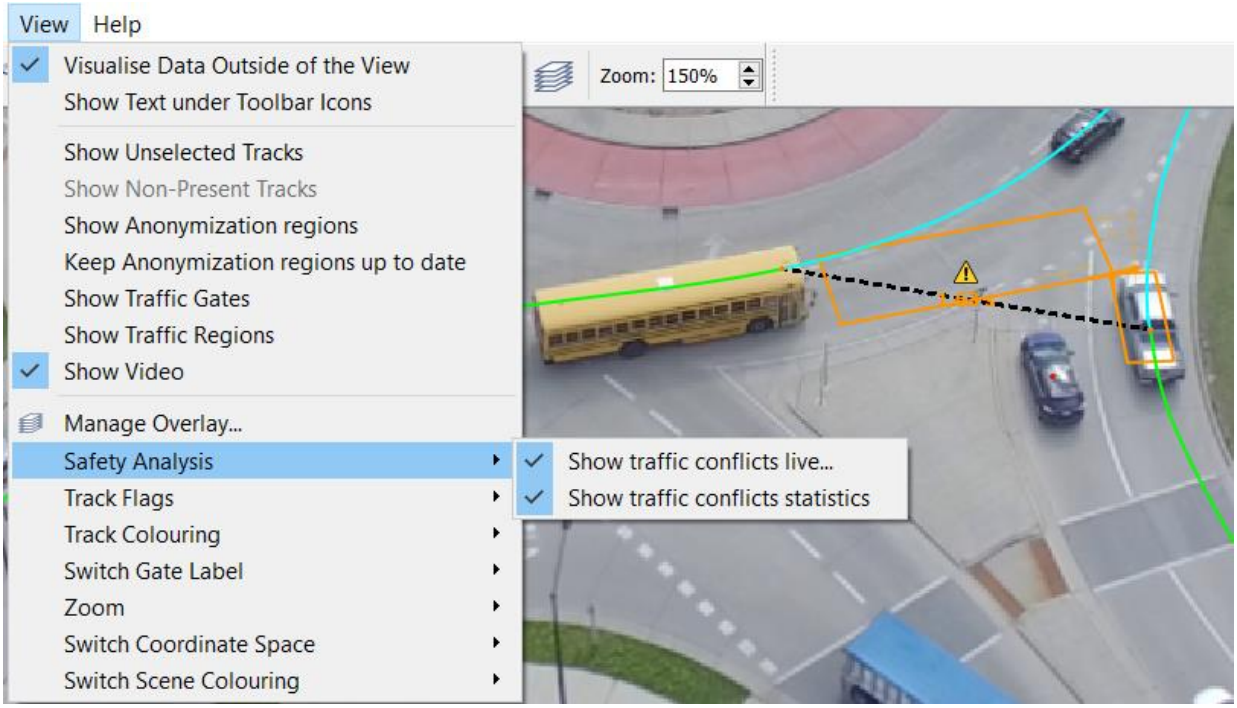


Figure 123: Safety analysis

Track Flags

Flags are used for easier identification of objects and to display information about objects such as ID, type, speed, acceleration, colour, etc. They can be displayed using the **Main toolbar** or the **View menu**. If you click on the Flag of the tracked object, its Track will be highlighted and displays the following information in the **Selected Trajectory** list.

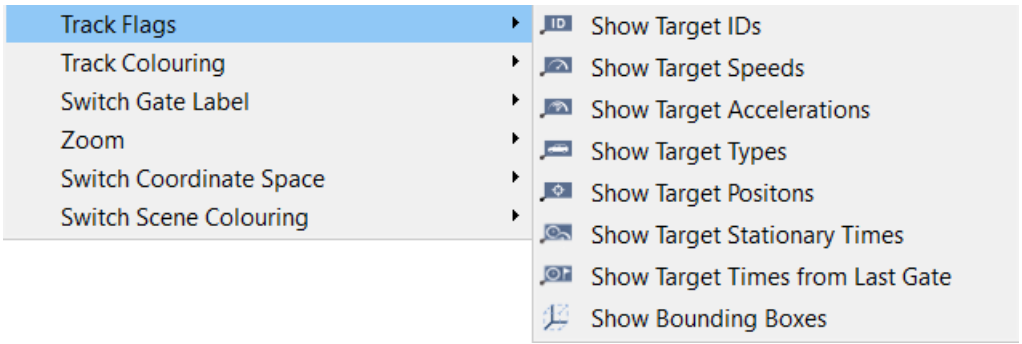


Figure 124: Track Flags

Show Target IDs – Check this box to display **Flags** with the relevant object **IDs**, the flag of the selected object is orange. The button for this function is also located on the **Main bar**.

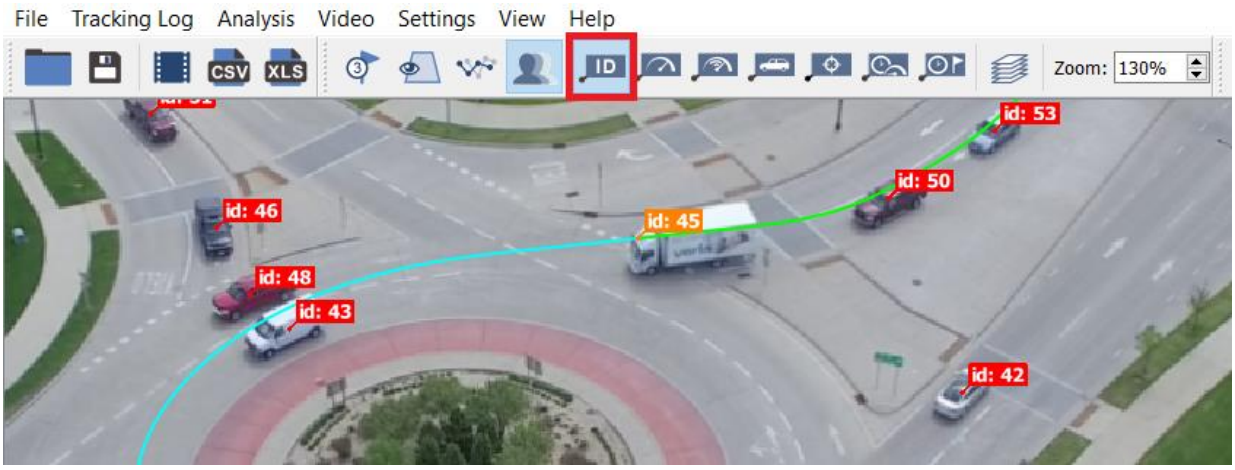


Figure 125: Show Target IDs

Show Target Speeds – Check this box to display the **Flag** with the **Speed** of the object. The button for this function is also located on the **Main bar**.

Figure 126: Show Target Speeds

Show Target Accelerations – Check this box to display the **Flag** with the **Acceleration** of the object. The button for this function is also located on the **Main bar**.

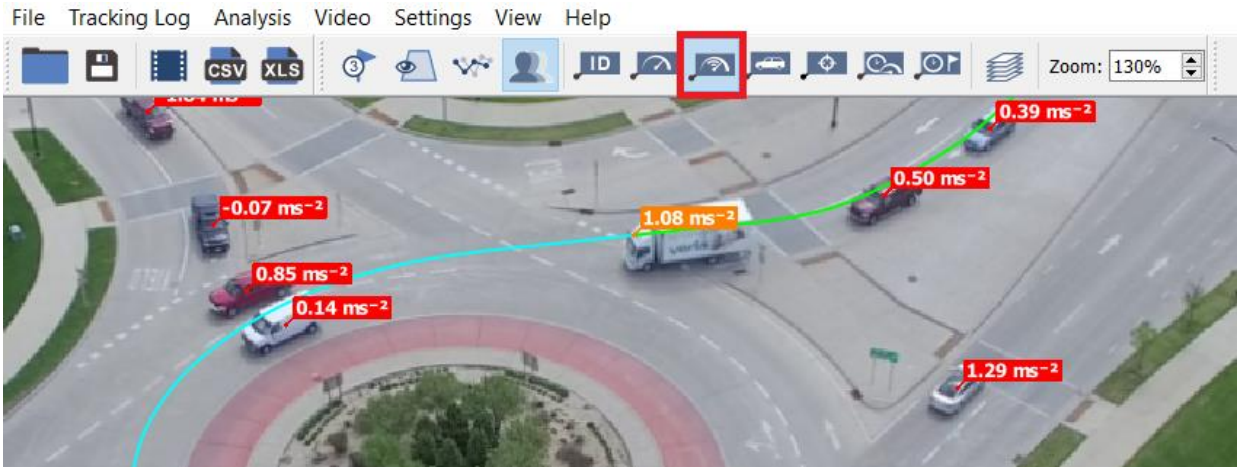


Figure 127: Show Target Accelerations

Show Target Types – Check this box to display the **Flag** with the object **Type.** The button for this function is also located on the **Main bar**.

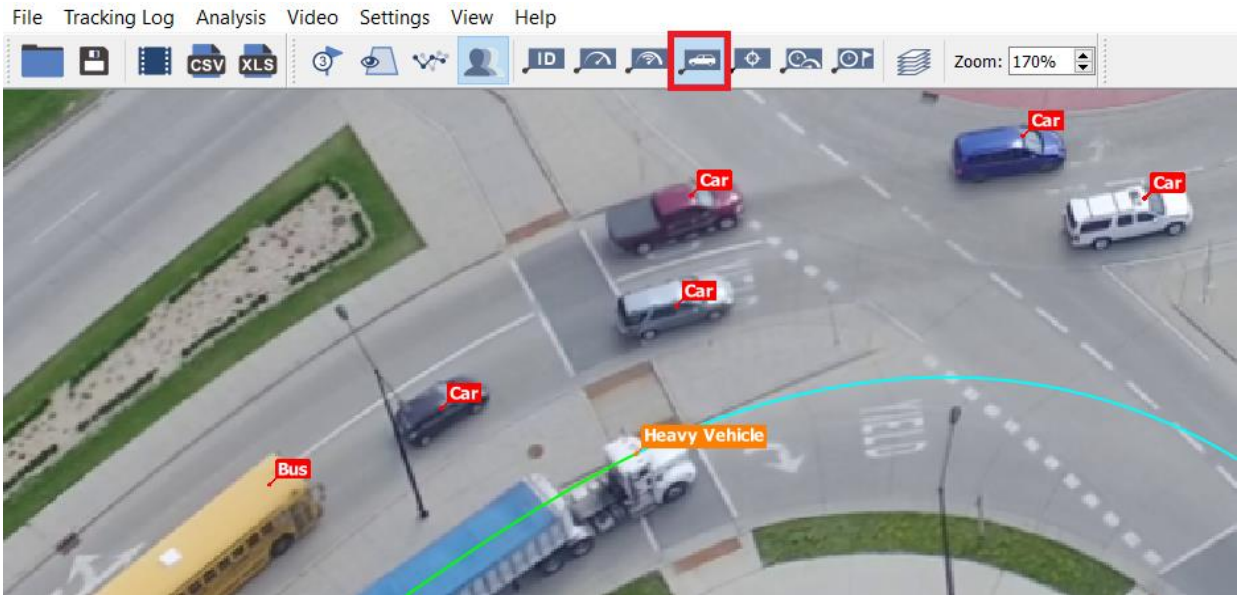


Figure 128: Show Target Types

Show Target Positions – Shows the current position of the object, in Units Settings you can change the coordinate system from **UTM** to **WGS 84**.

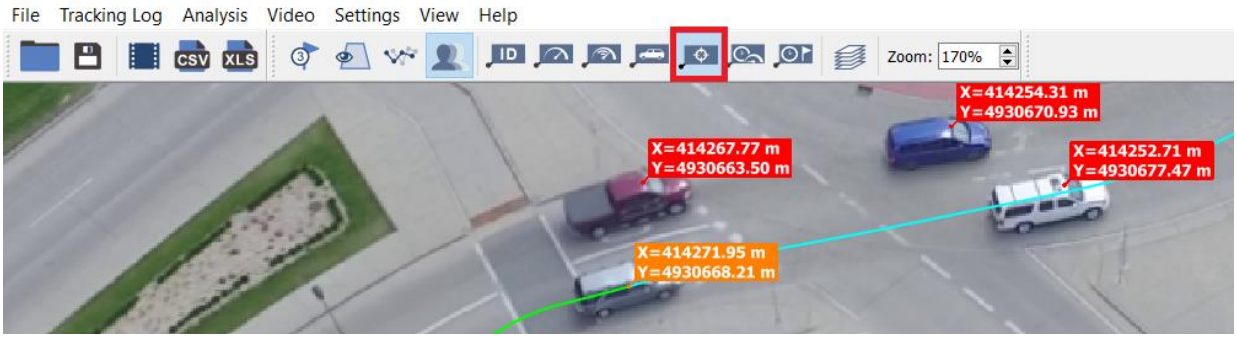


Figure 129: Show Target Positions

Show Target Stationary Times – This function displays the stop time of the object. The button for this function is also located on the **Main bar**. For more accurate settings you can set the **Max. Stationary Vehicle Speed** and the **Min. Stationary Vehicle Spell** in Flag Dynamics Settings.

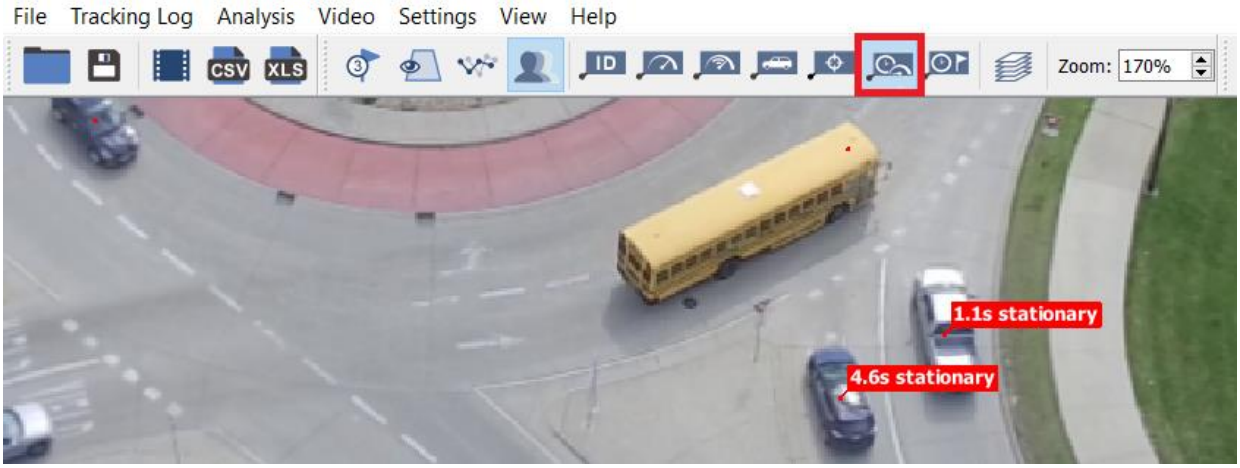


Figure 130: Show Target Stationary Times

Show Target Times from Last Gate – This function displays the time when the object last passed through the Gate. Traffic Analysis Gates must be inserted to display this value. The button for this function is also located on the **Main bar**. For more accurate settings you can set the **Min. Time from the Last Gate** in Flag Dynamics Settings.

Figure 131: Show Target Times from Last Gate

Track Colouring

You can set the track colour in the **Track Colouring Approach** menu, this menu allows you to change the colour of the track relative to the **Type**, **Speed** or **Direction** of the track. You can also check the option to **Apply Colouring For Track Flags**, after which the flags will be coloured according to the type or direction of the object.

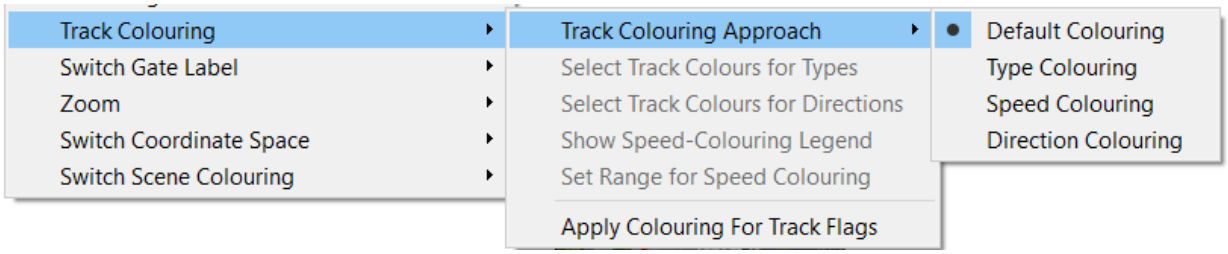


Figure 132: Track Colouring Approach

Default Colouring – The **Trajectory line** is double coloured; green colour represents already travelled part of trajectory and blue colour represents the part of trajectory that is to be travelled.

Figure 133: Trajectory line

Type Colouring – Sets Track Colour according to object type. If you set this option, you will be given the option to set the track colour for each object type by clicking **Select Track Colours for Types.**

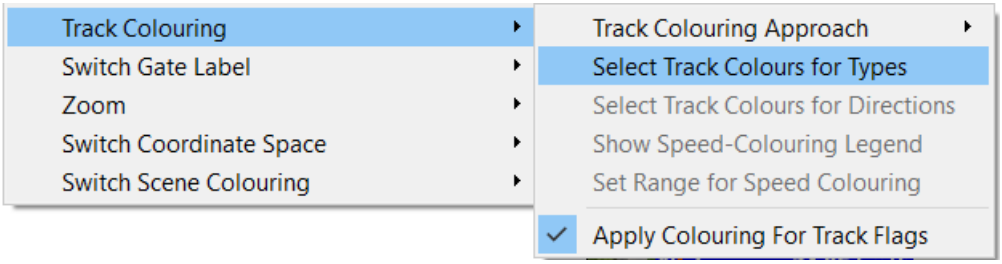


Figure 134: Select Track Colours for Types

Then appears a **Track Colours by Object Type** window where you can set the desired colours by object type.

Figure 135: Track Colours by Object Type

Speed Colouring –If you select this option, you can set whether you want to **Show Speed-Colouring Legend** and also **Set Range for Speed Colouring.**

Attention! Since there are no georegistered data in **SCOUT mode**, the velocity and acceleration values will be distorted due to perspective (distant objects move seemingly slower).

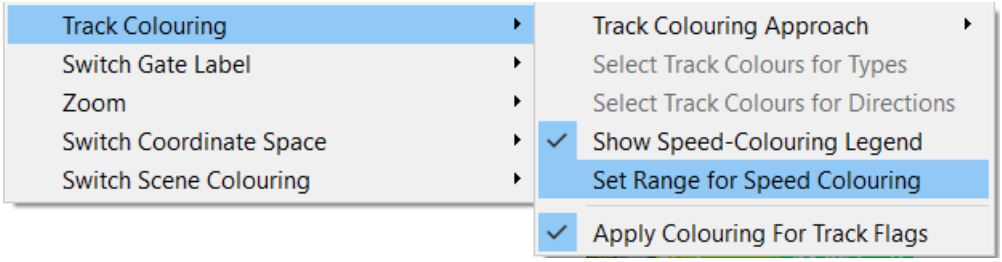


Figure 136: Speed Colouring Options

After clicking on the **Set Range for Speed Colouring** the **Set Maximal Speed** window appears, there you can set the highest speed at which objects move. Even though the speed is in kilo-pixels you can easily find out which parts of the roundabout the tracked objects pass at the highest speed.

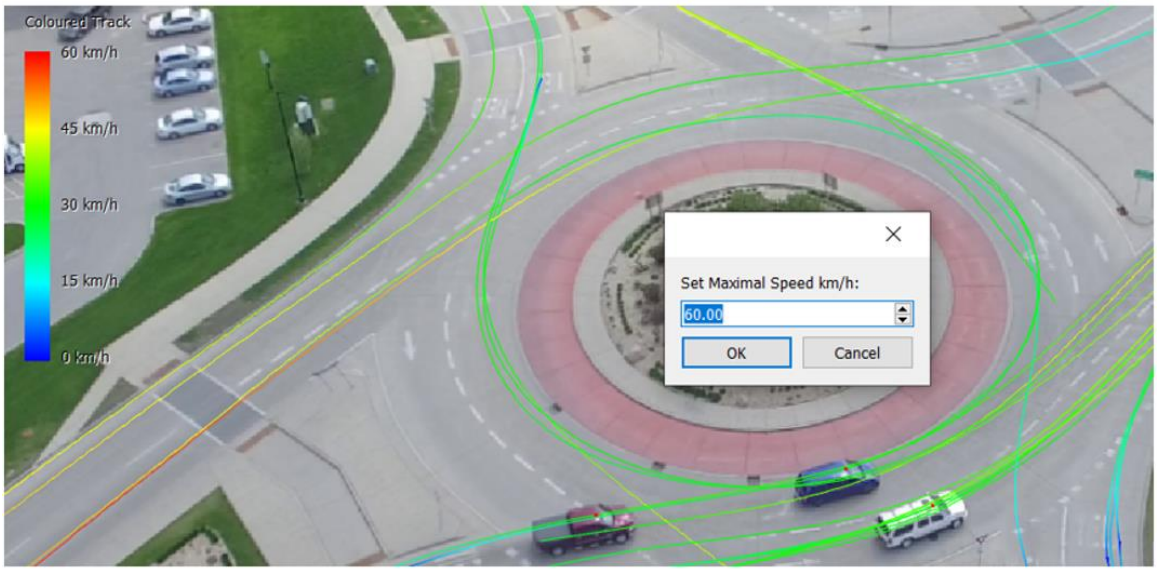


Figure 137: Set Maximal Speed

Direction Colouring – If you select this setting, you can select the desired colour for each direction in the **Set Track Colours for Directions** setting. Gates must be inserted for this setting to function properly.

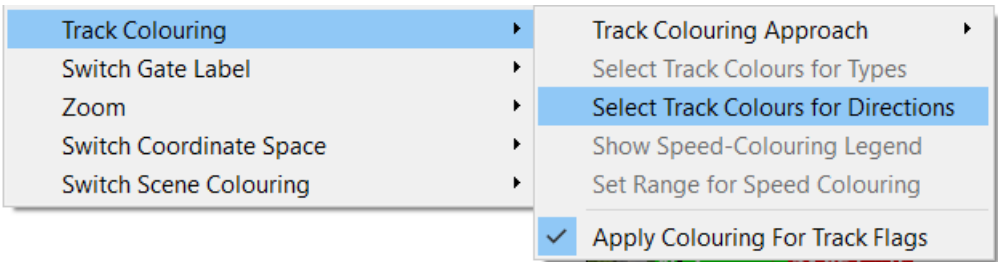


Figure 138: Set Track Colours for Directions

After clicking on **Select Track Colours for Directions** the **Track Colours by Direction** window appears, here you can choose colour for each pair of Gates or you can deselect **different exit gates colors** to display colors by **entry** gate only or **different entry gates colors** to display colors by **exit** gate only.

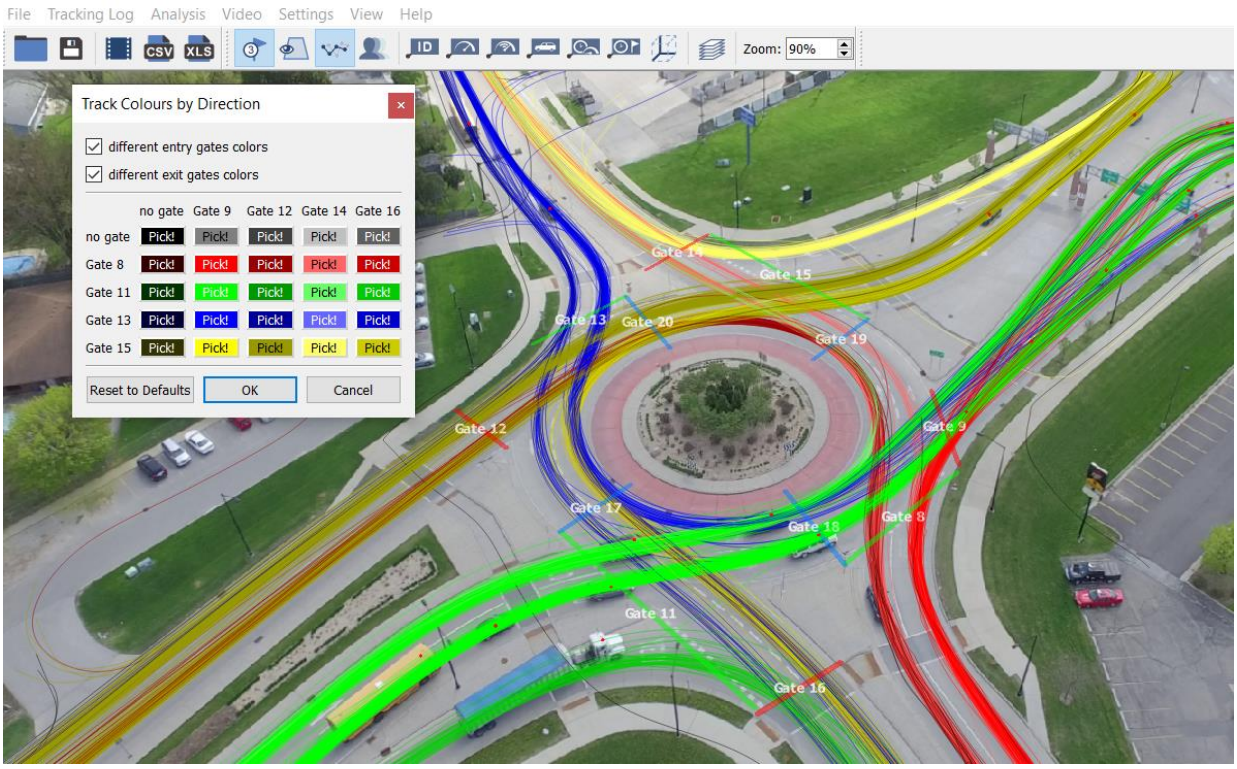


Figure 139: Track Colours by Direction

Switch Gate Label

This setting allows you to choose between displaying:

- **Gate Tags** – Displays the Gate name.
- **Gate IDs** – Displays the Gate identification number.
- **Gate Crossings** – Displays the number of objects that have passed through the Gate.

Figure 140: Switch Gate Label

Zoom

This setting allows you to **Zoom In** or **Out** of the scene view. To **Switch to Detailed View Zoom** you can use the **Ctrl + Z** shortcut and **Ctrl + X** to **Switch to Overview Zoom**.

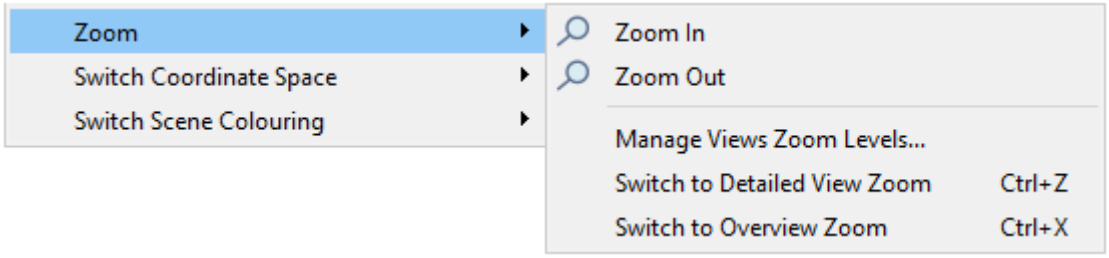


Figure 141: Zoom menu

If you click on **Manage Views Zoom Levels…**, the following window opens. You can set the zoom values for **Overview Zoom Level** and for **Detailed zoom Level**. If you click on the **Current Level** button you set the zoom value of the current view.

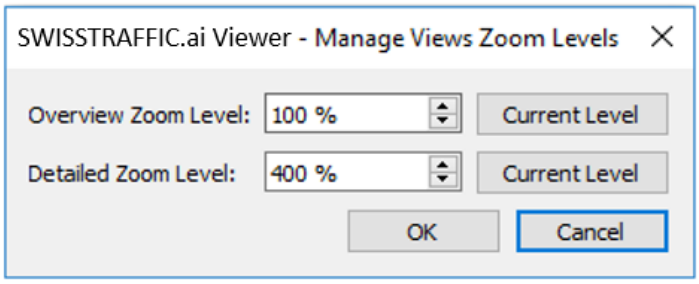


Figure 142: Manage Views Zoom Levels

You can also use the Mouse wheel to **zoom in or out** of the main image or you can set the desired zoom on the Main bar.

Figure 143: Zoom Setting

Switch Coordinate Space

In **DRONE** mode, three spaces are defined by default:

Show in Raw Coordinate Space – Input unstabilized video shot by camera. Since it is not a stabilized video, Trajectories must be recalculated for each frame, which is why Raw video playback is the most computationally demanding.

Show in Reference Coordinate Space – Stabilized video.

Show in Working Coordinate Space – A workspace that should display a bird's eye view. Playing video in this space is the least computationally demanding.

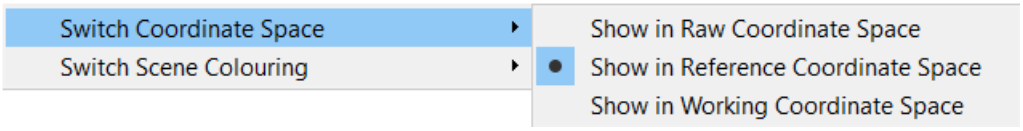


Figure 144: Switch Coordinate Space

Switch Scene Colouring

Here you can set whether the scene should be **Coloured** or **Grayscale**.

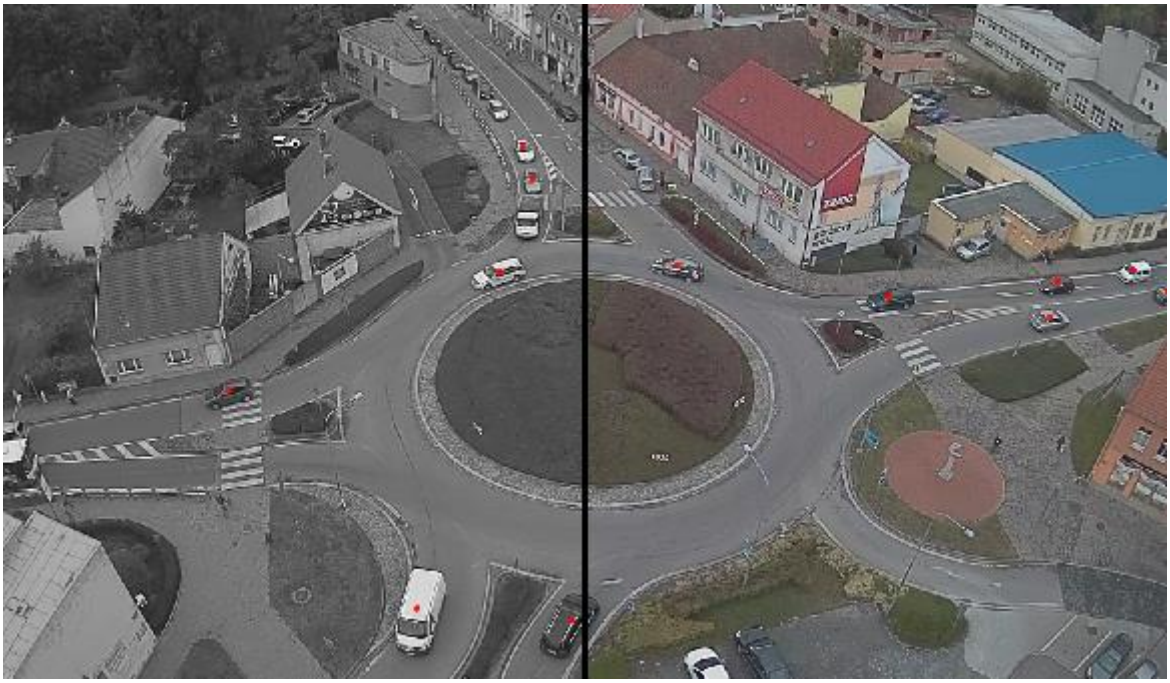


Figure 145: Scene Colouring

DATA EXPORTING

You can Export a number of useful information from **SWISSTRAFFIC.ai Viewer**, like **Visualisation Videos**, **Visualisation Snapshots** and **Traffic Analysis** in **CSV**, **TRJ**, **DXF** file or as an **Excel** file.

EXPORT TRACKING LOG

If you want to export the tracking log you can set these parameters:

- **Range Start Image ID** and **Range End Image ID** – Sets the video range, the first and last frame of the video.
- **Generate Trimmed Video –** If you want to export Tracking Log **without video sequence** check this box.
- **Export Anonymization Regions –** If you want to export **Anonymization Regions** check this box.
- **Rotate Video and/or Workspace –** After checking this box you can rotate **Video** or **Workspace** of exported log.

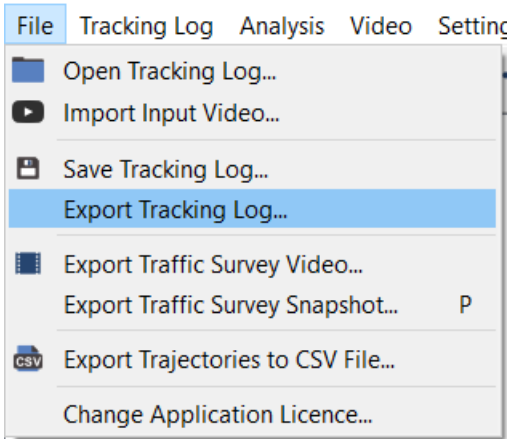


Figure 146: Export Tracking Log Window

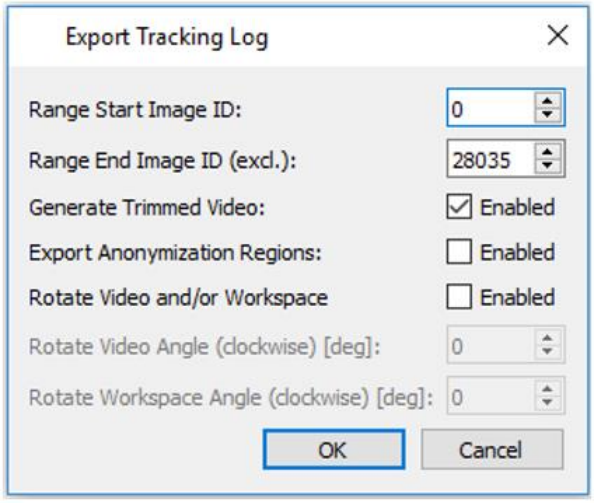


Figure 147: Export Tracking Log Window

EXPORT TRAFFIC SURVEY VIDEO

You can export a video using the **Export Traffic Survey Video** button located on main toolbar.

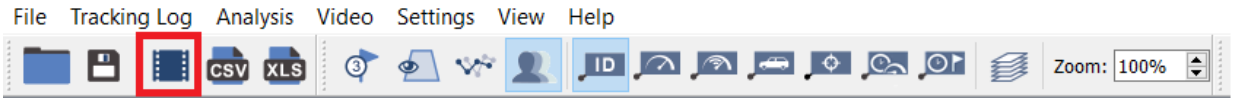


Figure 148: Export Visualisation Video button

Or you can use the File Menu and select **Export Traffic Survey Video**

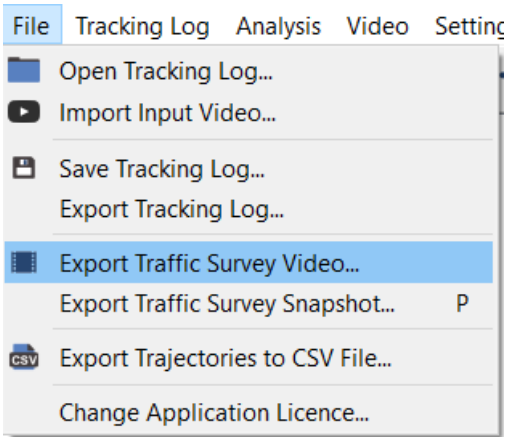


Figure 149: Export Visualisation Video…

In both cases, the **Export Traffic Survey Video** window appears. Here you can **Select** the Output **Path** where you want to save the file and the file format of the exported video. You can also select a **Preset** video format (HD, FullHD, 4K, Custom) and embed a **Logo**, **Info**, or a **Legend**.

- **Embed Logo** – If you want to display logo in video sequence check box **Embed Logo**. Then you can set **Logo size** relative to video image width and **Logo position** in the exported video.
- **Embed Info** – Similar setting is for displaying information, here you can choose what information you want to display (Time, Location, Survey ID Scene Type), if you want to **Add grey background** for its better visibility and if you want to display all **Info on one line**.
- **Embed Legend** – This setting is only available when a Legend is displayed, for example when using an Overlay. You can set here if you want to **Embed Legend** in, set **Legend size** relative to video image height, **Legend position** in the exported video, and if you want to **Add grey background** for its better visibility.
- **Skip rejected and unstabilised video-frames**
- **Export rejected and unstabilised video frames as a black screen**
- **Export whole video** or just a part of it. If you want to export only a part of the video, you can set its length by the number of frames or by dragging the slider.
- **Export Area** – whole scene, current view
- **Export Resolution** – Sets the resolution of the exported image.

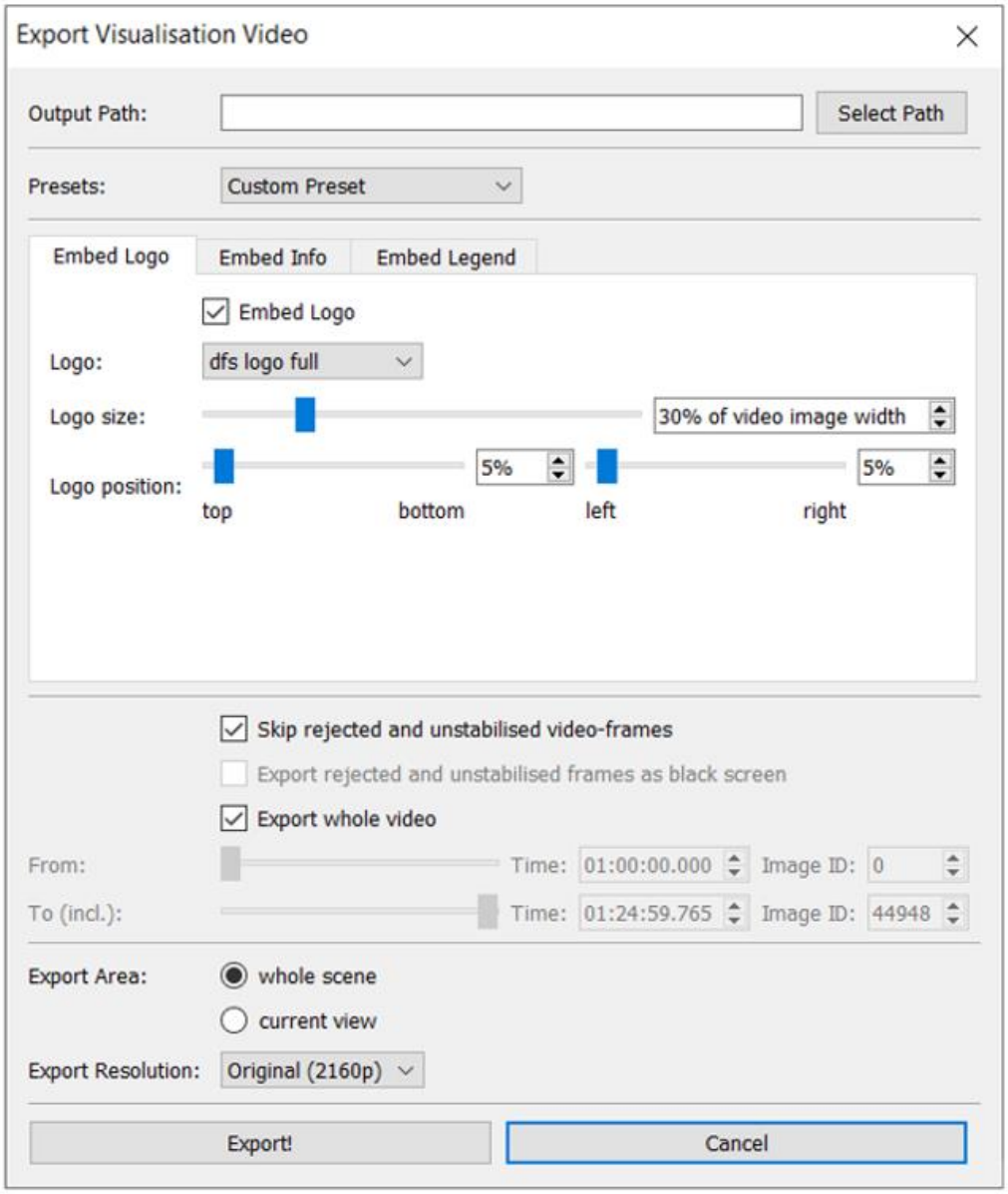


Figure 150: Export Traffic Survey Video window

By clicking on the **Select path** button the **Save Visualisation Video** window will be displayed, here you can choose the desired video format, the options are:

- **HuffYUV Lossless AVI video (*.avi)**
- **RGB Lossless AVI video (*.avi)**
- **FFMPE.G. Compressed AVI video (*.avi)**
- **XVID Compressed AVI video (*.avi)**

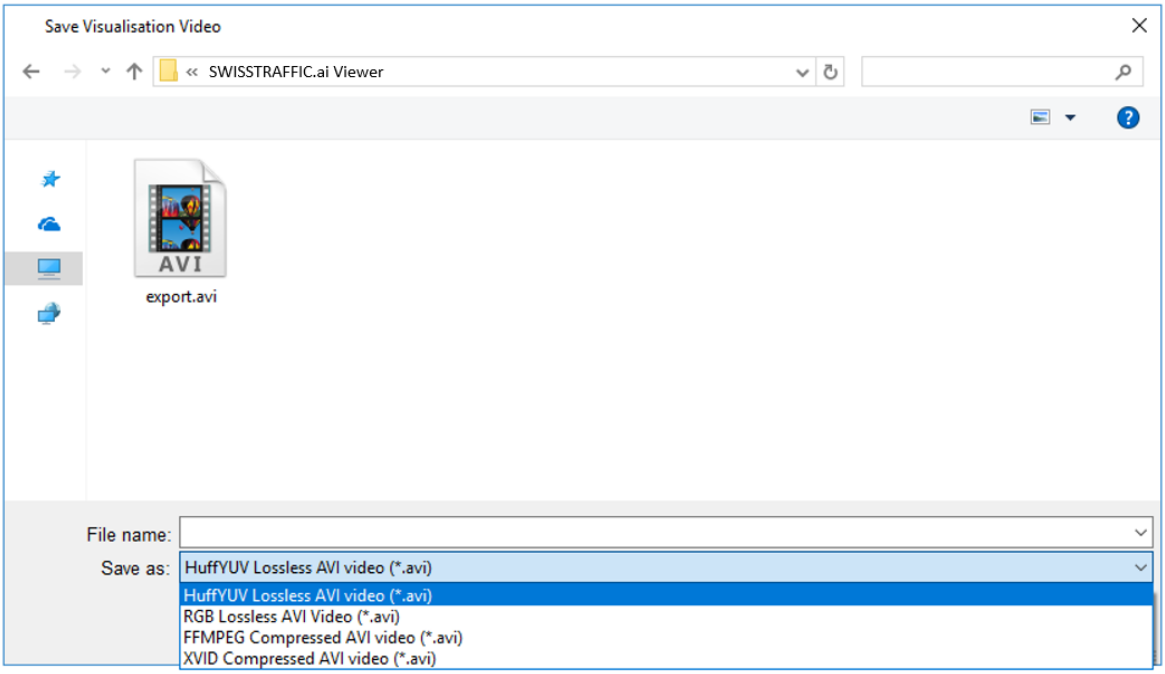


Figure 151: Save Visualisation Video

Then you can set the **Export Area** whether you want to export the **whole scene** or just the **current view** displayed on viewer. Then click the **Export** button, operation will take a few minutes.

EXPORT TRAFFIC SURVEY SNAPSHOT

You can also create a snapshot of the current view by clicking the File Menu and selecting **Export Traffic Survey Snapshot** or by pressing the **P** key on the keyboard.

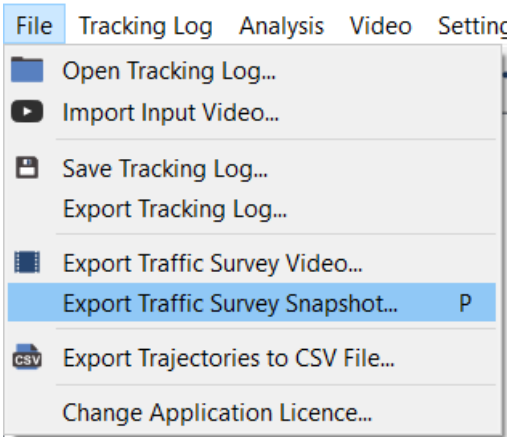


Figure 152: Export Visualization Snapshot

The **Export Snapshot** menu appears, **Select Path** where you want to save the snapshot, and then select the image quality **Pre-sets** (HD, Full HD, 4K, Custom).

- **Embed Logo** – If you want to display logo in Snapshot check box **Embed Logo**. Then you can set **Logo size** relative to image width and **Logo position** in the exported image.
- **Embed Info** – Similar setting is for displaying information, here you can choose what information you want to display (Time, Location, Survey ID Scene Type), if you want to **Add grey background** for its better visibility and if you want to display all **Info on one line**.
- **Embed Legend** – This setting is only available when a Legend is displayed, for example when using an Overlay. You can set here if you want to **Embed Legend** in, set **Legend size** relative to image height, **Legend position** in the exported image, and if you want to **Add grey background** for its better visibility.

Export Area – Whether you want to export the **whole scene** or just the **current view**.

Export Resolution – Sets the resolution of the exported image.

Then click the **Export** button.

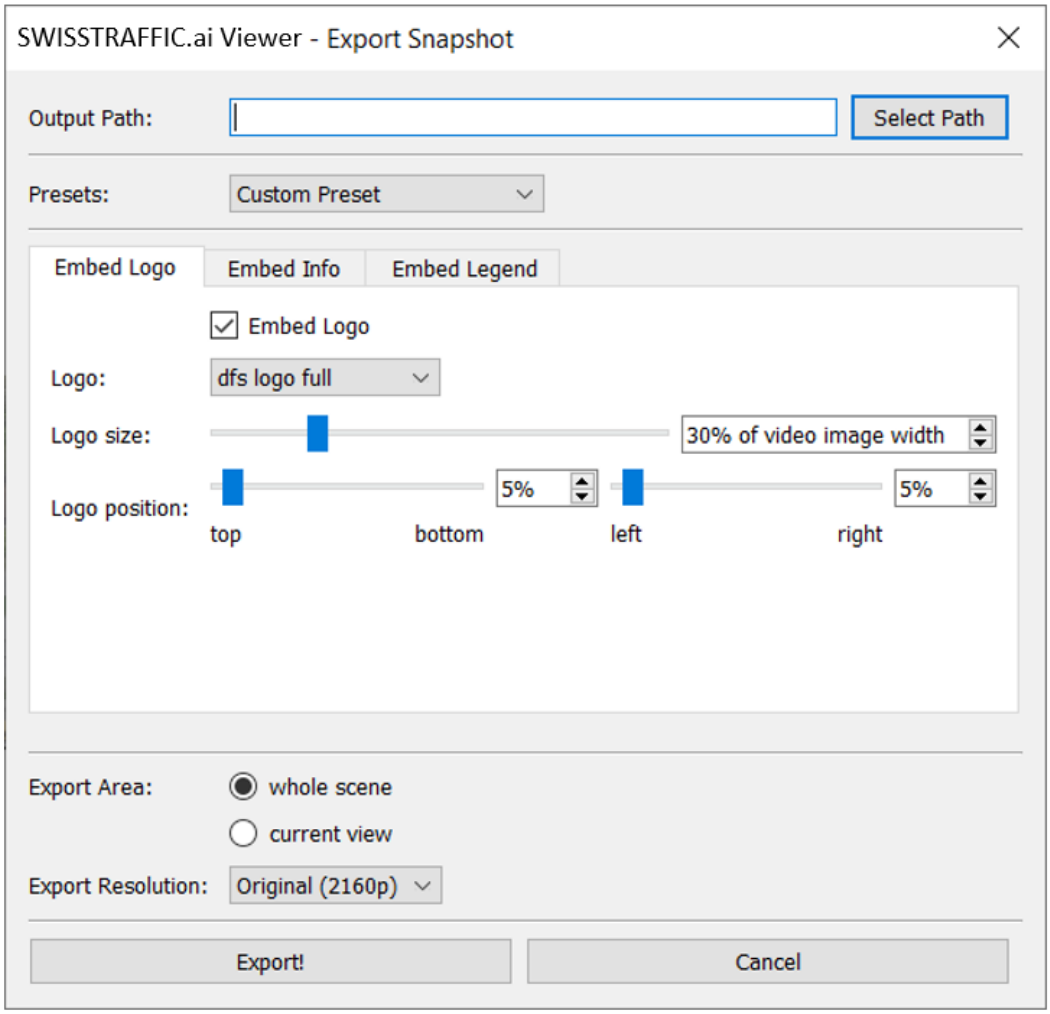


Figure 153: Export Snapshot

EXPORT TRAJECTORIES TO CSV FILE

If you want to **Export Trajectories to CSV File** you can use export button located on main toolbar. The exported CSV file contains only Trajectory data, e.g.:

Track ID, Object Type, Entry Gate, Entry Time, Exit Gate, Exit Time, Travelled Distance, Average Speed, i.e.

Figure 154: Export Trajectories to CSV File Button

Or you can use the **File menu** and select **Export Trajectories to CSV File**.

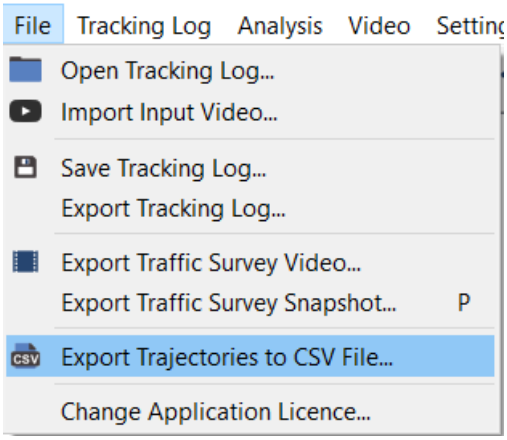


Figure 155: Export Trajectories to CSV File

In both cases, the Export window appears, here you can set the **Export Parameters:**

Export Trajectories – If you want to export Trajectories Check this box.

Export only part of trajectories between entry and exit gates

Export only current trajectory – Only the selected trajectory will be exported.

Export only valid trajectories – Only trajectories that pass through the Entry and Exit Gate are considered valid.

Export trajectories angles – Check this box if you want to export the vehicle angle for each exported position of Trajectory.

Export trajectory traffic regions assignment – For each step, the information to which Traffic Region a given Trajectory belongs is exported, this can be used for further analysis, e.g. if you define Traffic Regions as a road lane you can detect when the vehicle has moved from lane to lane.

Exporting step in frames – sets the size of one step of exported trajectory positions, default is 1 frame, that is, the positions of each trajectory are exported for each frame, if you enter 2, the positions for every second frame will be exported etc.

Entry Separator – Enter here which symbol you want to separate individual fields of the table.

Decimal mark – Choose whether you want a decimal Dot or Comma in the exported document.

Trajectory Time Origin – Specifies the video time:

- **Start of Video Sequence** – Sets the start time to the start of the Video Sequence.
- **Start of Tracking Log** – Sets the start time to the start of the Tracking Log, that means, the video capture time set in Tracking log Information will be used.
- **Start of Trajectory** – Sets the start time to the start of the Trajectory.

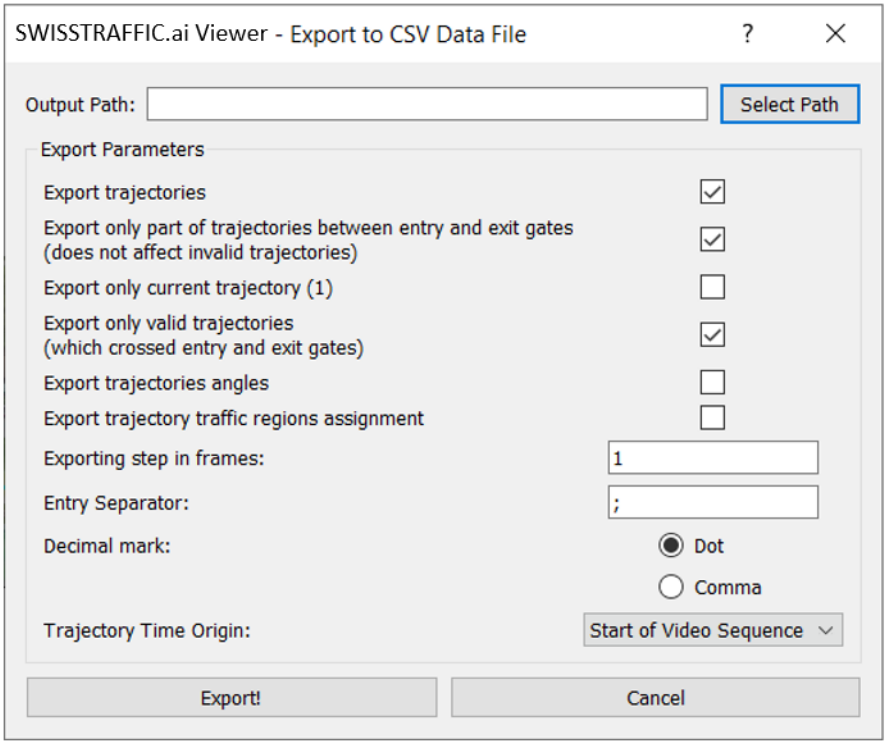


Figure 156: Export Trajectories to CSV File window

EXPORT TRAFFIC ANALYSIS

One of the most important features of the **SWISSTRAFFIC.ai Viewer** is exporting the Traffic Analysis to CSV or Excel file; you can find this option in the **Analysis menu.**

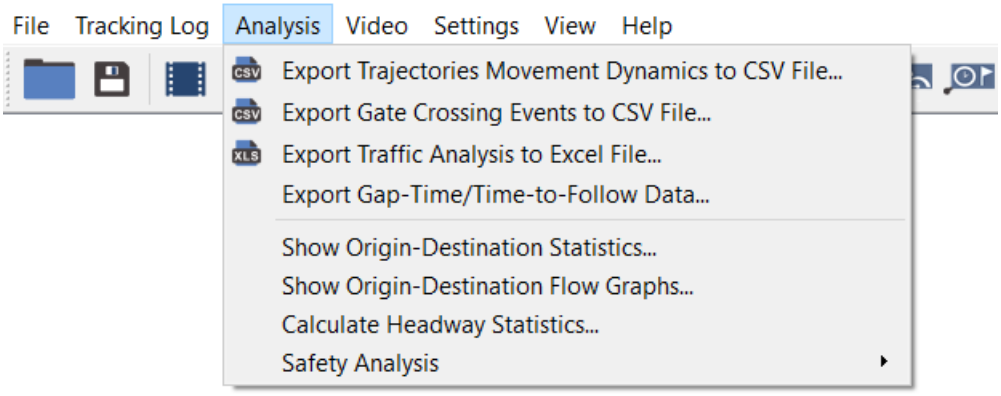


Figure 157: Analysis Menu

EXPORT TRAJECTORIES MOVEMENT DYNAMICS TO CSV FILE

Motion Dynamics contains the information about Track ID, Type, Entry Gate, Exit Gate, Gates Passed(list), Time Btw. Gates [s], Distance Btw. Gates [m], Time Total [s], Distance Total [m], Min. Speed Btw. Gates [km/h], Total Stationary Time [s], Longest Stationary Time [s], etc, for each trajectory.

In **Detailed Trajectory Info Export,** you can **Select** the Output **Path** where you want to save the file. You can also set **Separators** and **Decimal mark** in Exported File.

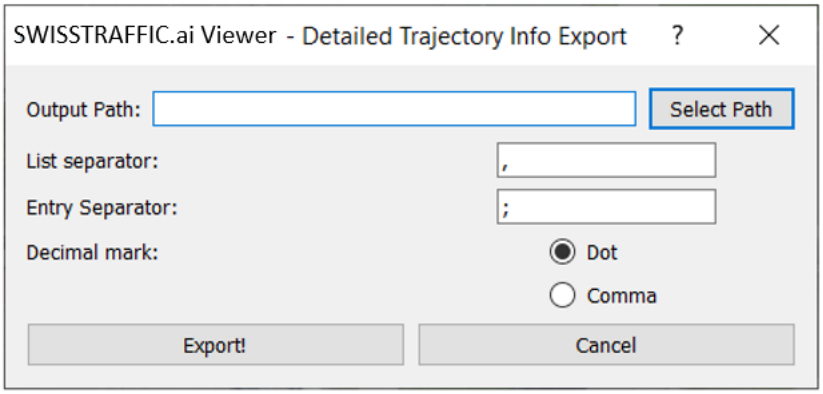


Figure 158: Export Trajectories Movement Dynamics to CSV File

EXPORT GATE CROSSING EVENTS TO CSV FILE

Exporting **Gate Crossing Events** is similar to exporting Traffic Analysis Gates Detailed Info, but in this case, all Gates data is exported to a single file. When you select this option, the Export field is displayed. Here you can **Select Output Path** and **Export Parameters** that contain the settings of the **Entry Separator** used for CSV format and the **Decimal Mark** settings.

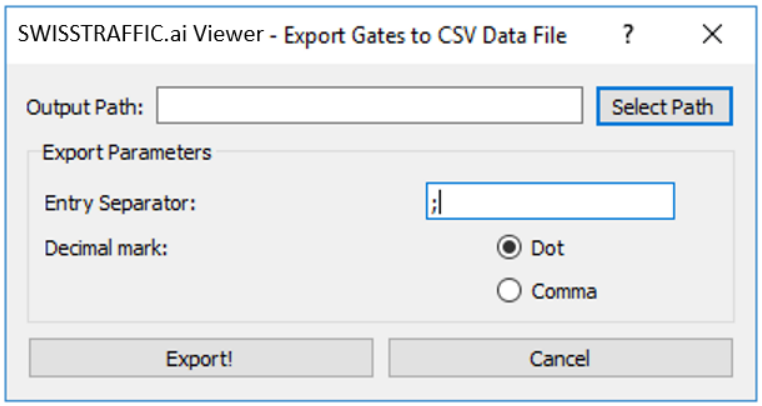


Figure 159: Export Gates to CSV Data File

EXPORT TRAFFIC ANALYSIS TO EXCEL FILE

In this file, you can find information about:

- **Survey overview** and **Overall statistics** – This is the information you can find in Tracking log Information and Tracking Log Statistics.
- **Gate Statistics** – Here you can find information about the number and speed of objects that have passed through the Traffic Analysis Gates.
- **Turning Movements** – Here you can find information about Turning Movements for each object type.

You can find this option in the **Analysis menu**.

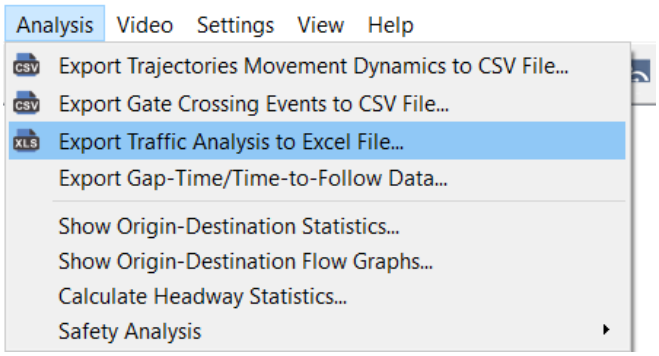


Figure 160: Export Traffic Analysis to Excel File

Or you can find **Export Traffic Analysis to Excel File** button on the Main toolbar.

Figure 161: Export Traffic Analysis to Excel File button

Export Traffic Analysis to Excel File offers these options:

- **Whole video sequence** – By unchecking this box, you can select a specific part of the video by setting specific time or ID of image, and the analysis will only be made for that portion of the video.
- **Turning Movements Analysis Periods** – Division of analysis into sub-intervals into 3 categories:
    - **Minor** – This interval is defined by time, sets after what time the analysis will be performed.
    - **Major** – Intervals are defined by the number of **Minor** intervals, after the set number of Minor intervals has elapsed, the analysis is aggregated for the Major period.
    - **Overall** – intervals are defined by the number of **Major** intervals, after the set number of Major intervals has elapsed, the analysis is aggregated for the Overall period.

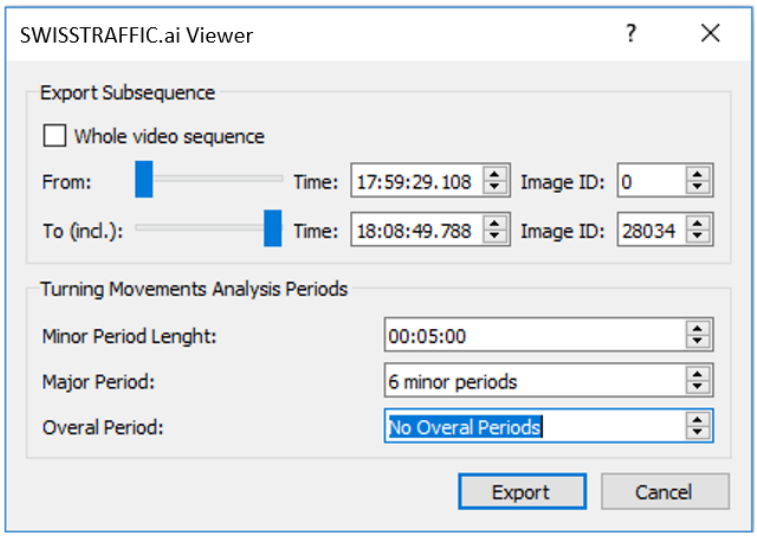


Figure 162: Export Traffic Analysis to Excel File window

EXPORT GAP-TIME/TIME-TO-FOLLOW DATA

Available in **DRONE** mode only. Export Gap Time and Time to Follow Data can be found in the Analysis Menu. The traffic scene has to be properly annotated (see item Measurement Node – Gap Time and Time to Follow in Tracking Log Menu).

SWISSTRAFFIC.ai Viewer

First you need to set the Gap Time and Time to Follow parameters:

Still speed threshold – In kilometres per hour. Vehicles moving bellow this threshold in the waiting lane are assumed to be still.

Still time length threshold – In seconds. The vehicles must be still for at least this time for them to be assumed to be relevantly still.

Vehicle crossroad join max distance - In metres. When the first waiting vehicle enters the crossroad, it is tracked for at least this number of metres.

Vehicle crossroad join max time – In seconds. When the first waiting vehicle enters the crossroad, it is tracked for at least this number of seconds.

Min time between same node blocking – In seconds. Minimal time of between the blocking of the same node by the same vehicle. This is used to deal with slight perturbation of data that can cause detection of multiple blocking events in short period of time even when the blocking vehicle passed beside the entry point only once.

Assume only successful trajectories – If you check this box, only trajectories that fully passed the crossroad are assumed.

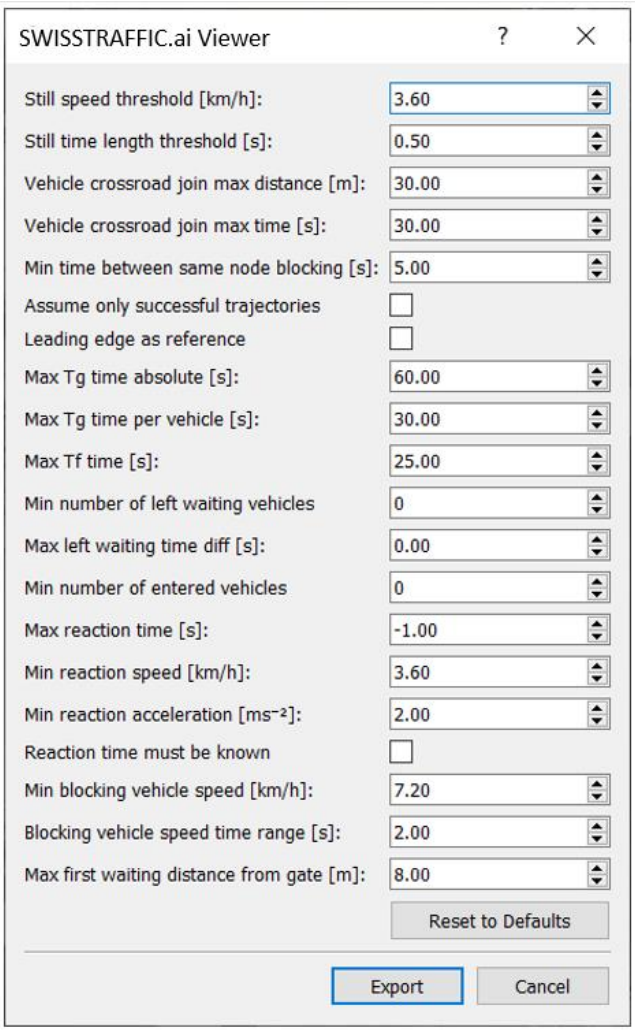


Figure 163: Tg and Tf parameters

Leading edge as reference – If you check this box, a centre of leading edge will be assumed as sensitive point for Gate passing detection. If false, the reference point is assumed.

Max Tg time absolute – In seconds. If Tg is greater than this, the event is rejected.

Max Tg time per vehicle – In seconds (per one vehicle that enters the blocking gap). If N waiting vehicles enters the crossroad, the Tg must be smaller or equal max Tg time per vehicle times N.

Max Tf time – In seconds. If Tf is greater than this, the whole event is ignored.

Min number of left waiting vehicles – At least this many vehicles must be left out in the waiting lane after the event. Otherwise, the event is ignored.

Max left waiting time diff – In seconds. Maximum time between the end of waiting of the last entered vehicle and start of waiting of the first left waiting vehicle.

Min number of entered vehicles – At least this many vehicles must enter the crossroad for event to be included in the output.

Max reaction time – In seconds. The maximum time window for the successive cars to fulfil reaction conditions after the previous car fulfilled its. Negative = the value is ignored (the check will not be applied).

Min reaction speed – In kilometres per hour. If the speed of vehicle goes above this threshold, it is assumed that reaction happened. Ideally, this should be the same as still speed threshold.

Min reaction acceleration – In metres per second per second. If the acceleration of the vehicle goes above this threshold, it is assumed that reaction happened. This and previous conditions are in OR relationship.

Reaction time must be known – If this is true, only events that contains reaction points for every entered vehicle will be kept.

Min blocking vehicle speed – In kilometres per hour.

Blocking vehicle speed time range – In seconds.

Max first waiting distance form gate – In metres.

After setting the required parameters, click the **Export** button.

Output description

The output of post-process extraction of Gap Time and Time to Follow values is in a CSV (comma-separated values) format, with one event per single line. A single event describes a situation when there was a gap in the main lane while there were waiting vehicles in the minor lane. It can cover two situations:

1. The vehicles are waiting in the waiting lane, and two successive blocking vehicles passed in the main lane, forming a gap, that the waiting vehicles do not use - they will still be waiting to enter the crossroad. This can be identified by value **entered_vehicles_count** to be equal to zero.
2. The vehicles are waiting in the waiting lane, and two successive blocking vehicles passed in the main lane, forming a gap, that the waiting vehicles (at least one) used. This can be identified by positive value **entered_vehicles_count**.

The data in the output file are formed into 12 mandatory columns, separated by semicolon:

Unique Event ID – Unique identification number of the event.

Measurement Node ID – Node ID at which the event happened.

Waiting Gate ID – ID of the gate at which the event happened.

Video Position of First Blocking [ms] – Video position (in milliseconds since the beginning of the video) when the first blocking vehicle of the gap in the main lane passed blocking gate.

First Blocking Vehicle ID – ID of the first blocking vehicle.

Second Blocking Vehicle ID – ID of the second blocking vehicle.

Number of Waiting Vehicles – Number of vehicles waiting in the waiting queue when the gap happened.

First Waiting Vehicle ID – ID of the first vehicle waiting in the waiting queue.

Tg Value [ms] – Gap time value in milliseconds - difference between the times when the second and first blocking vehicles passed the Blocking Gate.

Number of Left Waiting Vehicles – Number of waiting vehicles that were left out in the waiting queue.

First Left Waiting Vehicle ID – If number_of_left_waiting_vehicles is positive, this contains the vehicle ID of the first vehicle that was left out in the waiting queue and not entered the crossroad. If number_of_left_waiting_vehicles is zero, this contains string “---” (without quotes).

Entered Vehicles Count – Number of waiting vehicles that have entered the crossroad in the gap.

If Entered Vehicles Count > 1 (i.e. multiple waiting vehicles entered the crossroad in that gap), the output line contains (entered_vehicles_count - 1) repetitions of additional 4 columns:

Tf Value [ms] – Time to follow value of the next successive vehicle.

Reaction Time [ms] – Reaction time of the successive vehicle. It is time when the successive vehicle reacted to the reaction of the vehicle in front of it. The reaction in this context is “starting the movement towards the entry of the crossroad” by either reaching reaction speed or acceleration.

Following Entered Vehicle ID – Vehicle ID of the successive entered vehicle.

Video Position of Following Vehicle Entry [ms] – Video position (in milliseconds since the beginning of the video) when the successive waiting vehicle entered the crossroad.

These 4 columns are repeated for every successive waiting vehicle that have entered the crossroad (with exception of the first vehicle that entered the crossroad).

FREE DOWNLOAD!

If you want to try **SWISSTRAFFIC.ai Viewer**, you can download it at the following link:

http://SWISSTRAFFIC.ai./platform/software/

Try it! It's the ultimate solution for your Advanced traffic analysis.

For more interesting information and features of our product, check out our main website:

www.SWISSTRAFFIC.ai

and make your solutions high, wishes you

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