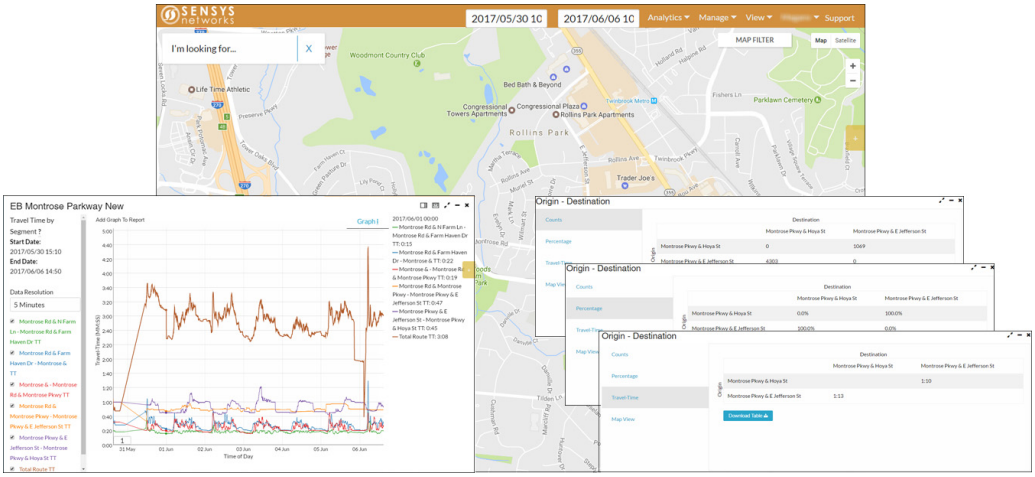
SensID

Sensys Networks SensID Application

Configuration and User Guide

P/N 152-240-001-081, Rev C

February 2018



Document Properties

This document is reference material for the SensID Application from Sensys Networks, Inc.

P/N 152-240-001-081 Rev C

Document Control

Sensys Networks continually reviews and revises its technical publications. Please email address questions, suggestions or corrections to support@sensysnetworks.com.

Sensys Networks Technical Publications

For additional information regarding Sensys Networks products and applications, design guides, configuration guides, and best practices, refer to the Sensys Networks technical documents library available at http://www.sensysnetworks.com/resources.php?tech_docs.

Contact Information

Sensys Networks, Inc.
1608 Fourth Street, Suite 200
Berkeley, CA 94710 USA
+1 (510) 548-4620

www.sensysnetworks.com

Contents

Introduction

This guide provides information and procedures for operating SensID[1] software from Sensys Networks, Inc. supported by Acyclica. It is intended for use by Sensys Networks customers, consultants, partners, dealers and others with an interest in the application of wireless communication technology to the measurement, reporting, and comparison of travel times, delay, and traffic distribution for urban arterials.

SensID application is part of the SensTraffic system. The SensTraffic system provides high-resolution performance measures, automated statistical processing of a wide variety of precise traffic detection data, and remote network monitoring and diagnostics. SensTraffic is powered by our robust SNAPS server architecture, and consists of the data solutions listed below to fit your needs:

- SensMetrics | Safety & Signal Optimization - High-Resolution data and analytics to optimize signal timing and safety
- SensFlow | Vehicle Counts - Volume, Occupancy & Speed traffic data
- SensBike | Bicycle Counts - Accurate real-time bicycle counts, including non-ferrous bike frames
- SensDiag | System Health - Remote diagnostics monitoring & alerts

For more information on SensTraffic, refer to the Sensys Networks website: http://sensysnetworks.com/products/senstraffic

What's Inside

This guide includes the following information:

- *Chapter 1: Introduction*, provides the purpose and scope of the guide, as well as an overview of each chapter.

1. Previously known as VIMS Analyzer

- *Chapter 2: Understanding SensID*, provides the basic navigation of the SensID site.
- *Chapter 3: Configuring and Administering SensID*, provides an overview, and information required to configure and administer a SensID installation.
- *Chapter 4: Using SensID and Generating Reports*, provides an overview and information on how to administer SensID analytics and reports.
- *Appendix A: Obtaining Your Data in XML Format - API Keys*, provides examples of the XML data feed types that are supported by SensID.

Understanding SensID

This chapter describes the steps required to access SensID and basic site navigation information.

The following sections are provided in this chapter:

- *Overview*
- *Accessing SensID*
- *SensID Navigation*

Overview

SensID is a web-based server application used for processing, and viewing vehicle identification data collected by the Sensys Networks VDS system. For the SensID application, the VDS system utilizes the FlexControl Card (i.e., APCC) or the FlexControl Module. The FlexControl Card or Module connects to a Wi-Fi or Bluetooth® radio that senses MAC addresses from Wi-Fi/BlueTooth devices in a detection zone, typically at traffic intersections or other data collection points. The FlexControl Card or Module then anonymizes the MAC addresses and forwards them to SensID server via SNAPS. The SNAPS server is hosted by Sensys Networks. SensID is designed to create graphs for reports and analytics.

NOTE:

For customer hosted SNAPS, access must be provided for external telnet sessions.

Accessing SensID

SensID can be accessed at https://sensys.acyclica.com. When visiting the SensID site for the first time, all new users must complete a brief registration process prior to accessing the software. The registration process includes the following steps:

1. Click **Create your account** on the *Sign In* page to initiate registration process.

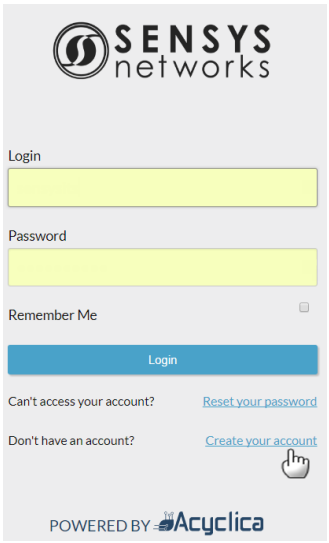


Figure 1. SensID sign in screen

The new user *Sign Up* screen displays.

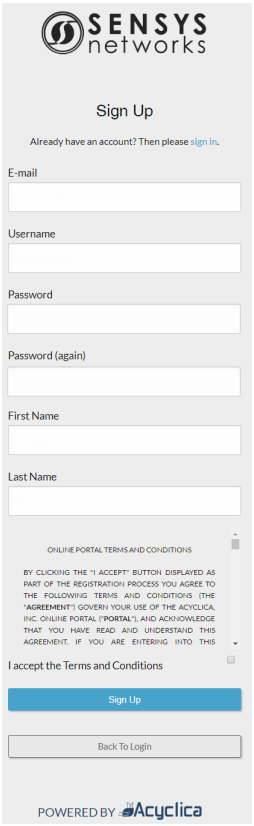


Figure 2. New user sign up screen

2. Enter a **First Name**, **Last Name**, **Username**, **E-mail** address, and **Password** in the text boxes.
3. Check the *Terms and Conditions* check box.
4. Click **Sign Up**. The *Email Verification* screen displays.

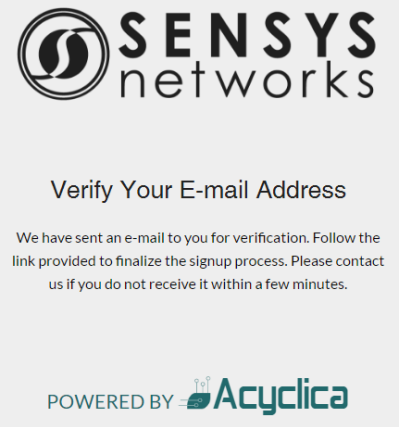


Figure 3. E-mail verification screen

An email confirming your registration is sent to the email address you provided. The email contains a link for activating your account that you need to visit in order to complete the registration process.

5. Click on the email link. The *Confirm E-mail Address* screen displays.

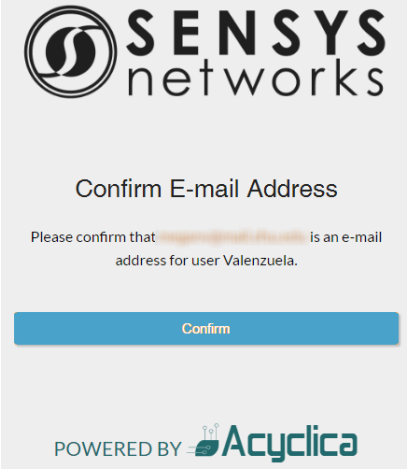


Figure 4. E-mail confirmation screen

6. Click **Confirm**. SensID's default main window displays without any SensID sites.

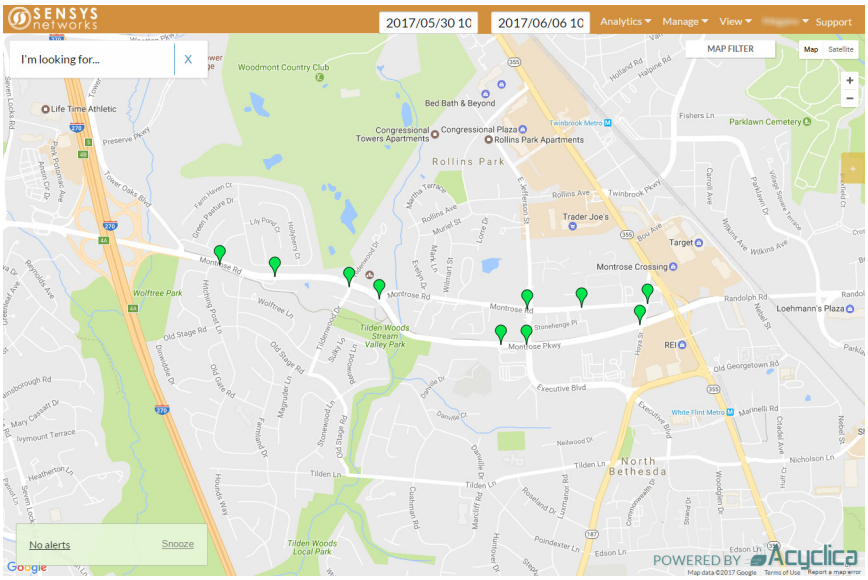


Figure 5. Main window

IMPORTANT:

Forward your verification email to your local SensID admin. The local SensID admin will then add you to the list of authorized users for the agency SensID application. When you log in again, your authorized SensID sites will display on the map.

If you are the local SensID admin, forward your verification email to sensidadmin@sensysnetworks.com with your contact information. The Sensys Networks admin will add you to the list of authorized administrators for the agency SensID application. When you log in again, you will be able to authorize other users. (For information on adding users, refer to the *Settings* section in *Chapter 3: Configuring and Administering SensID*.)

IMPORTANT:

SensID users must be added to the client group. This can only be performed via an administrative login established by Sensys Networks. Once this is done, a map (similar to the one shown in *Figure 2.5*) with the a map with the user's SensID sites displays. For information on setting up client groups, refer to the *Settings* section in *Chapter 3: Configuring and Administering SensID*.

SensID Navigation

Once you have logged into SensID, you are directed to the SensID workspace, which contains six main features: *Top Navigation Bar, Time Picker, Map, Search Bar, Locations, and Information Panels.*

Top Navigation Bar

Displayed along the top right of the workspace, this includes the *Time Picker* tools and dropdown menus to view *Analytics*, *Manage*, *View*, *Username*, and *Support*. The *Time Picker* tools, which are located at the top center of the screen, allows you to preset a time interval to focus your reporting.

The five dropdown menus provide the following functionality:

- *Analytics* – Dropdown menu contain links related to route reporting, signal timing reporting, performance metrics, device reporting, VSO analytics, and OD reporting.
- *Manage* – Dropdown menu contains links to viewing all existing alerts, alert creation, adding new routes, and adding new OD Groups.
- *View* – Dropdown menu contains links related to viewing active alerts, enable or disable the Snooze UI Alert Notifications, viewing exported reports, and the Lists window.
- *Username* – Dropdown menu contain links related to Account Settings and Logout that logs the user out of SensID.
- *Support* – Links to FAQs and other SensID technical documentation.

NOTE:

All reporting links are disabled until a route or device is selected. The date and time fields, however, can be adjusted at any time.

Map

The *Map,* which is located in the center of the screen, is the primary area of the page for viewing locations, segments, routes, and a visual representation of traffic data. Selecting a location or route will open the *Information Panel* on the left hand side. The default view displayed in the *Map* is the *Map* view, a centered view of the geography defined by the GPS coordinates assigned to your deployed devices. The *Map* and *Satellite* imagery can be toggled using the button next to *Map Filter*.

The *Map Filter* dropdown menu allows users to select what is visible on the *Map* view. The five object categories provide the following information:

- *Toggle All* – Selects all object categories to be viewable on map.
- *Sensors* – FlexControl Card or Module devices that are sending Wi-Fi or Bluetooth data to the SensID server.
- *VSO Sensors* – FlexControl Card or Module devices that are transmitting Volume, Speed, Occupancy data to SensID servers.
- *Overlays* – Displays overlays for Segments.

IMPORTANT:

Sensys Networks does not support Inrix and TomTom and will not show those options if chosen.

The *Sensors* or *VSO Sensors* statuses provide the following information:

- *Online* – data from devices is currently posting to the SensID servers.
- *Offline* – data from devices is not posting to the SensID servers.

Search Bar

The *Search Bar*, which is located at the top left of the *Map*, is one of three options for selecting the devices and routes in order to view their associated reporting. You can find a device or route by using either the serial number assigned by Sensys Networks to the device or the custom name you assign to your devices and routes.

Locations

Locations are devices or a collection of devices that are represented on the map by markers.

A marker can display one of five different states:

- Online (Green) – all equipment at a location is uploading data.

- Selected (Blue) – used when a location is selected.
- Offline (Gray) – no recent data uploaded from any hardware at a location.
- Some Hardware Offline (Split Green and Gray) – some hardware at a location has recently uploaded data, and some has not uploaded data recently.
- Alert (Red) – alert is in progress at a location.

Information Panels

The *Information Panel* displays when a location or route is selected and appears on the left side of the main window. The location *Information Panel* contains the following information when a device is selected:

- *Devices* – Contains device dropdown menu for the device's last Wi-Fi data, serial number, short name, description, the *Edit Name and Description* button, and options of CSV or XML file formats to download raw Wi-Fi data.
- *VSO sensor* – Contains VSO sensor dropdown menu for the device's last VSO data, short name, serial number, description, the *Edit Name and Description button*, created count station listings, and *Create Count Station* button.
- *View Alerts button* – Displays the *Alert List* window containing the current alerts the device or route has assigned to it.
- *Focus button* – Allows user to zoom into the map location where the selected device is located.
- *Move Contents button* – Displays the *Set Location Position* side bar window that enables the user to set the physical location of the device/route.
- *Available Analytics* – Displays the available *Signal Timing Tools*, *Performance Metrics*, *Device Tools,* and *VSO* analytics.
- *Associated Routes* – Displays a list of routes a device is grouped in by the route name.

The route *Information Panel* contains the following information when a route is selected:

- *Route* – Contains route's distance, Route ID, and last reported data.
- List of all the segments assigned to the route with current color threshold and name.
- *Manage Travel Time Alerts button* – Displays the route's current Travel Time and add new alerts window containing the current alerts route has assigned to it. and an option to add new alerts.
- *Focus button* – Allows user to zoom into the map location where the selected route devices are located.
- *Edit Route button* – Displays the *Edit Route Details* window allowing the user to change the name of the route or delete the route.
- *Available Analytics* – Displays the available *Route Tools*, *Signal Timing Tools*, and *Performance Metrics*.
- *Associated Sensors* – Displays a list of devices the route is comprised of.

- *Current VSO Count Stations* – Lists any VSO Count stations the route contains.
- *Create or Attach Count Station* – This section enables the user to create new count stations or attach existing count stations to the route.
- *Associated Segments* – Lists any segments assigned to the route by full name and number. Contains the *Edit Path* and *Edit Thresholds* buttons.

Configuring and Administering SensID

This chapter describes how to configure and administer a SensID installation.

The following sections are provided in this chapter:

- *Setup and Configuration*
- *Setting Up Your Devices*
- *Creating Routes*
- *Overlays*
- *Color Thresholds*
- *Alerts*
- *OD Groups*
- *Settings*
- *Changing Your Password*

Setup and Configuration

After logging into SensID, the next thing you need to do is configure your devices, routes, and overlays so that your data is processed as it is collected. This option can only be done if the user has admin privileges or is a Group Owner. This is accomplished by clicking the **View** menu. The following *View* dropdown menu then displays.

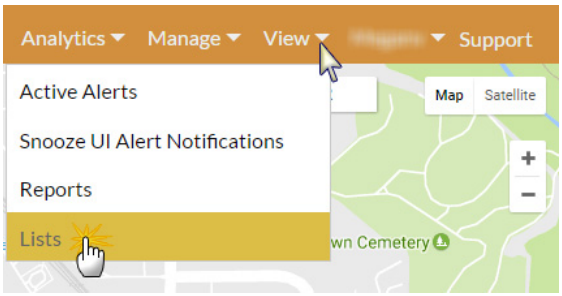


Figure 1. View menu

Click on the **Lists** link and on the bottom half of the map view the following window will display.

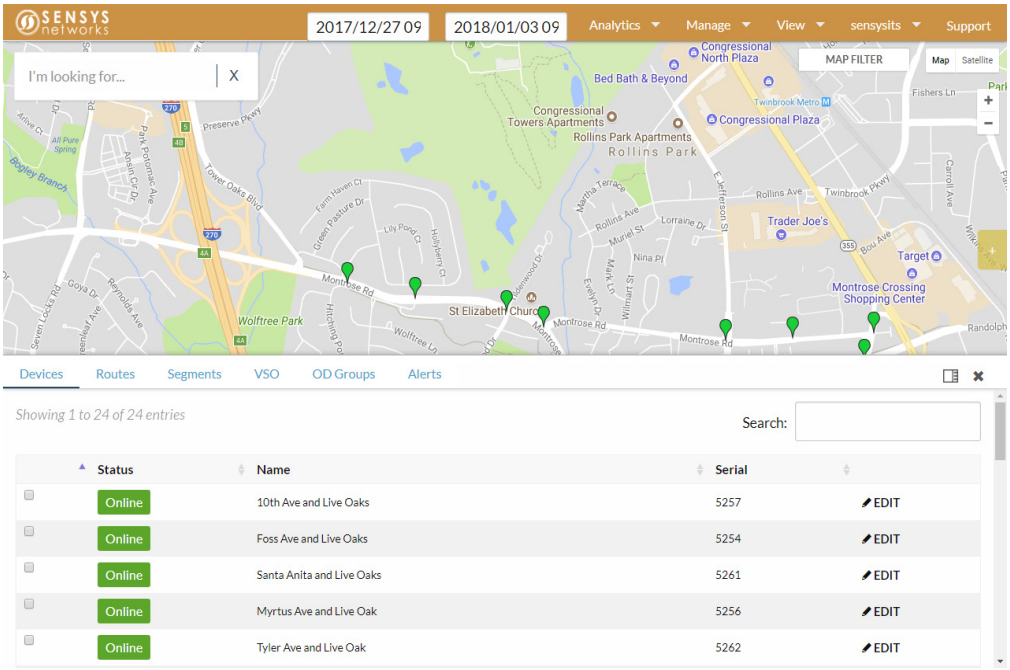


Figure 2. View Lists window

NOTE:

By default, the *Devices* subsection displays when the *Lists* link is selected.

NOTE:

Whenever you access the *View → Lists → Devices* view, the serial numbers for all of your sensors should be listed in the column titled *Serial*. If any of your devices are missing or the serial numbers are incorrect, please contact sensidadmin@sensysnetworks.com right away so we can address these issues promptly. Data should not be uploaded for a device until the serial number corresponding to it displays in this space.

NOTE:

All windows that display in SensID do not automatically close when you choose a different menu. You must click the **X** in the top right corner to close the window.

Setting Up Your Devices

Once you have confirmed your number of FlexControl Card or Module devices and their corresponding serial numbers, the next step is to assign clear, meaningful names and accurate GPS coordinates to their deployment location. Only users with admin privileges or is a Group Owner are able to use these features. To do so, click the **Edit** link to the right of the serial number you want to configure and the *Edit Device Details* window will display.

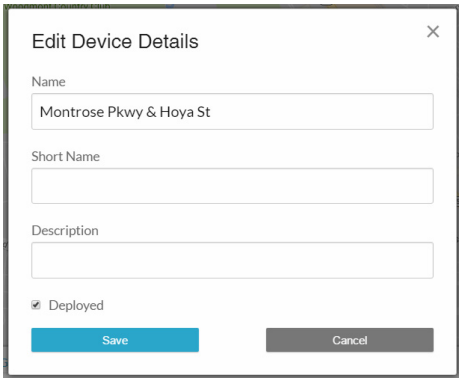


Figure 3. Edit Device Details menu

NOTE:

The most important fields are *Name* and *Short Name*.

The search bar at the top corner of the *Map* view uses the information you provide in the *Name* field to search on, so giving your devices simple, yet descriptive names make them easier to find.

To assign latitude and longitude of the device, select the device to pull up its *Information Panel*. This can be accomplished either by the search bar, going to the *Device* tab in the *Lists* window, or selecting the device from the map.

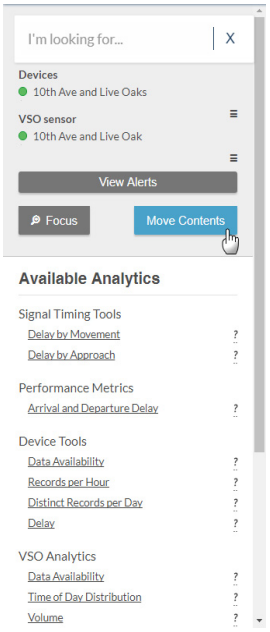


Figure 4. Device Information Panel

Click **Move Contents** button to access the *Set Location Position* window.

NOTE:

When editing new node(s), the node icon(s) will be in a SensID default location in Boulder, CO.

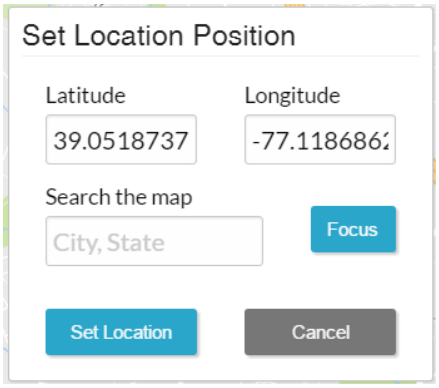


Figure 5. Set Location Position window

Assigning accurate latitude and longitude values is important for making sure your devices are properly located on the map, which not only affects the way your devices are represented and locatable via map navigation, but also impacts the accuracy of distances calculated when you construct overlays for them. The *Focus* button helps the user center the map in the location of the device by city and state.

Volume Speed and Occupancy Devices

Volume Speed and Occupancy (VSO) devices, in addition to providing those three metrics, can also combine with Travel Time and other route-based data for more advanced analytics. To setup a VSO device to a client group, please contact a member of the Sensys Networks tech support and email sensidadmin@sensysnetworks.com. You must have the serial of the device(s) you wish to associate with the VSO device(s).

After a VSO device has been added to your client group, you will need to configure the device parameters and set the location. Only a user with admin privileges or is a Group Owner will be able to set the location and other configuration parameters.

To configure a VSO device please do the following steps:

1. Click the **Search Bar** and enter the serial number of the device that will be associated with the VSO device.

NOTE:

In the resulting list, locate the device name starting with the sensor type that represents your VSO device (eg. a VSO device associated with device 9990 would be listed as "Sensys VSO: 9990 -").

2. Click the *Hamburger Menu* (three horizontal lines) to the right of the VSO device name to open the drop down menu.

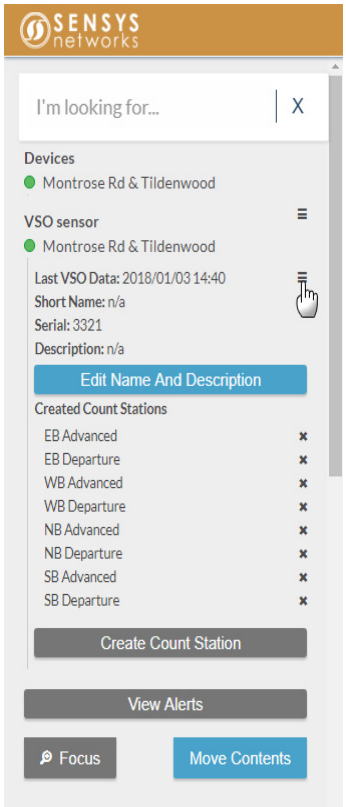


Figure 6. VSO sensor drop down menu

3. Click **Edit Name and Description** button to modify the name, short name, and/or description of the VSO device.
4. Click **Save** to keep changed name and description.

To modify the location of the device, click **Move Contents** button and follow the procedure for moving a device, as described in the *Setting Up Your Devices* section.

To associate a VSO device with an existing device:

1. Click **Move Contents** and then locate the map marker for the device you want to connect either by entering the longitude and latitude or using the map and selecting the device's marker.
2. Click **Set Location** to complete configuration.

Creating Routes

Once you have completed the process of naming and entering coordinates for your devices, the next step is to define your routes. To access the *Route Creation Tool*, go to the *Manage* menu and then click on **Add Route**. The following screen displays.

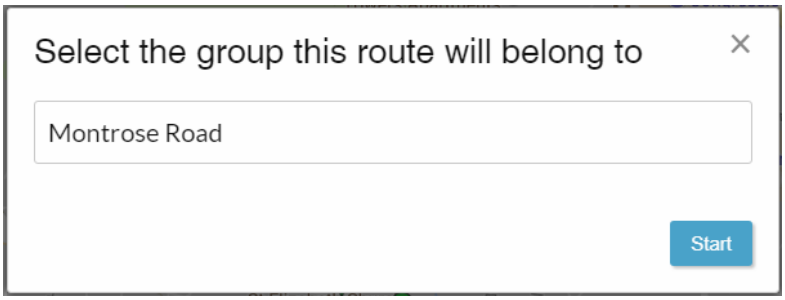


Figure 7. Assign Client Group for new route

Select the client group the new route will belong to and click **Start**. The following pop up window displays.

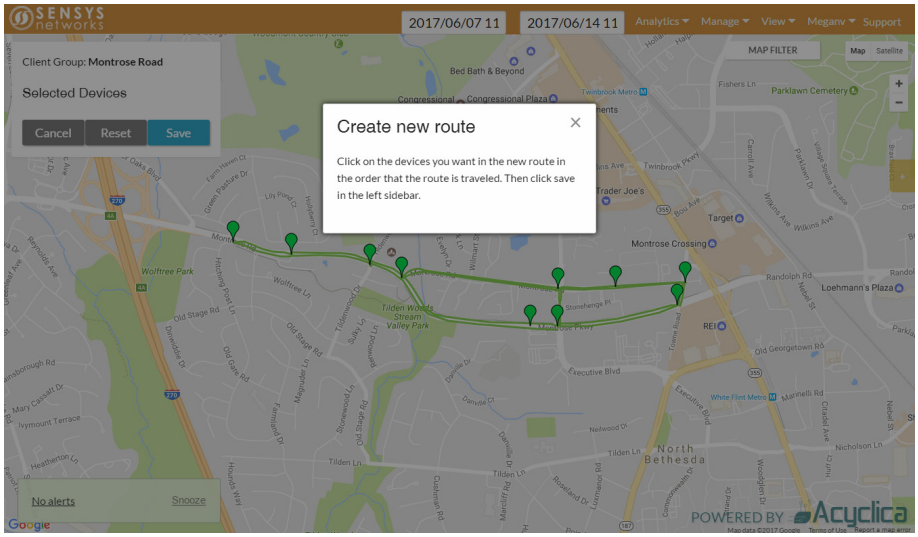


Figure 8. Add Route pop up window

Click on the **X** to close the pop up window, and the following map interface for creating routes displays. All devices within the selected location are available for selection.

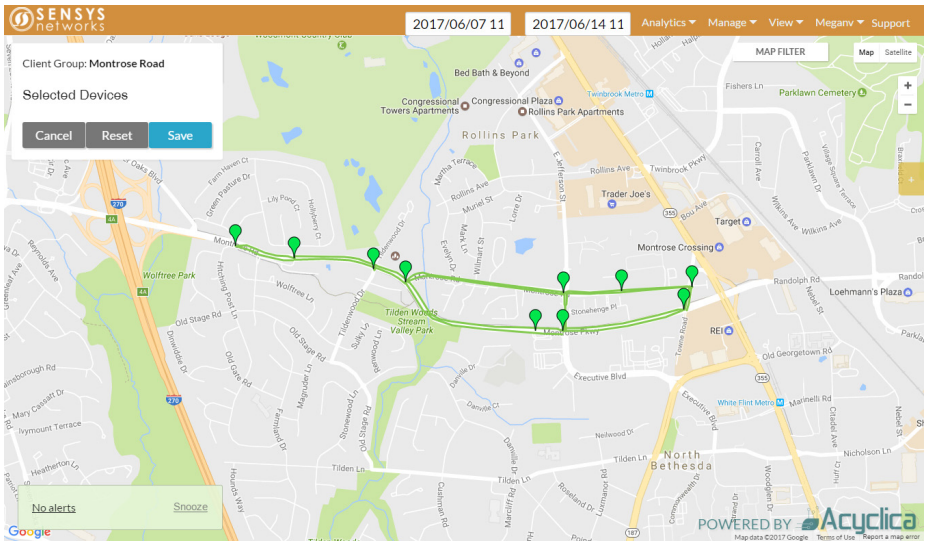


Figure 9. Add route window

To configure a new route, perform the following steps:

1. Select the devices comprising the route within the map interface.

   Once a device is selected, the route creation tool will determine which adjacent devices can be used to create routes by displaying adjacent devices in green and non adjacent or can't be used devices are grayed out. This ensures that devices are selected in the correct order, and that intermediate devices aren't skipped. When a device is selected for the route, it will display in blue. If one of

the grayed out devices should be available, select it, and there will be an option to notify support.

NOTE:

Devices need to be chosen in their proper sequence for route reporting to be accurate. This sequence shows as the devices are selected in the *Add Route* tab on the left.

2. Click **Save** to complete the route and the following pop up window will display.

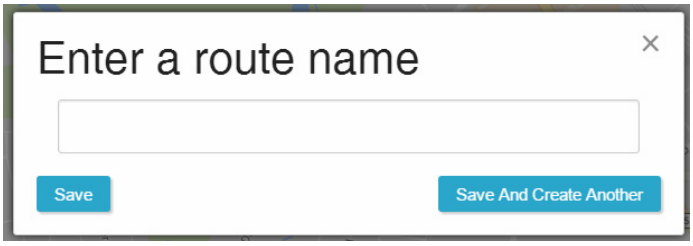


Figure 10. Route name window

3. Enter the desired name for the route in the *Name* text box.
4. Click **Save** to complete route and initiate processing.

Navigating the Route Creation Tool

By default, the route creation interface shows a map view that is near the geographic center of your deployment area. This default view may or may not span all devices required for the new route you are looking to create. If the devices that need to be included in the route do not display when the map is first generated, the mouse icon and zoom tools can be used to move up, down, left or right within the window or to zoom in and out to select the required devices.

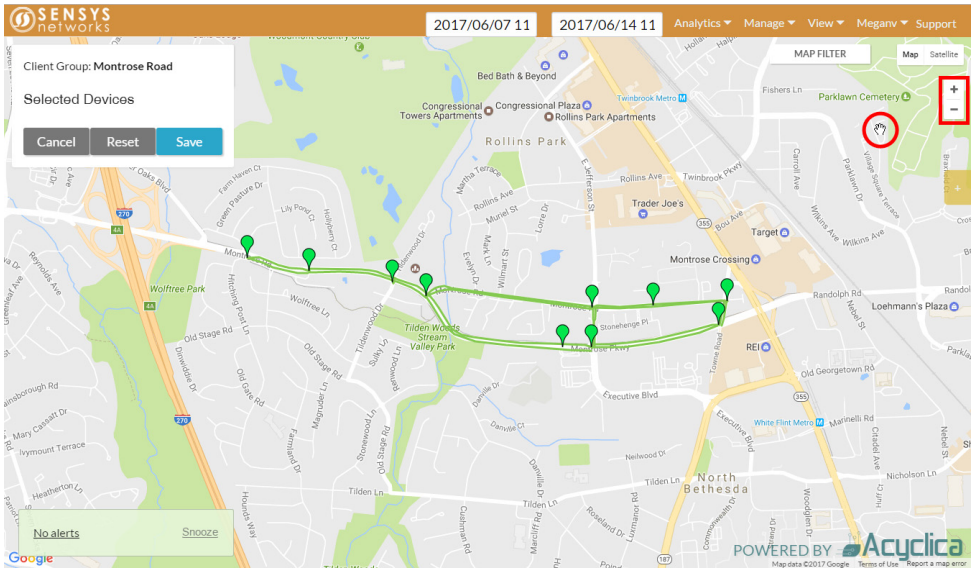


Figure 11. Route creation tool

These navigational tools are outlined in red in the previous figure. The magnification tool (vertical bar with + and - on either end) can be used to zoom in or away on the current geography displayed by the map. The mouse icon changes into a hand when over the *Map* view and can be used to move around within the map while keeping the map at the same magnification by clicking and holding the left mouse button while moving the mouse.

NOTE:

Once a device is selected to be included within the route, it does not need to stay within view while other devices are chosen.

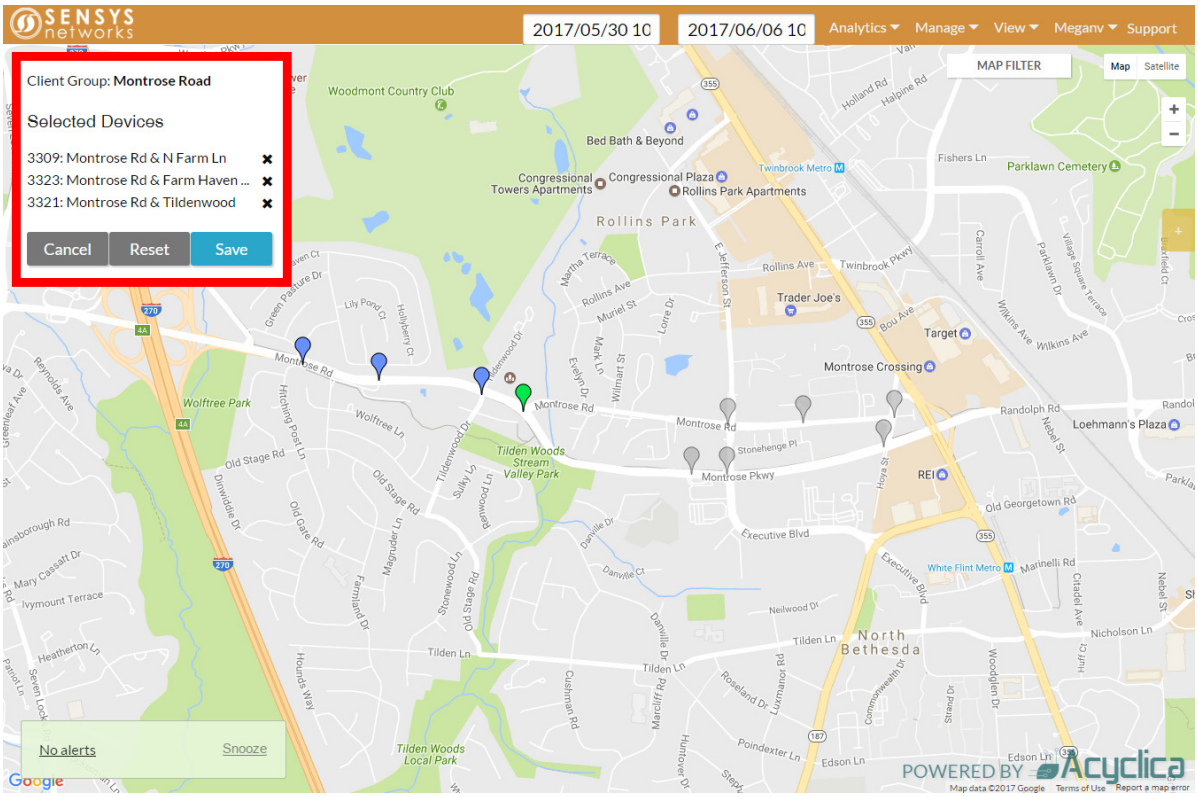


Figure 12. Devices selected for new route

In the previous figure, three devices have been selected for a route named *Montrose Road*. The selected markers are blue on the map, with their names listed on the left-hand sidebar in the sequence they were selected (outlined with a red rectangle for illustration purposes).

Once you have included all of the appropriate devices in your route in the proper sequence, click **Save**. The *Route Name* window will display. Type in the route name and click **Save**. The route is then put in the queue to start processing, which may take a variable length of time based on the number of records involved.

To view already configured routes, click on **View Lists** in the *Manage* menu. In the new pop up window click on **Routes** to display a list of current established routes (outlined with a red circle for illustration purposes).

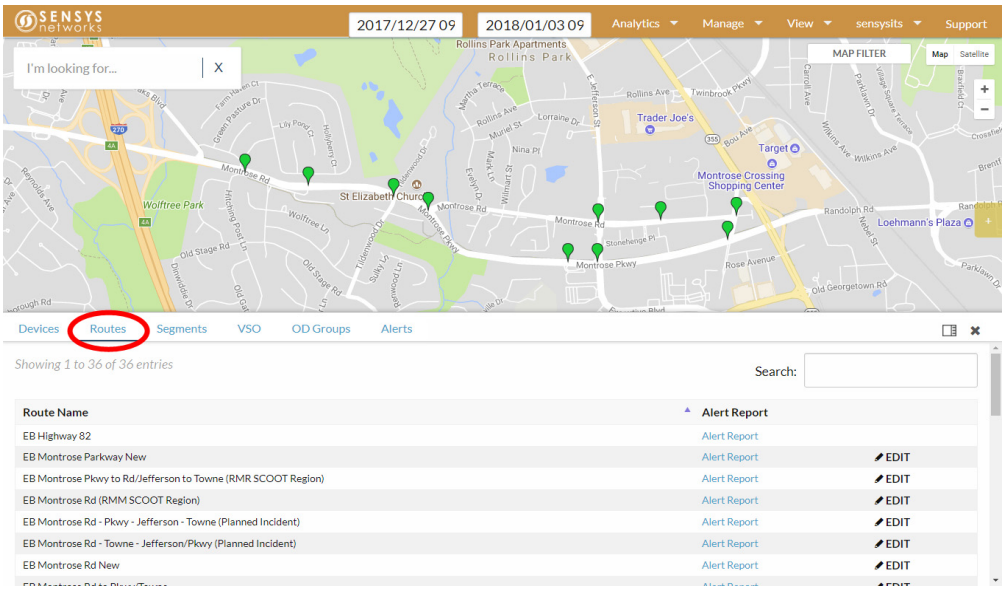


Figure 13. Route tab window

NOTE:

The *Route* section is blank until any routes are configured.

Routes and Segments

When a route consisting of a number **n** devices is created, it defines a set of **n - 1** segments that are used to calculate MAC address matches for generating route-based traffic information. For example, a series of five devices named A, B, C, D, and E (in that order) create the following segments:

- A → B
- B → C
- C → D
- D → E

Routes are uni-directional. If you want to obtain information for traffic in both directions along a corridor or arterial, you need to create two distinct routes with the devices in reverse order with respect to one another. To easily differentiate between the two, develop a global naming schema that allows you to easily identify the directionality, endpoints, and any other noteworthy features about the route's construction such as:

- I-70 WB: Federal to Kipling
- I-70 EB: Kipling to Federal

Matches are only computed for consecutive devices. Using the above route definition (A → B →. . E) to clarify, the following would be examples of segments that would **not** be created by that route:

- A → C, B → D, C→ E
- A → D, B → E
- A → E

Accordingly, in the event that you are interested in any of the above segments for the series of devices A, B, C, D, E, you need to create a new route to do so, one that makes the devices you want to match on consecutive, in proper directional order and omitting whatever sensors may be in between. The following are examples of how variations on the same route using different devices might be named:

- I-70 WB: Federal to Kipling (End points only)
- I-70 WB: Federal to Kipling (Excl. Sheridan)
- I-70 WB: Federal to Kipling (all)

Statistical filtering is done on both the segment and route level. Accordingly, it is important to create routes in a comprehensive fashion to achieve the best possible results and get the most value out of SensID's analytics and reporting.

Overlays

Defining routes set the computational basis of almost all of the traffic information for SensID's travel time and delay reporting. *Overlays* are required to define the proper distances for route segments and may be customized to create dynamic congestion mapping.

Creating Overlays

To add or edit a segment overlay path, the user must have admin privileges or be a Group Owner. To add a segment overlay path, click on the **Lists** under the *View* menu and then click **Segments** which shows you a list of all of the segments that have been generated from the routes that have been created to date. The segments are organized with *Start Serial* and *End Serial* columns. Under the *Path* column, click the **ADD** link for the selected *Start Serial* and *End Serial* row to display the *Edit Segment Path Menu*. The following screen displays.

NOTE:

After the overlay path is created, there will only be an *Edit* button under the *Path* column of the *Segments* tab.

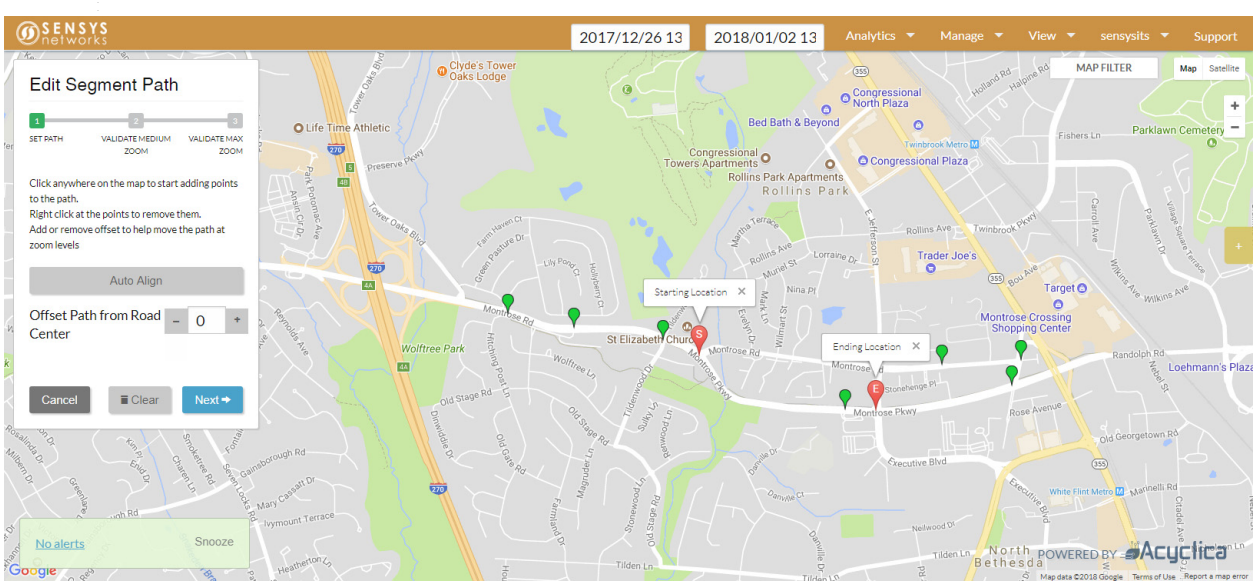


Figure 14. Edit Segment Path Menu

To configure a new overlay path, perform the following steps:

1. Left-click on the map at desired locations along your route between the start and end points.

   The first click causes a straight line with a white dot at the end to be drawn between the start point and the location where you clicked. Clicking at another location further along the route adds an additional dot segment to be drawn between that point and the one preceding it. The white dots can be manually moved by clicking and dragging the white dot to the preferred location. Between the white dot line segments are transparent dots that can be added to the line if clicked on.

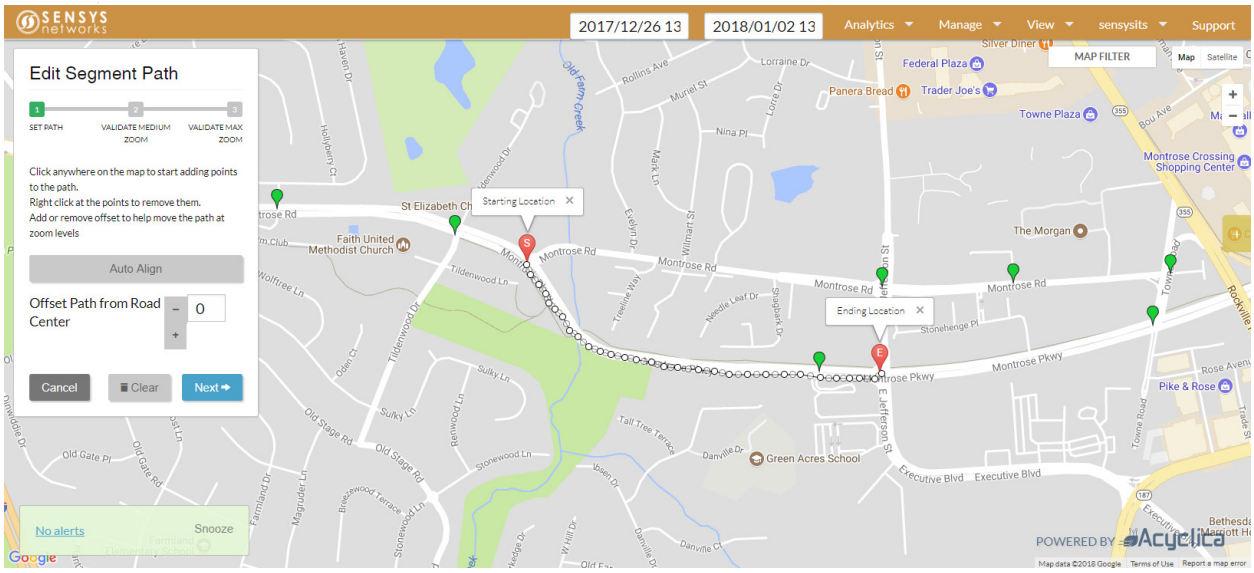


Figure 15. Creating a polyline

2. Click the **-** or **+** offset buttons to adjust the placement of the point line between starting and end points.
3. Click **Next** to and repeat step 2 to validate the offset for Medium Zoom and Max Zoom.

NOTE:

Validating the offset to allows for greater visual accuracy and prevent multiple overlays from overlapping each other on the map.

4. Click **Save** to complete the process of assigning the polyline to your route.

Edit Segment Path Menu Navigation

The *Segment Editing Menu* contains the following:

- *Autoalign* – Will align the pathways of all devices in overlay path.
- **-** – Adds a fixed offset in the opposite direction to the segment.
- **+** – Adds a fixed offset in one direction to the segment.
- *Clear* – Will delete overlay path from the map.
- *Next* – Will advance to the next step for zoom validation.
- *Save* – Applies the constructed overlay path to the map.
- *Cancel* – Displays the thresholds editing section of the selected segment's *Information Panel*. The overlay path editing section can be opened any time by selecting the *Edit Path* button.

NOTE:

The *Add Threshold (MM:SS) Menu* can also be directly navigated to by selecting the *ADD* button under the *Thresholds* column in the *Segments* tab in the *Lists* menu.

In the segment *Information Panel* the *Distance* value is 0 miles. The distance will change once the overlay is saved and the SensID server calculates the total distance of the devices assigned in the overlay.

In the event that your route is an absolutely straight road, click once close to the marker for the end device and a straight line is drawn connecting the two points. For more circuitous routes, multiple clicks along the route may be required to assign a best-fit line to the physical path between the two devices.

To edit a assigned overlay path, click on the *EDIT* button in the *Path* column of your selected segment to open the *Edit Overlay* sidebar. You can adjust the positioning of any device on the overlay path and click *Auto Align* button to realign the path. Click **Save** button to save your edits.

Color Thresholds

The color threshold selection feature allows the overlay to be color coded so that the polylines assigned to them can be used to reflect various levels of congestion that you can define yourself. To utilize this feature, click on the **ADD** link under the *Thresholds* column in the same row as the segment you would like to add this property, and the following sidebar displays.

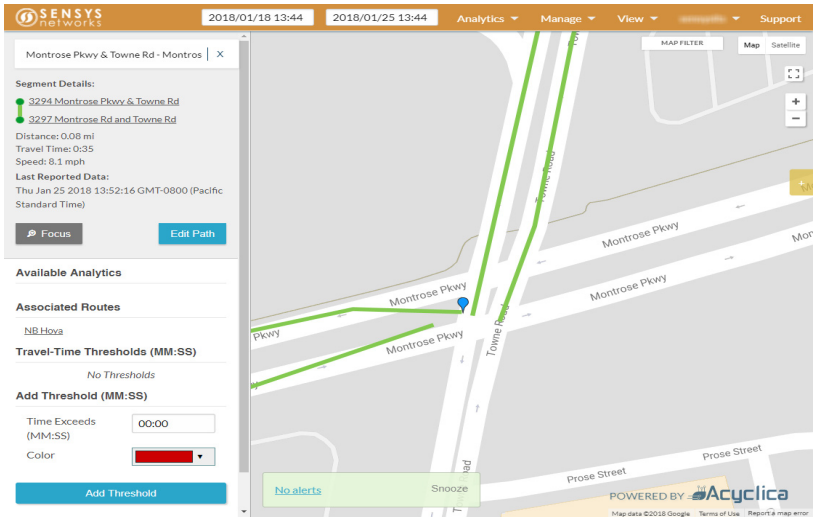


Figure 16. Color Threshold window

The threshold value corresponds to the limit (in minutes and seconds) of the polyline and changes to the **Color** selected. For example, the above values cause the polyline to show red when travel time exceeds one minute (or 60 seconds). Many thresholds can be created (as needed) to reflect the number of congestion levels desired.

Alerts

Along with routes, alert reporting can be created to produce email notifications when travel times exceed comparison thresholds as well as daily reports of observed travel times by day broken down by hour and at customizable time intervals.

Setting Up A Route Alert

To create alerts for a route, do one of the following:

- Search for route name in the *Search Bar*.
- Select a sensor that is apart of the route, then select the route from the *Information Panel* in the *Associated Routes* section.
- Hover over *View*, click **Lists**. In the *List* window, click the **Routes** tab and then click on the route.

All of the methods will bring the user to the route's *Information Panel*. This prompts a left-hand sidebar menu containing the following information:

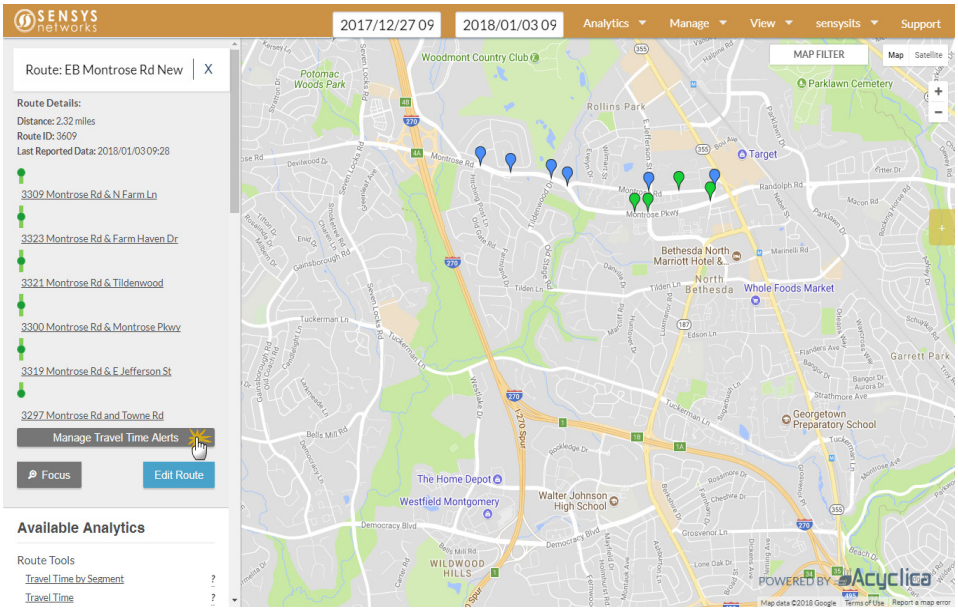


Figure 17. Info menu

- **Name of the Route:** Name you have given the route will appear in the search bar.

- **Distance:** The length of the route (in miles). Route distance is calculated from segment lengths, which can be calculated in two ways:
  - By default, when a segment is created, a default length is calculated automatically using straight-line distance.
  - Whenever a polyline is constructed for a segment, a distance is calculated as the line is created, piece by piece.
- **Route ID:** Whenever a new route is created, a unique ID number is assigned to it. This ID number is primarily for the purposes of API key features.
- **Last Reported Data:** Displays the date and time SensID server last received data from the devices.
- **Manage Travel Time Alerts**: Clicking on the *Manage Travel Time Alert* button takes you to the interface for creating your alert reporting.
- **Edit Route:** This button links to *Edit Route Details* window.
- **Available Analytics:** Contains all the reporting tools for routes, signal timing tools, and performance metrics.
- **Associated Devices:** Lists the devices in the route in the same sequence as the route.
- **Current VSO Stations:** Displays for routes only. Lists any VSO Count stations the route contains. Allows the user to o create new count stations or attach existing count stations to the route through the *Create or Attach Count Station* section. The section includes:
  - **Select VSO:** This section lists all of the current VSO Count Stations you can chose to add to the route. To add a VSO configuration, select a VSO Count Station id and click the **Add Count Station** button. Alternatively, you can click the **Create VSO Count Station** button to create a new VSO Count Station.

To set up an alert, click the **Manage Travel Time Alerts** button next to *Alerts*, which takes you to the following window.

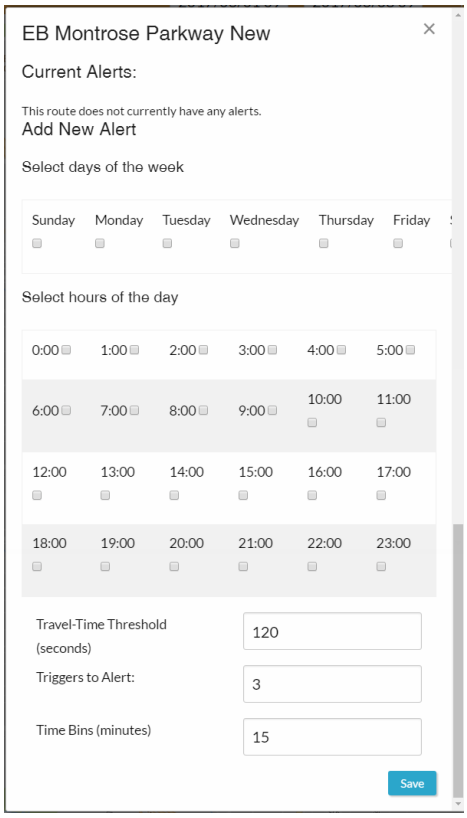


Figure 18. Alerts window

This alert creation tool has the following elements:

- **Current Alerts –** Provides a list all of the current alerts that have been set for the route.
- **Add New Alert –** Sets the specifics of the alert, which has the following components:
  - **Select days of the week:** Chooses the day(s) that you want a specific alert to be set for.
  - **Select hours of the day:** Chooses hour(s) that you want a specific alert to be set for.
  - **Travel-Time Threshold (seconds):** Sets the limit for triggering an alert. If average travel time for a complete interval exceeds the threshold, a qualifying event is registered for an alert to be produced.
  - **Triggers to Alert:** Sets the number of consecutive intervals over which the threshold must be exceeded for an alert to be issued (e.g., a value of three would mean that three consecutive intervals would need to have the threshold exceeded for an alert to be issued).
  - **Time Bins (minutes):** Breaks the days and hours selected for a threshold to be applied to into corresponding time intervals. Bins can be created for as small as five minute intervals.

Subscribing to Alerts

Once an alert has been created, it can then be subscribed to for enabling email alerts when a qualifying event has been observed. As you create new alerts and they are listed in the window at the top of the screen, the options *Delete* or *Subscribe* display.

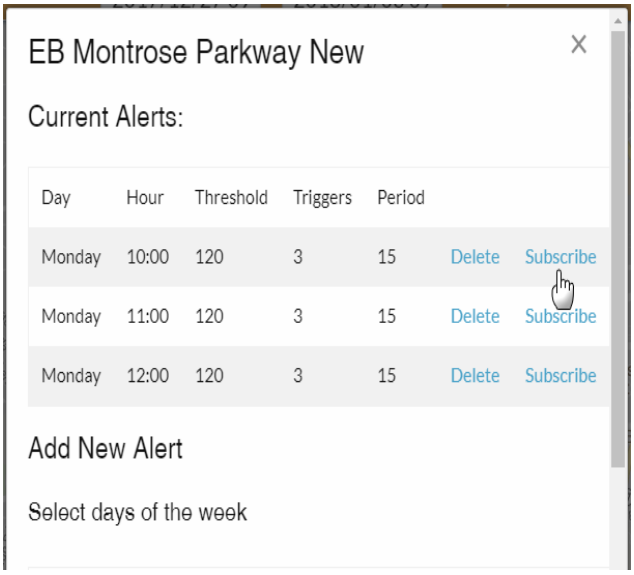


Figure 19. Current alerts window

Clicking **Subscribe** for a given interval subscribes you to alerts for all periods that share that common threshold value. For example, in the above image there are three time periods that share a threshold of 120s. Clicking **Subscribe** for any one of them sets up alert notifications for all three intervals shown and any other time periods for which 120s is the threshold.

Deleting and Changing Alerts

Alerts can be deleted or changed once created. Unlike subscribing to alerts, deleting alerts can be done one interval at a time. Using the above example, clicking **Delete** for any of the intervals that have 120s as the threshold only deletes that single alert period. To change an alert, simply create a new alert for the same time period. When the new alert is created, the threshold, triggers, and time bins update to the new values.

Daily Alert Reports

Beyond email notifications, the Alert Report feature also can be used to generate daily reports to show observed travel times by interval and instances where travel times exceeded the defined thresholds. To create an Alert Report for a specific day, go to *View → Lists → Routes* and then click **Alert Report** link in the *Alert Report* column. Doing so opens the following page in a new window.

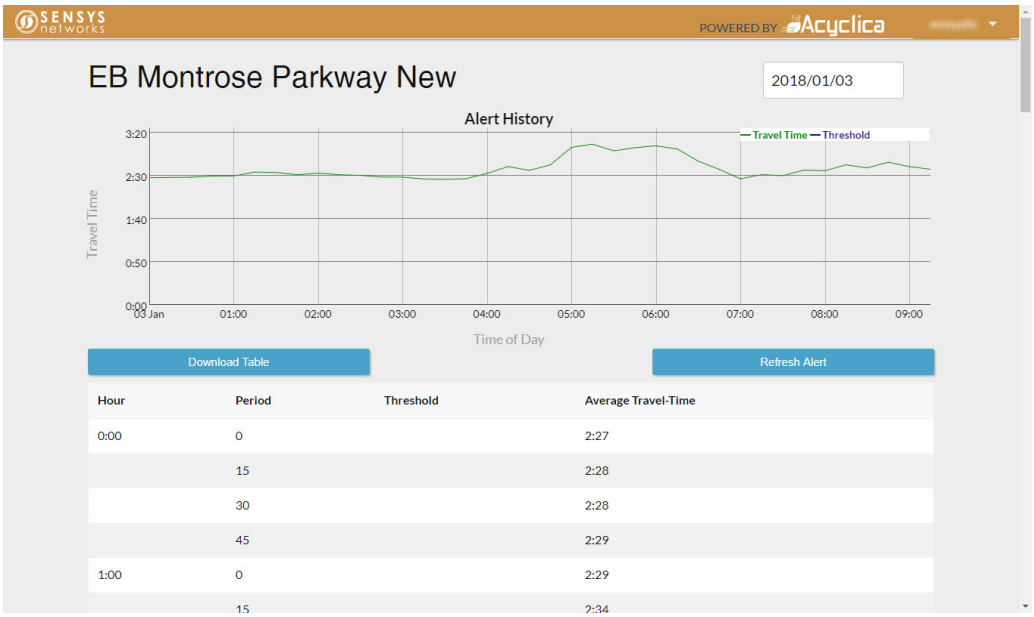


Figure 20. Alert report

This page is the *Alert Report*, which has two main components:

- A graph showing average travel time versus threshold values for the selected day.
- An hour by hour table showing hourly travel times by interval versus the corresponding threshold values. When a threshold value is exceeded for any interval, the entire row of data displays highlighted in red.

To select the day you want to view, click somewhere within the **Report Date** field above the graph in the top right corner, which calls a calendar tool that you can use to select the precise date you want to view. The current day's date is selected by default and results populate up to the most recent results reported.

Once the desired date has been selected, click **Refresh Alert** button to obtain the results for that day. Clicking on the **Download Table** button exports a CSV of just the tabular portion of the report.

OD Groups

Configuring an origin-destination group is very similar to setting up a route. User must have admin privileges or be a Group Owner to create OD groups. Once you have accessed the *Manage* menu, click on **Add O/D Group** to see the following screen display.

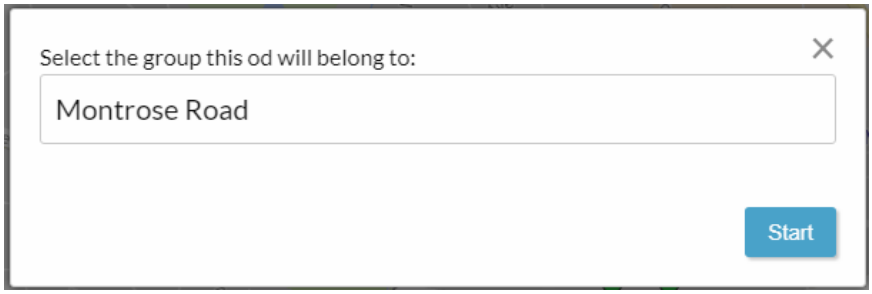


Figure 21. Select client group window

Select the client group the OD Group will be assigned to and click **Start**. The following pop up window displays.

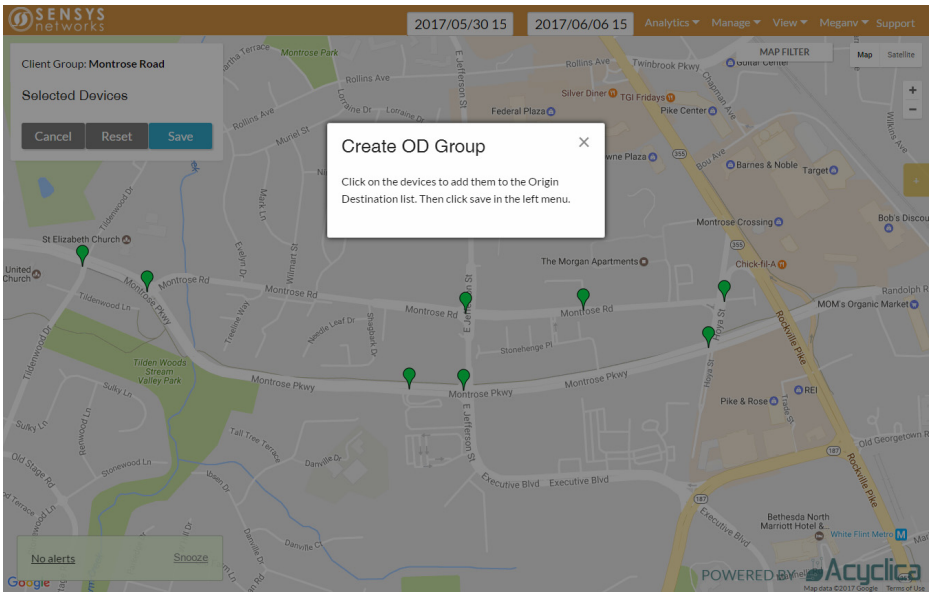


Figure 22. Create OD group instructions window

The pop-up window gives instructions on how to create a Origin Destination list. Click on the **X** to close the window and initiate the process.

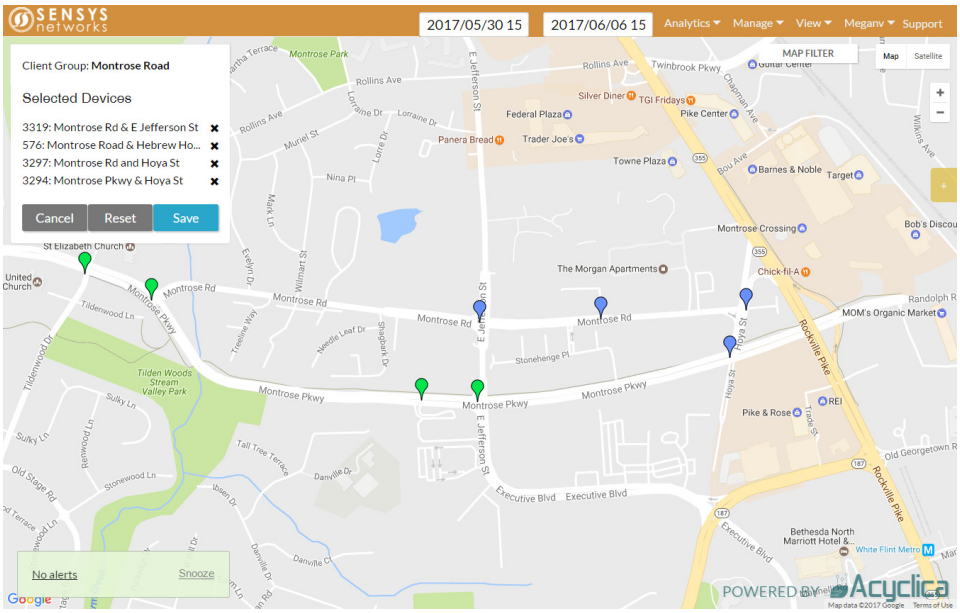


Figure 23. Add OD Group window

Unlike route setup, however, the order that you select your devices is not important to proper OD calculations. Once all of the devices in the group have been selected, click **Save**.

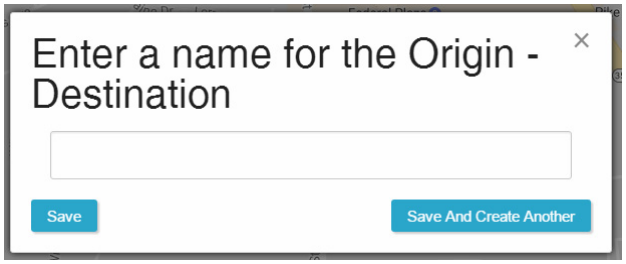


Figure 24. Origin - Destination name window

Enter the name for the Origin - Destination you created. Click **Save** to finalize creating your new Origin - Destination group.

Settings

The *Settings* window provides users who have admin privileges or are Group Owners to add users to their group. This option is only available to approved local SensID admins. Clicking on the **Username** link displays a dropdown menu listing the *Settings* and *Logout* links. The *Settings* page provides a view of your account preferences and a link allowing you to add new users.

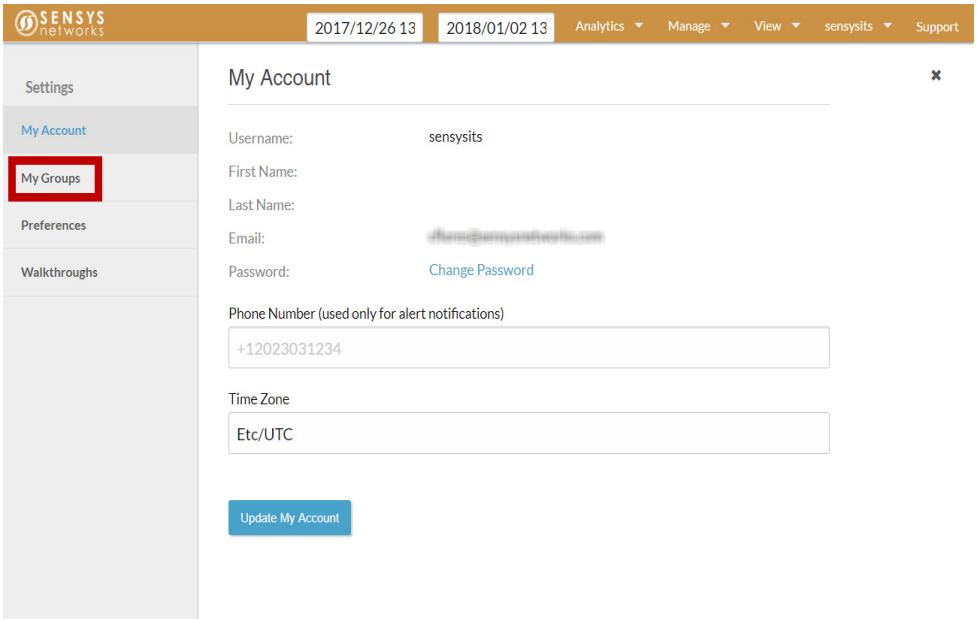


Figure 25. My Account page

User Permissions

The following is a list of user types for a client group:

- *Group Owners* - can manage group memberships, permissions, setup devices, and create routes, O/D Groups, and alerts; their permissions cannot be changed by user admins or other owners.
- *User Admins* - can manage client group membership including adding or removing users and setting admin levels.
- *Config Admins* - In addition to a Standard User permissions, can setup devices and create routes, O/D Groups, and alerts.
- *Standard Users* - has access to run and view analytics in the client group, but can't make any configuration changes.

Groups Owners and User Admins can modify users' access to the client group, and can raise or lower a user's permissions within the client group. An individual user's permissions can vary per client group. For example, a user may be a User Admin in Group One, but a standard user in Group Two. In this scenario, the user can manage the other users in the Group One, but can only run and view analytics in Group Two.

NOTE:

Group Owners can only be set by the Sensys Networks admin, please contact the admin at sensidadmin@sensysnetworks.com to ensure you are approved to be on the list of authorized administrators for the agency SensID application.

Adding New Users

Clicking on the **My Groups** tab (outlined with a red rectangle for illustration purposes) will display a page listing all the client groups the user can access. Depending the on the type of user the content on the **My Groups** page will vary. Clicking on the **Manage** button next to a client group displays a page listing all the current users assigned in the group.

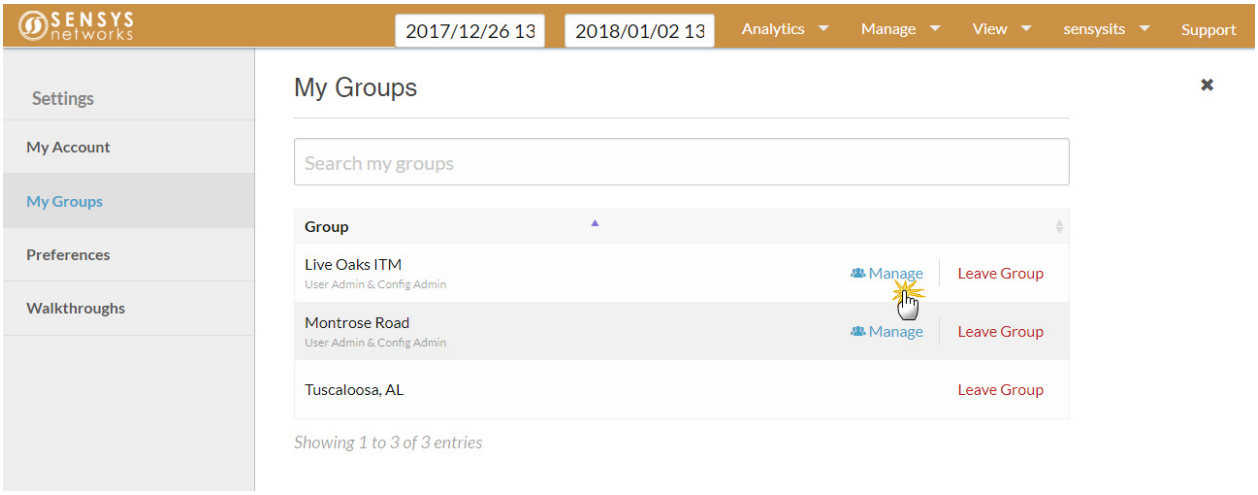


Figure 26. My Group page

Click **+ Invite Users** at the top of the page will display a page allowing you to submit the email address of the corresponding user to add them to you group and an option to label them a User or Config Admin.

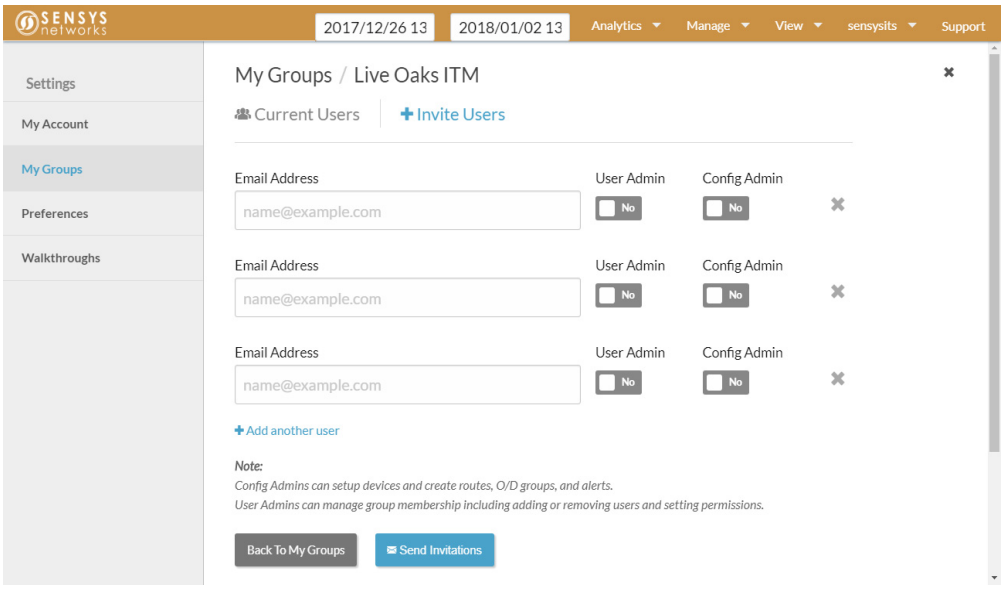


Figure 27. Add user email address

Once the appropriate email address has been entered, click **Send Invitations**. A notification displays confirming your submission.

Changing Your Password

Changing your password can be accomplished in the **Settings** window.

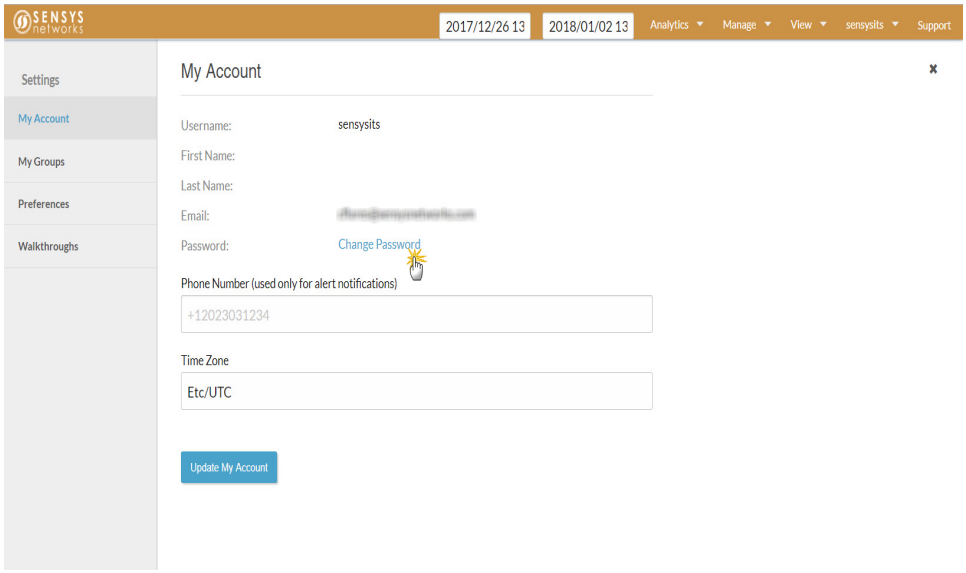


Figure 28. Change Password button

Clicking on **Change Password** takes you to a new page where you can establish your new password.

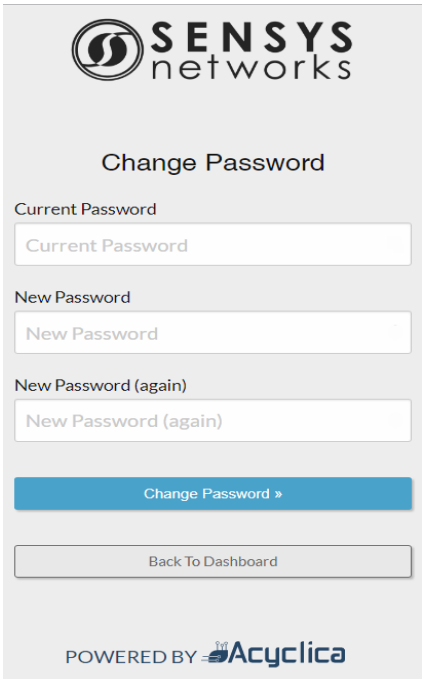


Figure 29. Change Password window

Once you have successfully completed the change password process, a notice indicating that your password was successfully changed displays. At this point, you can return to SensID by clicking the **Back to Dashboard** link below the confirmation notification.

Using SensID and Generating Reports

This chapter describes how to administer SensID analytics and reports. This chapter also describes how to use the system to establish and generate reports with wireless vehicle detection networks and users.

The following sections are provided in this chapter:

- *Data Posting*
- *Analytics*
- *Selecting Devices and Routes*
- *Setting the Time Interval*
- *Device Data Reporting*
- *VSO Analytics*
- *Performance Metrics*
- *Retrieving Your Graphs: The Report Tab*

Data Posting

The FlexControl Card or Module device submits the data it has collected through the SNAPS server to SensID software. The primary benefits of data posting are as follows:

1. **Device status monitoring:** The *Online/Offline* feature of SensID provides a means of verifying whether data from your devices is currently posting to the SensID servers. This can be an immensely valuable tool for both confirming correct setup/installation and catching network or power interruptions in your deployment environment that may be preventing your equipment from functioning properly.

The posting status of a device can be viewed in two places on SensID software — the *Map* view or *Manage → View Lists → Devices* section. When observed from the map, the marker for each device is color-coded with respect to two different factors:

- A device that has been selected in the software displays as blue on the map. Note that when you select a route, this involves multiple devices, all of which should display blue when a route is selected.
- Unselected devices are colored relative to their posting status. The parameter used for defining online/offline is 1 hour. When devices have not posted data in over an hour, they display as grey otherwise they display as green. For definitions of other colors refer to *Chapter 2: Locations*.

This information can also be obtained under the *Manage → View Lists → Devices* section. This status indicator can be found to the left of each device's serial number in the *Status* column. Using this method, the status of a device displays as either *Online* in green text or *Offline* in red.

NOTE: If device is red please contact your Sensys Networks Field Engineer.

2. **Enhanced data backup:** In the event of damage to your device for any reason, data that has been posted to the SensID server is stored and can be recovered. Links for downloading device data that has already posted to the SensID server can be found by clicking on a device in the *Map* view. A pop-up window displays under the search bar containing buttons for CSV or XML formats. The data for CSV has a one month limit and the data for XML has a one hour limit.

In order to achieve data posting to SensID software, all that you need to do is ensure that your devices are able to communicate over the internet to Sensys Networks SNAPS servers. If your devices are installed on your network, this may involve coordinating specific port access through your firewall with your IT department. In the event that you are deploying in remote areas or places without existing communications infrastructure, wireless modems may also be used.

NOTE: If you have any questions regarding configuring your FlexControl Card or Module device in SNAPS and SensID, please contact Sensys Networks at sensidadmin@sensysnetworks.com.

Analytics

Once your devices and routes are set up, everything is now in place for you to explore the analytics. The following provides instructions for accessing and creating custom views of SensID's reporting options as well as a brief synopsis of each of the reports currently provided by SensID.

Selecting Devices and Routes

Selecting a device or route in order to view the associated analytics can be accomplished in one of three ways: via the *Search Bar*, through the *Map,* or within the *Manage → View Lists* section. To review, the search bar functions by matching a string of text entered in the field to the names and serial numbers assigned to your routes and devices.

As you enter characters, a dropdown list displays all the device and route names matching the values that have been entered thus far. To select a route or device from this list, scroll down to the route or device you are looking for until it is highlighted and then left click. Your selection is confirmed by showing the device/ route you selected in both the search bar as well as on the map.

Selecting a device through the map is as easy as left clicking on the marker representing that device. Depending on the span of your deployment, this marker may already be shown in the default map view or you may have to navigate the map to find it (if the latter, it may be easier to use the search bar to locate the device).

The initial *Map* view that SensID displays is calculated by averaging the coordinates of your entered devices, providing a centered view of the geography determined by your devices. In the event that the desired device does not display in the default map view, the zoom in/out navigation or click and drag can be employed to move about the map. Once you have located the desired device, it can be selected by clicking on the marker at that location.

Finally, the *View→Lists* window contains both *Devices* and *Routes* tabs containing links to each of your devices and routes. Clicking on either a device or route name selects it, directing you to its location on the map and opening the corresponding *Information Panel* containing the reporting links.

Setting the Time Interval

After selecting the device or route you would like to view the analytics of, you can also preset a time interval to focus your reporting. Clicking on the text field of either **Start time** or **End time** causes the following calendar tool to display for selecting the desired date/time.

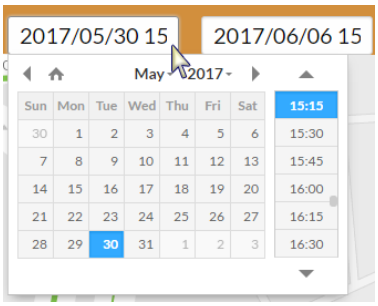


Figure 1. Setting time interval

Once you have selected the desired interval you would like to view for your selected device or route, you can then click on the link for the graph you would like to view in the *Device Tools* or *Route Tools* menu.

Algorithms

SensID uses five different algorithms to calculate travel time. These provide insight into different aspects of traffic conditions in order to develop a complete picture of roadway conditions. Travel time is calculated on a per-segment basis, and are summed to provide route travel time. The default algorithms displayed when optional are the Strength, Maximum and Minimum travel times. The user can toggle these travel time options temporarily when running analytics, and defaults can be changed by click Username drop down menu to access the *Settings* page and then clicking the *Preferences* tab. Refer to Figure 2 for an illustration of the five algorithms and the detection points that are used to calculate them.

- **Strength** – measures travel time from stop bar (Point B) to stop bar (Point B) between intersections. This is the best single representation of what a driver might expect to see when traveling a route.
- **Minimum (Min)** – calculates travel time from the last detection (point C) at the first intersection, to the first detection (Point A) at the second intersection. This excludes delay at the intersections, and provides a representation of free flow travel time.
- **Maximum (Max)** – calculate travel time from the first detection (Point A) at the first intersection to the last detection at the second intersection (Point C). By including all potential delay, this shows the maximum length of time it could take to traverse the route.
- **First** – travel time is calculated from the first detection (Point A) at the first intersection to the first detection (Point A) at the second intersection. This includes delay from the first intersection while excluding it from the second. Looking at data this way will have the greatest effect when looking at routes that are made up of smaller numbers of sensors.
- **Last** – travel time is calculated from the last detection (Point C) at the first intersection to the last detection (Point C) at the second intersection. This excludes delay from the first intersection and excludes it from the second. Looking at data this way will have the greatest effect when looking at routes that are made up of smaller numbers of sensors.

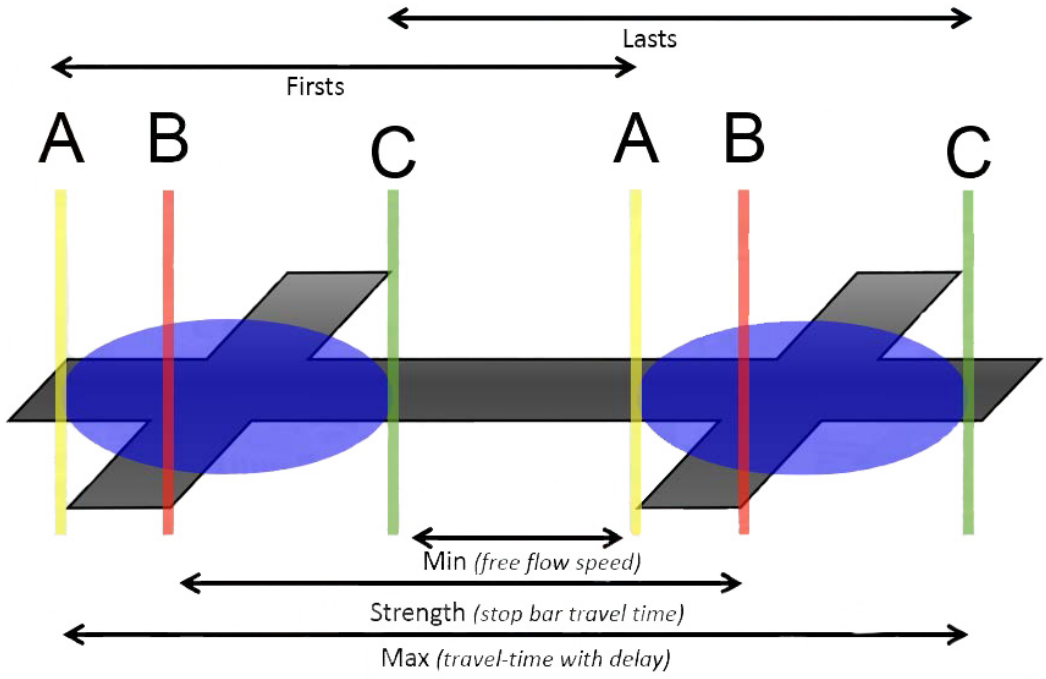


Figure 2. Five Travel Time Algorithms

Customizing Charts

Aside from setting a global time interval to a report, SensID also provides additional tools for customizing your graphs. These functions provide the ability to further dial in your graphs within the initial view determined by the *Start* and *End Time* parameters, as well as the ability to easily jump back to the initial graph if desired.

a. **Function**: Exploded view

   Charts: All reports

   How it works: Left click the mouse anywhere over the graph, hold and drag across the chart. Doing so produces a gray highlighted area on the graph. Releasing the mouse creates a new chart representing the area that was previously highlighted. You can return to the original graph at any time by double-clicking on the graph.

b. **Function**: Time interval selection for average value computation.

   Charts: Travel Time by Segment, Travel Time, Speed, Travel Time by Day of the Week, and Week Over Week

   How it works: In the lower left-hand corner of the *Travel Times* and *Speed* graphs, a small text box populated by a number display.

Figure 3. Travel time and speed graphs interval in seconds

This number represents the interval (in seconds) over which average travel time and speed are computed. The following are examples of *Travel Times* graphs for the same data set using 10 minute (600 seconds) and 15 second intervals.

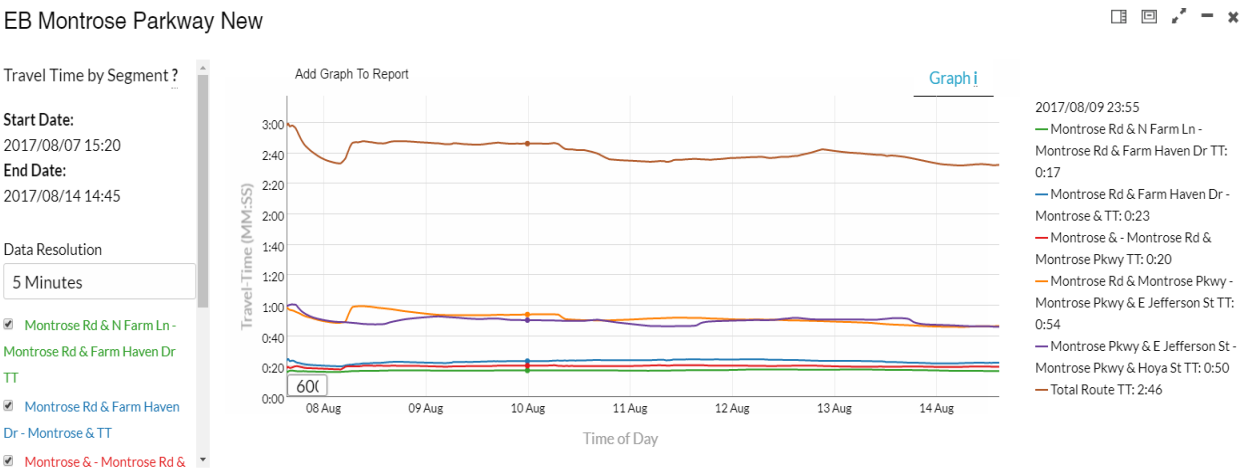


Figure 4. Segment travel time (600 seconds)

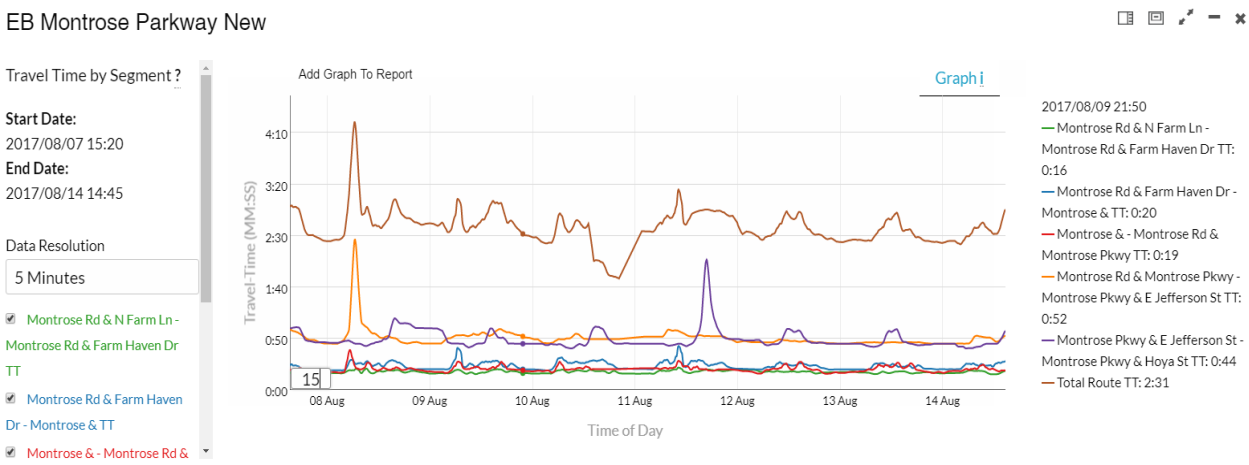


Figure 5. Segment travel time (15 seconds)

c. **Function**: Algorithm selection

Charts: Travel Time by Segment, Travel Time, Speed, Travel Time by Day of the Week, Week Over Week, Volume, Speed, and Occupancy

How it works: Check boxes to the left of the *Travel Times* and *Speed* graphs can be selected and de-selected to isolate calculations from any of the specific matching algorithms applied to your data. The following are the *six algorithms* definitions: First – First detections, Last – Last detections, Strength – Stop Bar Travel Time, Min – Free-Flow Travel Time, Max – Travel Time with Delay, and Interpolated – use of historical data to interpolate travel times during period the device was off.

The chart below shows the selection of the *Strength*, *First*, and *Last* algorithms for travel time calculation.

Figure 6. Segment travel times - Strength, First, and Last

Max and *Min* algorithms can also be selected to show matches calculating either comprehensive travel time (the first detection at the first device to the last detection at the second device for each segment in the route) or just the time elapsed between detections at each location (the last detection at the first device and first detection at the second device for each segment in the route). The following chart provides a comparison view of the *Min* and *Max* algorithms for the same data set and interval as shown in the previous figure.

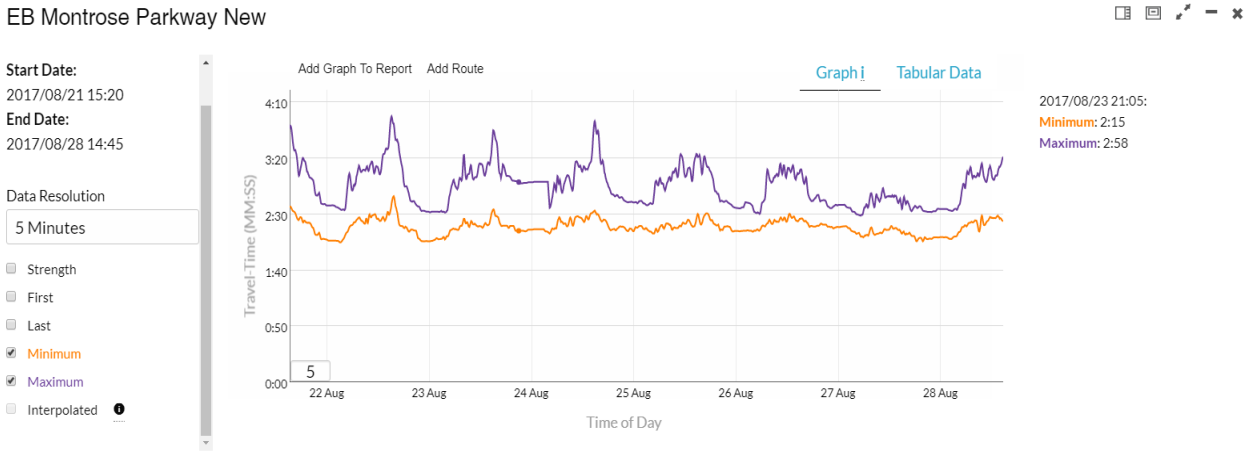


Figure 7. Segment travel times - Minimum and Maximum

d. **Function**: Data Resolution

Charts: Travel Time by Segment, Travel Time, Speed, Travel Time by Day of the Week, Week Over Week, Volume, Speed, and Occupancy

How it Works: The *Data Resolution* function allows you to select the rolling average time period to process the data from the dropdown menu.

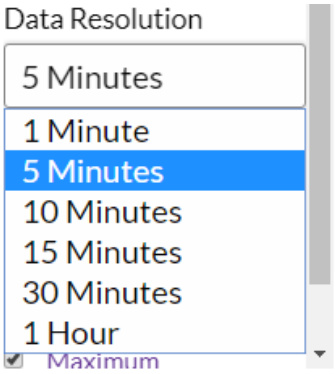


Figure 8. Data Resolution Dropdown Menu

e. **Function**: Add Sensor

Charts: Records per Hour

How it Works: The *Add Sensor* function allows you to compile data from multiple devices within a single chart. Clicking on the **Add Sensor** tab opens the following window.

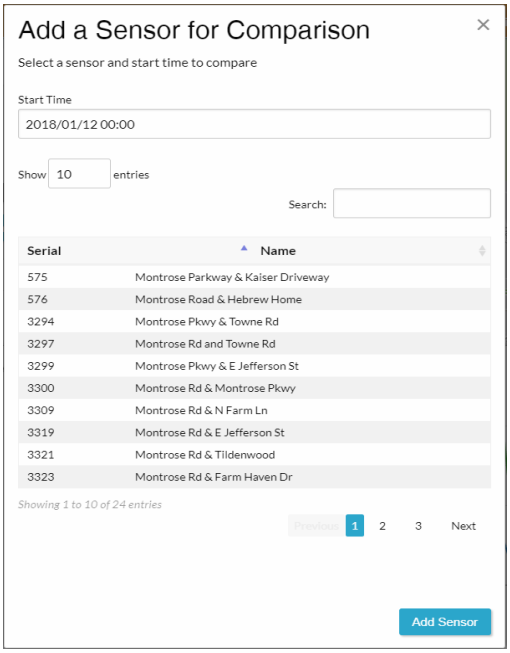


Figure 9. Add Sensor Comparison window

Within this window, you need to perform the following actions:

- Provide a start time for the comparison device's data to begin.
- Select the device you would like data from the menu list.

The use can use the search bar to fin a specific device by its serial number or name and the adjust the number of entries the list will show. Once the additional device is selected, a new graph displays showing total record data for the initial device and the added-in device on an hour by hour basis with time zero being the respective start times for the devices selected.

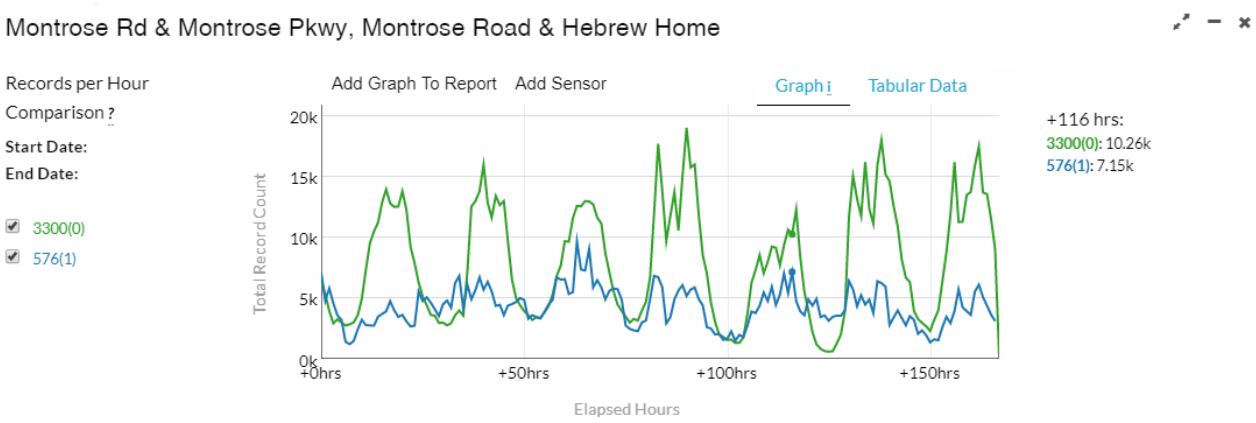


Figure 10. Sensor Records per hour comparison

Comparison charts can be created using different sensors or even the same device at different times. The previous graph, for example, shows two lines from the same device starting at the same time on different days.

f. **Function**: Add Route

Chart: Travel Time

How it works: Similar to the *Add Sensor* function, *Add Route* allows you to combine graphs from selected routes to create a comparison chart. Clicking the link causes a pop-up window containing a list of all of your existing routes to display, from which you can select the desired route for comparison.

g. **Function**: Tabular Data

Charts: Travel Time, Speed, Intersection Route Delay, Progression Diagram, Timing Plan Analysis, Travel Time by Day of the Week, Week Over Week, Records per Hour, Distinct Records per Day, Volume, Speed, and Occupancy

Data from a given chart can also be generated in tabular form. Clicking on the **Tabular Data** link creates a data table of the information contained within the graph. The following example below is the tabular data corresponding to the comparison graph drawn in the previous section.

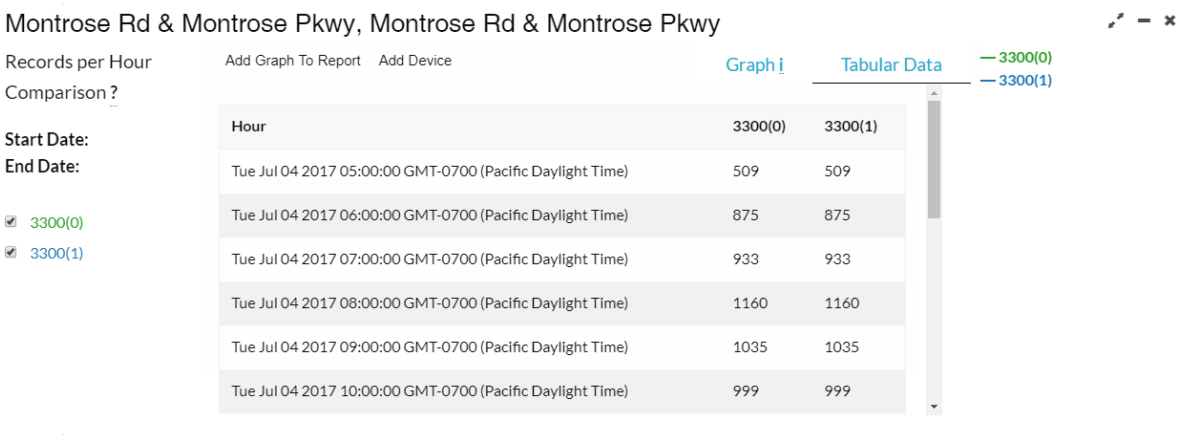


Figure 11. Tabular chart data

All of the data points from the Records per Hour Comparison graph on the previous page display, showing hour by hour figures from device 3300 at the same time of day on two different days of the same week (07/04/17 and 07/06/17).

Device Data Reporting

As mentioned earlier, the reporting for devices are separated into section on the left-hand sidebar of the device's *Information Panel*. The device data is under the *Available Analytics* section and separated into two categories: *Signal Timing Tools* and *Device Tools*. The *Signal Timing Tools* list contains *Delay by Movement* and *Delay by Approach* reporting. The *Device Tools* list contains *Data Availability*, *Records per Hour*, *Distinct Records per Day*, and *Delay* reporting.

Signal Timing Tools

Delay by Movement

The *Delay by Movement* bar graph displays the average dwell time based on where vehicles were coming from and where vehicles were going to through an intersection. Determine right, left, and through dwell time at an intersection over a given time period.

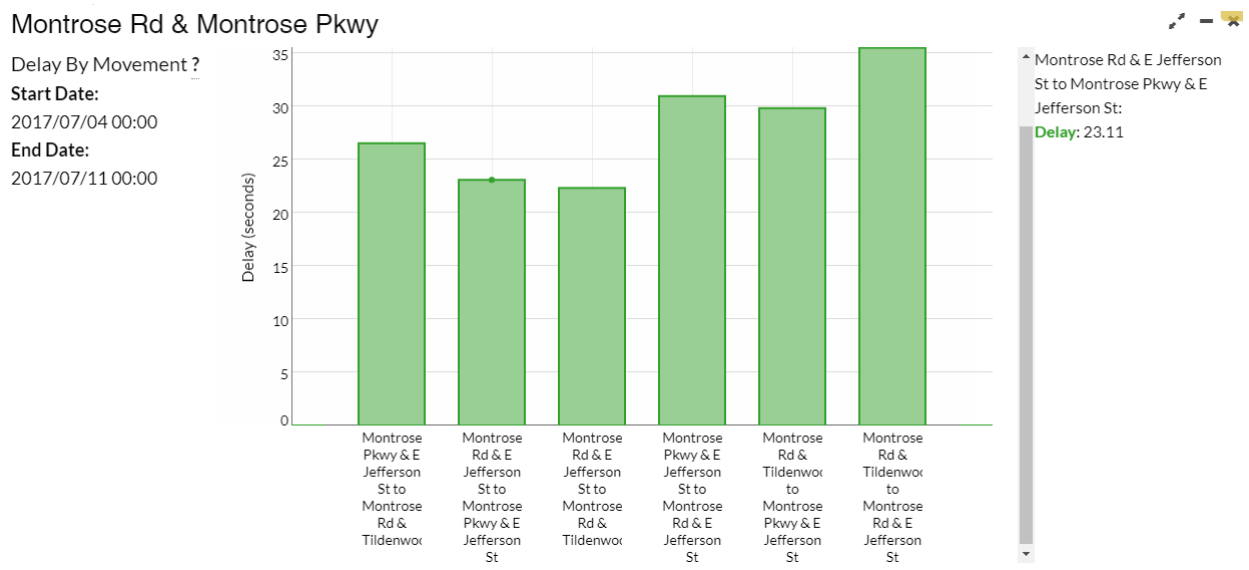


Figure 12. Device Signal Timing Tools - Delay by Movement

Delay by Approach

The *Delay by Approach* bar graph displays the average dwell time at the intersection based on where vehicles were coming from for a given time period.

Performance Metrics

Arrive and Departure Delay

The *Arrive and Departure Delay* line graph displays whether delay occurs when approaching an intersection, or after passing through. Hovering over the chart will show the date and time, and the delay in minutes and seconds that occurred before (*Upstream Delay* in green) or after (*Downstream Delay* in blue) vehicles have passed through the intersection. This graph has a maximum time frame of 31 days.

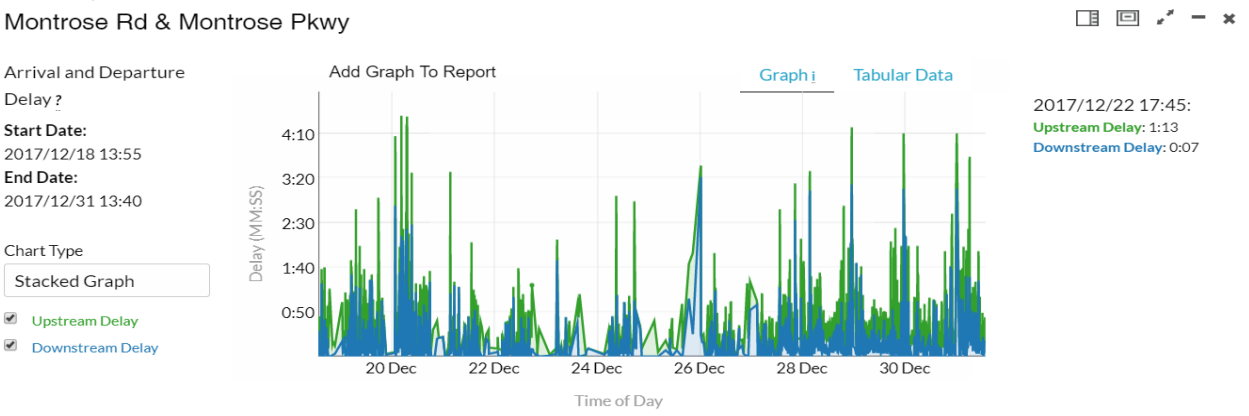


Figure 13. Device Performance Metrics - Arrive and Departure Delay

Device Tools

Data Availability

The *Data Availability* calendar view displays the total number of records on a device for a given day. The darker blue color indicates a larger number of records recorded for that day.

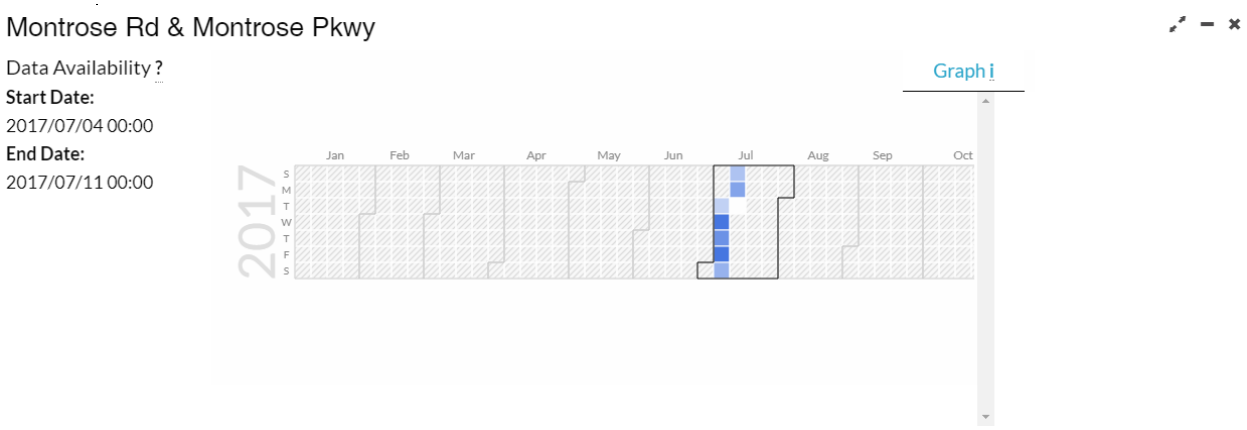


Figure 14. Device Tools - Data Availability Table

Records per Hour

The *Records per Hour* line graph provides historical information in regard to the specific device's detection rate on an hour by hour basis over a specified interval. This chart includes a line for total number of records (Total Records) as well as the number of unique MACs detected within that hour period (Distinct Records). This view is suitable for viewing detection rates for your devices over variable periods of time such as weeks, weekends, weekdays, months, etc.

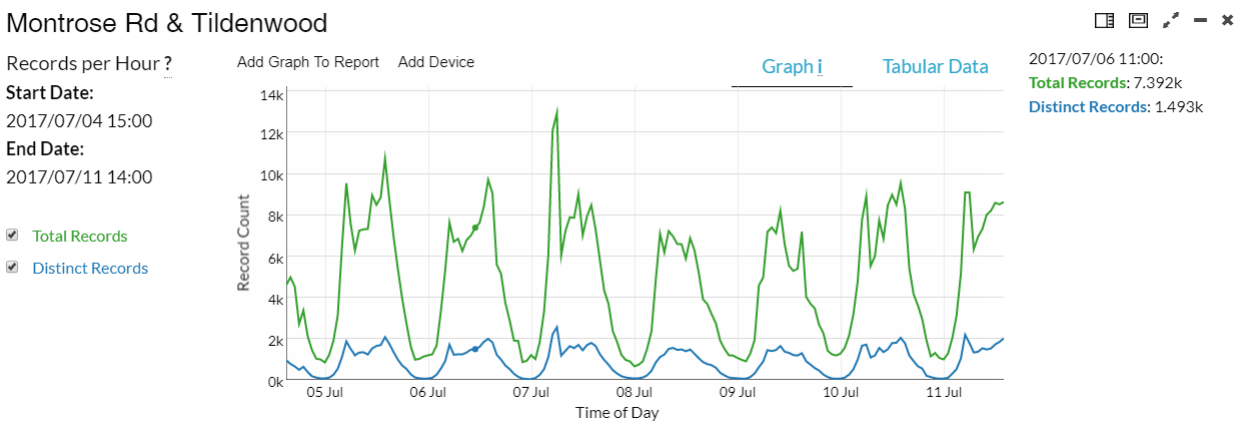


Figure 15. Device reporting data - Records per Hour

Distinct Records per Day

The *Records per Day* bar graph displays the total number of *distinct* MAC records per day for the selected time period. This can be useful for comparing the detection rates of different sensors on an day by day basis or analyze variations within a specific device's reporting over identical intervals on different days.

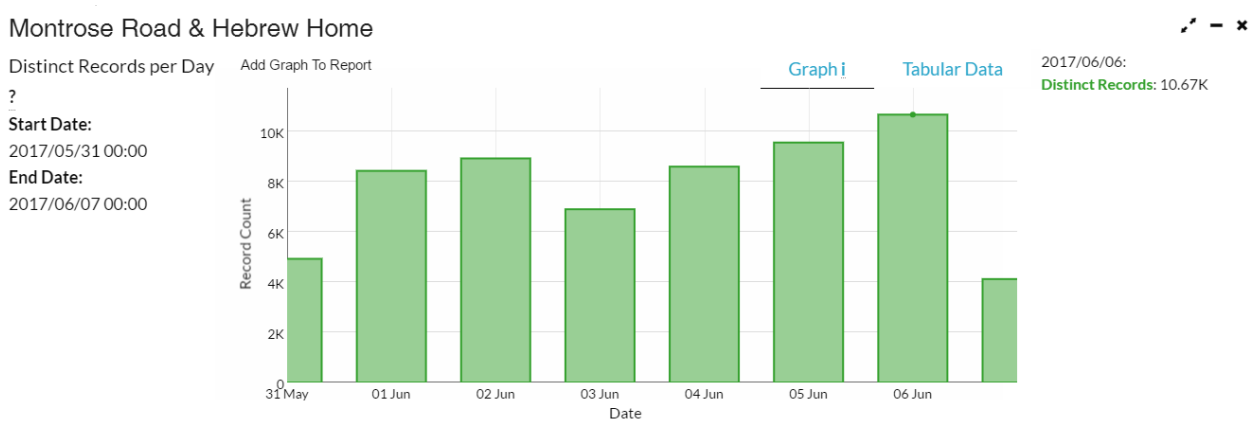


Figure 16. Device reporting data - Distinct Records per Day

Delay

The *Delay* graph is a scatter plot showing the amount of time a detected unit spends within the detectable range of a device. Overlayed on top of the individual data points is a line representing the average delay for the displayed data as well as a shaded region showing +/- 1 SD from the average. Hover over a green dot or the blue line and the *Dwell Time* (represents individual vehicle delay) and *Trend* (represents average vehicle delay) will display with the specific date and time in the window in the top right corner.

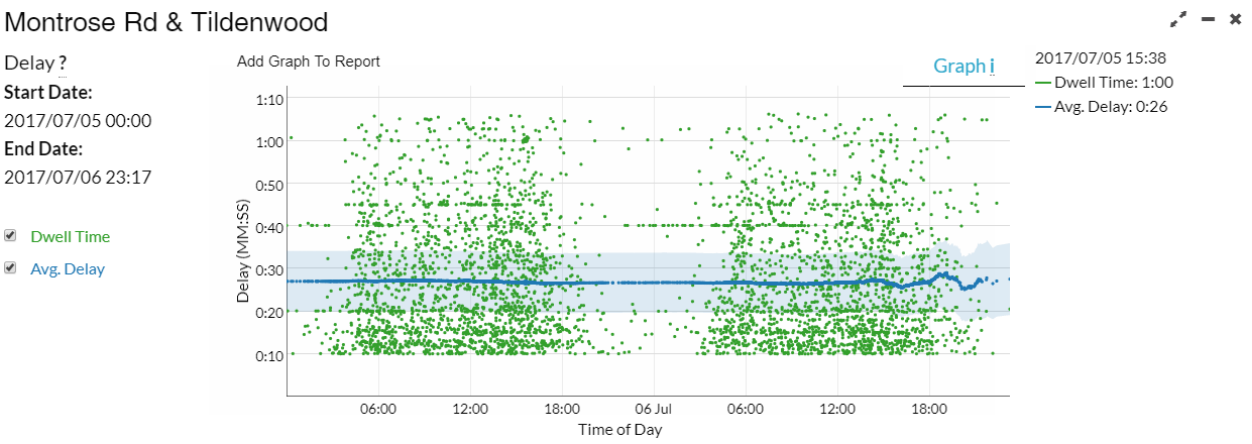


Figure 17. Delay graph data

VSO Analytics

Data Availability

The *Data Availability* calendar view displays the total number of records on a device for a given day. The darker blue color indicates a larger number of records recorded for that day.

Time of Day Distribution

The *Time of Day Distribution* pie graph displays the distribution of overall traffic volume collected during the following parts of the day: Early AM (before 7:00 am), AM Peak (7:00-9:00 am), Midday (9:00 am - 4:00 pm), PM Peak (4:00-6:00 pm), and Evening (after 6:00 pm). Each time period is represented as a slice of the pie, is color coded, and will display that time period's traffic volume within the start date and end date as a percentage. To the right of the pie graph will be a color legend for each time period. Hover over a pie slice will show time period, amount of counts, and the percentage of the traffic volume it represents. This graph has a maximum time frame of 4 months or 120 days.

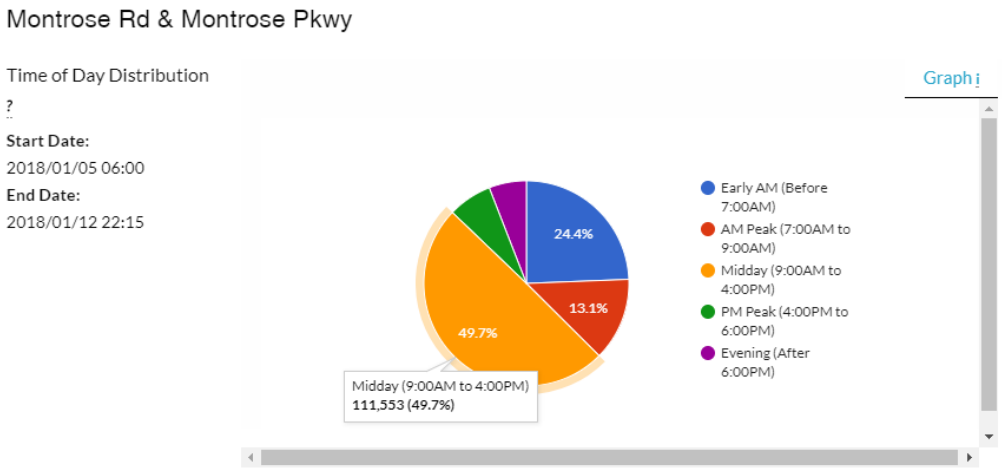


Figure 18. VSO Analytics - Time of Day Distribution

Volume

The *Volume* line graph displays the number of vehicles counted per minute, per detector, over the selected time period. To the left of the graph are three different variables to display: counts overall, by individual count station, or by count zones. Hovering over the chart will show the date and time, and volume. If more than one count station, or zone is displayed, these will be labeled in the display on the right side. This line graph has a maximum time frame of 4 months or 120 days.

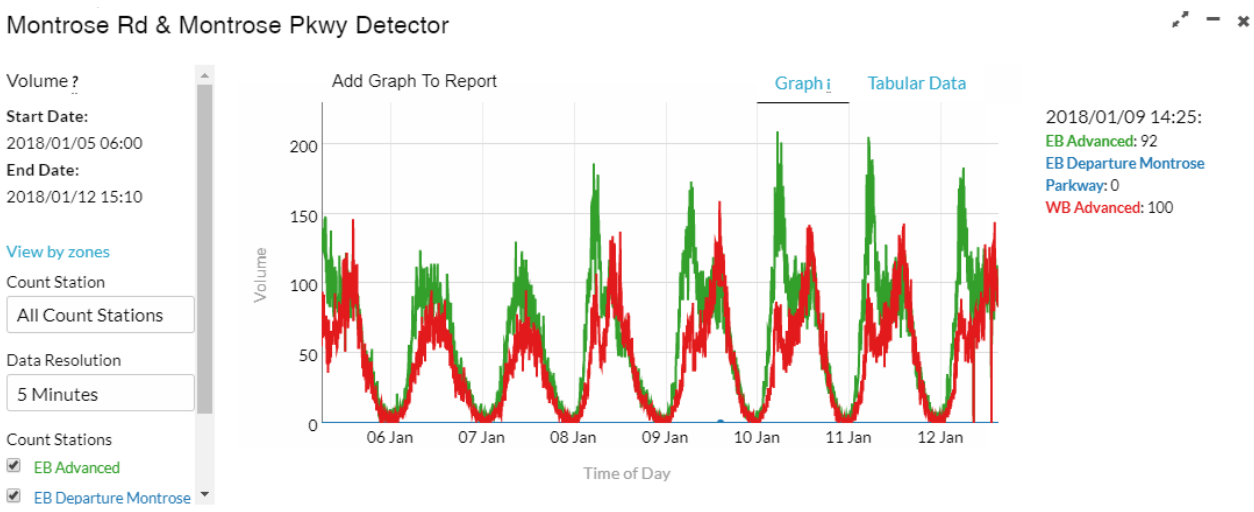


Figure 19. VSO Analytics - Volume

Speed

The *Speed* line graph displays the average speed of vehicles on a per detector basis, updated every minute. These are instantaneous speeds as measured by the detector and not average speeds along segments or routes. To the left of the graph are three different variables to display: speed overall, by individual count station, or by count zones. Hovering over the chart will show the date and time, and speed. If more than one count station, or zone is displayed, these will be labeled in the display on the right side. This line graph has a maximum time frame of 4 months or 120 days.

Occupancy

The Occupancy line graph displays the percent of time that the detection zone of a detector is occupied by a vehicle. To the left of the graph are three different variables to display: occupancy overall, by individual count station, or by count zones. Hovering over the chart will show the date and time, and occupancy. If more than one count station, or zone is displayed, these will be labeled in the display on the right side. This line graph has a maximum time frame of 4 months or 120 days.

Route Data Reporting

The route data is under the *Available Analytics* section and separated into two categories: *Route Tools*, *Signal Timing Tools*, and *Performance Metrics*. The *Route Tools* list contains *Travel Time by Segment*, *Travel Time*, *Speed*, and *Alert History (24 hours)* reporting. The *Signal Timing Tools* list contains *Intersection Route Delay, Progression Diagram, Speed by Segment, Timing Plan Analysis, Travel Time by Day of the Week, Week over Week Travel Times,* and *Timing Run* reporting *(refer to* Alerts section in *Chapter 3: Configuring and Administering SensID*. The *Performance Metrics* list contains *Cumulative Route Delay*, *Congestion Index*, *Vehicle Hours Traveled*, *Vehicle Miles Traveled*, *VMT vs. VHT*, *Idle Emissions*, *Vehicle Delay Hours*, and *Congestion Emissions*.

Route Tools

Travel Time by Segment

The Travel Time by Segment line graph displays the average travel times along every segment in a route, the total travel time in a route, as well as all the matched data records over a 24-hour period. These segments are each represented by their own line, which can be added or removed using the check boxes to the left of the graph. By default, all segments are selected.

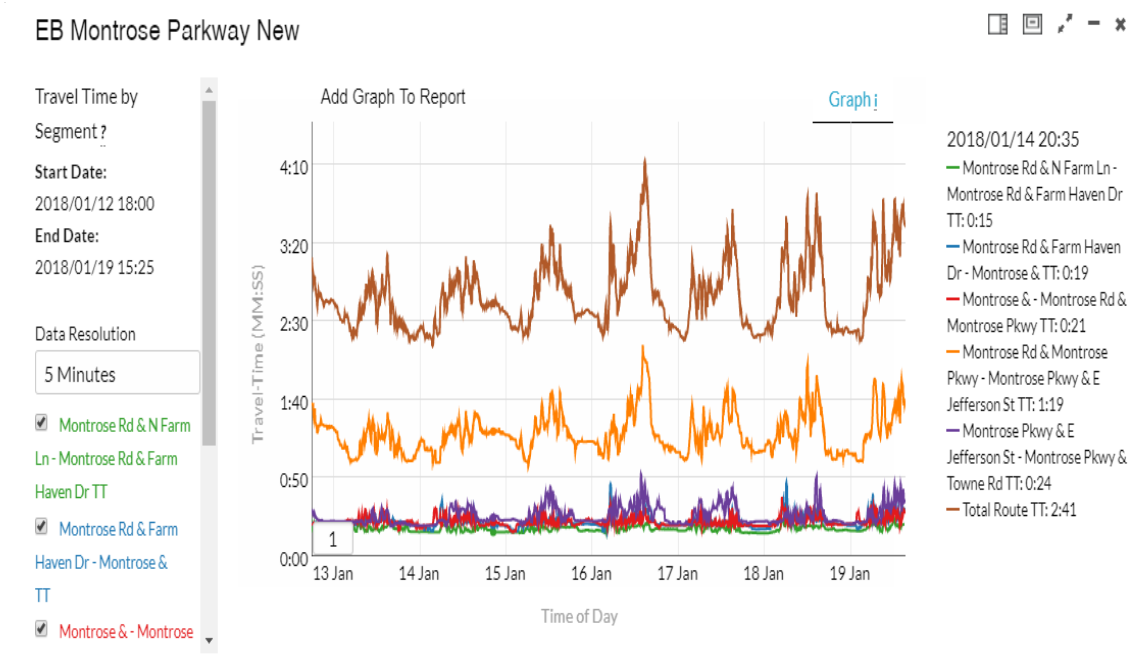


Figure 20. Route Tools - Travel Time by Segment graph

NOTE:

When displaying a longer time period than 24 hours, data will appear as a line instead of individual points.

Travel Time

The *Travel Time* line graph displays travel time estimates relative to the five algorithms applied to the data: first detections, last detections, signal strength, min and max. As was indicated in the *Customizing Charts* section earlier in this manual, these algorithms are each represented by their own line, which can be added or removed using the check boxes to the left of the graph. By default, *Strength*, *Min*, and *Max* are selected.

Speed

The *Speed* line graph is derived from travel time data by dividing the signal strength travel time calculation by the route distance. If you have defined polylines for all segments of a given route, the total route distance is calculated by summing the segment distances determined by the polylines. For segments where polylines have not yet been defined, the distance between any two points default to a straight-line distance between the GPS coordinates for the sensors of the segment.

Alert History (24 hours)

The *Alert Report (24 hours)* displays graph and table reports to show observed travel times by interval and instances where travel times exceeded the defined thresholds.

Signal Timing Tools

Intersections Route Delay

The *Intersections Route Delay* bar graph displays the average dwell time at each device along a route for any selected time period.

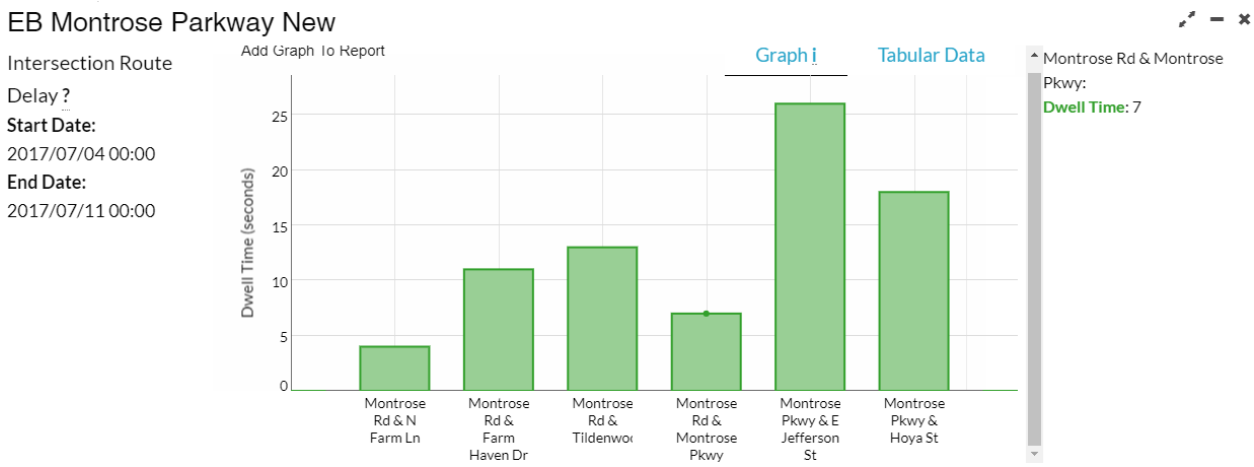


Figure 21. Route Signal Timing Tools - Intersections Route Delay

Progression Diagram

The *Progression Diagram* view displays the average travel time to get to each device and the distance from the starting device along a route for any selected time period.

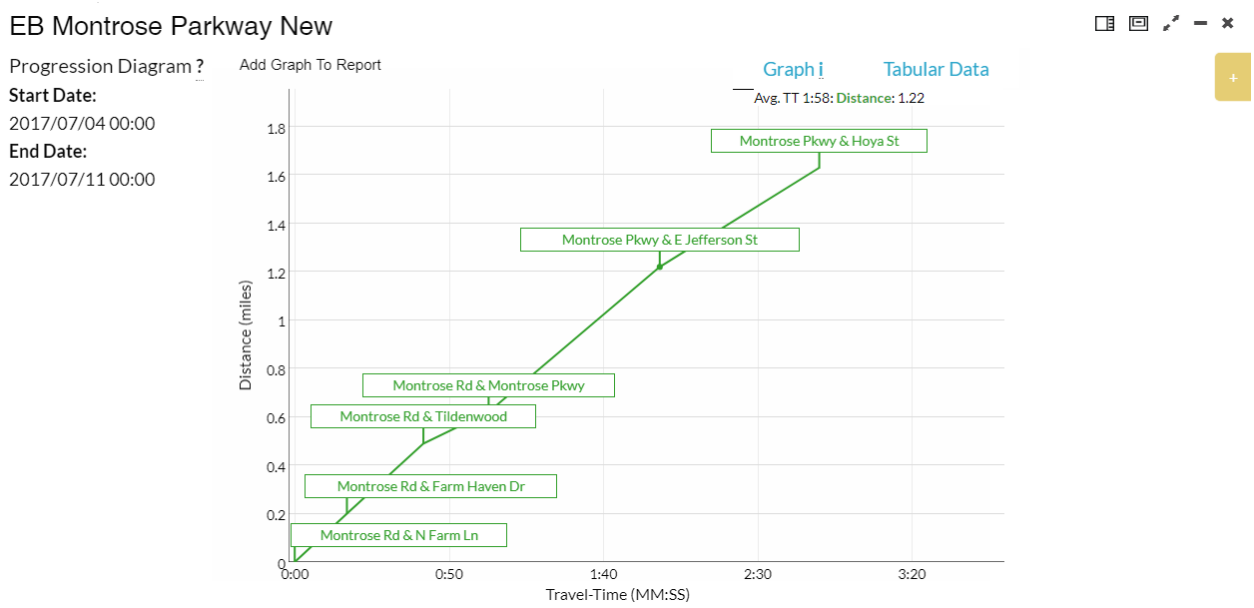


Figure 22. Route Signal Timing Tools - Progression Diagram

Speed by Segment

The *Speed by Segment* bar graph displays the speed for each segment along a route for any given time frame.

Timing Plan Analysis

The *Time Plan Analysis* bar graph displays the average travel time based on a timing plan for each weekday for any given period of time.

To create a *Timing Plan Analysis* report, click **Analytics** list, then click **Signal Timing Tools**, and then click **Timing Plan Analysis** or click the **Timing Plan Analysis** link in the *Signal Timing Tools* section of the route's *Information Panel* sidebar. The following window displays.

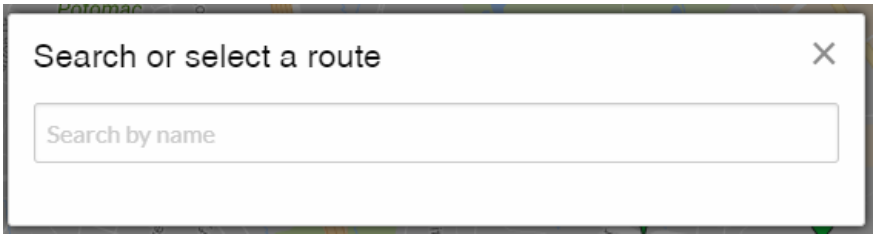


Figure 23. Select Route

Select a route by typing in the name and a dropdown menu will display. Select the correct route from the menu and the following window will display.

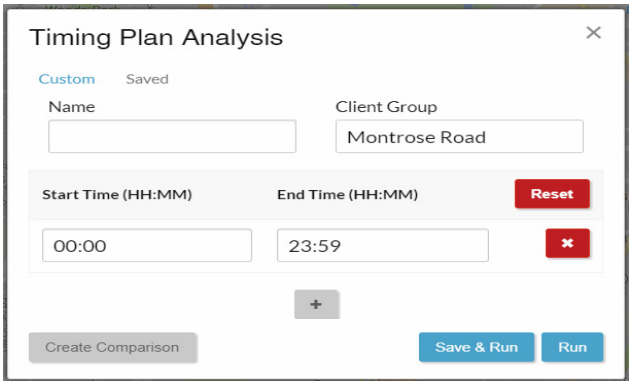


Figure 24. Timing Plan Analysis pop up window

Enter the *Name* of the report and ensure it is from the correct *Client group*. Enter the *Start Time* and *End Time* for a single time interval to be tracked. You can add multiple time intervals for the same report by clicking the + button. The user can add two different start dates by clicking the **Create Comparison** button and selecting *First Start Date* and *Second Start Date* in addition to the *Start Time* and *End Time*. If you want to save the report click **Save & Run**, if not click **Run**.

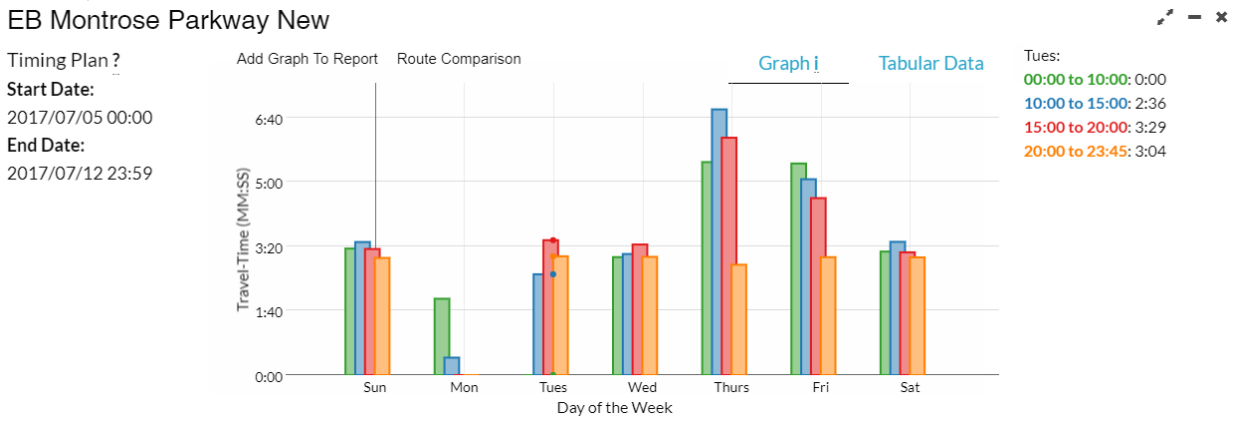


Figure 25. Route Signal Timing Tools - Timing Plan Analysis

As an example, the bars of the above chart represents four timing intervals for the EB Montrose Parkway New route. The bars are color coded for each individual timing interval.

Travel Time by Day of the Week

The *Travel Time by Day of the Week* line graph displays the average travel time for every weekday. The days are each represented by their own line, which can be added or removed using the check boxes to the left of the graph. By default, all days are selected.

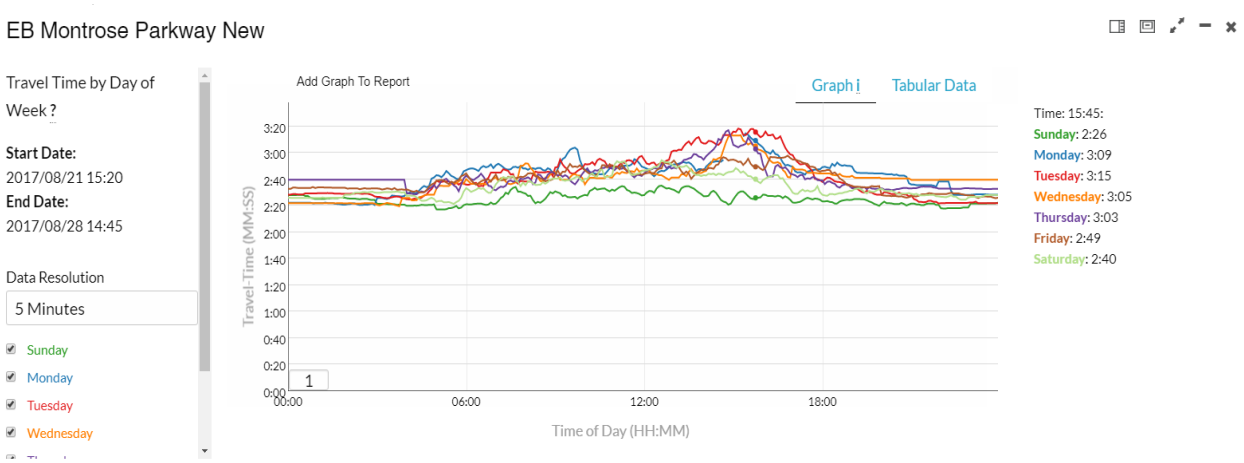


Figure 26. Route Signal Timing Tools - Travel Time by Day of the Week

Week Over Week Travel Time

The *Week Over Week Travel Time* view displays the average travel time for a particular day in the week over any given time period.

To create a *Week Over Week* report, click on the **Week Over Week** link in the *Signal Timing Tools* section of the route's *Information Panel* sidebar. The following window displays.

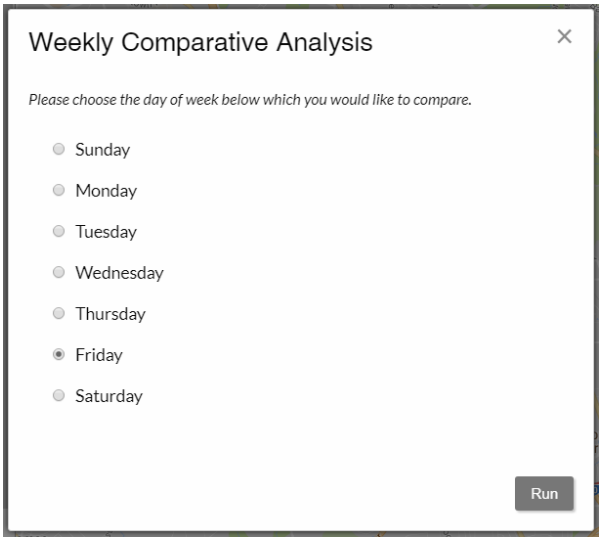


Figure 27. Weekly Comparative Analysis window

Select one day of the week you would like to compare and click **Run** for the report to display.

Timing Run

The *Timing Run* view displays the average travel time and dwell time at each segment along a route for random matched vehicles along the route. This calculation is limited to a 24-hour time period.

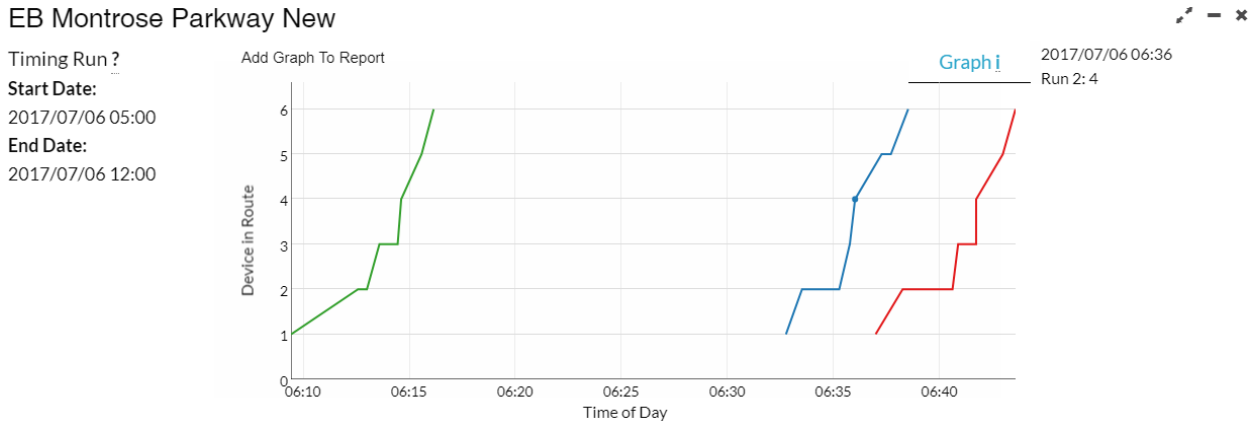


Figure 28. Route Signal Timing Tools - Timing Run

Performance Metrics

The *Performance Metrics* reports, excluding the *Cumulative Route Delay* and *Congestion Index* reports, are only available if there is a vehicle count station established in the route.

Cumulative Route Delay

The *Cumulative Route Delay* view displays the cumulative delay along a route between a given time period.

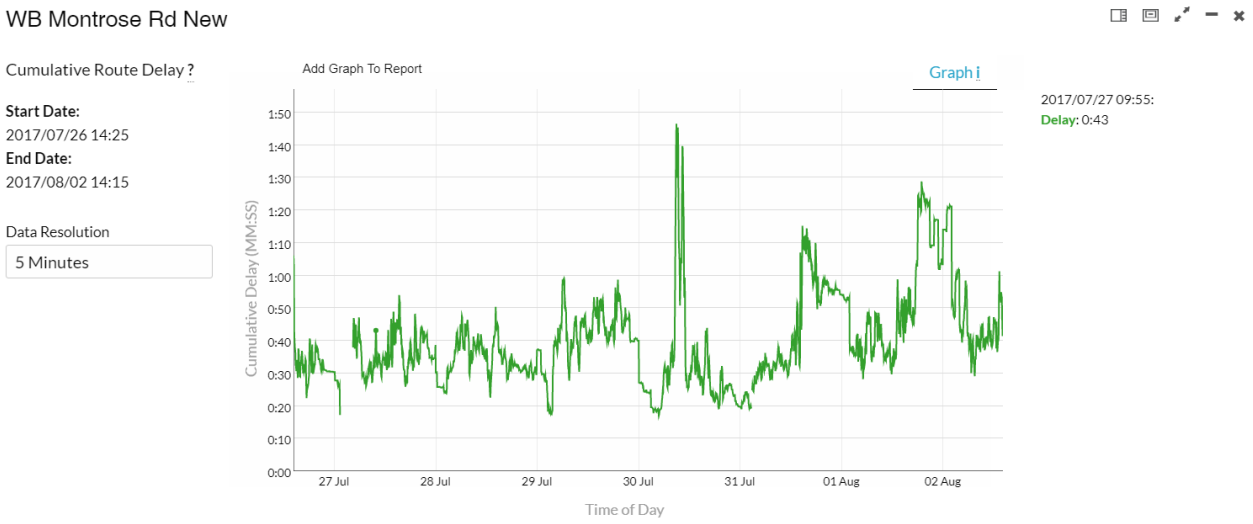


Figure 29. Cumulative Route Delay graph

Congestion Index

The *Congestion Index* view displays the travel time as a multiplier of the estimated free-flow travel time for a selected route (i.e. 1 would represent free-flow conditions and higher numbers indicate more congestion).

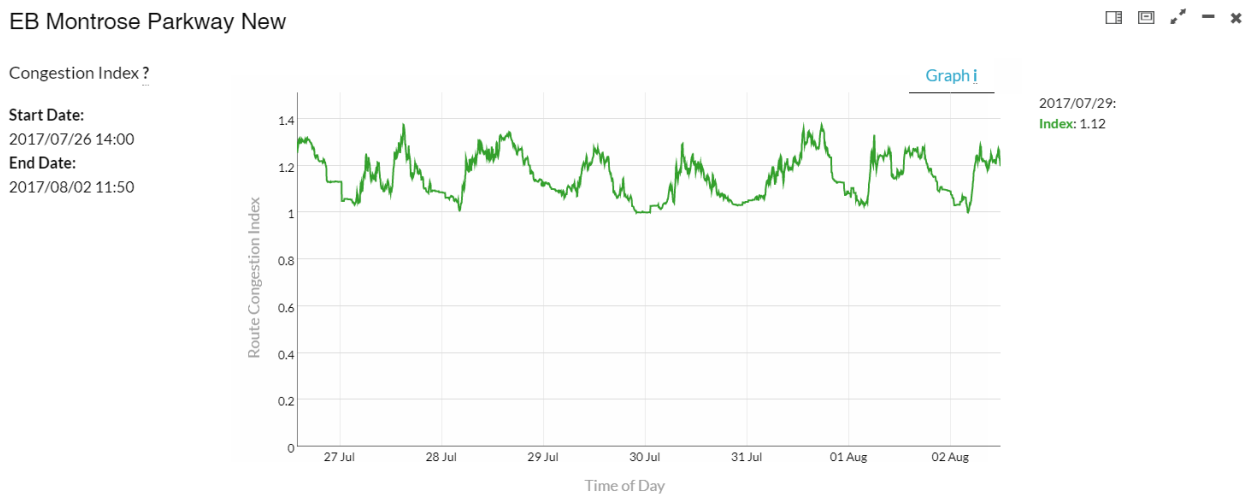


Figure 30. Congestion Index graph

Vehicle Hours Traveled

The *Vehicle Hours Traveled* view uses count and travel time data to estimate the total number of vehicle hours traveled on a selected route. The line graph uses the equation the total number of vehicles multiplied by the average travel time.

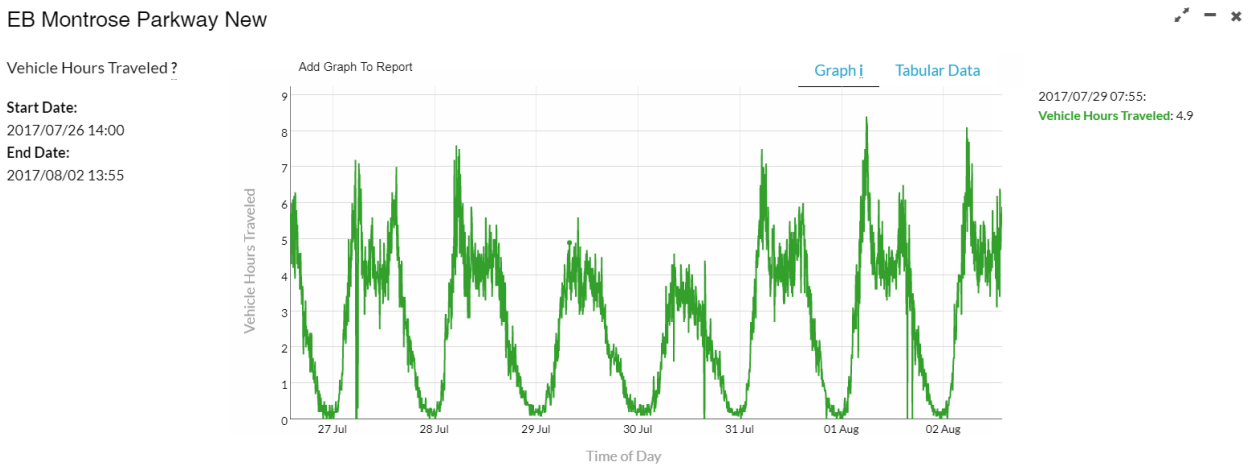


Figure 31. Vehicle Hours Traveled graph

Vehicle Miles Traveled

The *Vehicle Miles Traveled* view uses count data and distances between sensors to calculate the total number of vehicle miles that were traveled along a selected route with a set time period. The line graph uses the equations of the total number of vehicles multiplied by the length of the route to find miles traveled.

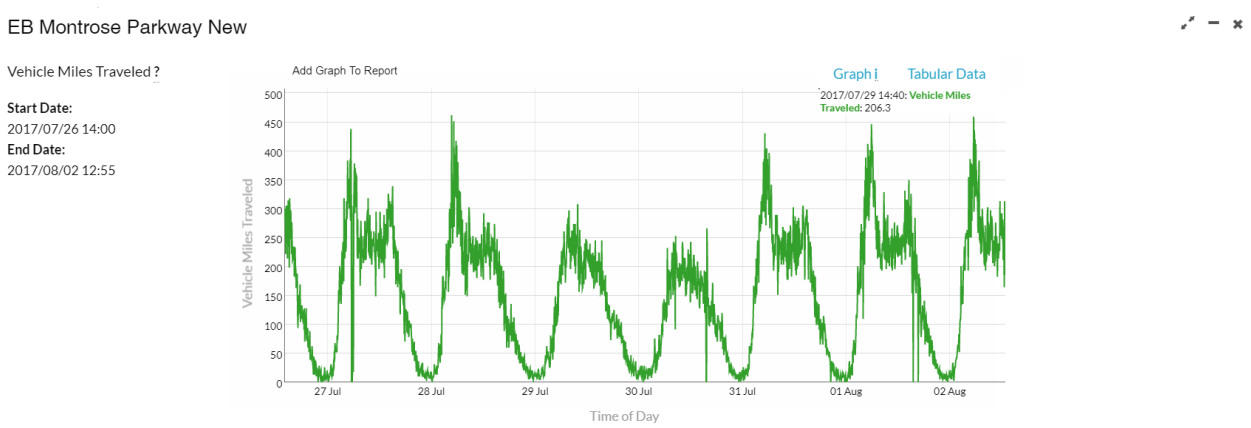


Figure 32. Vehicle Miles Traveled graph

VMT vs. VHT

The *VMT vs. VHT* view plots vehicle miles traveled (VMT) with vehicle hours traveled (VHT) to illustrate the relationship between the two metrics with a scatter plot graph.

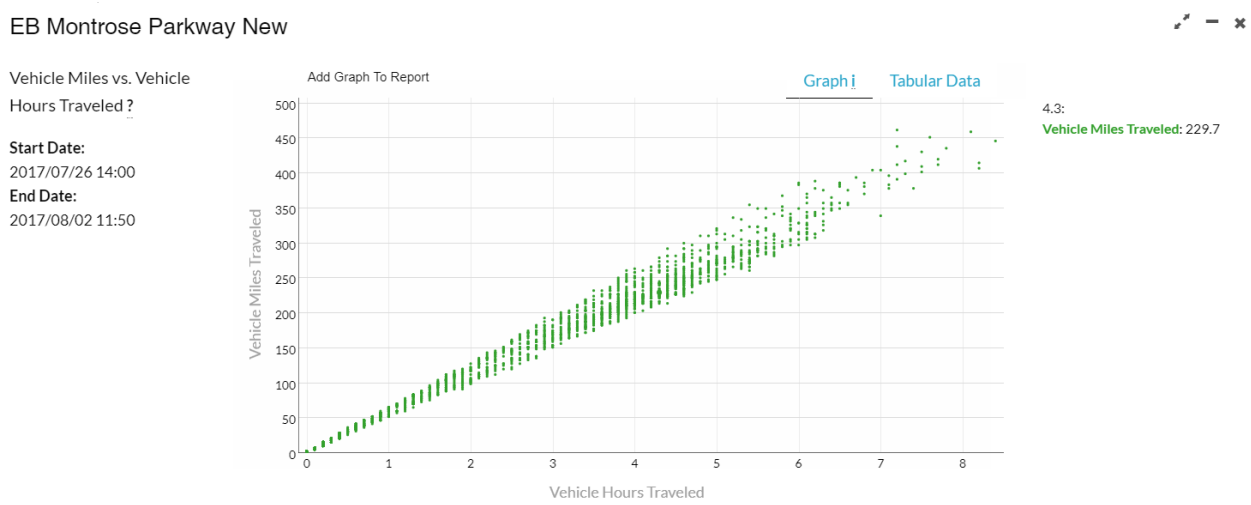


Figure 33. VMT vs. VHT graph

Idle Emissions

The *Idle Emissions* view uses vehicle counts and travel times to calculate the total amount of emissions from idle vehicles on a selected route.

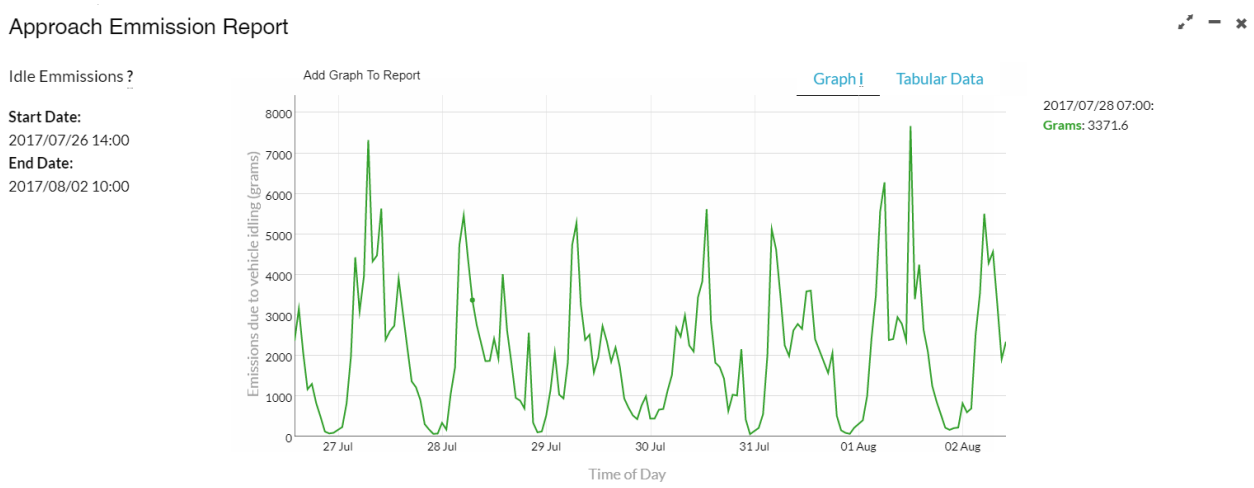


Figure 34. Idle Emissions graph

Vehicle Delay Hours

The *Vehicle Delay Hours* line graph displays the hours of vehicle travel time that are caused by delay. The report uses the equation of intersection delay multiplied by the count of vehicles.

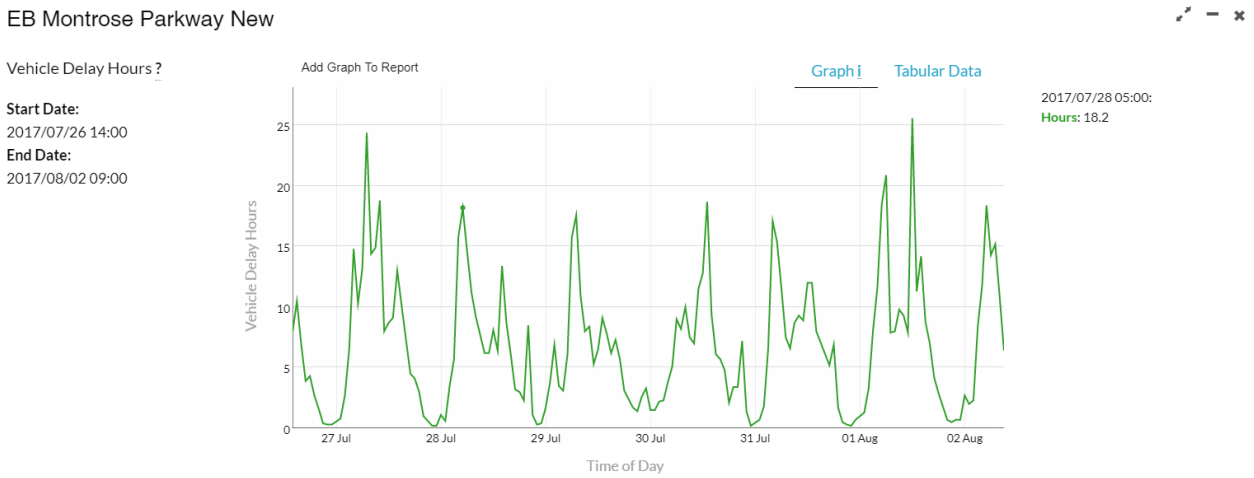


Figure 35. Vehicle Delay Hours

Congestion Emissions

The *Congestion Emissions* view multiplies travel time due to congestion with emission averages to find emissions due to congestion. The resulting line graph displays emissions along a route due to congestion over a set amount of time in grams.

Figure 36. Congestion Emissions graph

Origin-Destination

Once you have created an origin destination group, you can view OD data by selecting the desired OD group name by going to *Origin / Destination → OD Groups* in the *Analytics* menu. Click **Origin / Destination** and **OD Groups** and a pop-up window appears with a list of existing OD groups and search options. Once you have selected the appropriate route and time interval you would like to view, click **Run** and you are taken to the *Counts* view for *Origin-Destination* reporting.

NOTE:

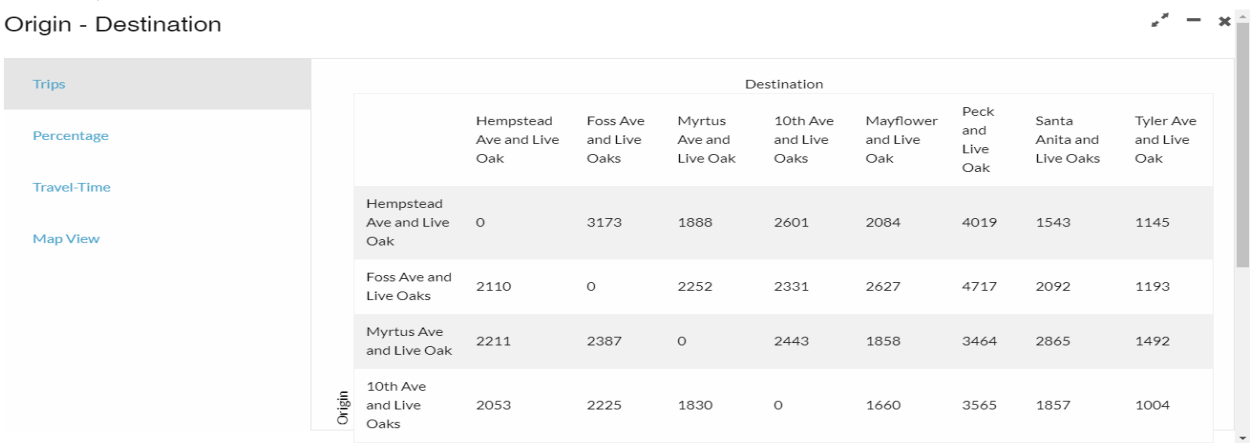
Select the time interval in the top navigation bar before opening the *OD Groups* pop up window.

Origin-Destination reporting includes all of the following:

- *Trips*
- *Percentages*
- *Travel-Time*
- *Map View*

Trips

The *Trips* view for *Origin-Destination* shows an n x n table for the "n" devices comprising the OD group. The name at the left of each row designates the "origin" device, with the numbers going across indicating the number of total matches at each of the above names over the time period selected.



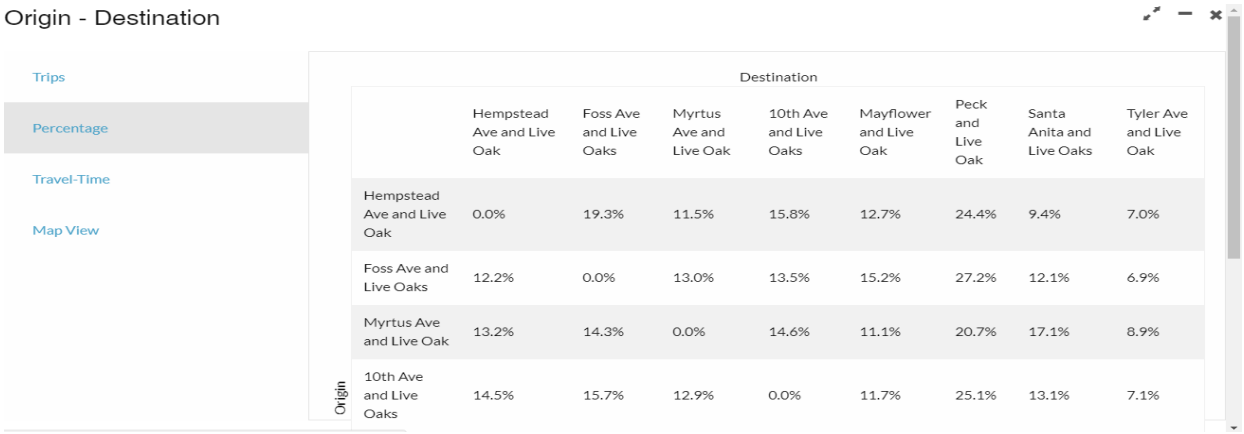
	Hempstead Ave and Live Oak	Foss Ave and Live Oaks	Myrtus Ave and Live Oak	10th Ave and Live Oaks	Mayflower and Live Oak	Peck and Live Oak	Santa Anita and Live Oaks	Tyler Ave and Live Oak
Hempstead Ave and Live Oak	0	3173	1888	2601	2084	4019	1543	1145
Foss Ave and Live Oaks	2110	0	2252	2331	2627	4717	2092	1193
Myrtus Ave and Live Oak	2211	2387	0	2443	1858	3464	2865	1492
10th Ave and Live Oaks	2053	2225	1830	0	1660	3565	1857	1004

Figure 37. Origin-Destination - Trips

As an example, the top row of the above chart shows Montrose Pkwy & E Jefferson St as the origin device. Looking across the row, there are 457 matches at device Montrose Rd & Montrose Pkwy for this time period, whereas there are 328 matches at device Montrose Rd & E Jefferson St.

Percentages

The *Percentages* table converts the data from the *Counts* table into percentages in order to illustrate the distribution of matches relative to each starting point over a selected time interval. The last matched location will be where that particular count is shown when you are choosing the origin.



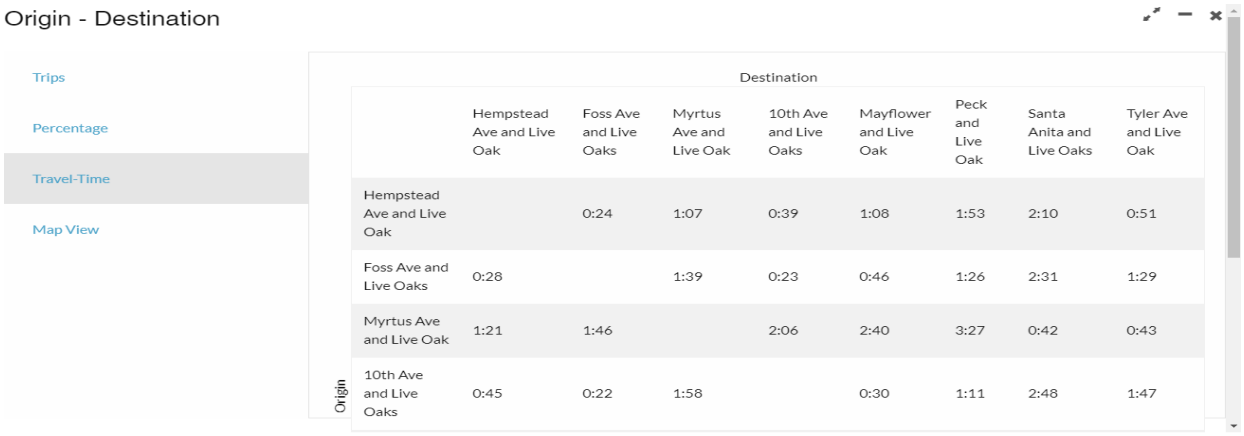
	Hempstead Ave and Live Oak	Foss Ave and Live Oaks	Myrtus Ave and Live Oak	10th Ave and Live Oaks	Mayflower and Live Oak	Peck and Live Oak	Santa Anita and Live Oaks	Tyler Ave and Live Oak
Hempstead Ave and Live Oak	0.0%	19.3%	11.5%	15.8%	12.7%	24.4%	9.4%	7.0%
Foss Ave and Live Oaks	12.2%	0.0%	13.0%	13.5%	15.2%	27.2%	12.1%	6.9%
Myrtus Ave and Live Oak	13.2%	14.3%	0.0%	14.6%	11.1%	20.7%	17.1%	8.9%
10th Ave and Live Oaks	14.5%	15.7%	12.9%	0.0%	11.7%	25.1%	13.1%	7.1%

Figure 38. Origin-Destination - Percentages

Again using the row for Montrose Pkwy & E Jefferson St as an example, there are matches at Montrose Pkwy & E Jefferson St represented only 0.0% of the total over the given time period, whereas the matches at Montrose Rd & Montrose Pkwy were relatively the highest at 58.2%.

Travel-Time

The *Travel-Time* chart for *Origin-Destination* reporting provides a table view of average travel time for origin-destination matches for the time period selected. No specific route is assumed.



	Hempstead Ave and Live Oak	Foss Ave and Live Oaks	Myrtus Ave and Live Oak	10th Ave and Live Oaks	Mayflower and Live Oak	Peck and Live Oak	Santa Anita and Live Oaks	Tyler Ave and Live Oak
Hempstead Ave and Live Oak		0:24	1:07	0:39	1:08	1:53	2:10	0:51
Foss Ave and Live Oaks	0:28		1:39	0:23	0:46	1:26	2:31	1:29
Myrtus Ave and Live Oak	1:21	1:46		2:06	2:40	3:27	0:42	0:43
10th Ave and Live Oaks	0:45	0:22	1:58		0:30	1:11	2:48	1:47

Figure 39. Origin-Destination - Travel-Time

This chart uses all of the matches enumerated in the *Counts* view and uses the elapsed time between them to create an average travel time for all such OD pairs. Staying with the top row to provide an example, for all instances where a MAC address was recorded at Montrose Pkwy & E Jefferson St and then matched at Montrose Rd & E Jefferson St, the average travel time for such pairs was 0:59 seconds.

Map View

The *Map View* for *Origin-Destination* reporting provides a map interface that allows you to select specific devices within an OD group as either Origin or Destination points. By default, *Origin>Destination* is selected, which allows you to select any device as a starting point of an OD segment and calculate the percentage distribution of valid matches for MAC addresses that were previously detected at each of the other sensors in the group. Clicking on **Destination>Origin**, on the other hand, allows you to select a device as a terminal point and then show the percentage distribution of valid matches at all other points.

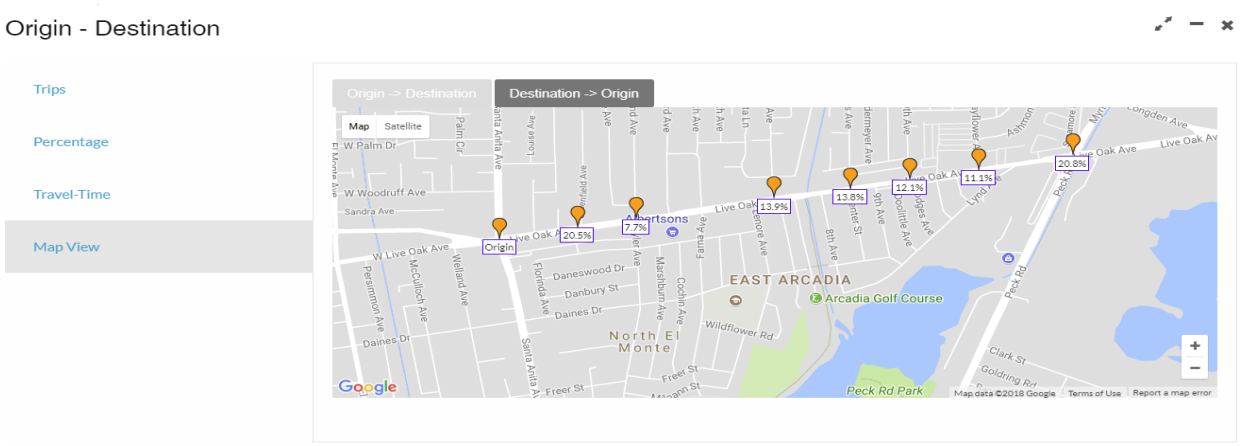


Figure 40. Origin-Destination - Map

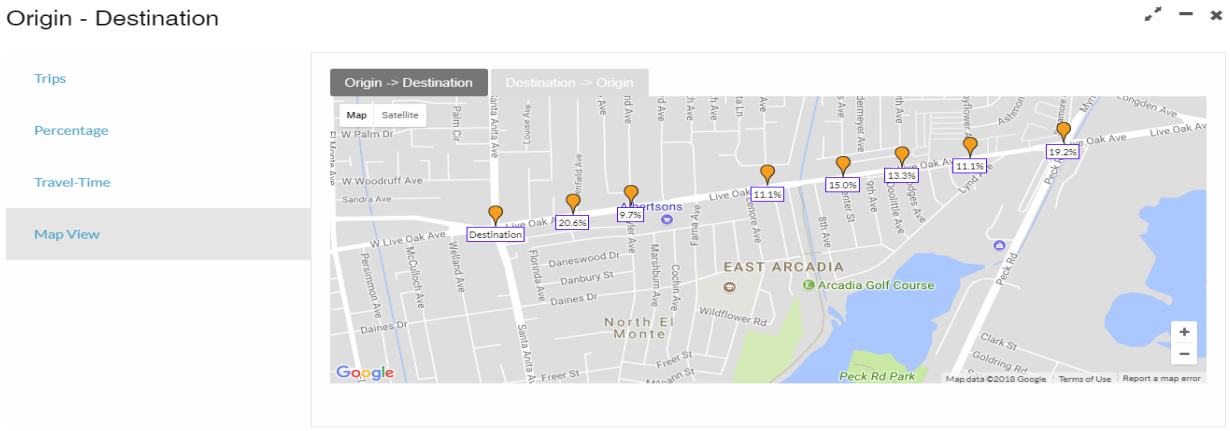


Figure 41. Destination-Origin - Map

Retrieving Your Graphs: The Report Tab

Once you get a graph exactly the way you want it, you can either do an immediate screen capture to save it or click **Add to Report**, which is shown in the upper left-hand corner of all graphs. When this link is clicked above a given chart, it exports the chart so that it displays under the *Reports* menu which can be accessed in the *View* tab dropdown menu. A pop up window will appear in the top center of the map view briefly, confirming the report has been added to the *Reports* menu.

IMPORTANT:

This area is meant for temporary use only and **is emptied if the SensID page is either refreshed or navigated away from**.

Obtaining Your Data in XML Format - API Keys

This appendix provides examples of the XML data feed types that are supported by SensID. All available API methods are HTTP GETs. Please contact sensidadmin@sensysnetworks.com to learn more about the limits on our API. Successful calls will correctly include HTTP Status Code 200, while failures will include appropriate 4XX codes. The default endpoint host is https://go.acyclica.com.

Accessing to the API

The GO API now requires all requests to contain an Authentication header, containing the API_KEY for the user making the request. This enhances the security of the API, and is a generally accepted API standard. This section will explain how one might make a request to the updated API.

[API_KEY]:

- A generated user access token used to authenticate a user against the Acyclica Go platform. Contact sensidadmin@sensysnetworks.com to receive your API key.

CURL

With cURL, you may make requests as follows:

```
curl -H "Authentication: Token [API_KEY]" \
    https://go.acyclica.com/datastream/device/inventory/xml
```

Figure 1. cURL Example

Which should return the Sensor Inventory call for your available sensors. Refer to *Sensor Inventory* for more details)

Python

Using the requests module, the following sample should work to request data:

```
import requests

url = 'https://go.acyclica.com/datastream/device/inventory/xml'
headers = {'Authentication': 'TOKEN [API_KEY]'}
r = requests.get(url, headers=headers)
```

Figure 2.Python Example

Sensor

Sensor Inventory

This provides a formatted listing of all of the sensors that your user has the ability to access, with the following information about each sensor:

- Sensor Serial
- Sensor Name (Long form, as set in Acyclica Go)
- Sensor Description (As set in Acyclica Go)
- Latitude
- Longitude
- Last Report (the last time the sensor reported data)

Endpoint

`/datastream/device/inventory/[FORMAT]`

Parameters

- **[FORMAT]**

  The format of the data you are querying, either ”xml” or ”json”.

Example Output

XML

```
<AcyclicaSensorInventory>
    <AcyclicaSensor>
        <Serial>Sensor Serial Number</Serial>
        <Name>Sensor Name</Name>
        <Description>Sensor Description</Description>
        <Latitude>39.7537229580521</Latitude>
        <Longitude>-105.001809597015</Longitude>
        <LastReport>1489588555</LastReport>
    </AcyclicaSensor>
    ...
</AcyclicaSensorInventory>
```

Figure 3.Sensor Inventory XML feed

Sensor Data

This provides the data from one requested sensor over the time frame requested.

Endpoint

```
/datastream/device/[FORMAT]/time/[DEVICE_ID]/[START_TIME]/
[END_TIME]
```

Parameters

- **[FORMAT]**

  The format of the data you are querying, either ”xml” or ”csv”.

- **[DEVICE_ID]**

  The 4.7 digit number that represents an individual diffrf sensor, cabinet, or other sensor.

- **[START_TIME]**

  The beginning time in the range you are searching. Time values must be in epoch format, in **milliseconds**. March 15, 2017 00:00 would be represented by 1489536000000.

- **[END_TIME]**

  The end time in the range you are searching. Time values must be in epoch format, in **milliseconds**. March 15, 2017 03:00 would be represented by 1489546800000.

Example Output

XML

```
<TrafficSensor ID="" Owner="">
  <HardwareType/>
  <FirmwareType>Independent</FirmwareType>
  <Group/>
  <Detector ID="">
      <HardwareType>Wireless Probe</HardwareType>
      <Name>[Sensor Name]</Name>
      <Description>[Sensor Description]</Description>
      <Data>
          <Time format="unix" zone="utc" capture="first">1489104000.898</Time>
          <Hash>
              [Match_1]
          </Hash>
          <Strength>-51</Strength>
          <SensorType>[Sensor_ID]</SensorType>
      </Data>
      <Data>
          <Time format="unix" zone="utc" capture="first">1489104000.898</Time>
          <Hash>
              [Match_2]
          </Hash>
          <Strength>-50</Strength>
          <SensorType>[Sensor_ID]</SensorType>
      </Data>
      ...
  </Detector>
</TrafficSensor>
```

Figure 4.Sensor Data XML feed

CSV

```
Timestamp    MAC Hash     Strength    Serial
1489536000.112  [Match_1]    -44 999912
1489536000.151  [Match_2]    -41 999912
1489536000.197  [Match_3]    -50 999912
...
```

Figure 5.Sensor Data CSV feed

Sensor Record Count

This provides a JSON-formatted count of data records between two given times for a given sensor.

Endpoint

```
/datastream/device/json/recordcount/[DEVICE_ID]/
[START_TIME]/[END_TIME]
```

Parameters

- **[DEVICE_ID]**

  The 4.7 digit number that represents an individual diffrf sensor, cabinet, or other sensor.

- **[START_TIME]**

  The beginning time in the range you are searching. Time values must be in epoch format, in **milliseconds**. March 15, 2017 00:00 would be represented by 1489536000000.

- **[END_TIME]**

  The end time in the range you are searching. Time values must be in epoch format, in **milliseconds**. March 15, 2017 03:00 would be represented by 1489546800000.

Example Output

JSON


```
{
    "serial": [
        "[SERIAL]"
    ],
    "count": 72810,
    "start_time": "2017-03-15 00:00:00 ",
    "end_time": "2017-03-15 10:00:00 "
}
```


Figure 6.Sensor Record Count JSON feed

Sensor Delay Matches

This provides an XML-formatted listing of hashed MAC addresses during the given time frame, which is limited to **1 minute**, as well as other information about this delay data. Times are in **seconds**.

Endpoint

```
/datastream/device/delay/xml/time/[DEVICE_SERIAL]/
[START_TIME]/[END_TIME]
```

Parameters

- **[DEVICE_ID]**

  The 4.7 digit number that represents an individual diffrf sensor, cabinet, or other sensor.

- **[START_TIME]**

  The beginning time in the range you are searching. Time values must be in epoch format, in **milliseconds**. March 15, 2017 00:00 would be represented by 1489536000000.

- **[END_TIME]**

  The end time in the range you are searching. Time values must be in epoch format, in **milliseconds**. March 15, 2017 03:00 would be represented by 1489546800000.

Example Output

XML

```
<device id="">
    <name>Sensor Name</name>
    <description/>
    <delaydata>
        <data>
            <hash>
                Hashed MAC Address
            </hash>
            <first_time>1467266416.05</first_time>
            <strength_time>1467266416.05</strength_time>
            <last_time>1467266416.05</last_time>
            <timespan>0.0</timespan>
            <strongest>-63</strongest>
        </data>
        ...
    </delaydata>
</device>
```

Figure 7.Sensor Delay Matches XML feed

OD Groups

Origin-Destination Group Listing

This will enumerate all of the sensors in each of the Origin/Destination Groups your user may access.

Endpoints

`/datastream/odgroup/inventory/xml`

Parameters

- None

Example Output

XML

```
<AcyclicaODInventory>
    <AcyclicaODGroup>
        <Name>Origin Destination Group Name</Name>
        <ODGroupID>OD Group ID</ODGroupID>
        <AcyclicaSensors>
            <AcyclicaSensor>
                <Serial>Sensor 1 Serial</Serial>
                <Name>Sensor 1 Name</Name>
                <Latitude>Sensor 1 Lat</Latitude>
                <Longitude>Sensor 1 Lon</Longitude>
            </AcyclicaSensor>
            <AcyclicaSensor>
                <Serial>Sensor 2 Serial</Serial>
                <Name>Sensor 2 Name</Name>
                <Latitude>Sensor 2 Lat</Latitude>
                <Longitude>Sensor 2 Lon</Longitude>
            </AcyclicaSensor>
            ...
        </AcyclicaSensors>
        ...
</AcyclicaODGroup>
```

Figure 8.Origin-Destination Group Listing XML feed

Route

Route Listing

This will enumerates all routes available to your user in an XML format.

Endpoint

`/datastream/route/inventory/[FOMRAT]`

Parameters

- **[FORMAT]**

  The format of the data you are querying, either ”xml” or ”json”.

Example Output

XML

```
<AcyclicaRouteInventory>
    <AcyclicaRoute>
        <Name>Route 1 Name</Name>
        <RouteID>1</RouteID>
        <AcyclicaSegments>
            <AcyclicaSegment position="0">
                <Start>Sensor ID 1</Start>
                <End>Sensor ID 2</End>
            </AcyclicaSegment>
        </AcyclicaSegments>
    </AcyclicaRoute>
    <AcyclicaRoute>
        <Name>Route 2 Name/Name>
        <RouteID>2</RouteID>
        <AcyclicaSegments>
            <AcyclicaSegment position="0">
                <Start>Sensor ID 3</Start>
                <End>Sensor ID 4</End>
            </AcyclicaSegment>
            ...
            <AcyclicaSegment position="4">
                <Start>Sensor ID 11</Start>
                <End>Sensor ID 12</End>
            <AcyclicaSegment>
        </AcyclicaSegments>
    </AcyclicaRoute>
    ...
</AcyclicaRouteInventory>
```

Figure 9.Route Listing XML feed

Route Data

This will provide you with basic information about a route for a given time frame. The algorithms used are organized as follows:

1. Strength
2. First
3. Last
4. Minimum
5. Last

Endpoint

```
/datastream/route/[FORMAT]/time/[ROUTE_ID]/[START_TIME]/
[END_TIME]
```

Parameters

- **[FORMAT]**

  The format of the data you are querying, either "json", "xml", or "csv".

- **[ROUTE_ID]**

  The route identifier, found in Acyclica Go or in the Route Listing API call.

- **[START_TIME]**

  The beginning time in the range you are searching. Time values must be in epoch format, in **milliseconds**. March 15, 2017 00:00 would be represented by 148953600000.

- **[END_TIME]**

  The end time in the range you are searching. Time values must be in epoch format, in **milliseconds**. March 15, 2017 03:00 would be represented by 148954680000.

Example Output

XML

```
<TrafficRoute ID="Route ID" Owner="">
    <HardwareType/>
    <FirmwareType>Independent</FirmwareType>
    <FirmwareVersion/>
    <Group/>
        <Route ID="Route ID">
        <HardwareType>Acyclica Probe</HardwareType>
        <Name>Route Name</Name>
        <Description>Route Description</Description>
        <Data>
            <Time format="unix" zone="utc" capture="first">1489104001816</Time>
            <Record Algorithm="1" Elapsed_time="632728"/>
            <Record Algorithm="2" Elapsed_time="604255"/>
            <Record Algorithm="3" Elapsed_time="641072"/>
            <Record Algorithm="4" Elapsed_time="537571"/>
            <Record Algorithm="5" Elapsed_time="677242"/>
        </Data>
        <Data>
            <Time format="unix" zone="utc" capture="first">1489104004478</Time>
            <Record Algorithm="1" Elapsed_time="632728"/>
            <Record Algorithm="2" Elapsed_time="604255"/>
            <Record Algorithm="3" Elapsed_time="638474"/>
            <Record Algorithm="4" Elapsed_time="536917"/>
            <Record Algorithm="5" Elapsed_time="677242"/>
        </Data>
        ...
    </Route>
</TrafficRoute>
```

Figure 10.Route Data XML feed

CSV

```
Timestamp,Strengths,Firsts,Lasts,Minimums,Maximums
1489104001816,632728,604255,641072,537571,677242
1489104004478,632728,604255,638474,536917,677242
1489104008260,632728,604255,638474,536917,677242
...
```

Figure 11.Route Data CSV feed

Route Information - Most Recent Data

This will return the last reported data for a given route in an XML format.

Endpoint

`/datastream/route/xml/time/last/[ROUTE_ID]`

Parameters

- **[ROUTE_ID]**

  The route identifier, found in Acyclica Go or in the Route Listing API call.

Example Output

XML

```
<TrafficRoute ID="Route ID" Owner="">
    <HardwareType/>
    <FirmwareType>Independent</FirmwareType>
    <FirmwareVersion/>
    <Group/>
    <Route ID="Route ID">
        <HardwareType>Acyclica Probe</HardwareType>
        <Name>Route Name</Name>
        <Description/>
        <Data>
            <Time format="unix" zone="utc" capture="first">1489557570797</Time>
            <Record Algorithm="1" Elapsed_time="369112"/>
            <Record Algorithm="2" Elapsed_time="343179"/>
            <Record Algorithm="3" Elapsed_time="369395"/>
            <Record Algorithm="4" Elapsed_time="321634"/>
            <Record Algorithm="5" Elapsed_time="408376"/>
        </Data>
    </Route>
</TrafficRoute>
```

Figure 12.Route Information - Most recent Data XML feed

VSO Sensors

VSO Listing

This enumerates the VSO sensors available to your user account.

Endpoint

`/datastream/vso/meta/[FORMAT]`

Parameters

- **[FORMAT]**

  The format of the data you are querying, either ”json” or ”xml”.

Example Output

JSON

Figure 13.VSO Sensors JSON feed

XML

```
<vso_sensors>
    <vso_sensor>
        <id>1</id>
        <serial>306</serial>
        <name>Office 2</name>
        <short_name/>
        <description/>
        <dev_type>Sensys</dev_type>
        <latitude/>
        <longitude/>
        <lastdata/>
        <zones></zones>
        <count_stations></count_stations>
    </vso_sensor>
    ...
</vso_sensors>
```

Figure 14.VSO Sensors XML feed

VSO Count Station Data

This returns the data for a VSO sensor count station over the given time frame, using the given period, in the requested format.

Endpoint

```
/datastream/vso/count_station_data/[FORMAT]/time/
[DEVICE_ID]/[PERIOD]/[START_TIME]/[END_TIME]
```

Parameters

- **[FORMAT]**

  The format of the data you are querying, either "json", "xml", or "csv".

- **[DEVICE_ID]**

  The sensor ID as noted in the enumeration query.

- **[PERIOD]**

  This is an integer representing the millisecond period for which the data should be grouped. Must be larger than 60000 (ms).

- **[START_TIME]**

  The beginning time in the range you are searching. Time values must be in epoch format, in **milliseconds**. March 15, 2017 00:00 would be represented by 1489536000000.

- **[END_TIME]**

  The end time in the range you are searching. Time values must be in epoch format, in **milliseconds**. March 15, 2017 03:00 would be represented by 1489546800000.

Example Output

JSON

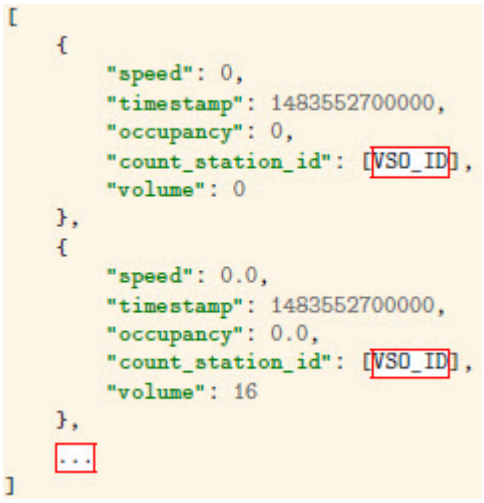


Figure 15.VSO Count Station Data JSON feed

XML

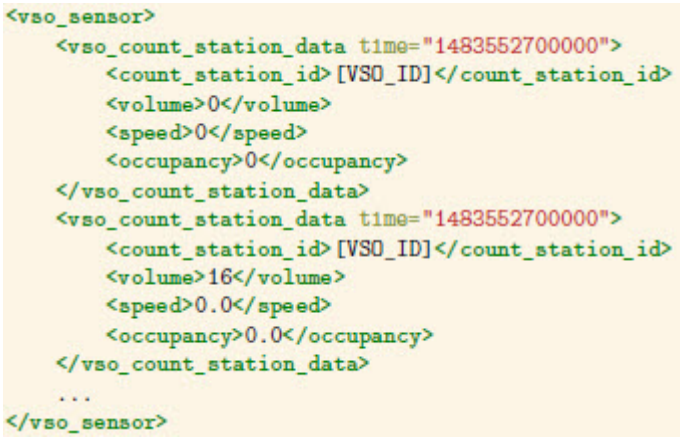


Figure 16.VSO Count Station Data XML feed

VSO Zone Data

This returns data formatted as requested for the zone data for the VSO sensor requested over the time frame requested, using the period requested.

Endpoint

`/datastream/vso/zone_data/json/time/[DEVICE_ID]/[PERIOD]/[START_TIME]/[END_TIME]`

Parameters

- **[FORMAT]**

  The format of the data you are querying, either "json", "xml", or "csv".

- **[DEVICE_ID]**

  The sensor ID as noted in the enumeration query.

- **[PERIOD]**

  This is an integer representing the millisecond period into which the data should be grouped. Must be larger than 60000 (ms).

- **[START_TIME]**

  The beginning time in the range you are searching. Time values must be in epoch format, in **seconds**. March 15, 2017 00:00 would be represented by 1489536000.

- **[END_TIME]**

  The end time in the range you are searching. Time values must be in epoch format, in **seconds**. March 15, 2017 03:00 would be represented by 1489546800.

Example Output

JSON

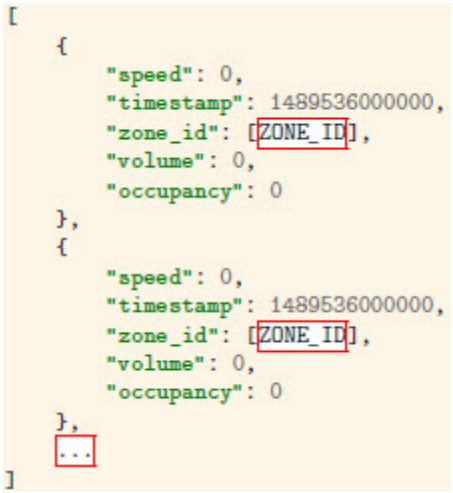


Figure 17.VSO Zone Data JSON feed

Segments

Segment Match Data

This returns the total time for a match to progress through a segment of two adjacent sensors in a segment on a route for all available algorithms. The algorithms are as follows:

1. Strength
2. First
3. Last
4. Minimum
5. Maximum

Endpoint

```
/datastream/segment/[FORMAT]/time/[DEVICE_ID1]/[DEVICE_ID2]/
[START_TIME]/[END_TIME]
```

Parameters

- **[FORMAT]**

  The format of the data you are querying, either "xml" or "csv".

- **[DEVICE_ID1]**

  The serial for the first sensor in a segment, must be adjacent to sensor 2.

- **[DEVICE_ID2]**

  The serial for the first sensor in a segment, must be adjacent to sensor 1.

- **[START_TIME]**

  The beginning time in the range you are searching. Time values must be in epoch format, in **seconds**. March 15, 2017 00:00 would be represented by 1489536000.

- **[END_TIME]**

  The end time in the range you are searching. Time values must be in epoch format, in **seconds**. March 15, 2017 03:00 would be represented by 1489546800.

Example Output

XML

```
<TrafficSegment ID="[SEGMENT_ID]" Owner="">
    <HardwareType/>
    <FirmwareType>Independent</FirmwareType>
    <FirmwareVersion/>
    <Group/>
    <Segment ID="[SEGMENT_ID]">
        <HardwareType>Acyclica Probe</HardwareType>
        <Name/>
        <Description/>
        <Data>
            <Time format="unix" zone="utc" capture="first">1489104019.299</Time>
            <Hash>
                [MATCH_1]
            </Hash>
            <Elapsed_time>43.647</Elapsed_time>
            <Algorithm>1</Algorithm>
        </Data>
        <Data>
            <Time format="unix" zone="utc" capture="first">1489104019.299</Time>
            <Hash>
                [MATCH_2]
            </Hash>
            <Elapsed_time>10.0</Elapsed_time>
            <Algorithm>2</Algorithm>
        </Data>
        ...
    </Segment>
</TrafficSegment>
```

Figure 18.Segments Match Data XML feed

Segment Match Algorithm Data

This gives the five algorithms for matches between a given time range for the match to progress through a segment of two adjacent sensors in a segment of a route.

Endpoint

```
/datastream/segment/v2/xml/time/[DEVICE_ID1]/[DEVICE_ID2]/
[START_TIME]/[END_TIME]
```

Parameters

- **[DEVICE_ID1]**

  The serial for the first sensor in a segment, must be adjacent to sensor 2.

- **[DEVICE_ID2]**

  The serial for the first sensor in a segment, must be adjacent to sensor 1.

- **[START_TIME]**

  The beginning time in the range you are searching. Time values must be in epoch format, in **seconds**. March 15, 2017 00:00 would be represented by 1489536000.

- **[END_TIME]**

  The end time in the range you are searching. Time values must be in epoch format, in **seconds**. March 15, 2017 03:00 would be represented by 1489546800.

Example Output

XML


```xml
&lt;segment id="[SEGMENT_ID]"&gt;
    <matchdata>
        <data>
            <time>1489104019.299</time>
            <strength>43.647</strength>
            <first>10.0</first>
            <last>114.995</last>
            <minimum>10.0</minimum>
            <maximum>114.995</maximum>
        </data>
        <data>
            <time>1489104000.573</time>
            <strength>489.062</strength>
            <first>549.969</first>
            <last>489.126</last>
            <minimum>488.978</minimum>
            <maximum>550.117</maximum>
        </data>
        ...
    </matchdata>
&lt;/segment&gt;
```


Figure 19.Segment Match Algorithm Data XML feed

Segment Match Filtered Algorithm Data

This returns a filtered CSV-formatted listing of the five algorithms for matches found having progressed between two adjacent sensors during the given time period.

Endpoint

```
/datastream/segment/filtered/csv/time/[DEVICE_ID1]/
[DEVICE_ID2]/[START_TIME]/[END_TIME]
```

Parameters

- **[DEVICE_ID1]**

  The serial for the first sensor in a segment, must be adjacent to sensor 2.

- **[DEVICE_ID2]**

  The serial for the first sensor in a segment, must be adjacent to sensor 1.

- **[START_TIME]**

  The beginning time in the range you are searching. Time values must be in epoch format, in **seconds**. March 15, 2017 00:00 would be represented by 1489536000.

- **[END_TIME]**

  The end time in the range you are searching. Time values must be in epoch format, in **seconds**. March 15, 2017 03:00 would be represented by 1489546800.

Example Output

CSV

```
Timestamp,MAC Hash,Elapsed,AlgoId
1489104017.628,2ac18e62c91b35003af5eda83fef94526d842df478e8bc8c51857686f0a5a020,150.457,1
1489104017.628,2ac18e62c91b35003af5eda83fef94526d842df478e8bc8c51857686f0a5a020,10.0,2
1489104017.628,2ac18e62c91b35003af5eda83fef94526d842df478e8bc8c51857686f0a5a020,10.0,3
1489104017.628,2ac18e62c91b35003af5eda83fef94526d842df478e8bc8c51857686f0a5a020,10.0,4
1489104017.628,2ac18e62c91b35003af5eda83fef94526d842df478e8bc8c51857686f0a5a020,150.457,5
...
```

Figure 20.Segment Match Filtered Algorithm Data CSV feed