# VTC USER MANUAL

ROADOMETRY INC https://roadometry.com

Roadometry

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This document is a guide to the 2019 version of VTC, a desktop Windows application used for counting and monitoring traffic in video footage.

VTC is a desktop Windows application developed and sold by Roadometry Inc, a software development company based in Calgary, Alberta, Canada.

The desktop software can work together with a web-based dashboard for counting traffic in real-time. Users can view traffic counts on the web dashboard as they happen.

## Contents

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# EULA

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# Hardware Requirements

## Computer requirements

**OS:** Windows 7, Windows Vista, Windows 8, Windows 10, Windows 2016 Server

**RAM:** 4GB+

**CPU:** i5 or better recommended

**GPU:** nVidia GPU with 6GB VRAM or more. GTX1070 series or better recommended.

## Camera requirements

**FPS:** 10FPS+

**Resolution:** 640x480 or higher

Color or mono: Color only

**Accepted video formats:** MP4, AVI, WMV, 3GP, ASF, H264, MKV, TS, MOV

**Compression:** Set to lowest setting

## Mounting position requirements

**Height:** 12ft minimum; 20-50ft recommended

Scene distance: 40-500ft

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# Installation

Download the installer from the following link:

https://s3.amazonaws.com/traffic-camera.vtc/VTC.zip

Once the installer zipfile is downloaded, unzip the folder and run the installer **VTC.exe**. The installer will install several prerequisites (VC++ Redistributable) if they are not already present on your computer.

The installer will add two icons to your desktop: VTC and Trajectory Analyzer. Launch VTC with the desktop icon; a license-registration window should appear. Enter your license code into this box to enable all features.

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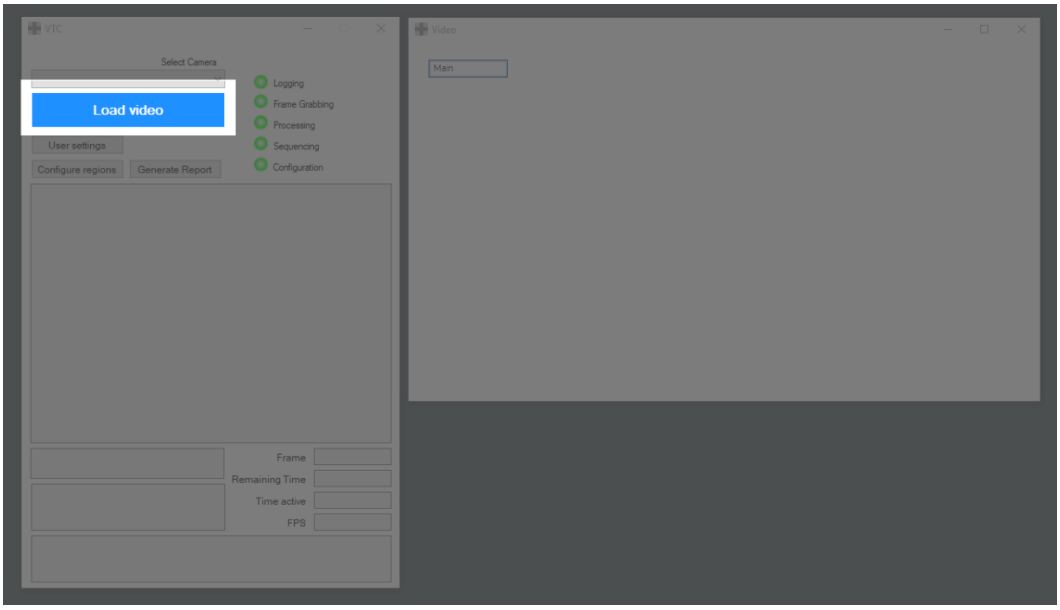
# Configuration

VTC can be configured to count traffic on highways, 4-way intersections, roundabouts, T-intersections, forks, and most other road junction layouts. The main element of configuration is setting up the paths to be counted by VTC.

VTC can count vehicle movements on roads (car, bus, truck, motorcycle, bicycle) as well as pedestrian movements on sidewalks and crossings.

To begin configuration, start by loading a video.




After choosing a video, click “Manage Region Configs” to configure VTC for this video location.

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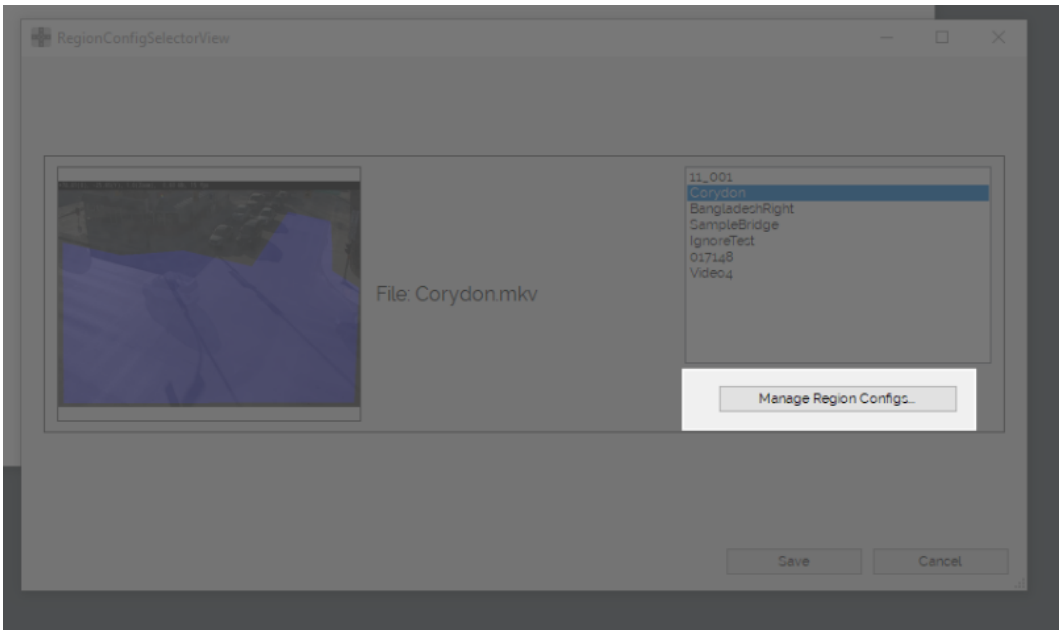


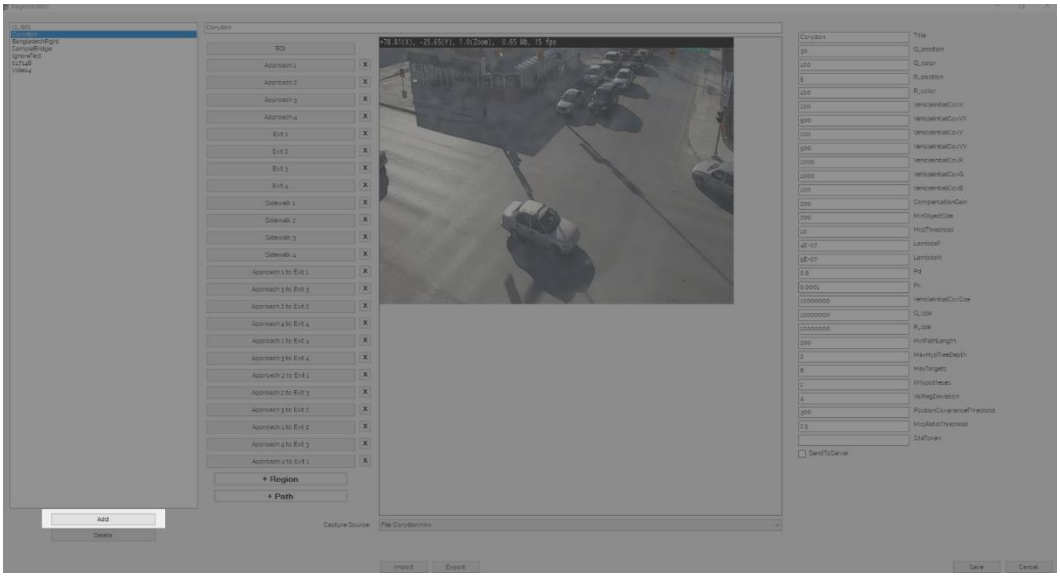

Click 'Add' to create a new Region Configuration for your video.

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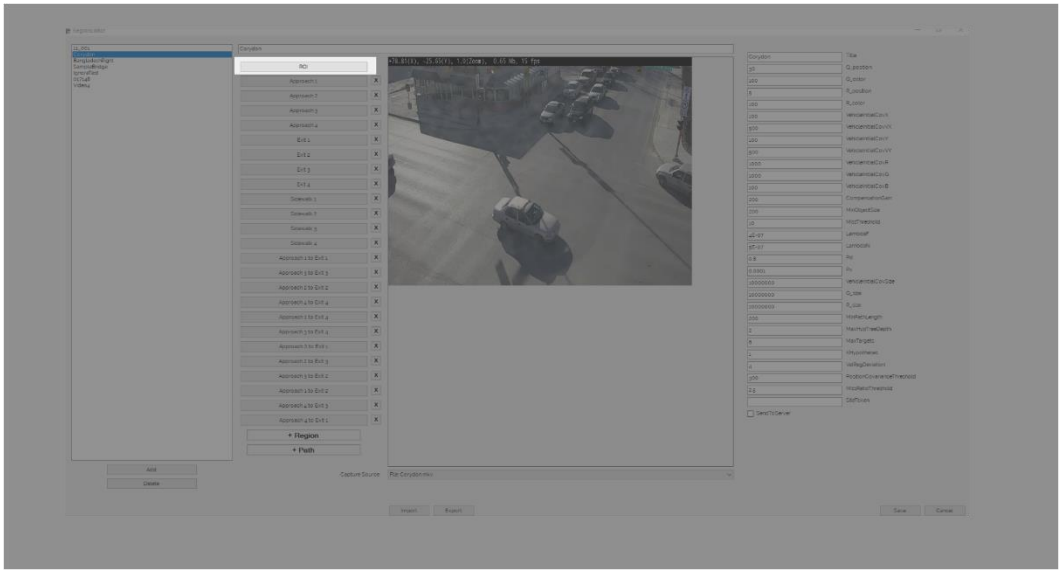
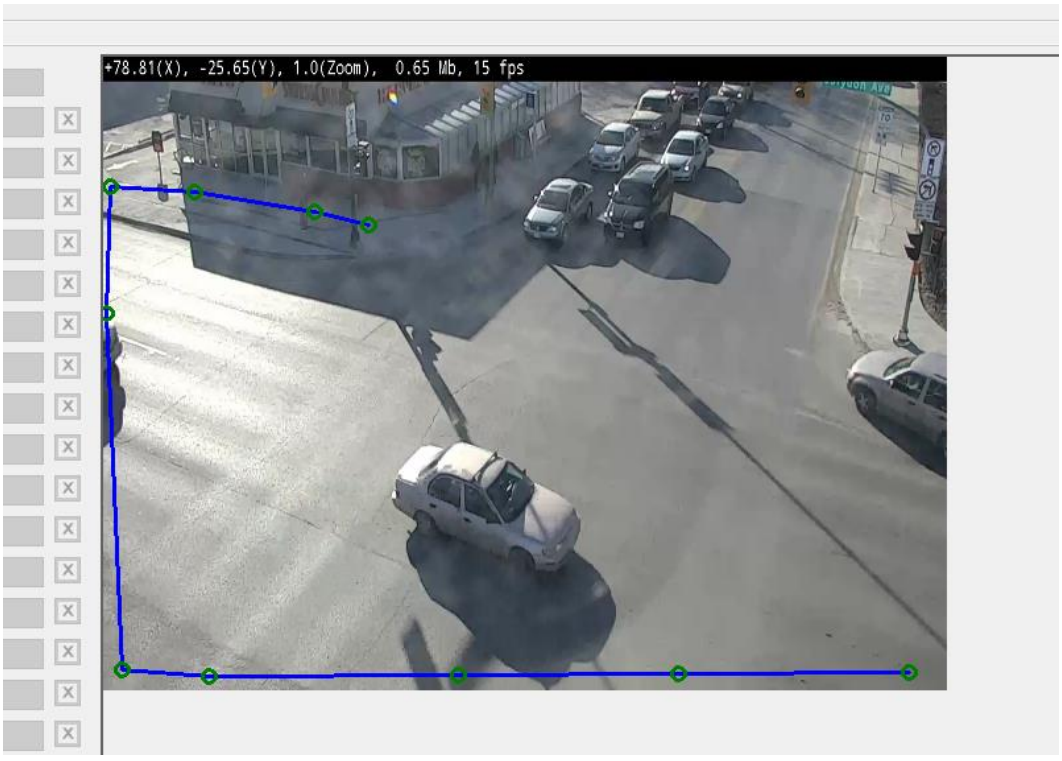


The first item to be configured is the Region of Interest (ROI). The purpose of the ROI is to eliminate areas of the image which the user does not want to count.




Draw an outline around the area of the video with traffic to be counted.

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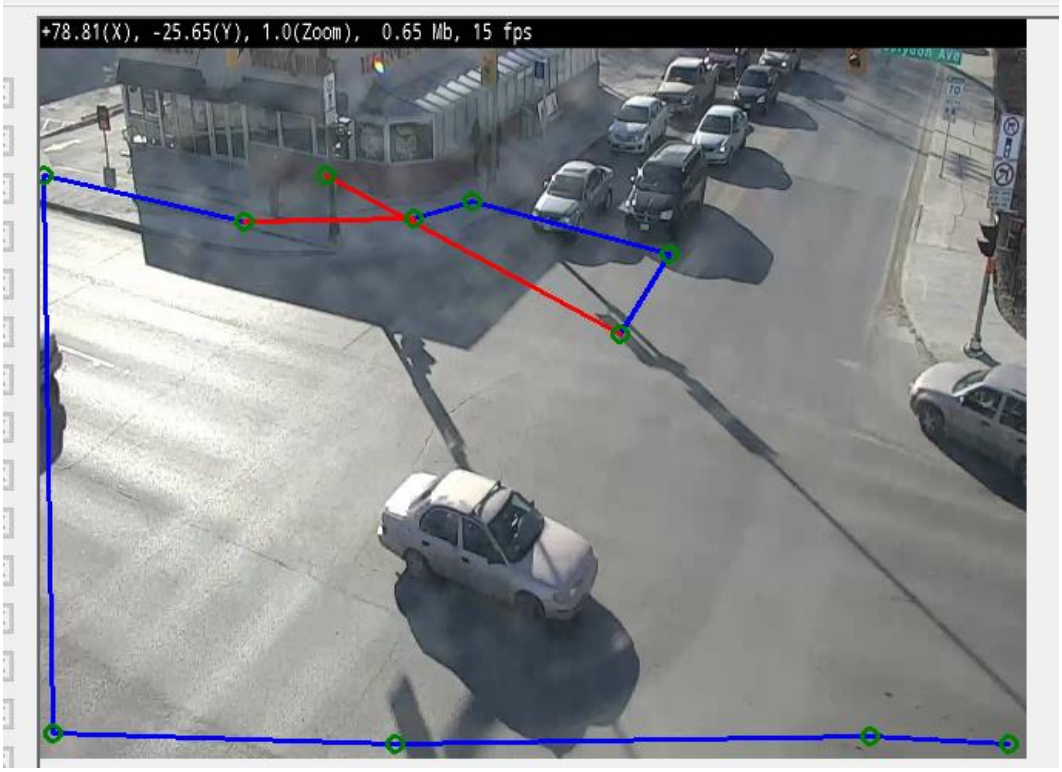


If the polygon crosses itself, red lines will indicate an error.

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When the polygon is closed/completed without errors, it will be colored green.

## Region-based Configuration

Since this intersection is a typical 4-way intersection, we will be using the region-based configuration method.

Proceed to configure Approach 1, Exit 1, Approach 2, Exit 2, and continue in a counter-clockwise order around the intersection configuring Approach/Exit 1-4.

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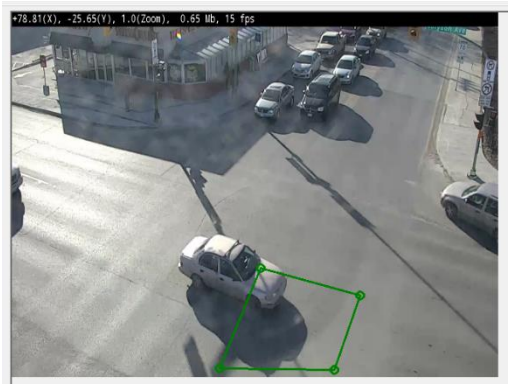


*Figure 1: Approach 1*


*Figure 3: Approach 2*


*Figure 2: Exit 1*


*Figure 4: Exit 2*

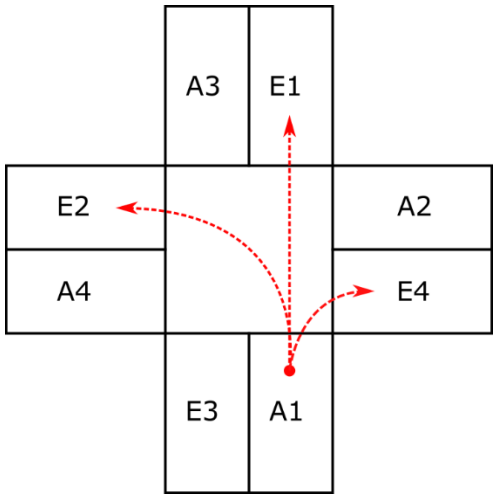


*Figure 5: Regions legend*

It's important to follow the order of regions defined in the diagram above in order for turns to be classified correctly.

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Using the region-based configuration method, VTC will automatically create paths to classify vehicles into straight, left, and right-turn movements. For example, VTC will generate a variety of artificial paths from Approach 1 to Exit 1; these are known as *synthetic trajectories*. Synthetic trajectories are compared against the trajectories of tracked objects; the most-similar synthetic trajectory is matched against tracked objects and used to classify each movement.

### Single-Lane Highway

The region-based configuration method can be used for 4-way intersections, single-lane highways or opposing 2-direction highways. To adapt the region-based configuration method for a single-lane highway, simple configure only a single approach/exit pair (Approach and Exit 1).

### 2-Direction Highway

To adapt the region-based configuration method for a 2-direction highway, configure Approach/Exit 1 in one direction and Approach/Exit 3 in the opposite direction.

A common mistake is configuring Approach/Exit 1 in one direction, and Approach/Exit 2 in the opposing direction for 2-direction highways. Review Figure 5 to see why Approach/Exit 1 and Approach/Exit 3 should be used for opposing lanes.

## Example Path-based Configuration

VTC provides a very general method of configuration for traffic sites which don't fit into a well-defined pattern. This can include roundabouts, forks, multi-lane highways, T-intersections, and more.

The *example path*-based configuration method requires the user to draw individual paths through the site, in contrast to the region-based method where the VTC software creates paths automatically.

To use the example-path method, begin by creating a new path with the '+ Path' button.

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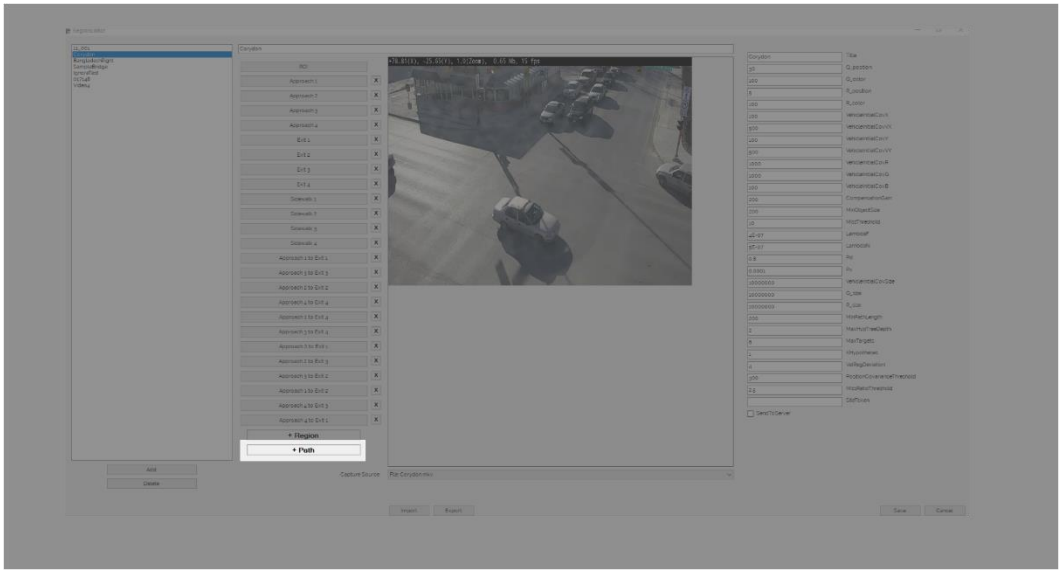

Instead of drawing a polygon, draw a path following the movement which you want to count.

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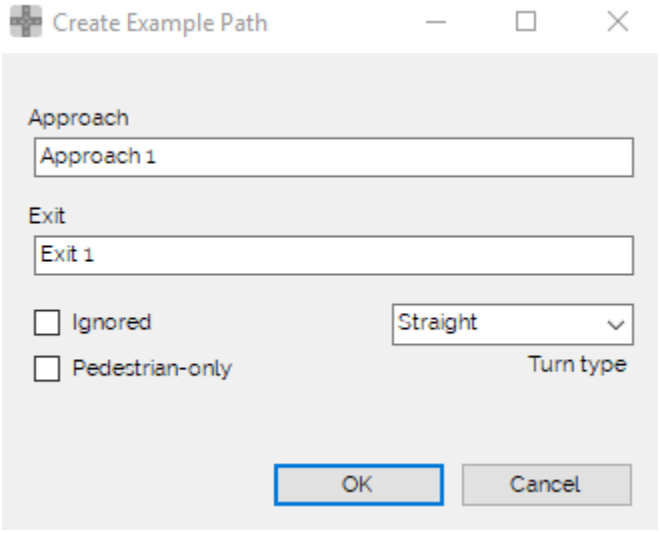
Using this method, the user may specify complex paths to be counted.

When creating a new Example Path, several options are presented:




The **Ignored** check-box makes it possible to identify a path, but exclude it from reports. This is helpful when a particular movement cannot be excluded via the Region of Interest, but is not intended to be counted.

The **Pedestrian-only** check-box is useful for paths where only pedestrians should be counted; for example, crosswalks on streets.

Trajectories matching this Example Path will be counted as the type of movement selected in the **Turn Type** drop-down.

## Numerical Configuration Values

In addition to the geometric configuration (regions or paths), each site configuration is associated with a list of numerical parameter values. These parameters affect VTC's tracking algorithm.

In general, parameters with the contraction *Cov* in the name are covariance estimates. Covariance is a measure of the amount of movement in a process. Increasing these parameters increases the 'looseness' of the tracking algorithm.

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Parameters of the form *Q_x* and *R_x* represent process noise in the tracked object's motion-model. See documentation on Kalman filter for references on these matrix parameters. This software uses a 2D motion-model with R, G, B and size forming another four (stationary) states in the object's state vector.

Many of the other parameters (*LambdaF, LambdaN, Pd, Px, KHypotheses, MaxHypTreeDepth*) are related to the tracking algorithm, Multiple Hypothesis Tracking. These parameters are too technical to be covered in depth here; Roadometry can be hired for consulting when custom tuning is necessary.

Some variables (*MinPathLength, PositionCovarianceThreshold, MissRatioThreshold*) are used as filters when counting objects. If an object's path exceeds one of these thresholds, the object is discarded and excluded from count reports.

The *SiteToken* configuration item is used for identifying this site to the Roadometry Dashboard, a web-based tool for monitoring counts using a web-based dashboard. The *SendToServer* checkbox goes along with the SiteToken; if a SiteToken is configured, *SendToServer* should be checked.

## Webcam Configuration

No specific configuration is necessary to configure most webcams; simply plug the camera in via USB, and it should be detected by VTC.

## IP Camera Configuration

The user may enter up to 3 IP camera URLs on the **User Settings** configuration page. A name must be provided along with each camera URL. When VTC is relaunched, the IP cameras will be available for selection from the drop-down URL.

## User Branding

Users may add a file-path to their own logo for display in VTC's GUI. This option (*Logopath*) is available under User Settings. Users may also configure the *Organization* text label which is displayed in the VTC GUI.

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## Output Path

The location for output folders (including movement-count reports) is user-configurable via the *OutputPath* configuration setting on the User Settings page.

## Server URL

The server URL is configurable in case the user is running a private instance of the Roadometry Dashboard server application. For most users, this is not the case; do not adjust this from the default setting.

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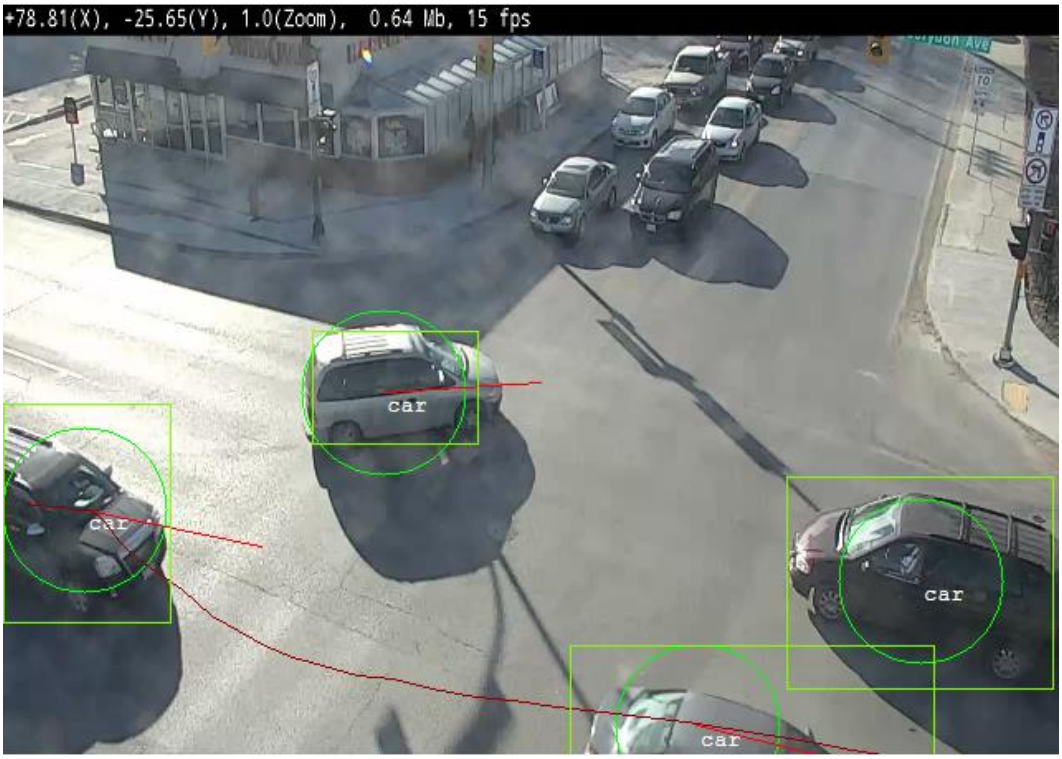
# User Interface




The user interface is meant to assist the user in confirming that the software is configured correctly. The most important aspect is ensuring that objects are being tracked correctly.

The user interface (UI) shows **green rectangles** to indicate that an object has been *detected*. The UI shows **green circles** to indicate that an object is being *tracked*. Detection is a single-frame event; trackers follow objects from frame to frame.

A **red bar** projecting from a tracker's center indicates the object's estimated motion vector.

A **red path** appearing when an object leaves the scene is a *trajectory*. Trajectories are the basic units to be counted in the output reports.

This image shows correct detection and tracking. The vehicles in the upper half of the image are not detected, because they are excluded by the ROI configuration.

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# Dashboard

The Roadometry Dashboard can be used in conjunction with VTC to count live traffic and provide a web interface for viewing. Users can download CSV count-reports based on a selected time-range.

**SITE REPORT:** BB-AVC-WEST-L-1-2-3

**Start time**: 2019-07-17 00:01:00 -0600
**End time**: 2019-07-21 00:01:00 -0600
**Duration**: 4 days, 0 hours, 0 minutes
**Report generated at**: 2019-07-21 00:01:45 -0600

**Category**: All
**Approach**: All
**User**: alex@roadometry.com



**Total traffic:** 12759

| | Car | Bus | Truck | Motorcycle | Bicycle |
|---|---|---|---|---|---|
| Approach 2 | 213 | 202 | 4441 | 16 | 0 |
| Approach 1 | 152 | 81 | 3163 | 6 | 0 |

Contact Roadometry for assistance with configuring a site dashboard. Access to the dashboard requires a monthly subscription fee per camera.

Organizational access to the dashboard is available for multi-user accounts.

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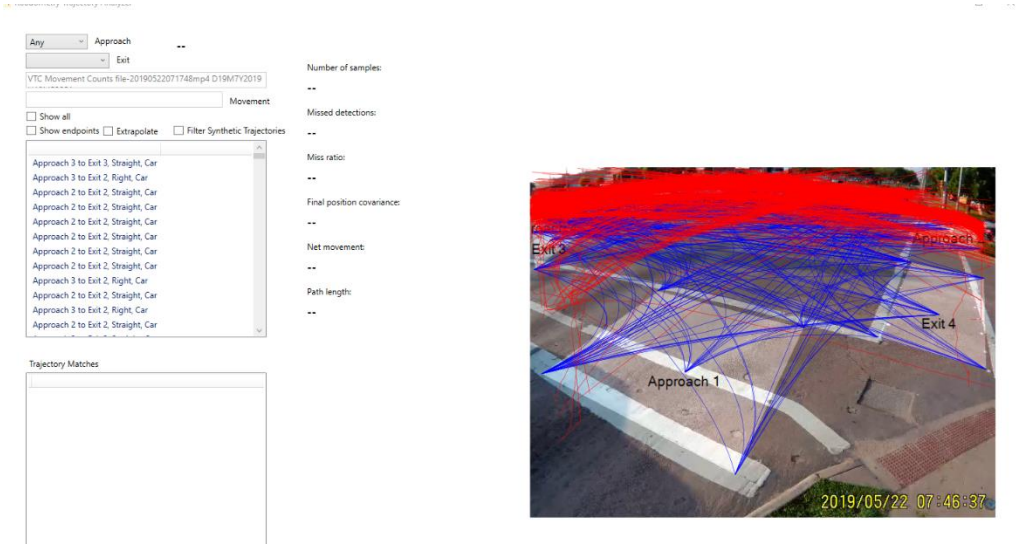
# Trajectory Analyzer

**Trajectory Analyzer** is a desktop accessory application provided with VTC as a tool for reviewing trajectory classification.

Trajectory Analyzer can only be used after using VTC to processing traffic footage. Once an output folder has been generated, terminate VTC and launch the Trajectory Analyzer application. Drag-and-drop the VTC output folder into the Trajectory Analyzer window.




Make a selection from the 'Approach' drop-down box to choose which movements are displayed.

This tool is useful for reviewing the characteristic of tracked objects; various configuration issues can be diagnosed using this tool, including problems with region/path configurations and numerical configuration issues.

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# Output

VTC provides output through two channels: files saved to the user's local drive (using the standard VTC desktop application) and movements logged remotely using Roadometry Dashboard.

An output folder generated by VTC includes the following types of files:

- Binned **.csv** files where each row represents counts in a [5,15,60]-minute time slot
- **Detections.json**, a raw data output where each line is a JSON array containing object detection information for a single frame
- **Movements.json**, a raw data output where each line is a single JSON object trajectory (an array of movement data)
- **HTML** report files including summary statistics and a graphical legend
- **Synthetic Trajectories.json**, a file used for analysis in Trajectory Analyzer
- Version.txt and video_metadata.json document various configuration aspects of the software and video used to generate this output folder

For most users, the HTML and CSV files should be sufficient. The .json files are intended for advanced users who want to process VTC output according to their own needs.

The dashboard allows users to download CSV files of movement-counts similarly to the CSV files included in the desktop output folders. In addition, the dashboard includes a web-based chart and summary-statistics display for the previous 24h.