Software Users Manual R-ICMS:

Regional Integrated Corridor Management System

Version: ***4.0***

Approval date: ***3/8/2021***

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Created By:	Clay Weston, SwRI	12/15/2020
Reviewed By:		
Modified By:		
Approved By:	Tushar Patel	3/8/2021

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1 Introduction

This document is intended to provide end users with instruction on the functions and features of the Regional Integrated Corridor Management System (R-ICMS). This document provides basic overviews and workflows that the user should follow in order to efficiently and successfully understand the high-level concept of the application and complete tasks within the R-ICMS system.

The primary objective of this document is to successfully guide the end user on how to utilize the Dashboards, Map Module, Admin module, Events List and Response Plans. Basic functionalities have been outlined through the use of step-by-step descriptions and images of the screens required to navigate through the application modules.

2 General Navigation

The following sections provide an overview of the system features and some common scenarios for using the system. Some features may not be available to all users based on their roles/permissions when accessing the system.

2.1 System Navigation

This section explains the general Navigation buttons available from the left navigation bar.

	**Home Page**	**Default view of the application.**
	**Notifications**	**Access to system notifications**
	**Event List**	**Tabular view of all events affecting the transportation network**
	**RPS Module**	**Response Plan Simulation Module**
	**Map Page**	**Map view of the transportation network**
	**SOT**	**Signal Optimization Timing Module**
	**API**	**Application Programming Interface Module**
	**Report List**	**Access to available reports**
	**Administration**	**System management capabilities**
	**Help Page**	**Access to user reference documentation**

2.2 Map Features

The following features are available when using the map.

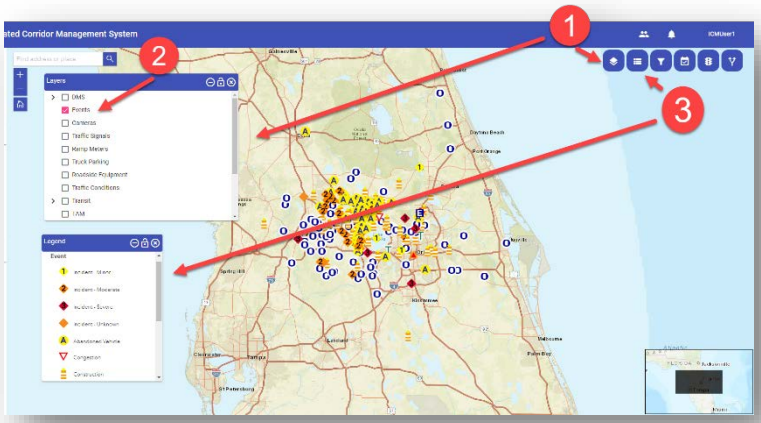
	**Search**	**Enter key words and values to search the map**
	**Zoom In**	**Click to increase details of map display**
	**Zoom Out**	**Click to decrease details of map display**
	**Home**	**Return to default view**
	**Layers**	**Select to display available GIS layers of information**
	**Legend**	**Select to display available GIS presentation details**
	**Layer Filters**	**Access to available map filter options**
	**Event List**	**Enable display of the Event List within the map view**
	**SOT List**	**Access to the SOT module within the map view**
	**RPS List**	**Access to the RPS module within the map view**

2.3 Common User Scenarios

2.3.1 Viewing Layers on the Map

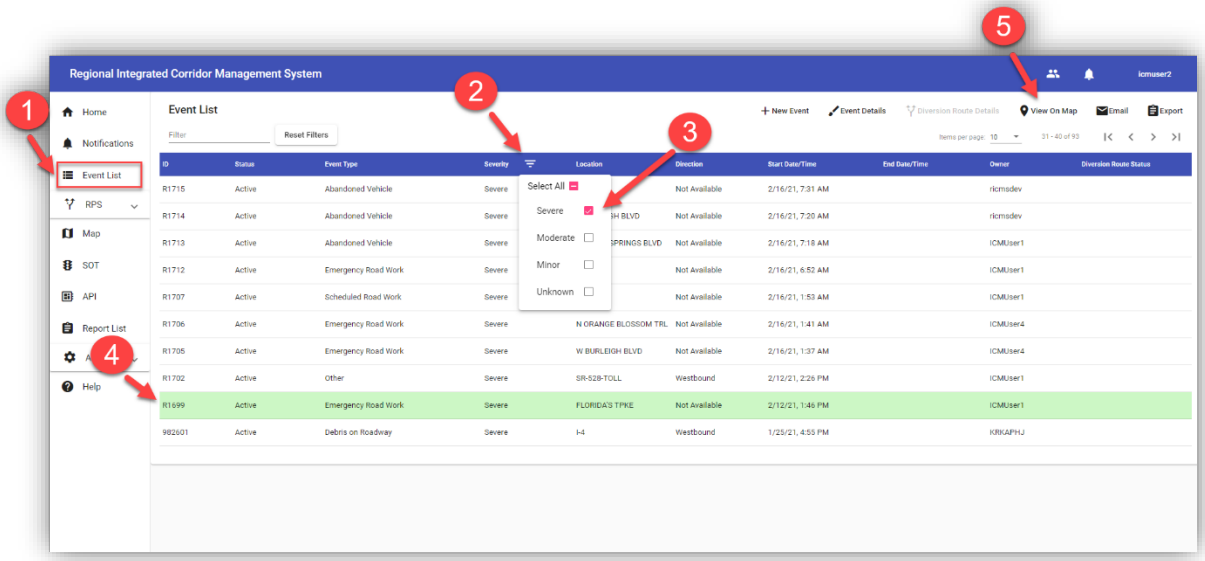
The following use case supports the ability for authorized users to view available data layers on the map page.

1. Select the Layers icon from the map page. The system will display a pop-up of the available layers that can be viewed on the map.
2. Select the Camera layer option. The system will display all available camera devices.
3. Select the Legend icon from the map page. The system will display a legend of the camera statuses.



2.3.2 Using the Event List

The following use case supports the ability for authorized users to view events in a tabular format and access available features.



1. Select the Event List option from the left navigation menu. The system will display a tabular view of active event records.
2. Select the filter option for the Severity column. The system displays the available values for the user to select.
3. Select the Select All option to unselect all values and select Severe. The system will display all event records with matching values.

4. Select an Event records. The system will highlighted the selected row and enable the Event Details and View on Map functions. NOTE: If more than event record is selected, the Event Details function becomes disabled.
5. Select the View on Map function. The system will display the map page and zoom to the selected event location.

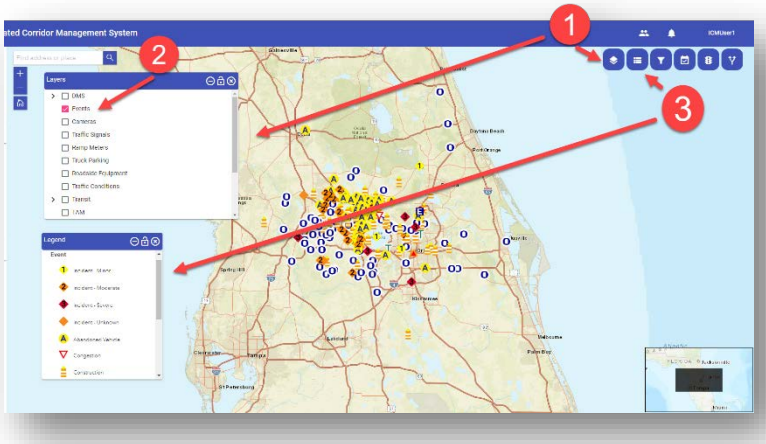
NOTE: SunGuide Events are identified by the six digit ID. RICMS events begin with an "R" in the ID sequence.

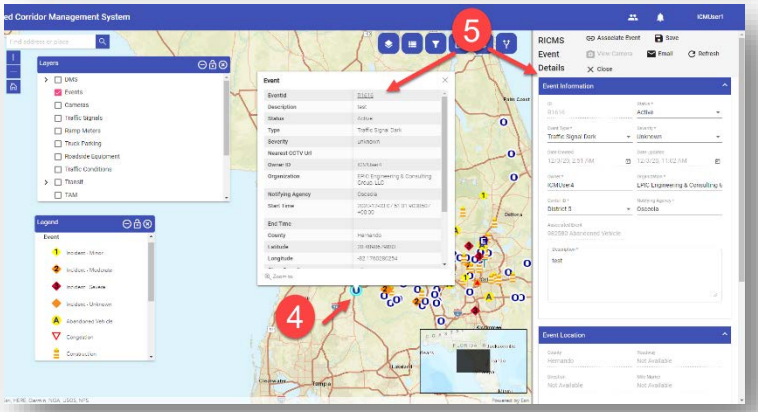
2.3.3 Viewing Events on the Map

The following use case supports the ability for authorized users to view events and event details from the map page.

1. Select the Layers icon from the map page. The system will display a pop-up of the available layers that can be viewed on the map.
2. Select the Events layer option. The system will display all active events affecting the roadway network.
3. Select the Legend icon from the map page. The system will display a legend of the Event icon descriptions.
4. Select an Event icon from the map. The system will display an info window with details about the event.
5. Select the Event ID from the info window. The system displays the full event details and available features including lane blockage diagrams.

NOTE: SunGuide Events are displayed as read-only as SunGuide is the system of record for the event data. However, RICMS users can post comments that will be sent to SunGuide.

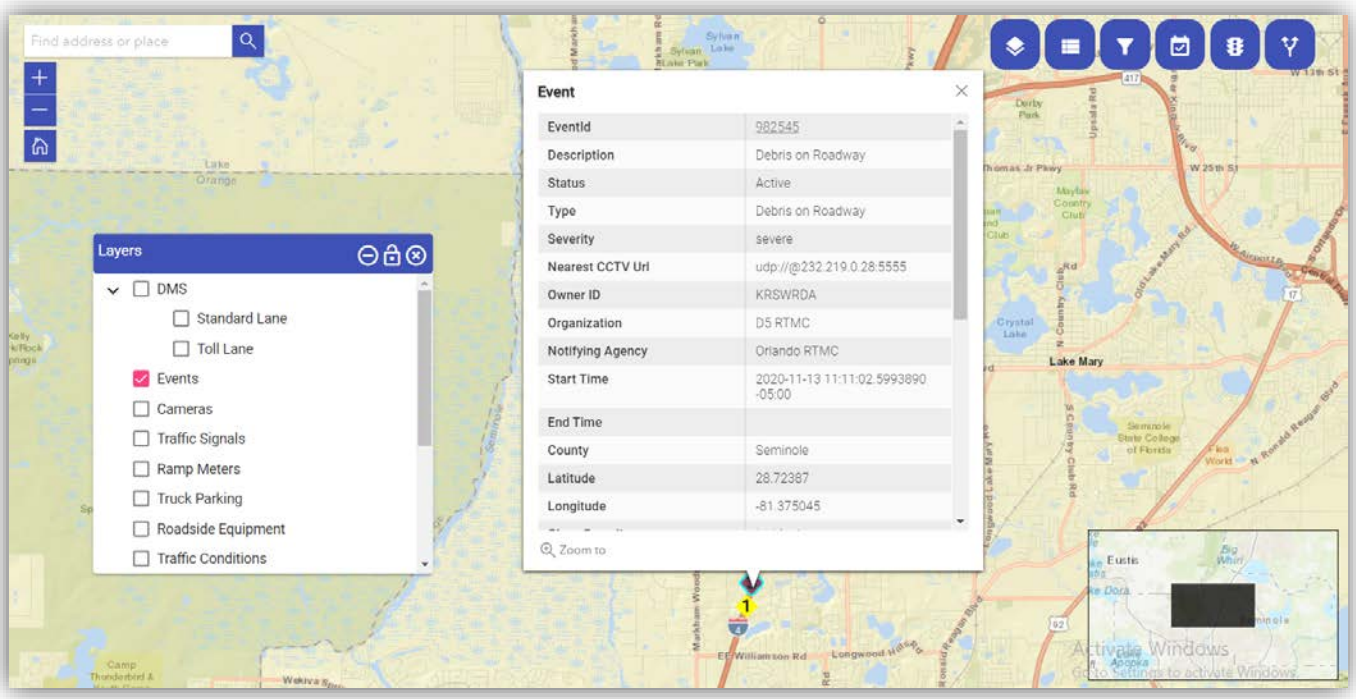




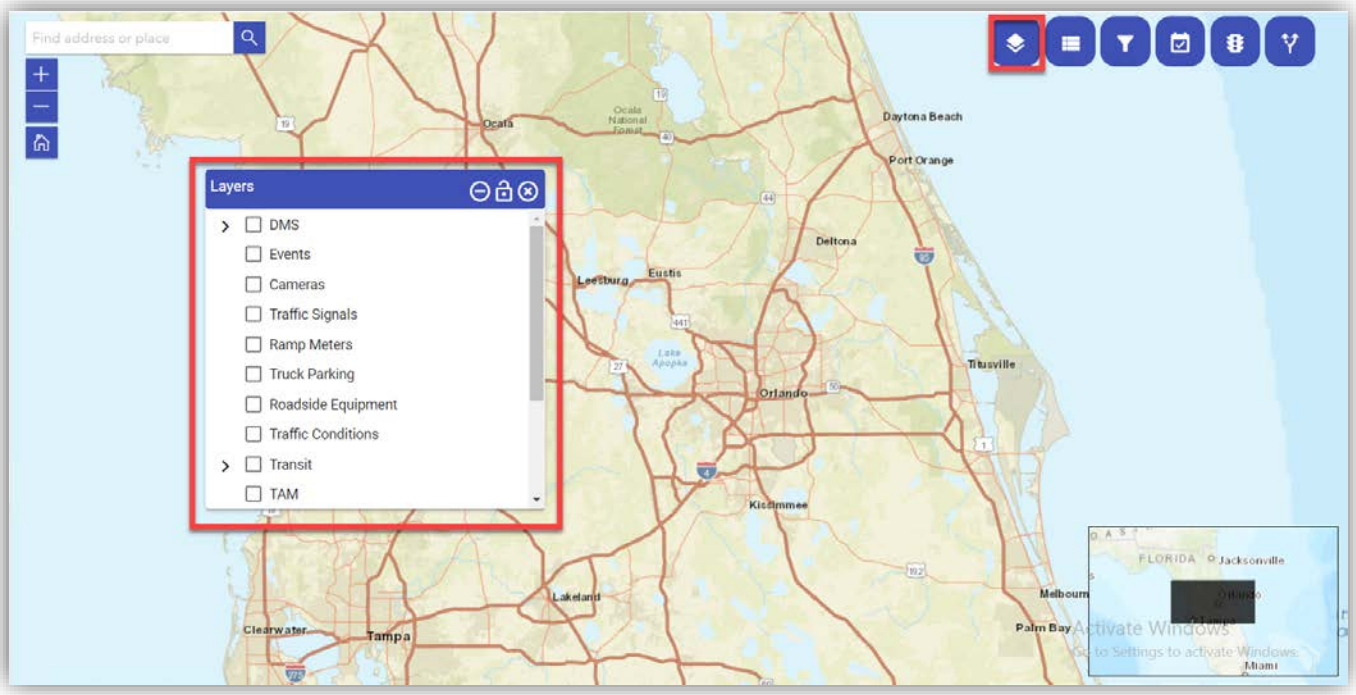
3 Map

The map page is the landing page that is loaded when a user accesses the RR-ICMS application. The map page can be accessed from the main left menu when a user needs to navigate back to the map page from another location within the RR-ICMS application.

All icons displayed for selected layers on the map can be selected to view the item's details.

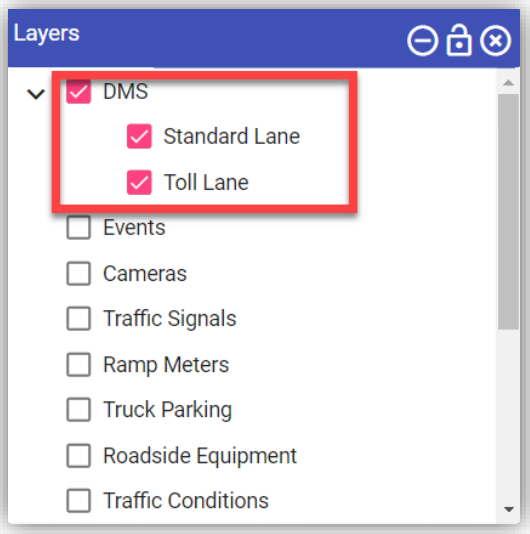


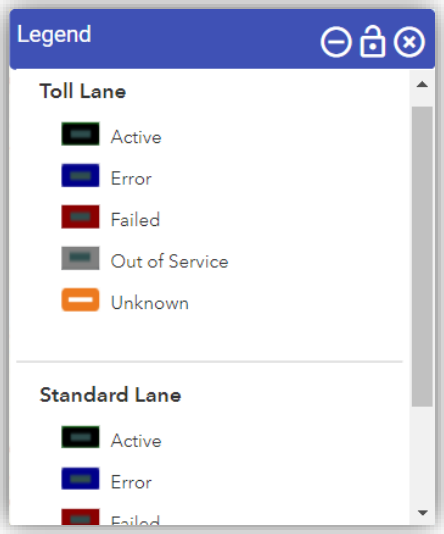
The Layers List provides the user a list of available data layer sets. To select desired layers to be viewed on the map, click the corresponding check box to the left of the layer name. The system will load the user selected layers onto the map.



3.2.1 DMS

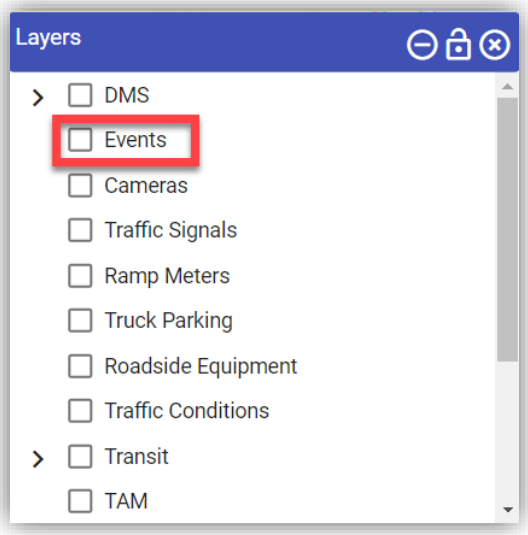
Dynamic Message Signs (DMS) are electronic signs used on roadways to provide drivers with important travel information. Users can select to view DMS layers specific to Standard Lanes and Toll lanes. Status information is available in the legend details.

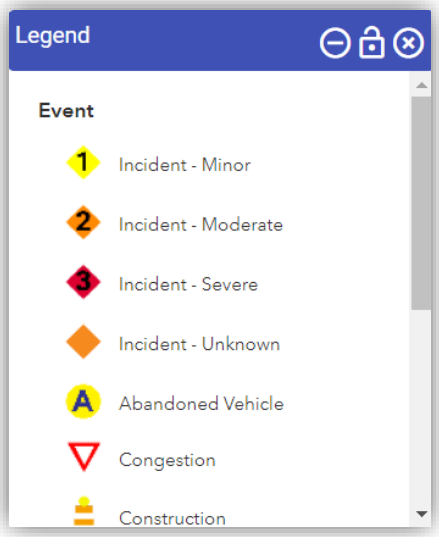




3.2.2 Events

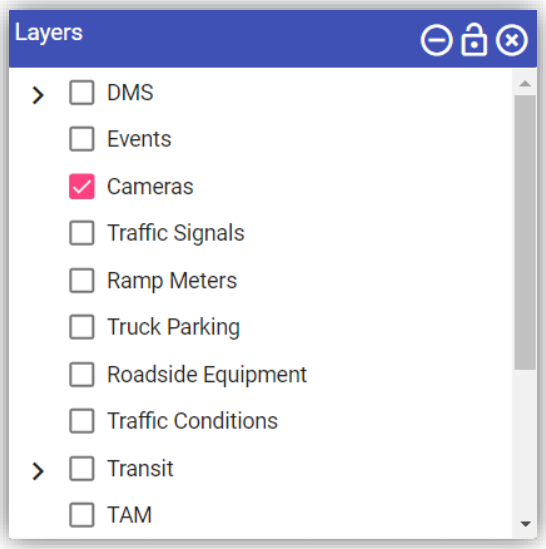
Events are incidents that are active or planned that will affect the transportation network. Event Type information is available in the legend details.

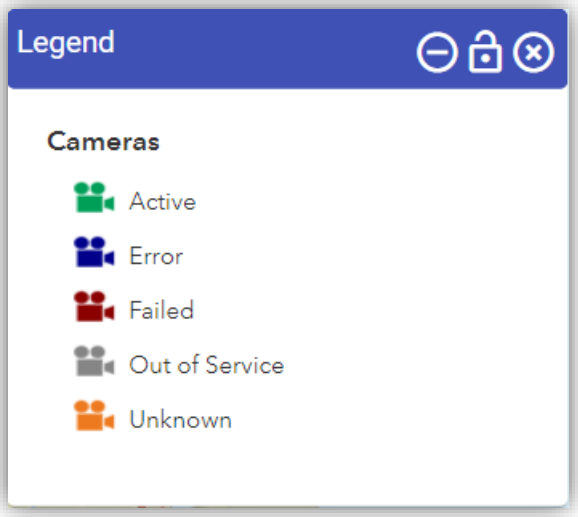




3.2.3 Cameras

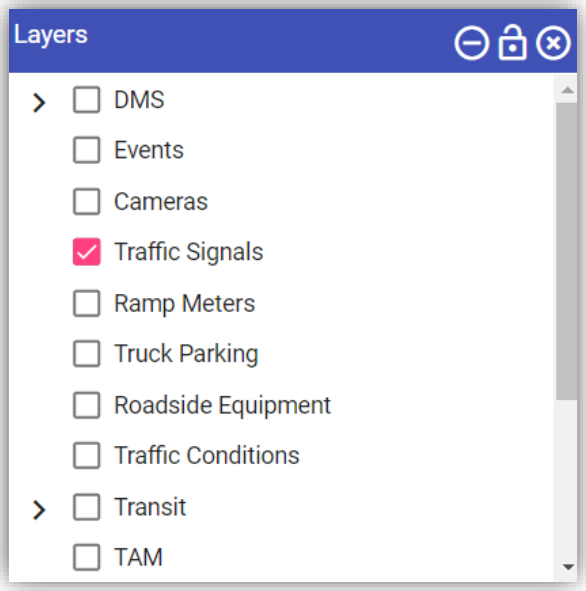
The camera details on the map allows users to view live video feeds of available camera devices along the transportation network. The cameras provide location and time details of the video feed. Status information is available in the legend.

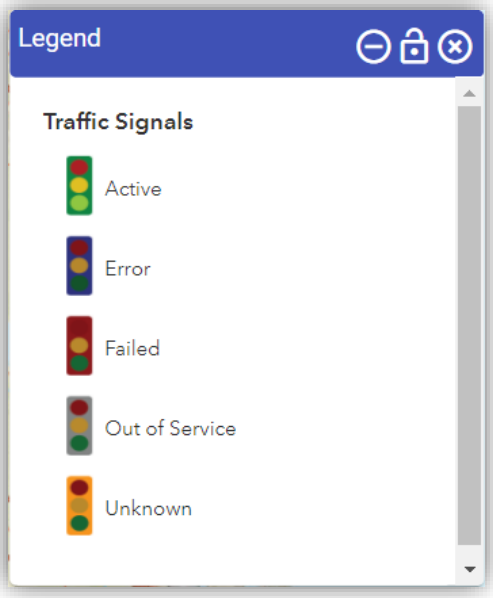




3.2.4 Traffic Signals

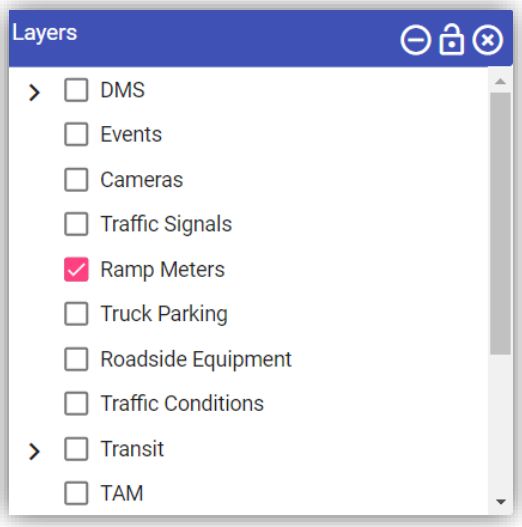
Traffic signals display the available traffic signal information including access to the SOT module from the info window when an individual icon is selected. Status information is available in the legend details.

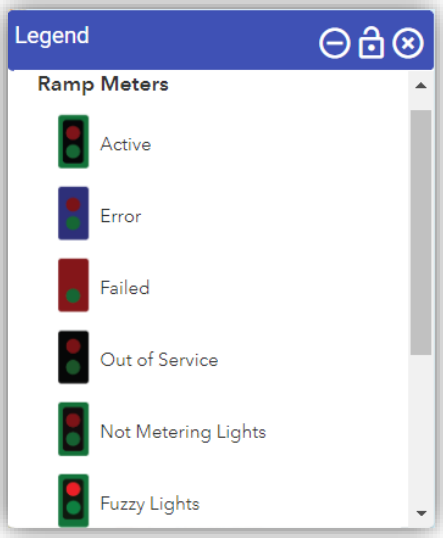




3.2.5 Ramp Meters

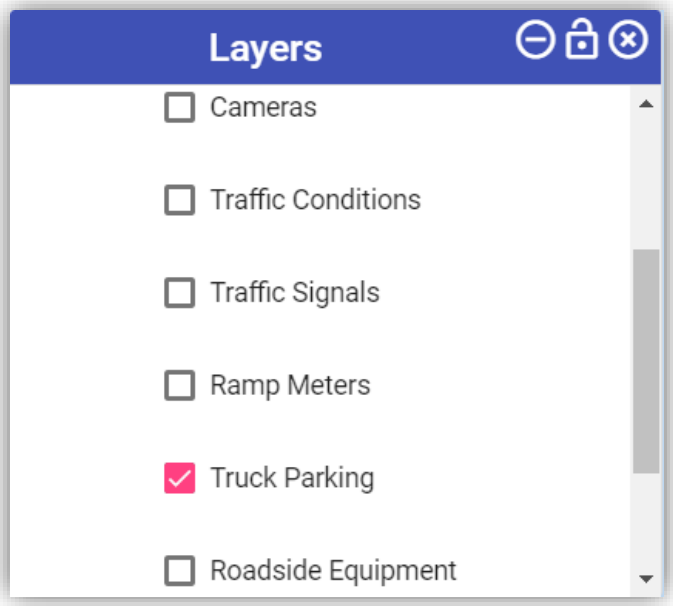
Ramp meters display the available ramp meter information including access to the SOT module. Status information is available in the legend details.

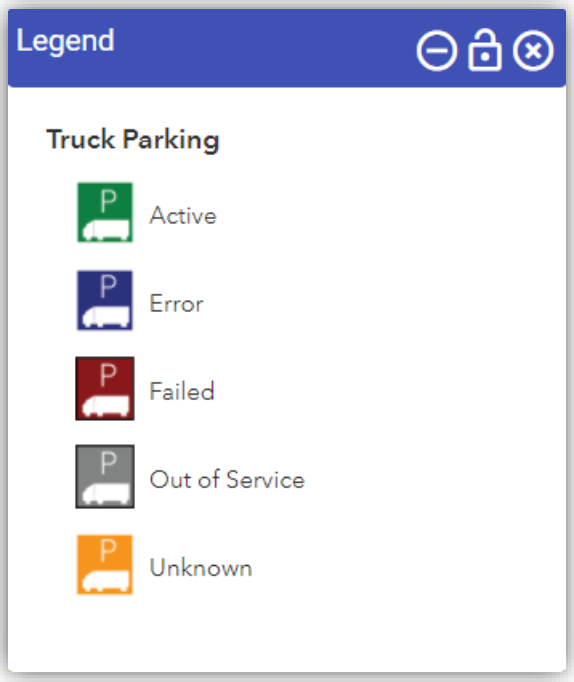




3.2.6 Truck Parking

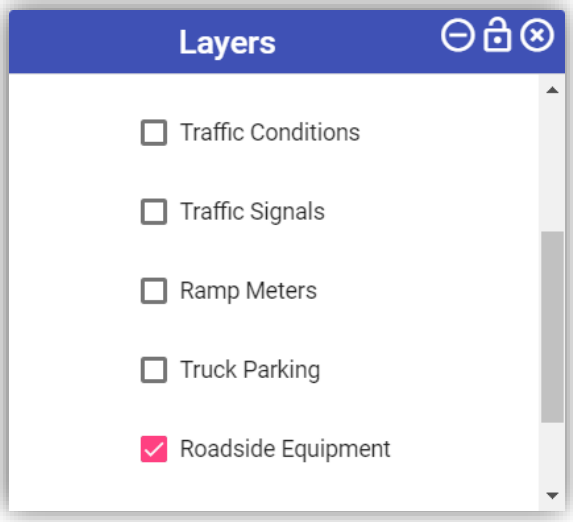
Truck Parking displays where commercial grade vehicles have designated areas throughout the transportation network. Status information is available in the legend details to inform the user if capacity details are available for each location.

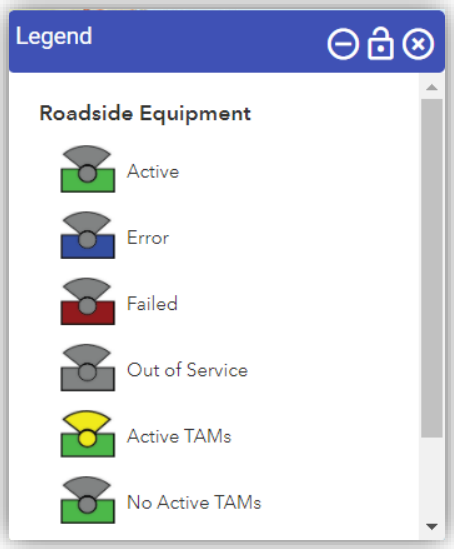




3.2.7 Roadside Equipment

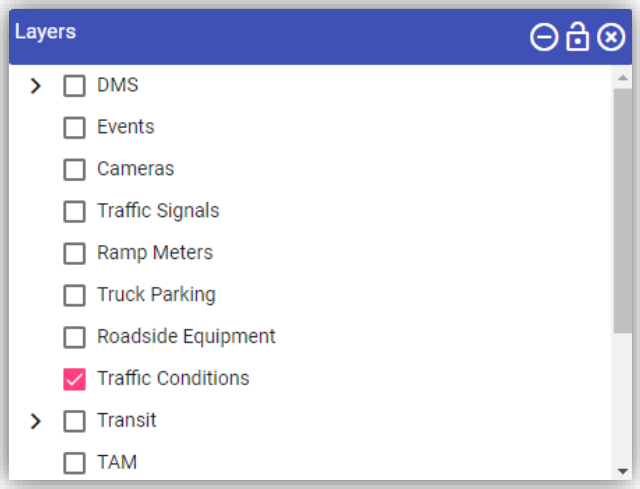
Roadside equipment represents the Connected Vehicle roadside devices that are used to send messages to, and receive messages from, nearby vehicles using Dedicated Short Range Communications (DSRC) or other alternative wireless communications technologies. Status information for the RSE's is available in the legend details.

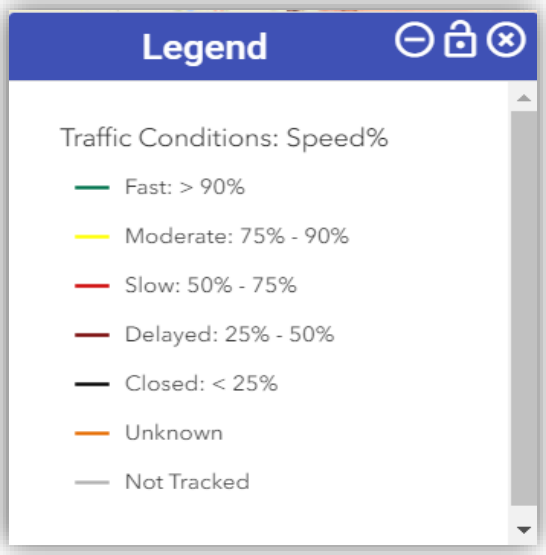




3.2.8 Traffic Conditions

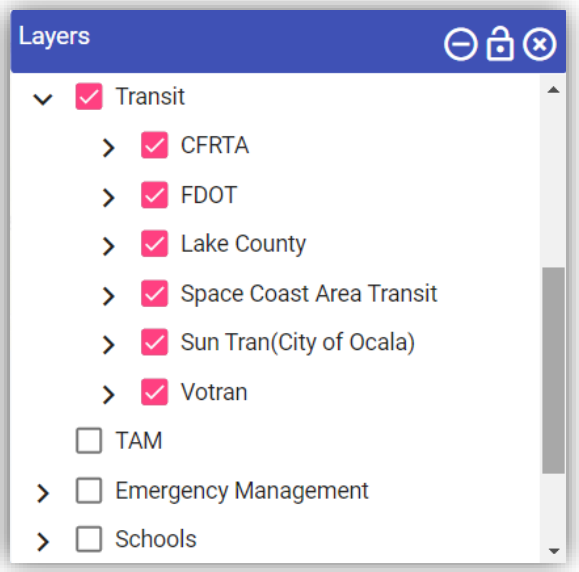
Traffic Conditions provide a view of the traffic conditions on the roadway network of the speed at which vehicles are traveling in comparison to the posted speed on that roadway.

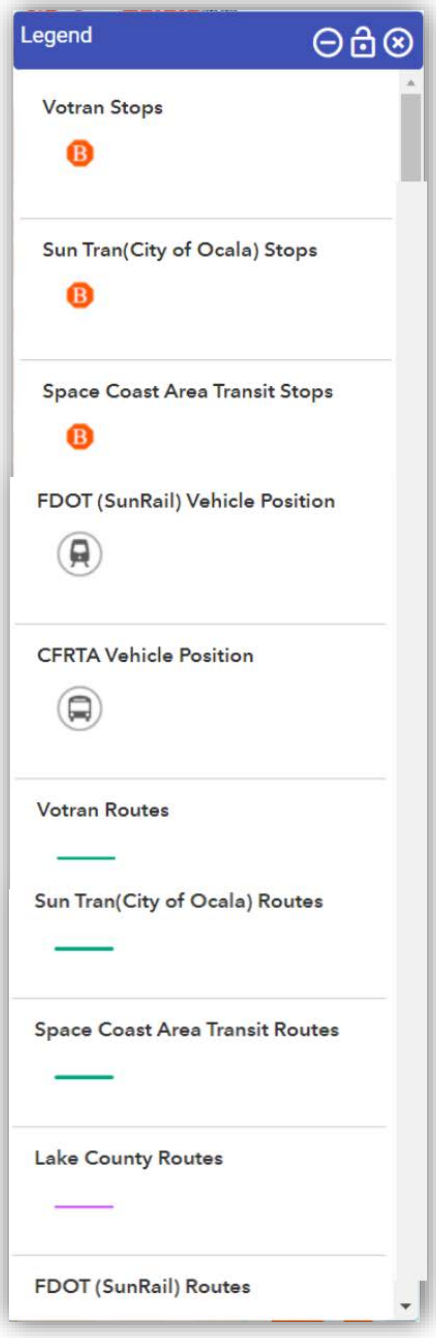




3.2.9 Transit

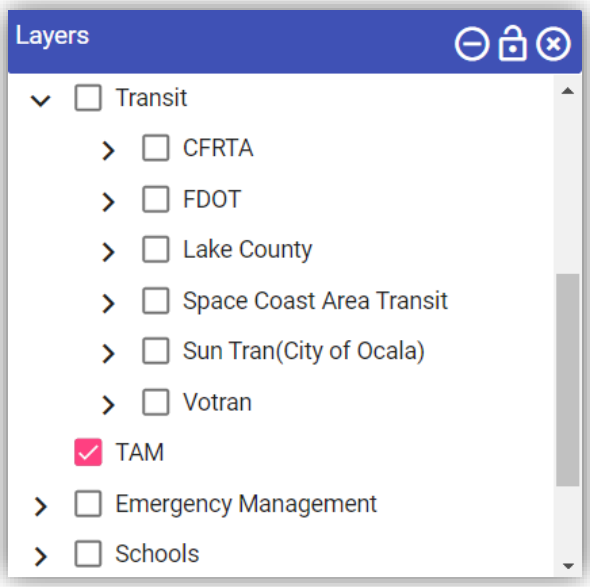
Transit layer displays the routes, stops and public transit vehicle locations at their last known position. Users can select or deselect any of the sub-layers to display on the map.

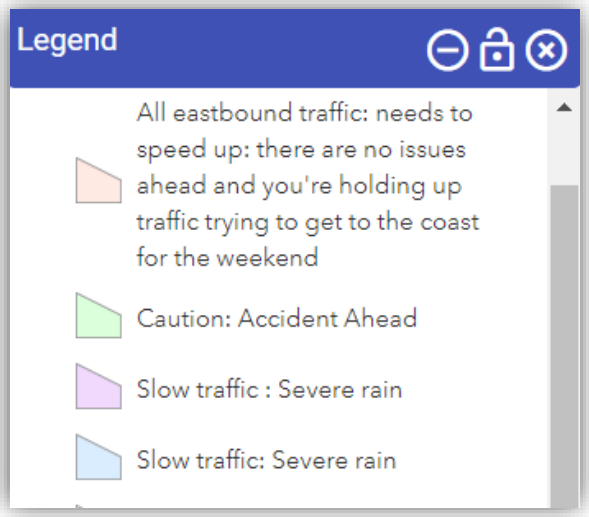




3.2.10 TAM

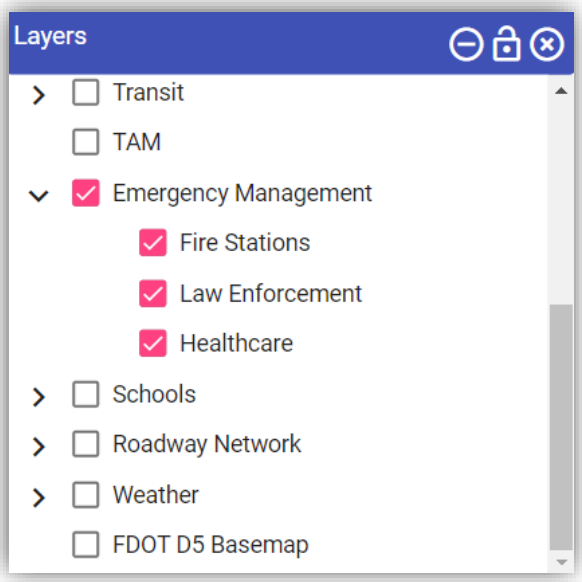
Travel Advisory Messages (TAM) are uniquely displayed on the map along as a semi-transparent polygon with the directionalities the message is being broadcast. Each unique message is displayed in the legend details.

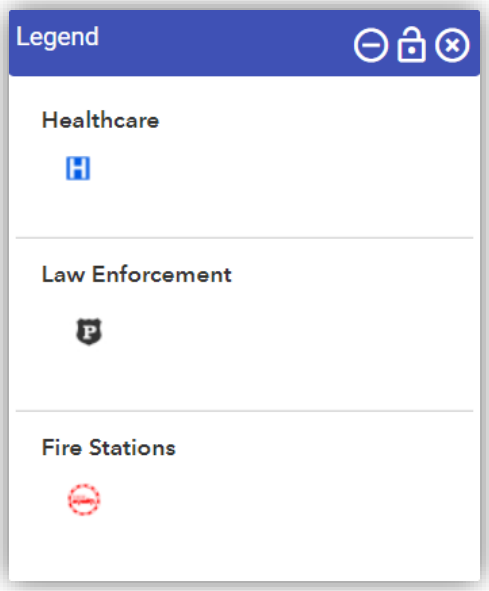




3.2.11 Emergency Management

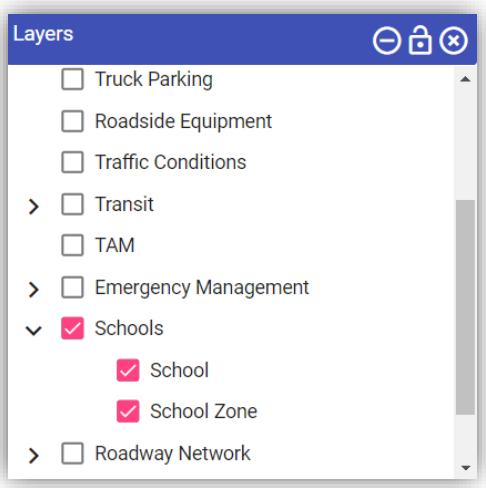
The Emergency Management layer displays available fire stations, healthcare, and law enforcement agency locations on the map. Users can select any of the sub-layers to display them on the map.

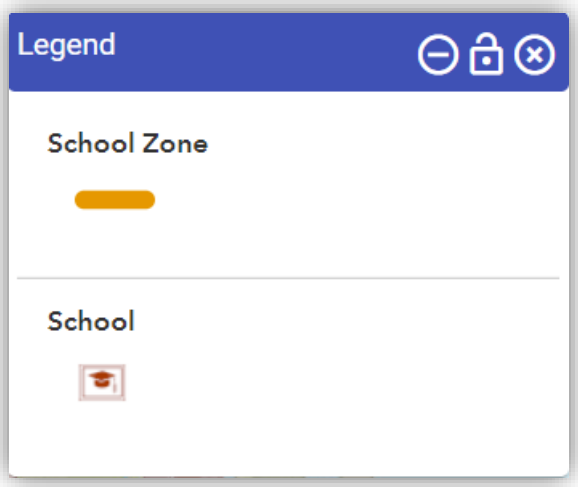




3.2.12 Schools

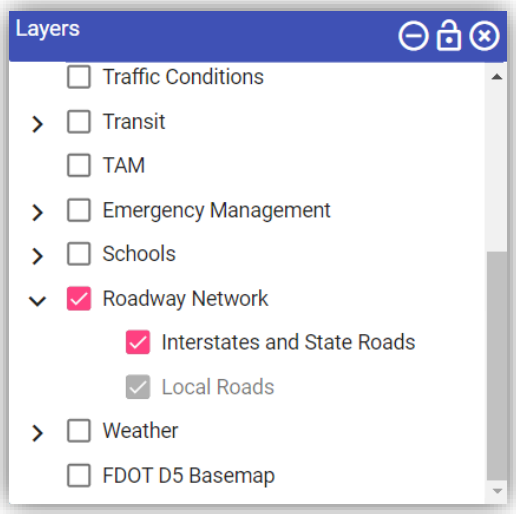
The Schools layer displays the available school locations and school zones. Users can select or deselect any of the sub-layers to display on the map.

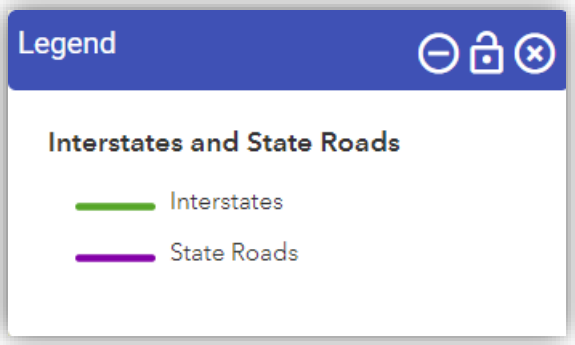




3.2.13 Roadway Network

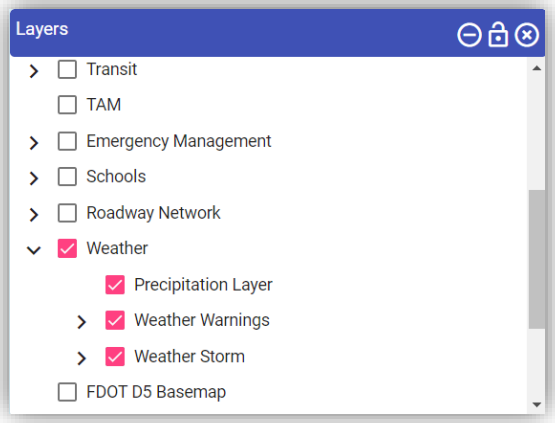
The roadway network visually highlights Interstates and state roads within the transportation network.

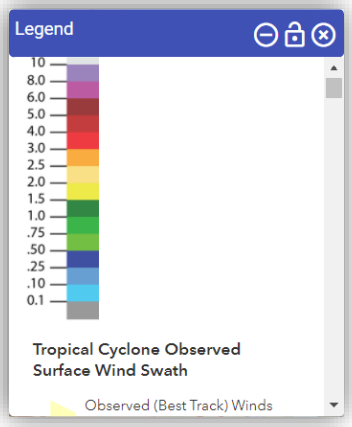




3.2.14 Weather

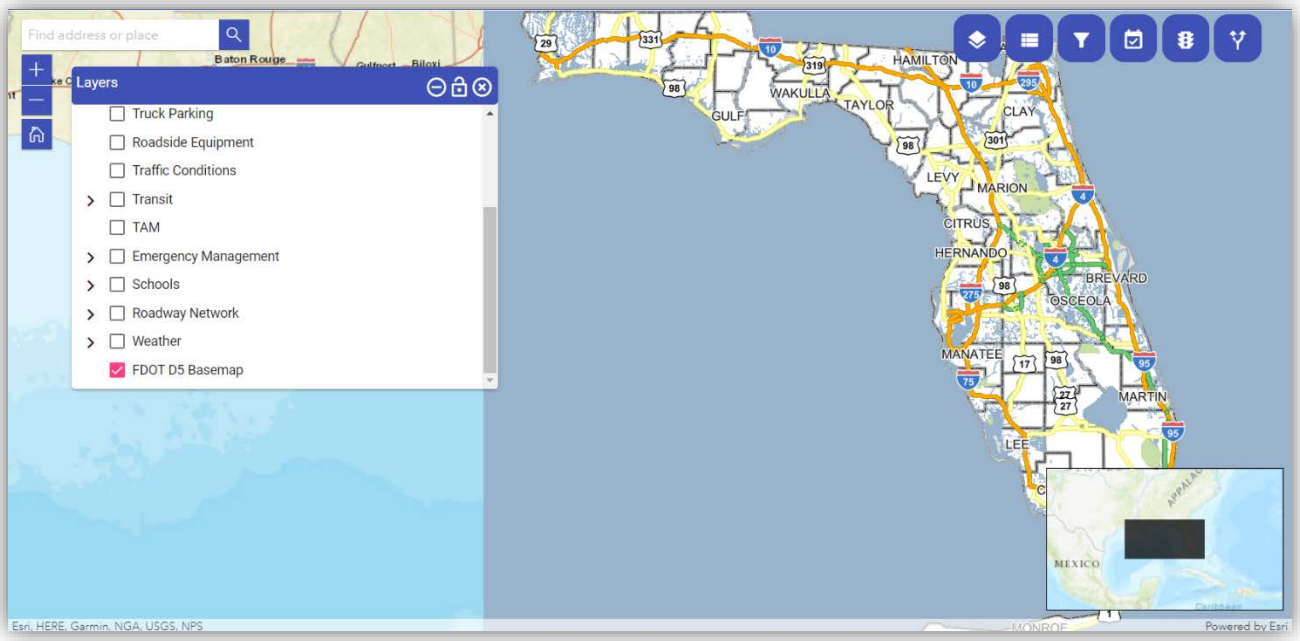
The weather layer displays the precipitation layer, weather warnings and storm warnings affecting the transportation network. Users can select or deselect any of the sub-layers to display on the map.





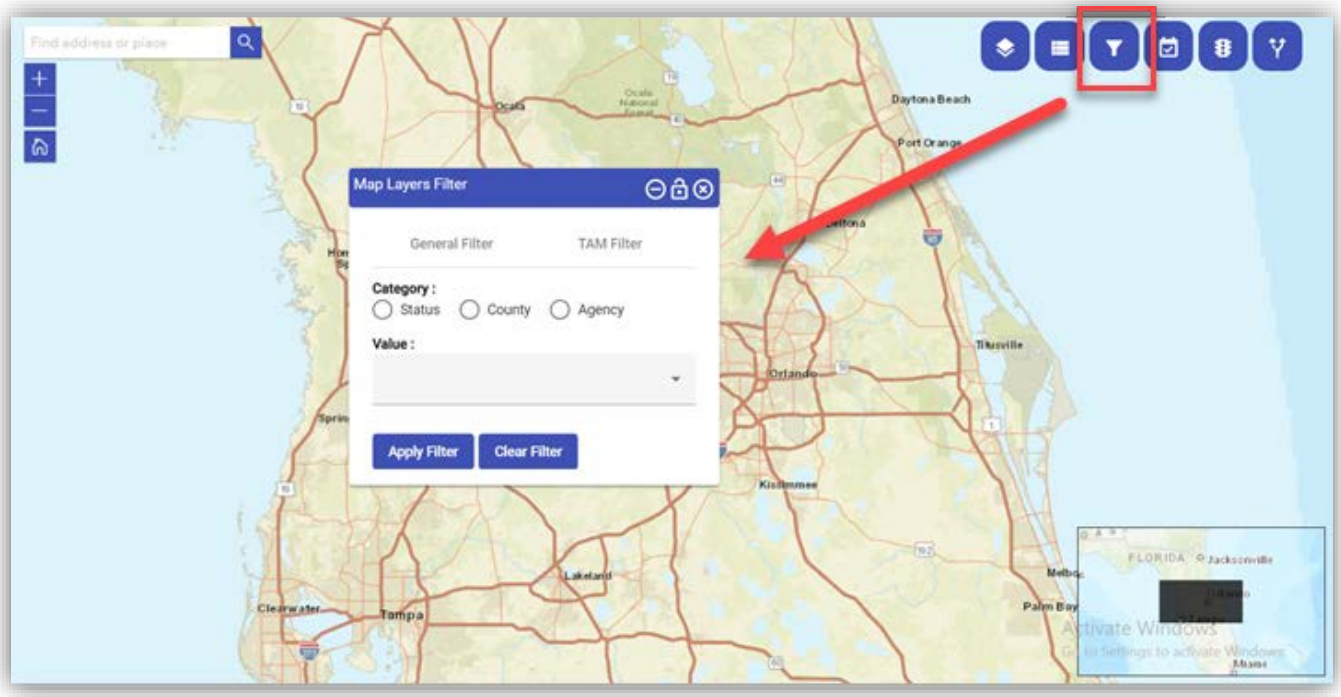
3.2.15 FDOT D5 Base Map

The FDOT D5 Base Map displays the transportation roadway network that is shared by all FDOT agencies.



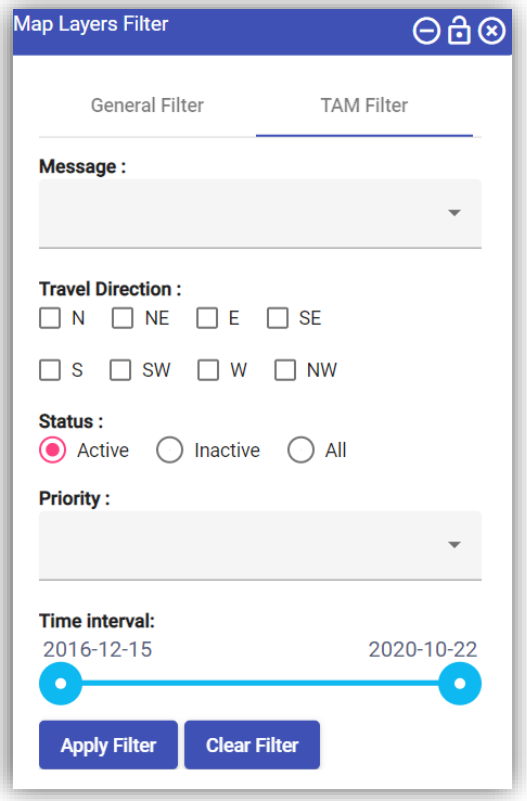
3.3 Layer Filters

The Layer filter icon on the map allows users to limit the display of map layer data. By selecting the filter icon, the system will display a prompt window. There are two types of filters available: General Filter and the TAM Filter. The default filter is the General Filter.



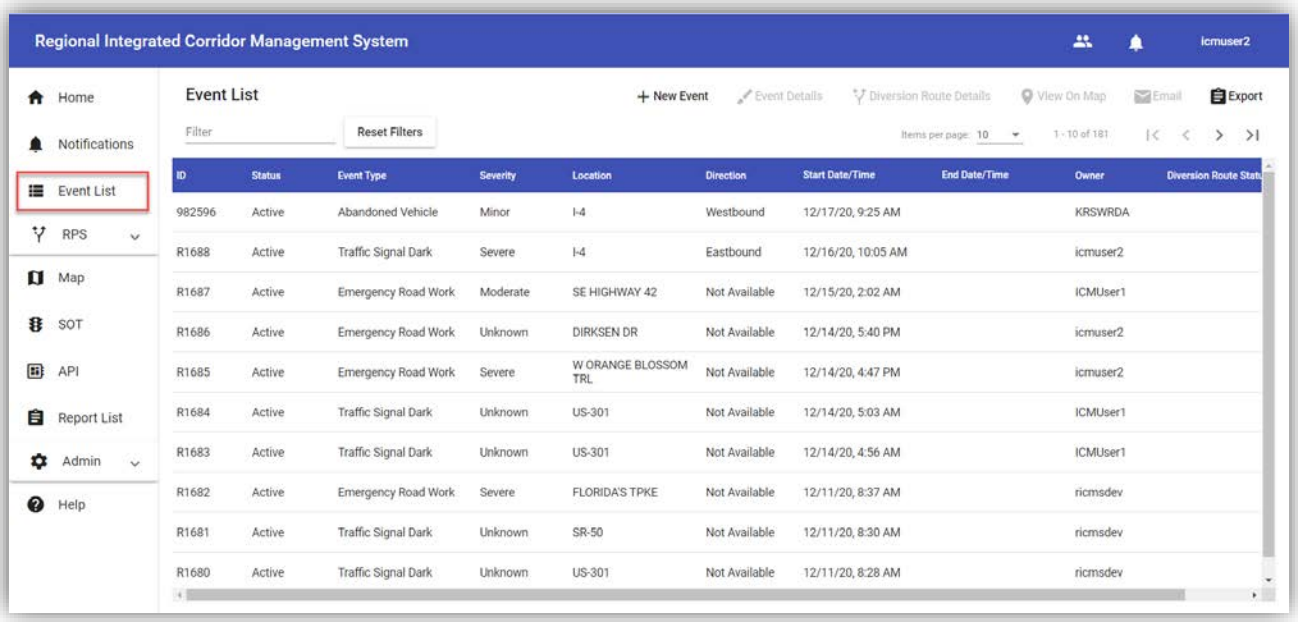
The General filter allows the user to filter all available map layers by Status, County or Agency. When the user selects a filter category, the Value list will be updated to display the available filter options. The user selects a value from the list and selects Apply Filter. The system will display all available layers with matching values. For instance, if a user selects County and then Seminole, the system will display all available layer elements that have Seminole County as an attribute.

The TAM filter allows the user to filter TAM messages in the region. The user can choose to filter by Message, Travel Direction, Status, Priority or Time interval. The user selects a filter option and selects Apply Filter. The system will display all available layer elements with matching values. For instance, if a user selects North as the Travel Direction, the system will display all TAMs that broadcast Northbound.

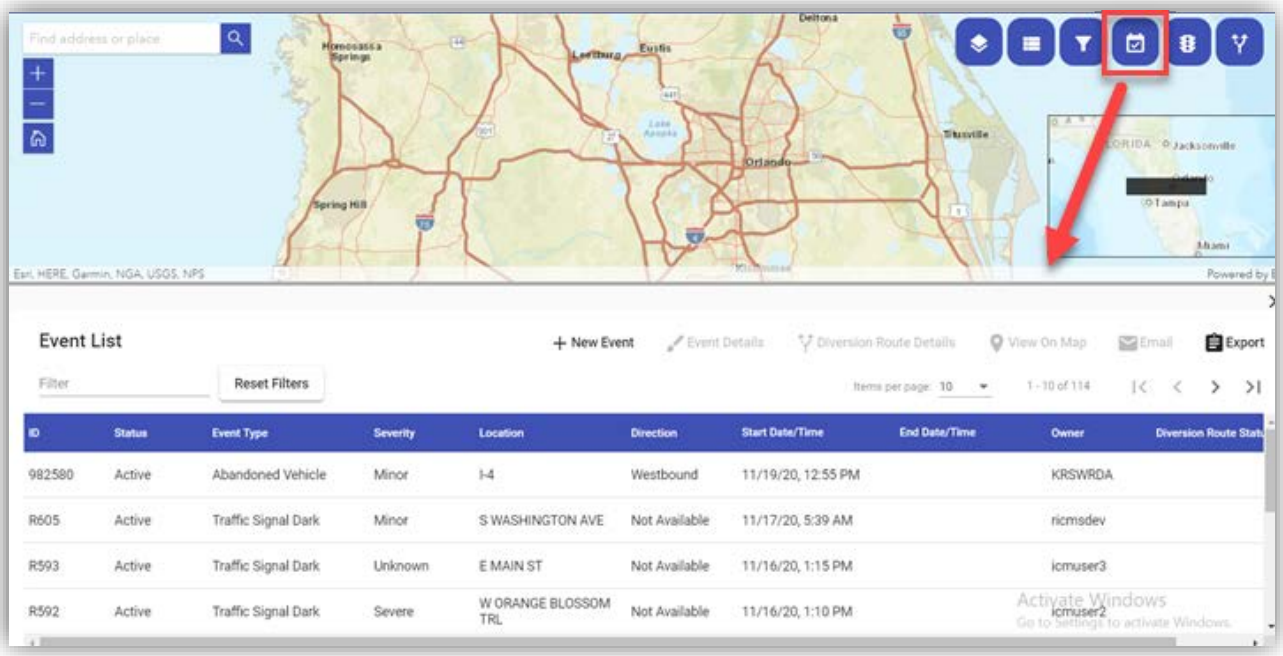


4 Event list

The R-ICMS Event list page can be accessed from the left navigation menu. The list displays SunGuide and R-ICMS events that are available in the system. The Event list allows users to search, sort, filter and export the list details.

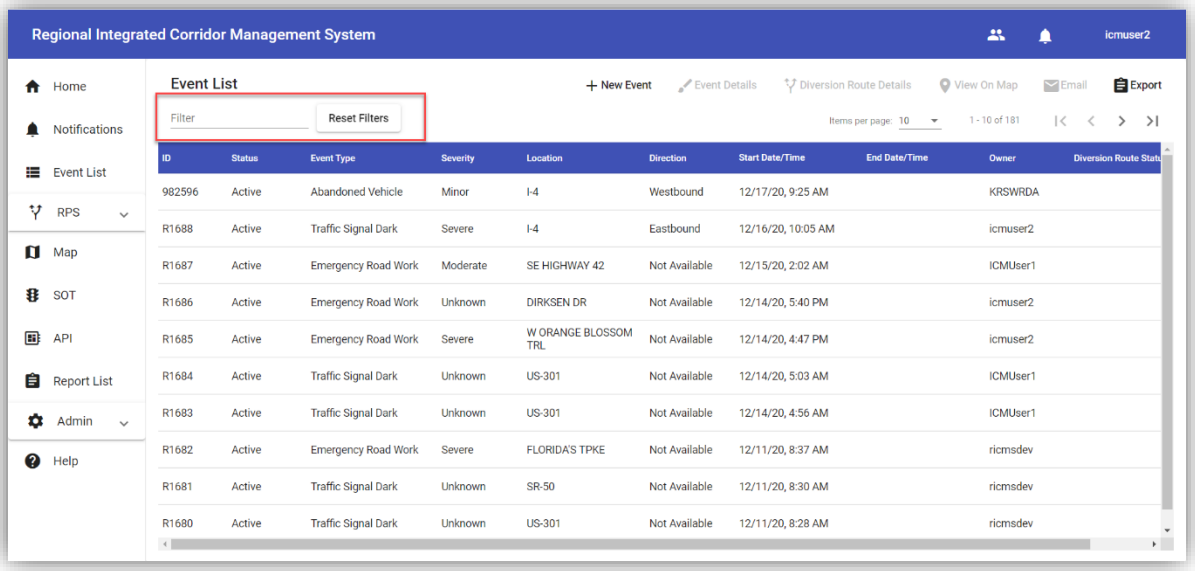


The Event list icon is also accessible from the map display. Upon select, the event list is displayed directly on the map. The event list display allows users to view, filter and select events to view on the map.



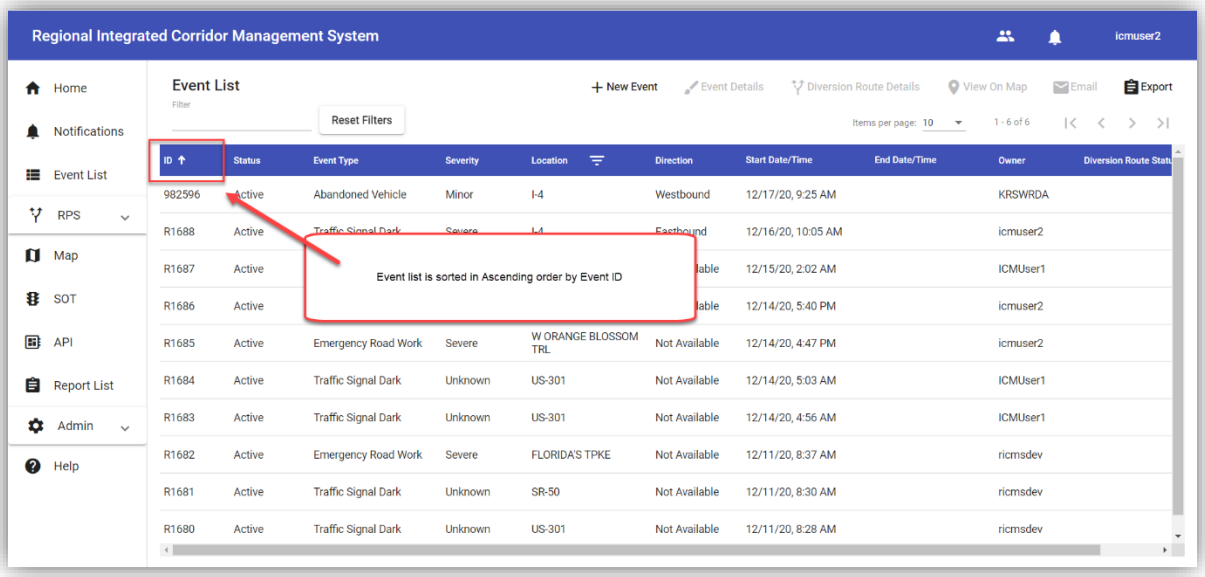
4.1 Event List Filter

The Event List Filter function allows users to enter keywords or numbers to locate matching records in the list display.



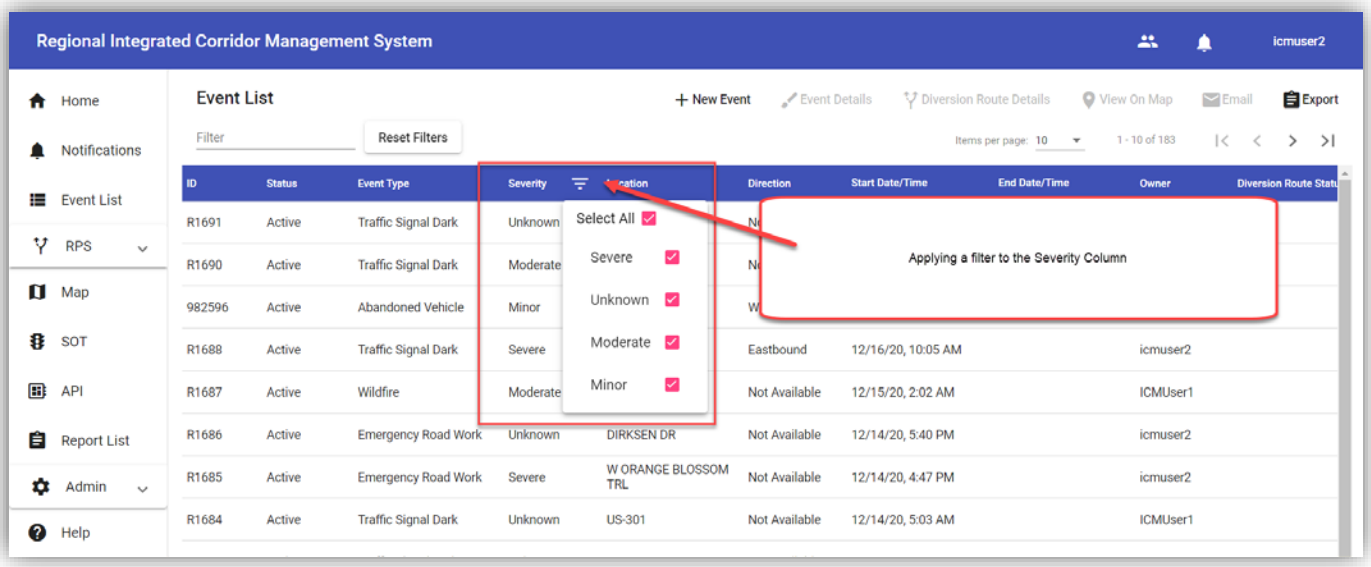
4.2 List Column Sort

The List Column Sort function allows users to sort records in ascending order by clicking the column label you want to sort by. Upon the second click, the list will be sorting in descending order. The system displays an icon to inform the user of the current sort order.



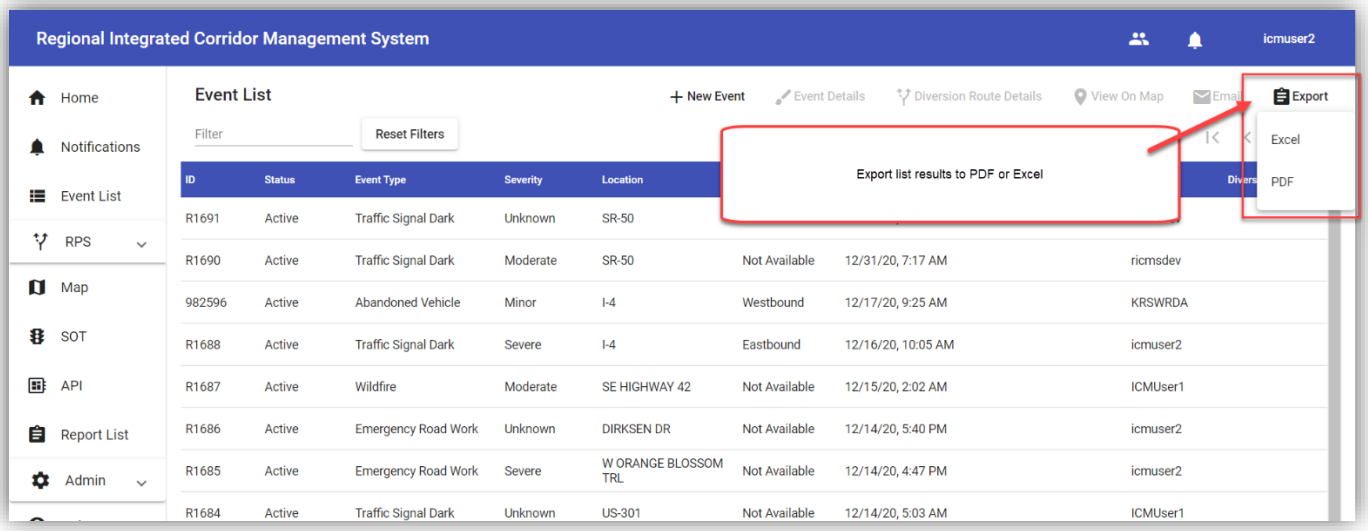
4.3 List Column Filter

The List Column Filter function allows users to limit records. The function is displayed by hovering over the column name. The system will display the available field values for the user to select. Users can select to apply filters on multiple columns. The system displays a filter icon in the column header for all columns with an active filter applied.



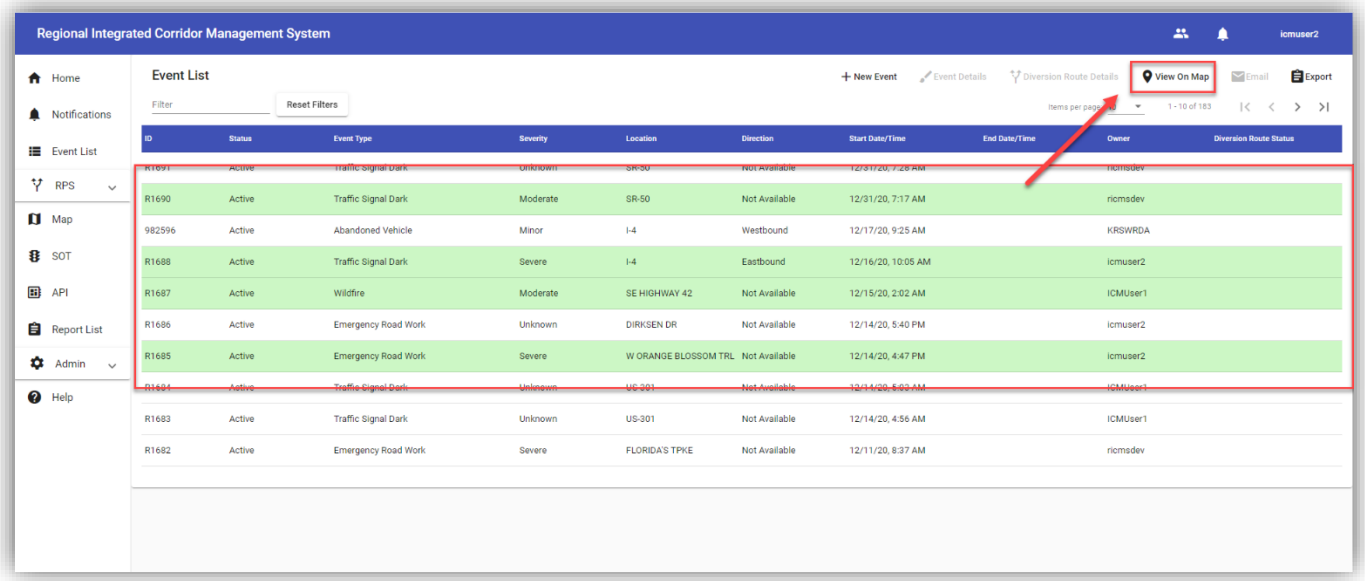
4.4 Event List Export

The List Export function allows users to download event list records to PDF or Excel format. The export will adhere to any column sort or filters that have been applied by the user.



4.5 View on Map

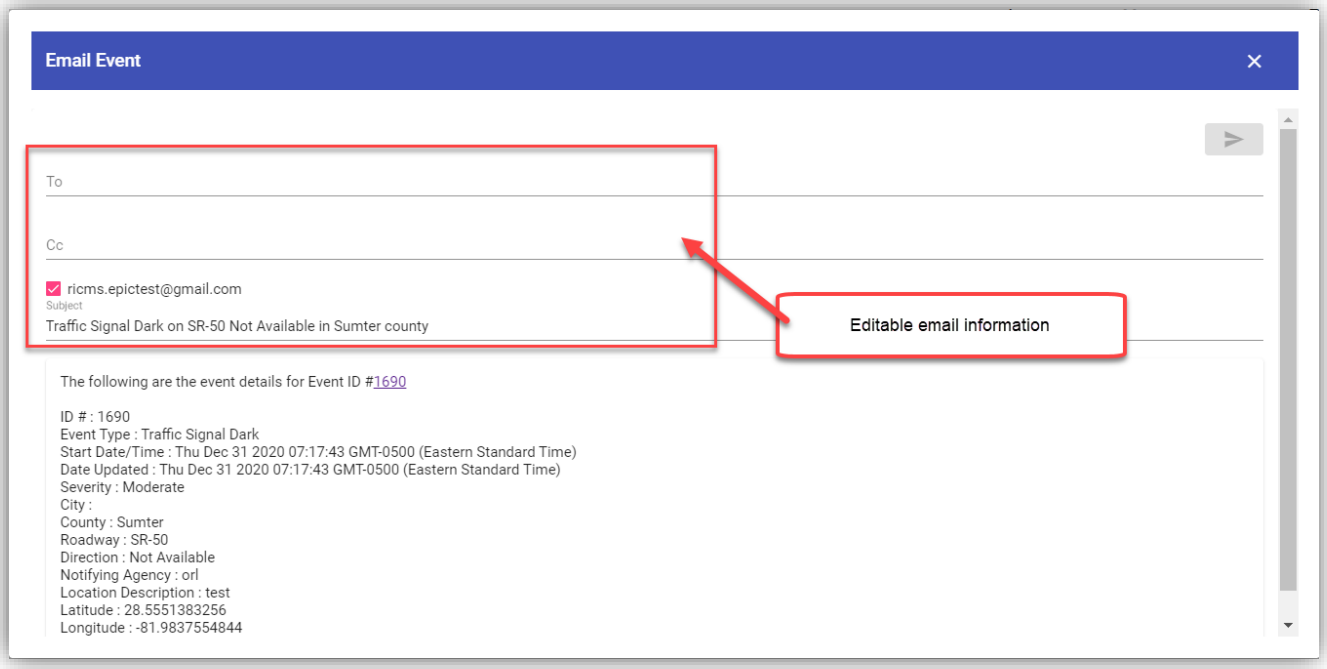
The View on Map function allows users to select multiple records and view them on the map. To select a record, the user clicks anywhere within the desired row. The system will zoom to the required setting to display all selected event icons on the map.



4.6 Email Event

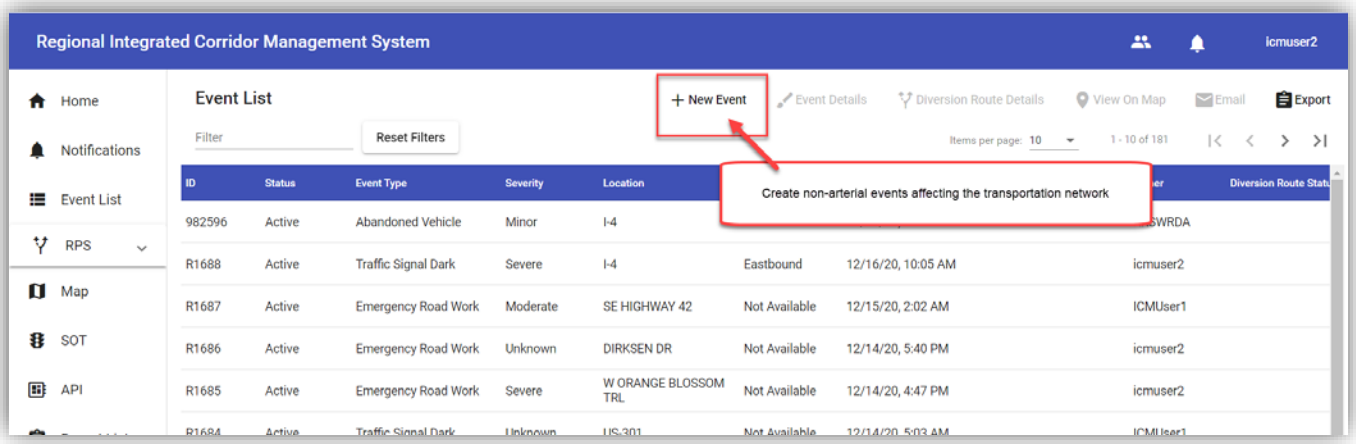
The Email Event function allows users to select a single record and initiate an email of the event details to users outside of the system. Users select any record from the event list and click the Email Event function. The system will display a

draft view of the email providing users with the opportunity to make changes to the email addresses and Subject line. If more than one record is selected, the email function will be disabled.

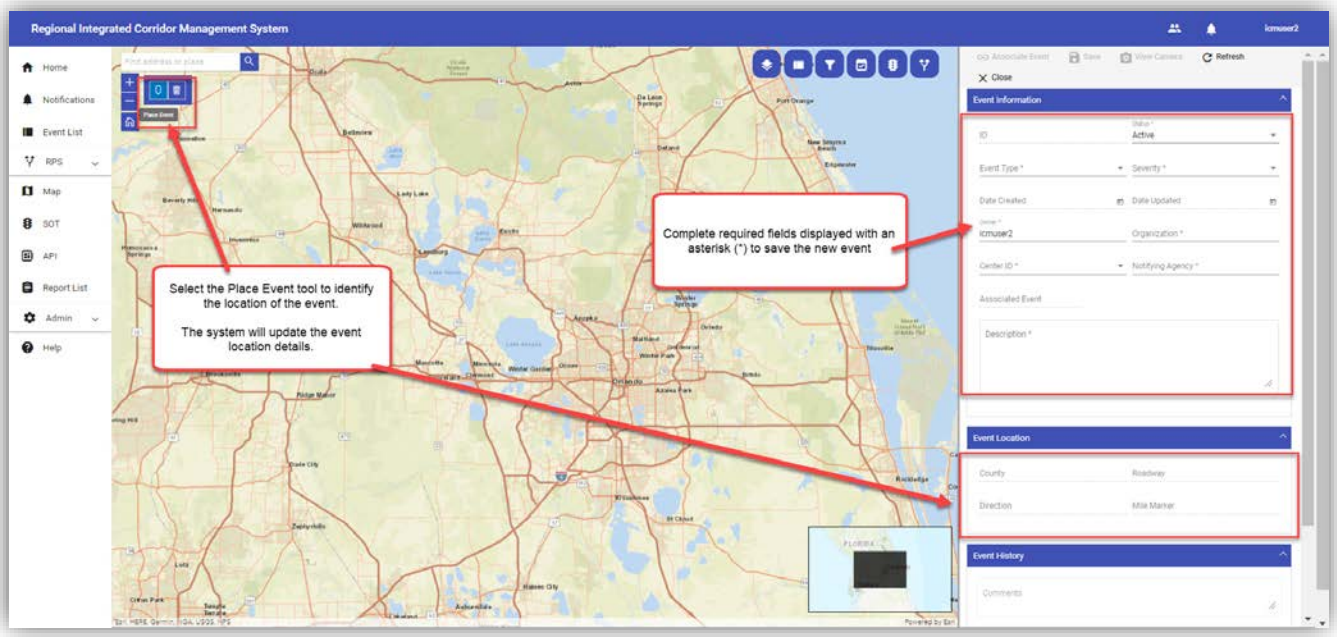


4.7 New Event

From the event list display, users can select to create an event directly within the RR-ICMS system.



When users select to create a new event, the system will display the map view with the event details entry form available. Users can select the Place Event tool  to pick the location on the map for the event and the system will update the event location details.

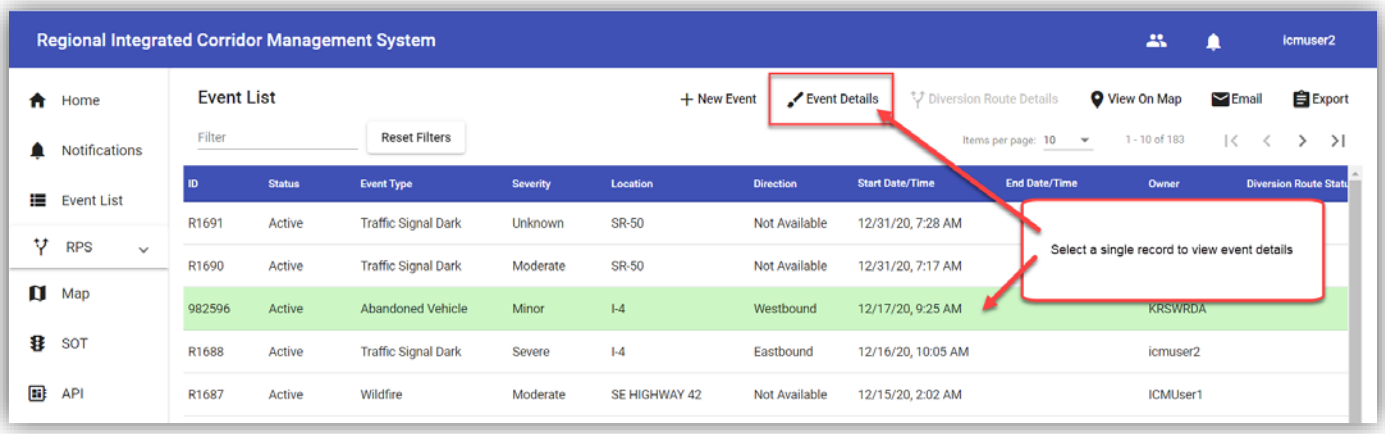


If the wrong location is selected, users can select the Remove Event tool  . The system will clear the event location details and the user can reselect the Place Event tool.

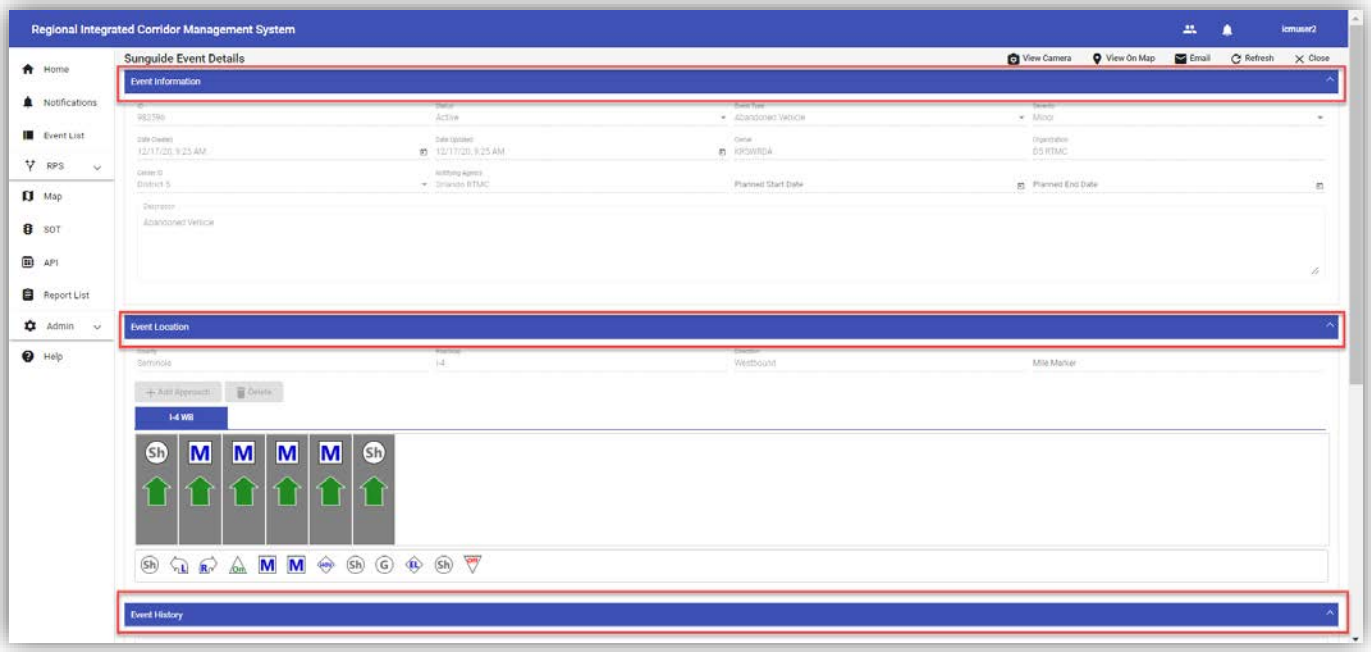
Users must complete the remaining required event details indicated with an asterisk and select the Save button. The system will assign an RR-ICMS Event ID and update the Date Created and Date Updated fields.

4.8 Event Details

The Event Details function allows users to select a single record and view the details of that event. If more than record is selected, the function will be disabled.

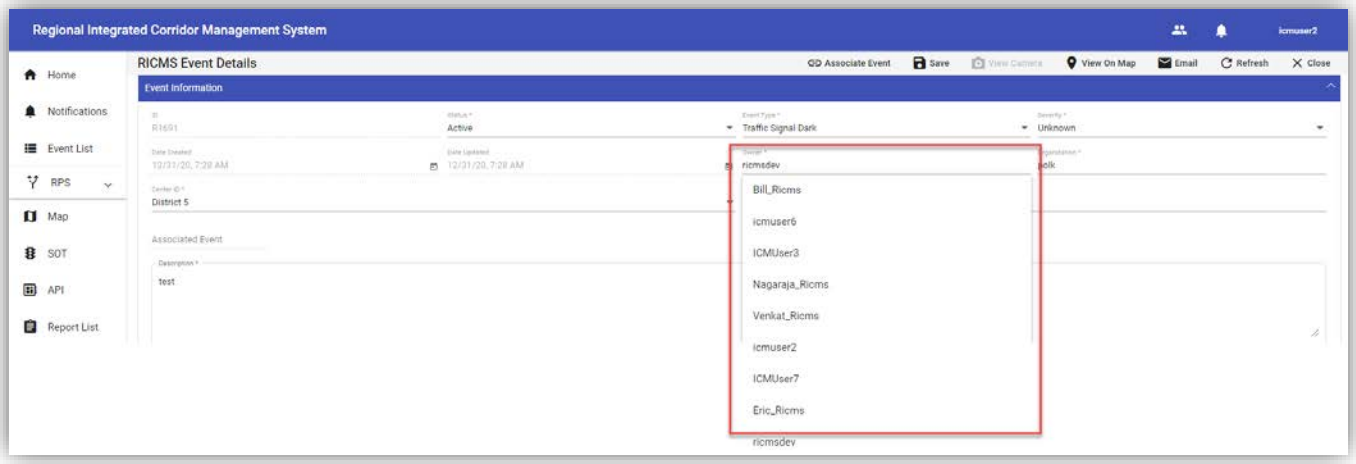


The Event Details form has three sections: Event Information, Event Location, Event History. Each section of the event details form can be collapsed to conserve display space on the page.



4.8.1 Event Information

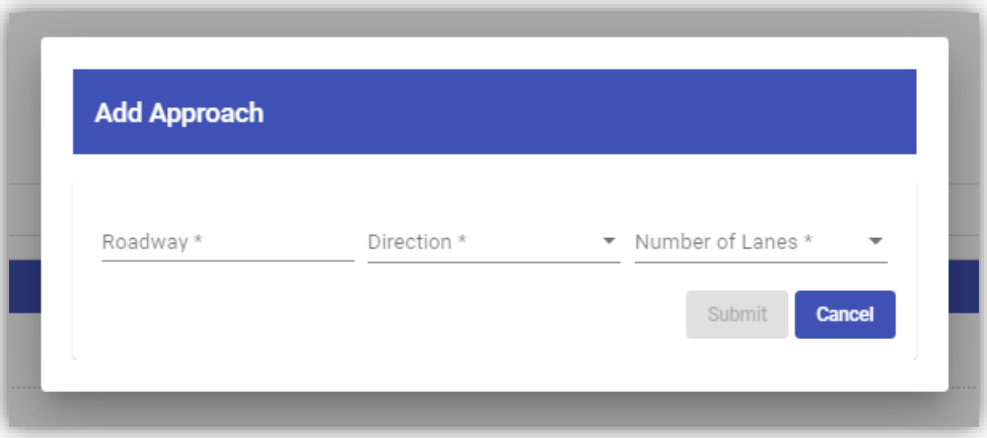
The Event Information section contains the key information about the Event Type, Severity, Status and Ownership. Authorized users can update and transfer ownership of events by selecting the Owner field. The system will display a list of owners in the system.



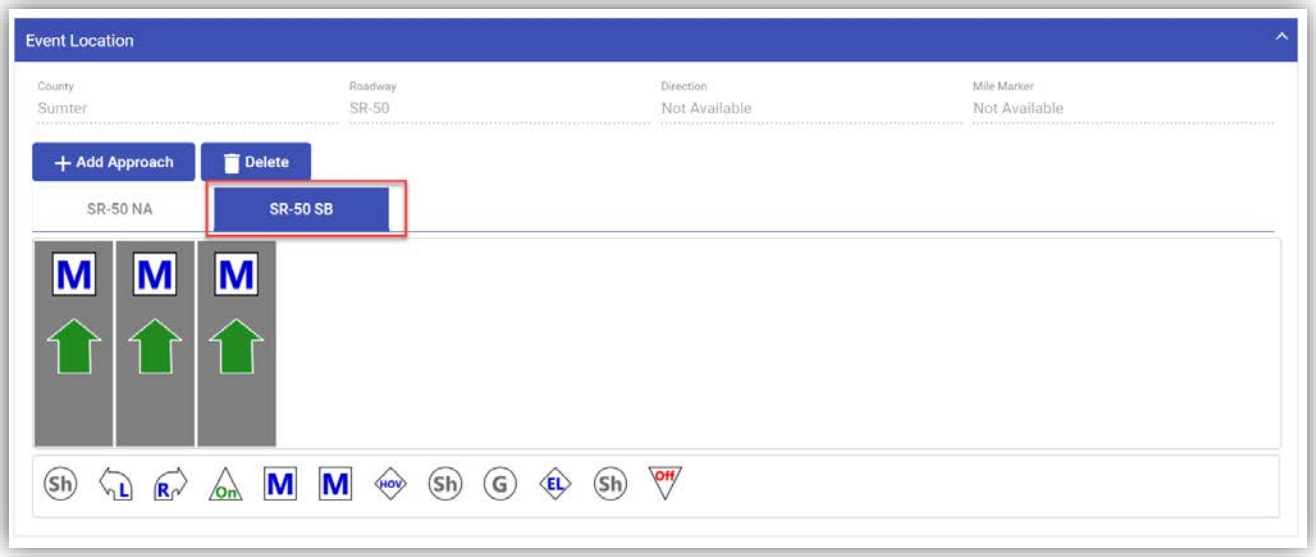
4.8.2 Event Location - Lane Blockage Diagrams

Within the Event Location section, the system allows users to only view SunGuide event lane blockage information or view/create/edit RR-ICMS event lane blockage details. The system will display the primary approach information as the first tab by default.

For RR-ICMS events, users can update lane blockage information by clicking the icon displayed for each lane. Users can also add additional lanes by dragging the icons displayed below the diagram to their desired location.
Users can also select the Add Approach button to document additional approaches (if needed). The system will display a prompt for the user to specify the Roadway, Direction and Number of Lanes of the new approach.

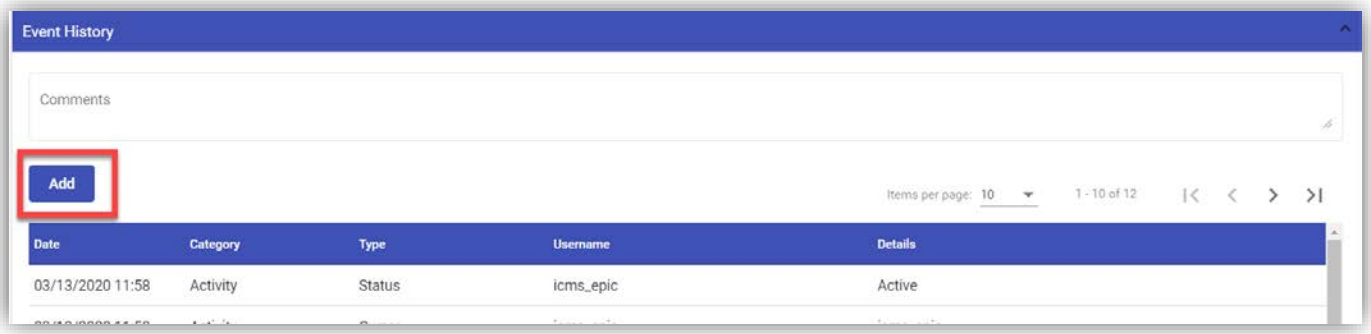


Upon Submit, the system will add an additional tabular display for the user to update the lane profile and lane blockage details.



4.8.3 Event History

Users can view the log of all changes to an event in the Event History section of the Event Details. Users can also add comments to the history log to share information with other users about the event. Comments can be added for both R-ICMS events as well as SunGuide events. Comments added to SunGuide events are shared with the SunGuide system.


Event History
Comments
Add
Items per page: 10
1 - 10 of 12
Date
Category
Type
Username
Details
03/13/2020 11:58
Activity
Status
icms_epic
Active

5 Response Plan Selection (RPS)

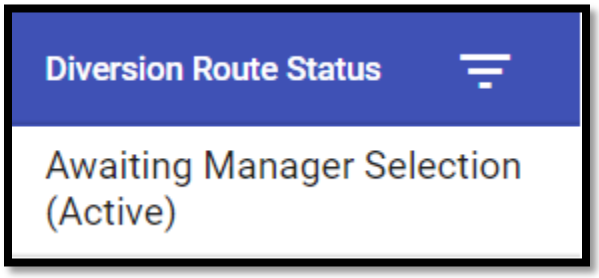
5.1 Overview

5.1.1 Evaluation Creation

Not all events are eligible for response plan evaluation. There are several criteria that must be met such as event locations, levels of congestions, and response plan availability. Any event that is eligible will have a Diversion Route Status on the Event List Page. Once an event is determined eligible, the candidate response plans are assessed. The candidate response plans are filtered down based on criteria specified in the **Response Plan Settings** (see section 5.3) of the event's roadway. Some of this criterion includes a minimum number of traffic related devices (traffic signals and DMS) and a maximum volume over capacity threshold. Once the event and the available response plans are determined eligible, the Response Plan Selection process will notify the appropriate users through the R-ICMS's notification service.

5.1.2 Evaluation Stages

An event's response plan evaluation transitions through several different stages. These stages help a user understand the status of an evaluation and affect the availability of response plan related actions.



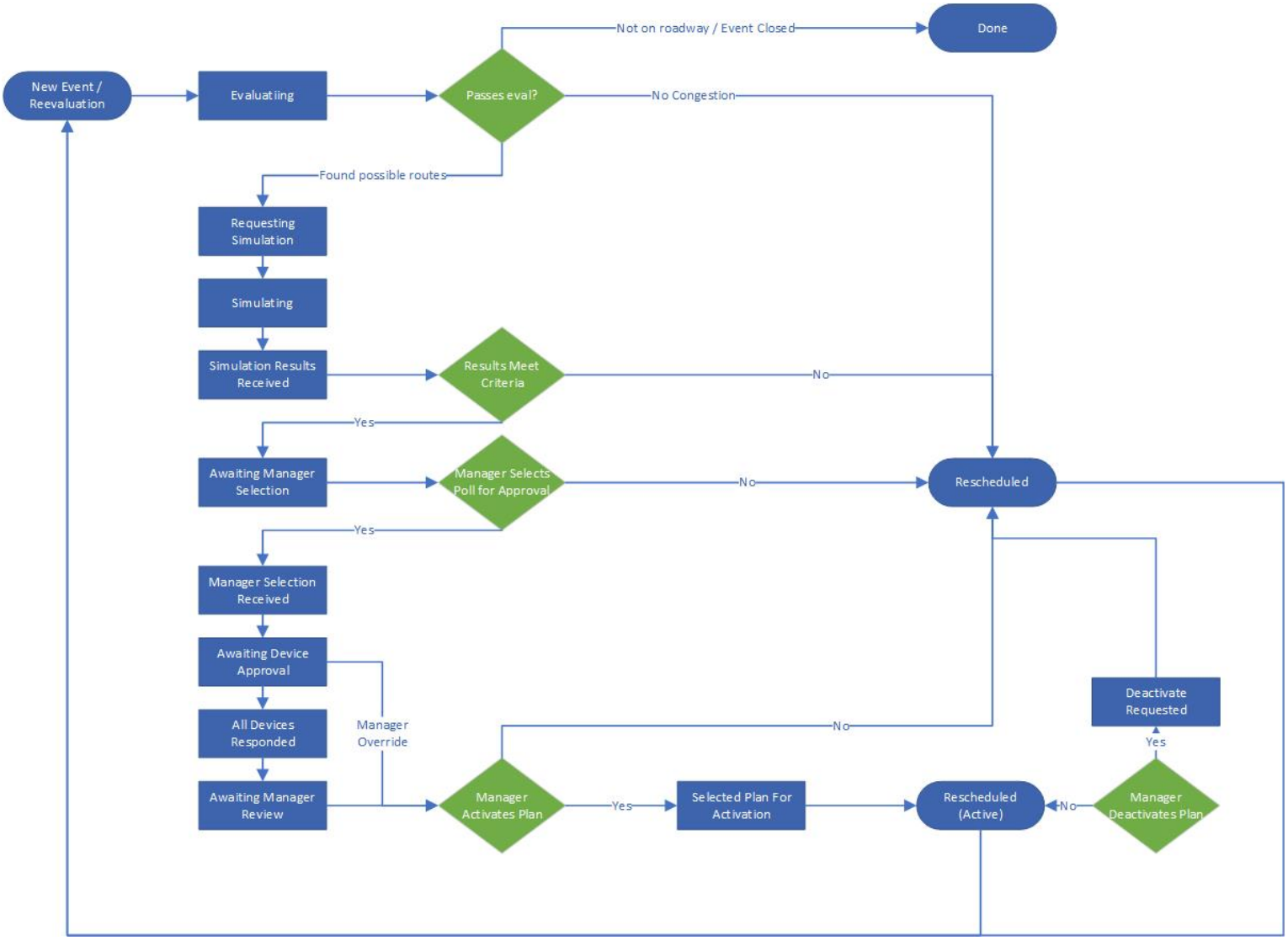
Diversion Route	Signal Pattern	Score	Confidence	Speed (MPH)	Flow	Delay (Seconds)	Travel Time (Seconds)	Status
Do Nothing	N/A	0.65	0.9	42.1	1.2	2.3	4.5	Awaiting Selection
101BA-L-92-3-1	Balanced	0.55	0.1	31.7	1.3	2.4	4.6	Awaiting Selection
101BA-L-92-3-1	Directional	0.55	0.1	31.7	1.3	2.4	4.6	Awaiting Selection
101C-L-94-3-1	Balanced	0.55	0.1	31.7	1.3	2.4	4.6	Awaiting Selection
101C-L-94-3-1	Directional	0.55	0.1	31.7	1.3	2.4	4.6	Awaiting Selection

The status of an event's evaluation can be seen in two locations. One in the **Diversion Route Status** column on the **Event List** page (the first image above) and the other on the **Diversion Route Details** page of an event (outlined in red in the second image above). If an event does not have a value in the Diversion Route Status column, the event did not meet the response plan evaluation criteria and diversion route details will be unavailable.

All possible evaluation stages are described below. Some stages (labeled as an “interim stage”) have very short lifespans and only act as an informative update.

- Evaluating – The event is evaluated for response plan eligibility. Once an event is determined eligible, candidate response plans are assessed.
- Requesting Simulation – Candidate response plans are sent to the Simulation Engine. This is an interim stage.
- Simulating – The candidate response plans have been received by the Simulation Engine and simulation has begun.
- Simulation Results Received – All results from the Simulation Engine have been received. This is an interim stage.
- Awaiting Manager Selection – The RPS Manager is notified candidate response are available for review and selection.
- Manager Selection Received – A response plan has been selected for Device Approval by the RPS Manager. This is an interim stage.
- Awaiting Device Approval – Agency users are notified a Response Plan has been selected and is awaiting device approval.
- All Devices Responded – All devices have an approval response. This is an interim stage.
- Awaiting Manager Review – The RPS Manager can review the device approval responses and choose to activate the plan. If some devices have been denied, the manager can override and activate the plan. The manager also has the option for selecting a different plan.
- Selected Plan For Activation – The RPS Manager has selected the plan for activation and the activation request is sent to SunGuide.
- Deactivate Requested – The RPS Manager has chosen to deactivate the selected plan and the deactivation request is sent to SunGuide. This function is used for when the RPS Manager no longer wants the ICM response plans to be running.
- Rescheduled – The event is rescheduled for Response Plan Evaluation. At different points of an event’s lifecycle, an event might not be ready for a response plan (no congestions) or the event has an active plan but could benefit from a different one. Because of this, events can be rescheduled for evaluation.
- Stale – A new evaluation that was scheduled for the event has started and the current evaluation is completed.
- (No Status) – All processing is complete and no further evaluation is required because the event did not meet response plan evaluation criteria.

For a complete start to finish flow of a response plan evaluation, see the flow chart below.



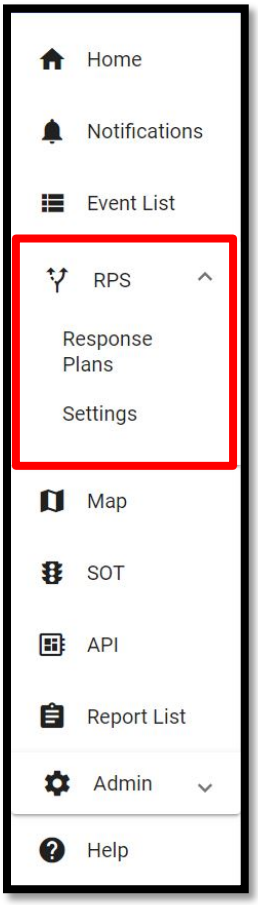
5.1.3 Authorization

There are two authorization policies in place throughout the Response Plan Selection process to ensure only authorized personnel have access to Response Plan related data and actions. Those two policies are Permissions and Device Groups. The different Response Plan related permissions allow users to view details, select and activate a Response Plan, and approve Response Plan Devices. In addition to the permission policy, there is also the Device Group policy. A Device Group is a collection of different devices that are usually associated with an agency that manages the device's operation. If a user is a member of a Device Group, they will have permission to manage those devices within the R-ICMS. However, to approve a Response Plan related device, a user must have the required permissions and be a member of the device's Device Group.

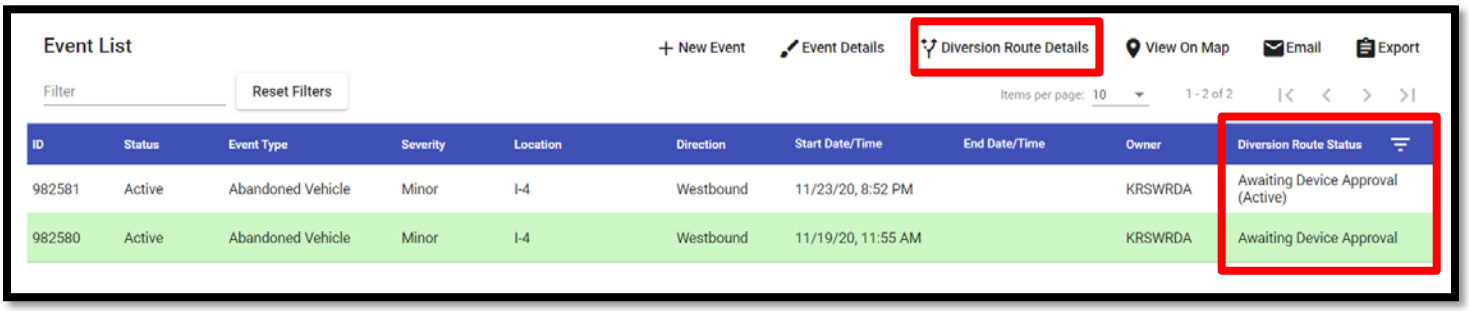
5.2 Managing Response Plans

5.2.1 RPS Event List

To view the active Response Plan Evaluations, click the **RPS** dropdown on the main navigation pane and click the **Response Plans** option.



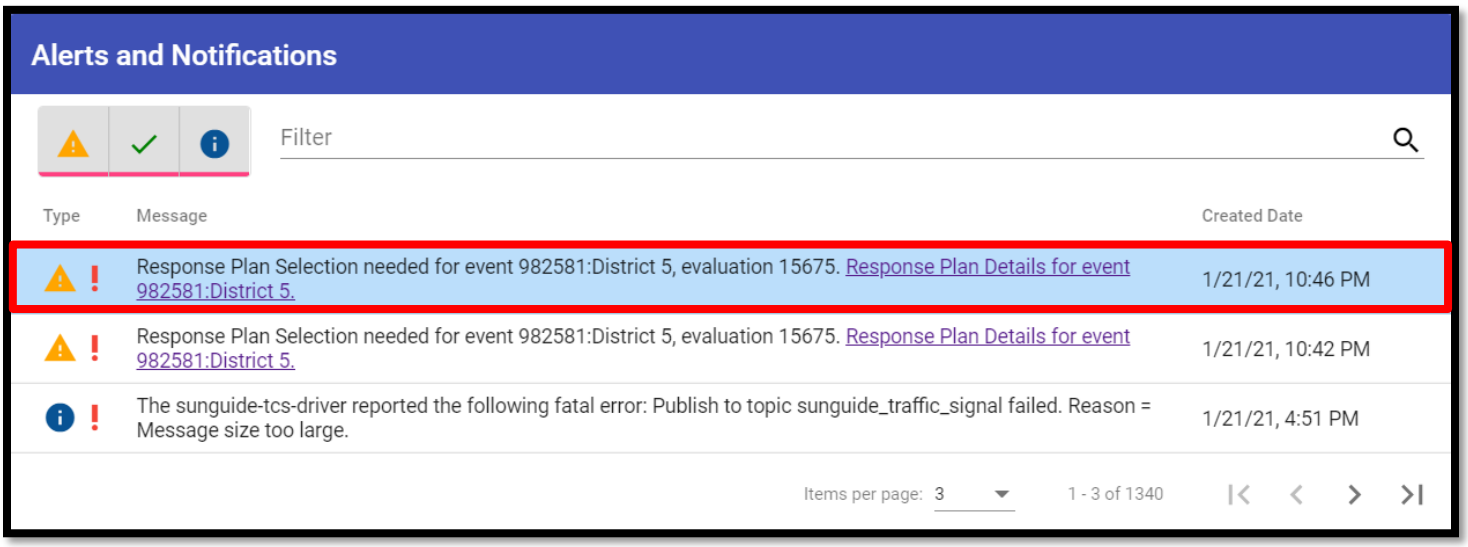
This will direct the user to a prefiltered Event List containing only events with active Response Plan Evaluations.



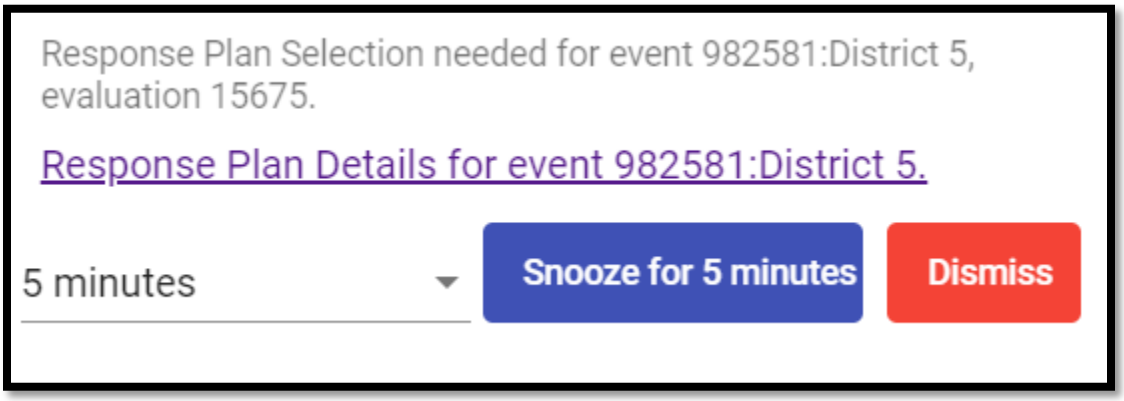
ID	Status	Event Type	Severity	Location	Direction	Start Date/Time	End Date/Time	Owner	Diversion Route Status
982581	Active	Abandoned Vehicle	Minor	I-4	Westbound	11/23/20, 8:52 PM		KRSWRDA	Awaiting Device Approval (Active)
982580	Active	Abandoned Vehicle	Minor	I-4	Westbound	11/19/20, 11:55 AM		KRSWRDA	Awaiting Device Approval

The **Diversion Route Status** column displays the stage of each event's response plan evaluation. Events that have already been through Response Plan Selection process and have an active Response Plan will be denoted with "**(Active)**" at the end of their current re-evaluated status.

Once a user selects an event, the **Diversion Route Details** button will be enabled. This button will direct you to the diversion route details of the selected event. Users can also view the diversion route details of an event through notifications. As a Response Plan evaluation transitions through different stages, it may result in the creation of notifications containing a link to the diversion route details.



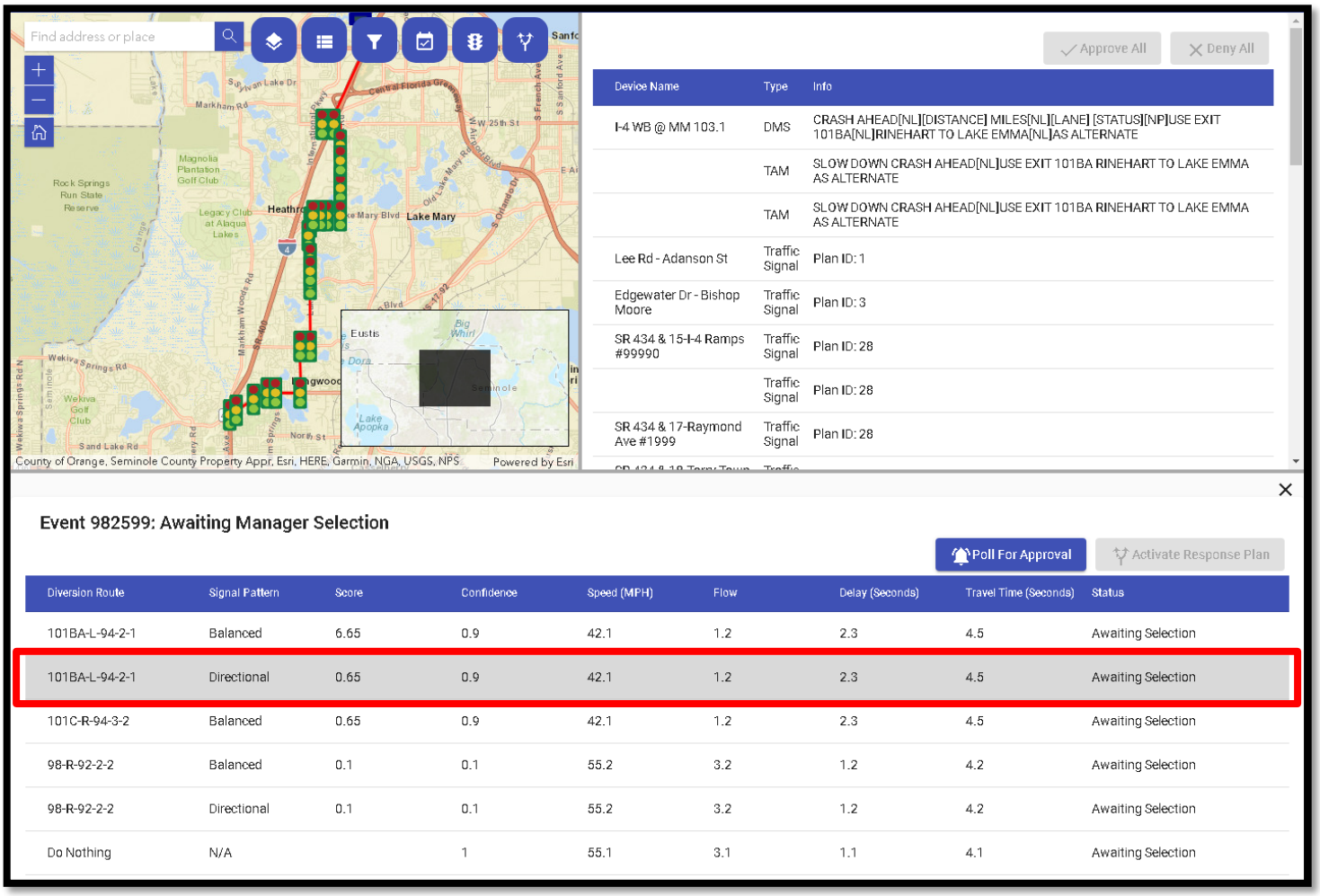
The notification highlighted above appeared in the **Alerts and Notifications** feed (see section 7.1) when the Response Plan Evaluation entered the "**Awaiting Manager Selection**" stage.



In addition to the entry in the notification feed, a popup notification will appear in the bottom right of the screen with similar information and link.

5.2.2 RPS Evaluation Details

Once a user clicks the **Diversion Route Details** button or any of the notification related links, they will be directed to the details page.



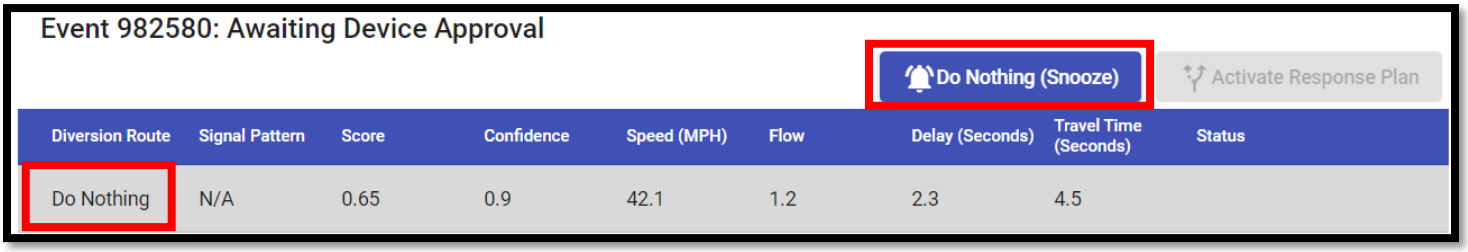
The details page has 3 different sections. The list of eligible diversion routes is located on the bottom half the screen. Selecting a row in the diversion route table will change what is displayed in the other two sections. The map is located in the top left hand of the screen. When a diversion route is selected, the map will display the route and its devices. The device table is located in the top right hand of the screen. When a diversion route is selected, this table will display the devices of the route.

5.2.2.1 Diversion Route Table

In the top left-hand side of the diversion route section is the title of the Response Plan Evaluation. The title contains the Id of the event followed by the current Evaluation Stage.

The diversion route table contains information about the route itself such as the name and the signal pattern that is used (columns 1 and 2). It also displays performance metrics for each diversion route calculated by the Simulation Engine (columns 3 - 8). The simulation results can help a user decide which diversion route may be the most efficient. The last column displays the status of the current diversion route. This status is based on the stage of the evaluation and whether the diversion route has been selected for device approval. In the image above, the title states that the evaluation is "**Awaiting Manager Selection**", therefore all routes have a status of "**Awaiting Selection**".

The top right hand of the diversion route section contains the "**Poll For Approval**" and "**Activate Response Plan**" buttons. The availability of these actions is determined by the stage of the evaluation and what row is selected in the table.

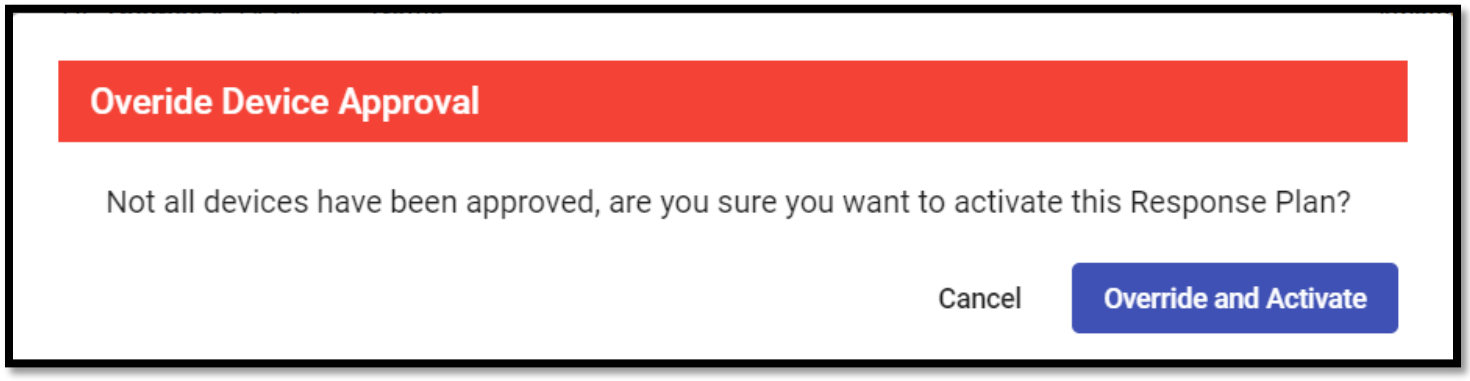


The action and text of the buttons can even change in some scenarios. When the "**Do Nothing**" route is selected, the "**Poll For Approval**" button changes to "**Do Nothing (Snooze)**". The "**Do Nothing**" plan ends the current evaluation and takes no further response plan action for now.

Once a user picks a diversion route, they can select the route's row and click the "**Poll For Approval**" button. This action transitions the evaluation and the selected diversion route's stage to "Awaiting Device Approval". The routes that were not selected will now display blank statuses.

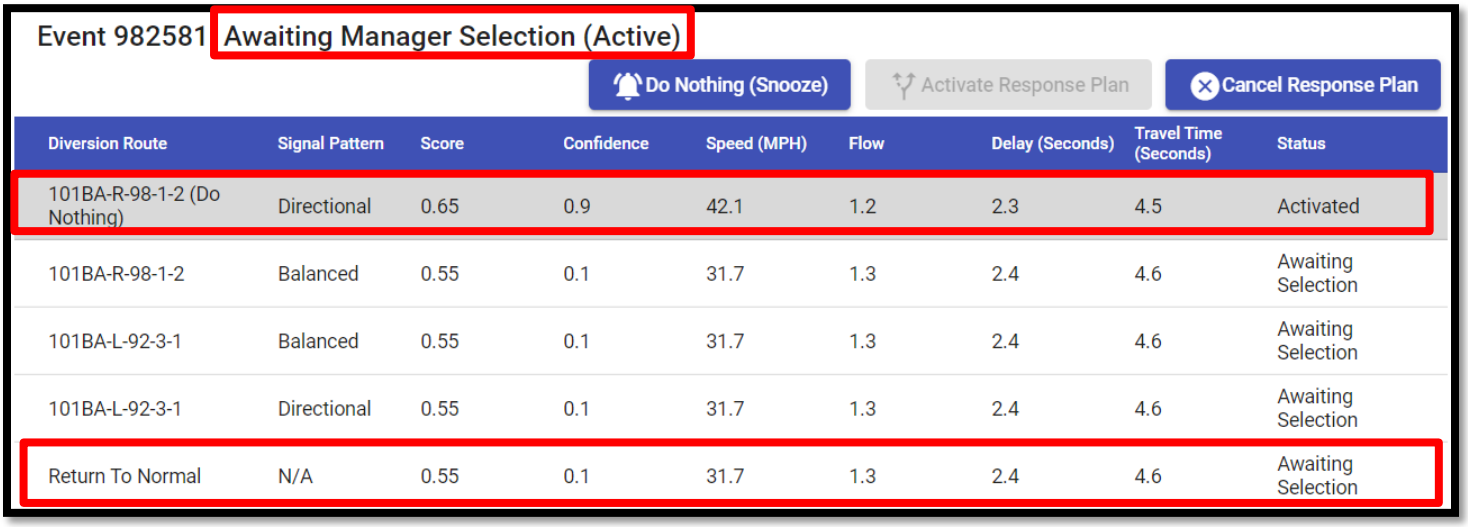
This action also changes the state of the two buttons. The "**Poll For Approval**" button is disable because the selected route has already been selected for device approval. However, if a user decides to select a different route for device approval, they can simply select a different row and the button will be enabled again.

At this point, if the user still has the designated diversion route selected in the table, the "**Activate Response Plan**" button will be enabled. However, if not all devices have been approved, this will trigger a warning message.



If a user chose to continue, the remaining approvals will be overwritten, and the response plan will be sent to SunGuide for activation.

Once a route has been selected for activation, the associated event can be reevaluated. Evaluations for an event with an active plan have a few different features.



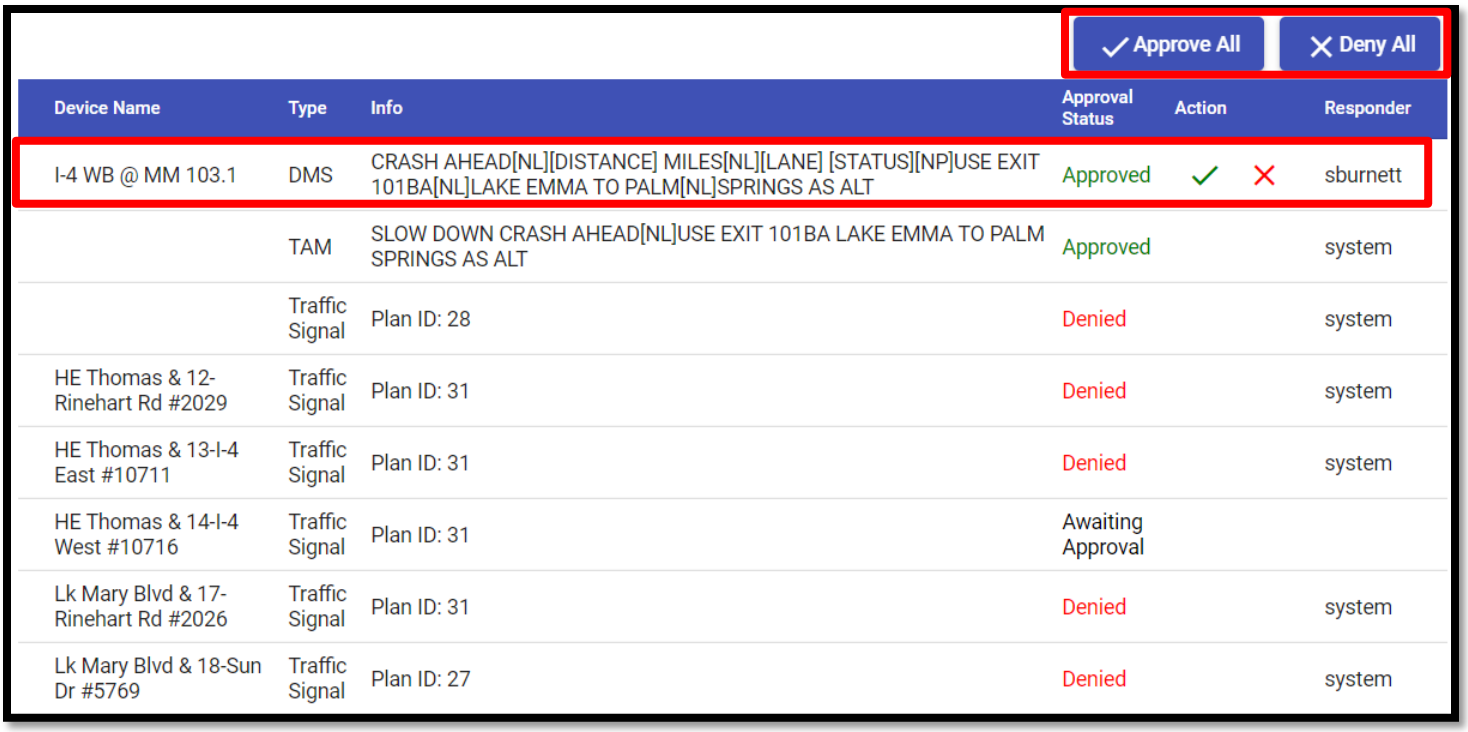
The title of this new evaluation will now be denoted with "**(Active)**" at the end of the status. The diversion route table is now populated with the activated route of the previous evaluation. The activated route's name ends with "**(Do Nothing)**" and the status of the route is "**Activated**". If this row is chosen, it will have the same effect of the "**Do Nothing"** plan described above.

The table is also populated with the "**Return To Normal**" plan. If this plan is selected, it will cancel the event's active R-ICMS response plan.

To proceed with the "**Return To Normal**" plan, select the plan's row and click the "**Deactivate Response Plan**" button or click the "**Cancel Response Plan**" button at any time.

5.2.2.2 Device Table

The device table display the devices of the currently selected diversion route row.



The table contains information about the device as well as the approval information. A green check and red X will appear in the "**Action**" column for rows the user has permission to. In the above image, the user only has device permissions for the first device in the table. If the user clicks on the green check button, the "**Approval Status**" will change to a green "**Approved**" and their username will appear in the "**Responder**" column. If the user clicks on the red X button, the "**Approval Status**" will change to a red "**Denied**".

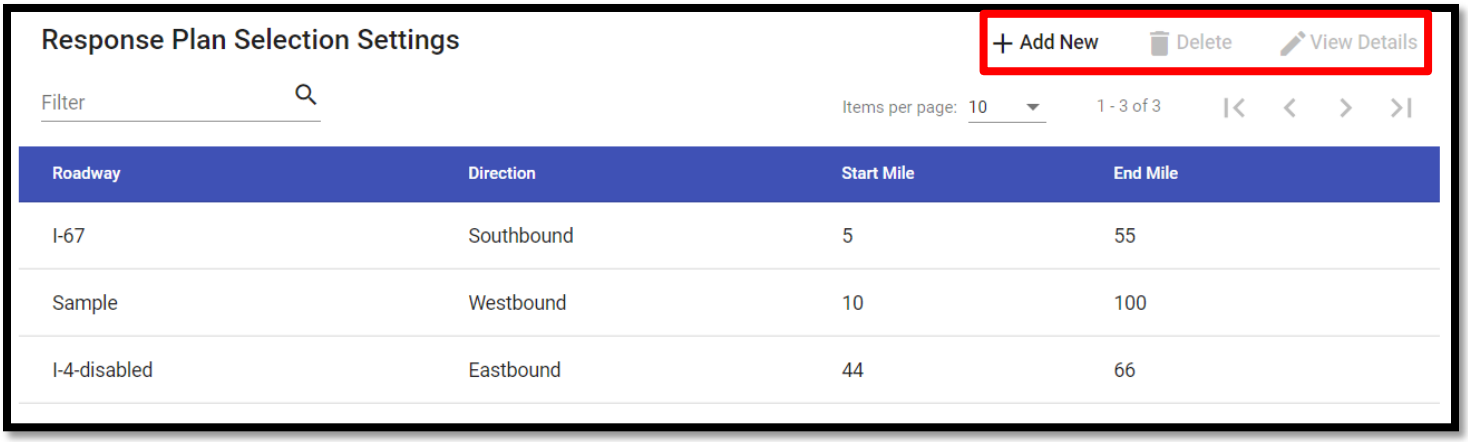
When device approval actions are available, some of the device row's "**Responder**" column will have a value of "**system**". These devices were auto approved/denied based on approval profiles. Approval profiles are explained more in depth in the Admin section.

The "**Approve All**" and "**Deny All**" buttons will approve/deny all the devices the user has permission to. As stated above, the approve/deny actions (green check and red X) only appear for devices the user has permission. In the above image/scenario, the "**Approve All**" and "**Deny All**" buttons would only affect the first row.

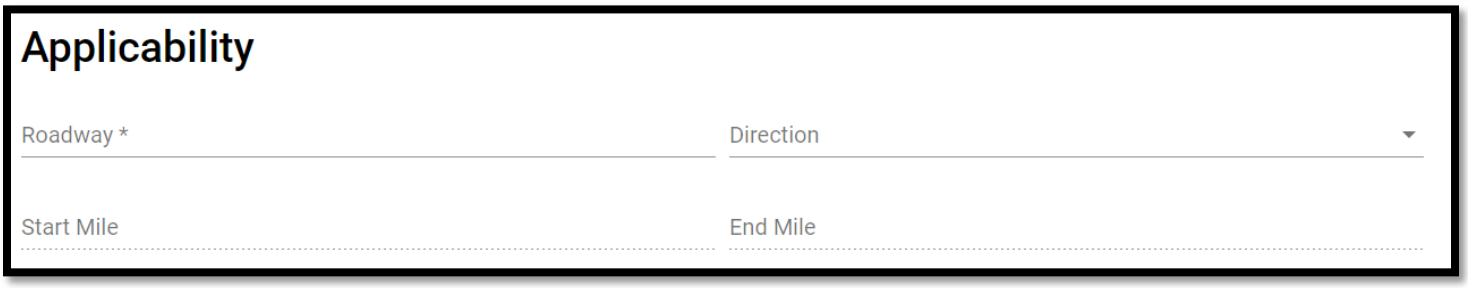
Once all device approval responses have been received, the manager will be notified through the notification service to take further action.

5.3 Settings

Response Plan Selection Settings affect the eligibility criteria for events and response plans. To access the list of current settings, click on the "**Settings**" option in the "**RPS**" dropdown.



On this page, you can choose to add a new setting, delete an existing setting, or edit an existing setting. The "**Delete**" and "**View Details**" buttons become enabled once a row is selected. When a user clicks the "**Add New**" or "**View Details**" button, it will pop up the RPS Settings form. This form is broken up into 4 groups containing several fields that affect the response plan selection process. All fields are required, excluding some fields within the "**Applicability**" section.

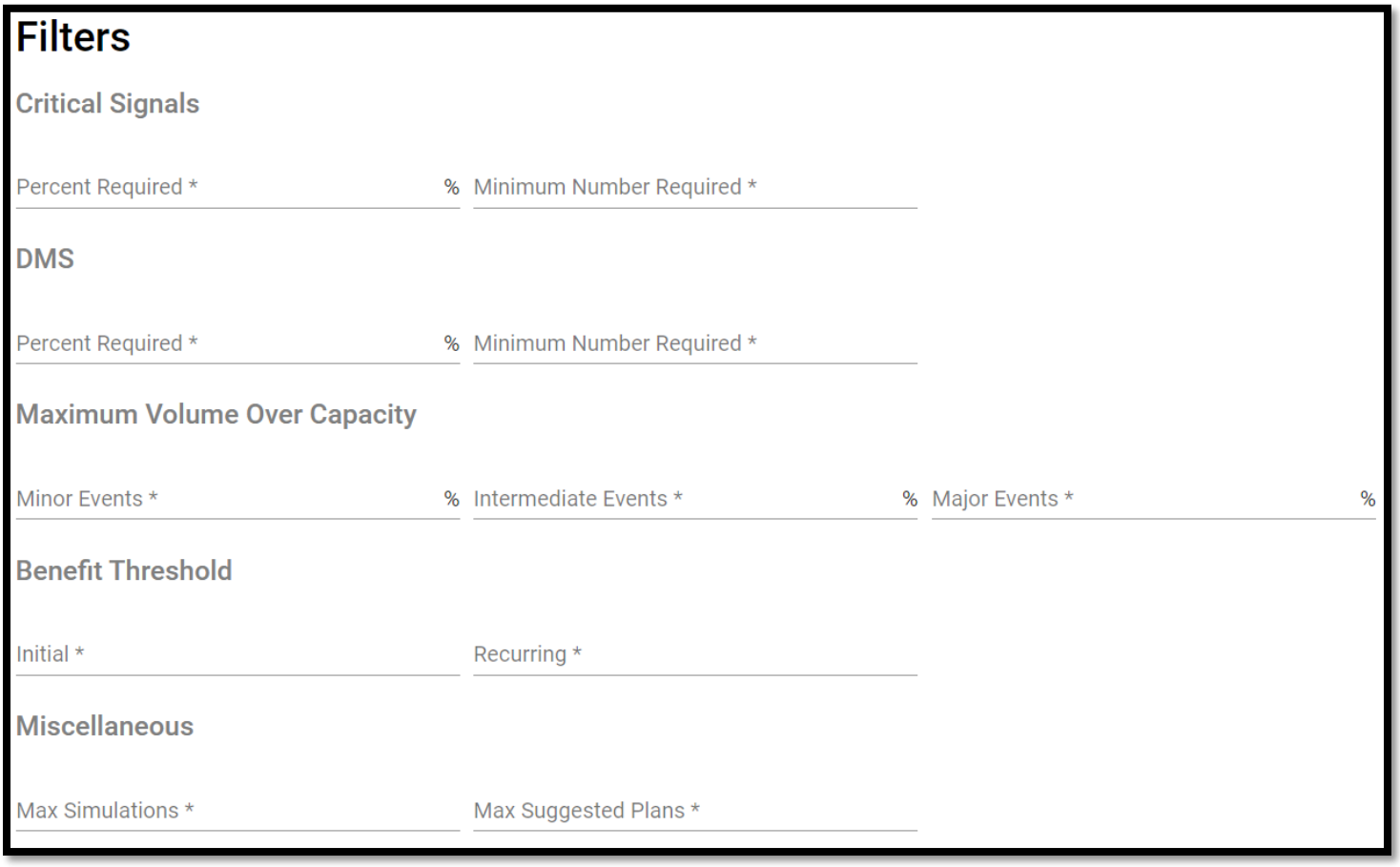


The "**Applicability**" section is used for determining what events the settings apply to. If an event's location occurs within the boundaries defined in this section, the event's response plan evaluation uses this setting.

- Roadway – The roadway this setting applies to. This is the only required field of this section.
- Direction – The direction of the roadway this setting applies to.
- Start Mile – The start mile of the roadway this setting applies to. If this field is used, "**End Mile**" is required.
- End Mile – The end mile of the roadway this setting applies to. If this field is used, "**Start Mile**" is required.

The "**Queue Thresholds**" section is used to determined what is considered congestion for a roadway. If an event's congestion does not meet these properties, the event will not be considered for response plan evaluation.

- Congestion Speed (MPH) – The speed that is considered congested for the configured roadway.
- Congestion Speed Relative to Historical Norm – The current speed compared to the historical norm used for determining congestion.
- Uncongested Buffer (Miles) – The length of non-congested links used to determine the end of the congestion queue. This helps determine the area that a response plan needs to route around.



The "**Filters**" section is used to determined what response plans are eligible. This section is broken up into 5 subsections.

- Critical Signals – Critical signal requirements for a response plan. Both requirements must be met.
    - Percent Required – The percent of the diversion route's Critical Signals required for it to be considered for evaluation.
    - Minimum Number Required – The minimum number of Critical Signals on a diversion route required for it to be considered for evaluation.
- DMS – DMS requirements for a response plan. Both requirements must be met.
    - Percent Required – The percent of the diversion route's DMS required for it to be considered for evaluation.
    - Minimum Number Required – The minimum number of DMS on a diversion route required for it to be considered for evaluation.
- Maximum Volume Over Capacity – The maximum volume over capacity thresholds for events with different severity. Volume over capacity (V/C) is the number of vehicles currently passing through a roadway/intersection

compared to the number of vehicles that could theoretically pass through when at capacity. If a diversion route's V/C exceeds these values, it is not considered for further evaluation.
    - Minor Events – The maximum volume over capacity threshold for severity 1 events.
    - Intermediate Events – The maximum volume over capacity threshold for severity 2 events.
    - Major Events – The maximum volume over capacity threshold for severity 3 events.
- Benefit Threshold – The simulated score thresholds for response plans.
    - Initial – The value that a simulated response plan score must meet or exceed during the initial evaluation.
    - Recurring – The value that a simulated response plan score must meet or exceed after the initial evaluation.
- Miscellaneous – Other response plan related filters.
    - Max Simulations – The maximum number if simulations the Simulation Engine will run.
    - Max Suggested Plans – The maximum number of suggested plans.

The "**Reevaluation Delays**" section is used to determine when an event should be reevaluated under different situations.

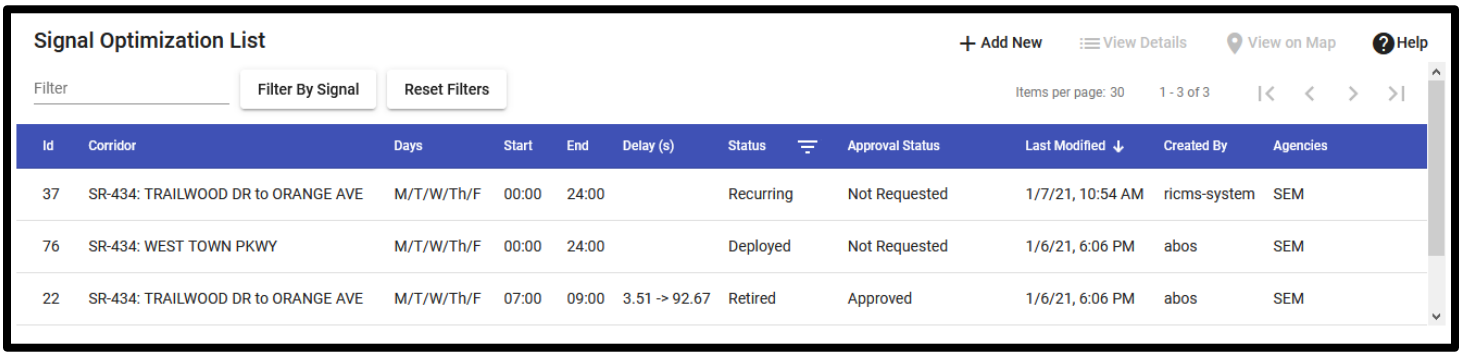
- No Suggested Plan – The reevaluation time in minutes when no plan was selected.
- Suggested But Not Activated Plan - The reevaluation time in minutes when a plan was selected but not activated.
- Activated Plan - The reevaluation time in minutes when a plan was activated.

6 Signal Optimization Tool

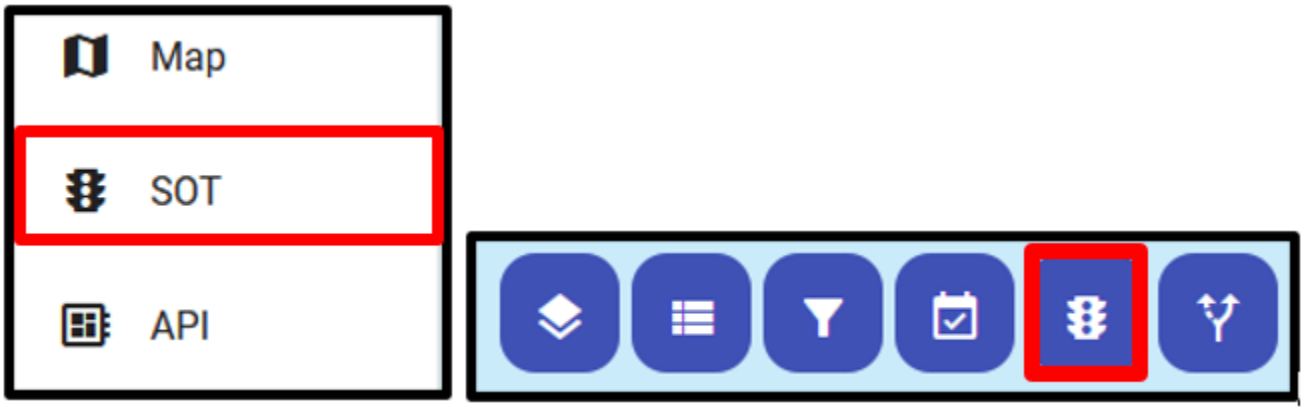
The SOT tool is designed to allow users to optimize one or more traffic signals along a corridor using up to date information including intersection geometry and turning movement counts. This will help users determine if/when traffic signal timing plans need to be updated and will provide simulated data showing the expected outcome of implementing timing plan changes. A SOT corridor includes one or more traffic signals scheduled to operate specific timing patterns or modes on coordinated days and times. SOT users may create, clone, optimize, modify, simulate, approve, sign, deploy, retire, and archive corridors. The SOT list shows general information for all corridor configurations in any stage of their life cycle.

6.1 SOT List

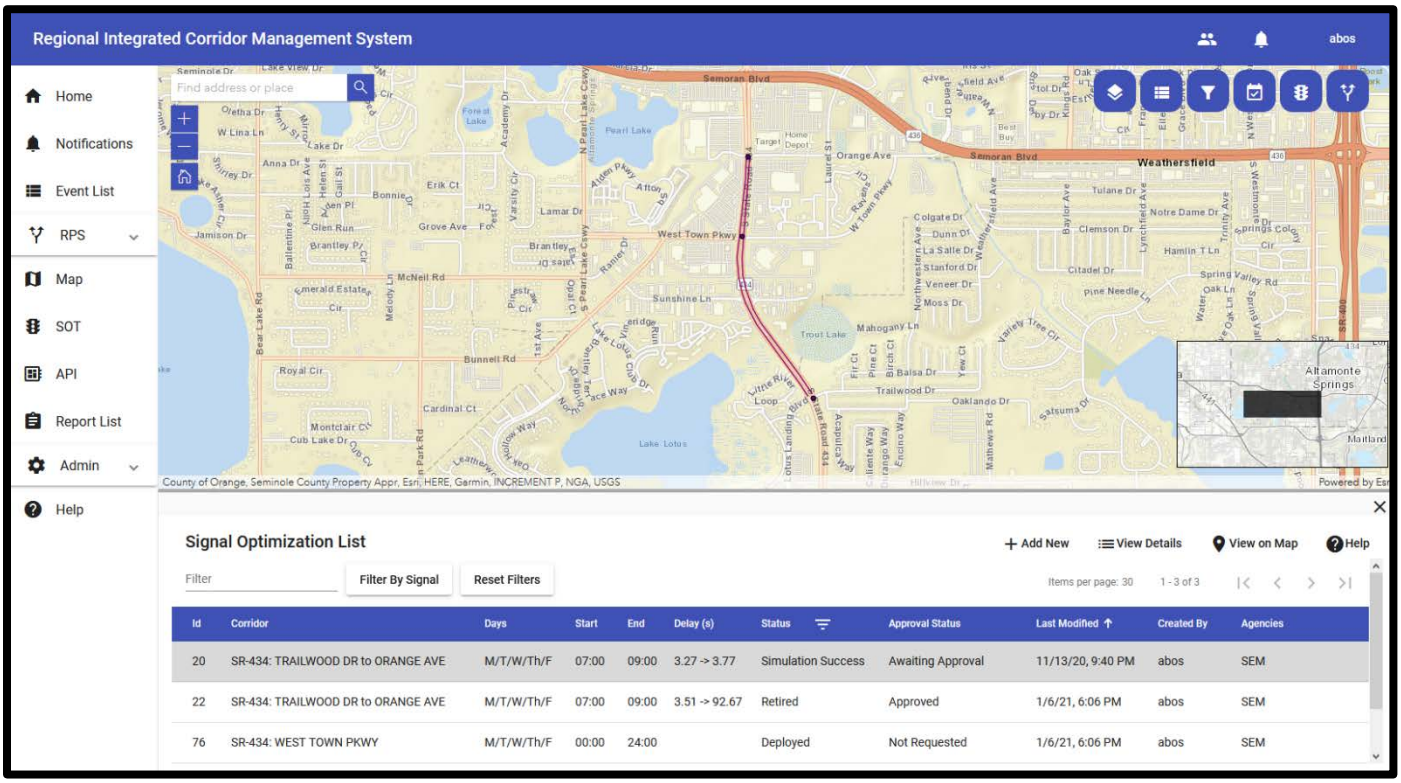
An SOT corridor includes one or more traffic signals scheduled to operate specific timing patterns or modes on coordinated days and times. The SOT list shows general information for all corridor configurations in any stage of their life cycle. The SOT list receives live updates, so data rows may change dynamically while the view is displayed.



The SOT list page may be viewed full screen by clicking the SOT button in the main navigation menu, or alongside the map by clicking the SOT map button, both of which use traffic signal shaped icons as shown below.

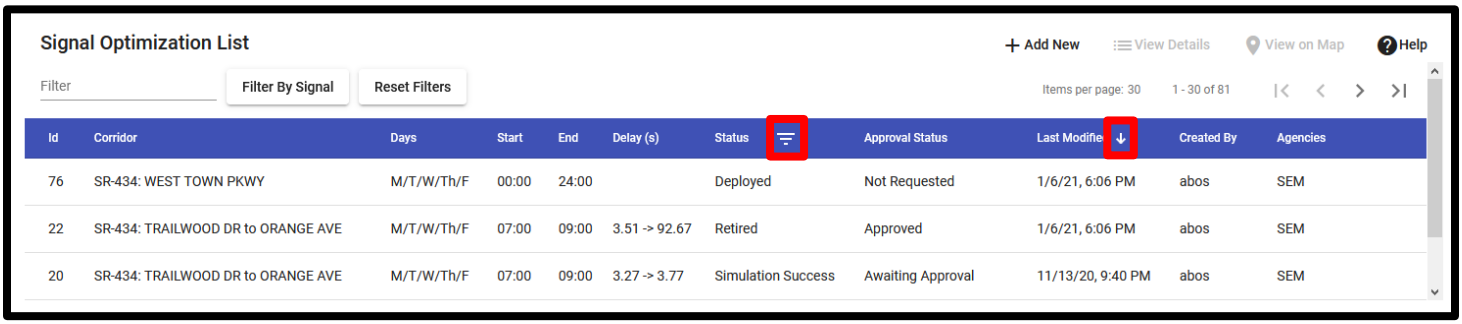


Selecting a SOT list item and using the “View on Map” button, or simply changing the list selection in the map view, zooms the map view to the selected corridor.

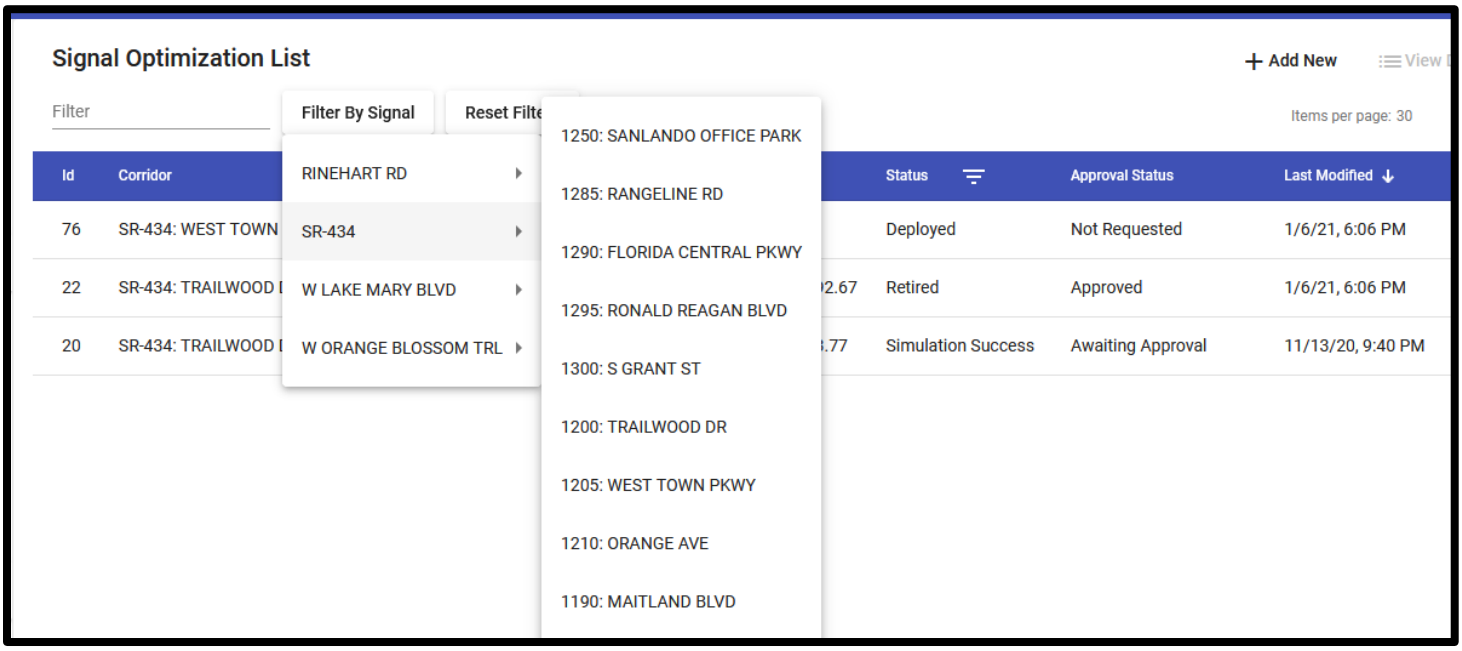


Double-clicking a row or using the “View Details” button on a selected row switches to the corridor details view. Using the “Add New” button redirects to the detail view for a new corridor configuration. Detailed configuration is described in the Signal Optimization Tool section.

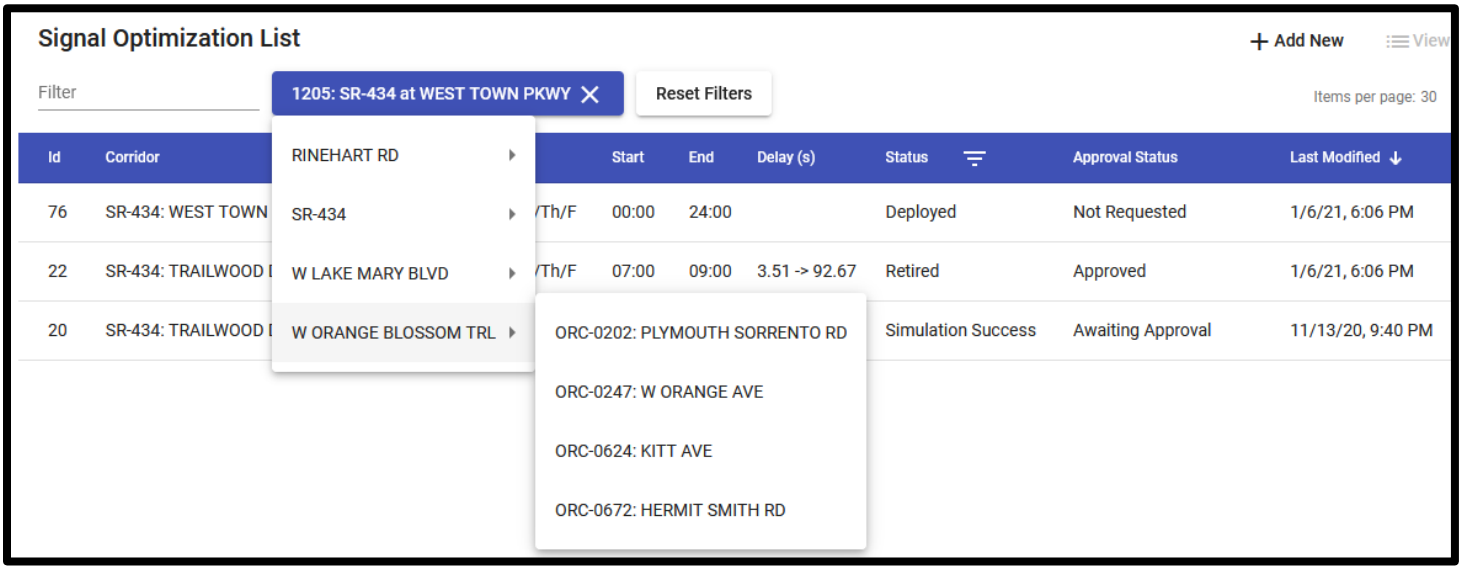
Hovering over column headers in the SOT list shows filter and sort options. Columns with enabled filters and sorts will have solid display of the filter and/or sort icons, as highlighted in the image below. By default, the SOT list filters out corridors with a status of “Archived” and sorts by “Last Modified” date in reverse order to show the most recently updated items on top.



In addition to the table column filters, the SOT list may also be filtered for corridors containing a specific signal using the “Filter By Signal” button, then select the main roadway, then select the signal id and cross street.



When a signal filter is enabled, click the "X" to disable, or click on the signal name to change the filter. The text input filter adjacent to it matches all fields in the table with the user inputted value.



6.2 SOT Life Cycle

A typical SOT corridor life cycle:

- Create/clone a new configuration
  - Set roadway and signals
  - Set schedule for timing patterns

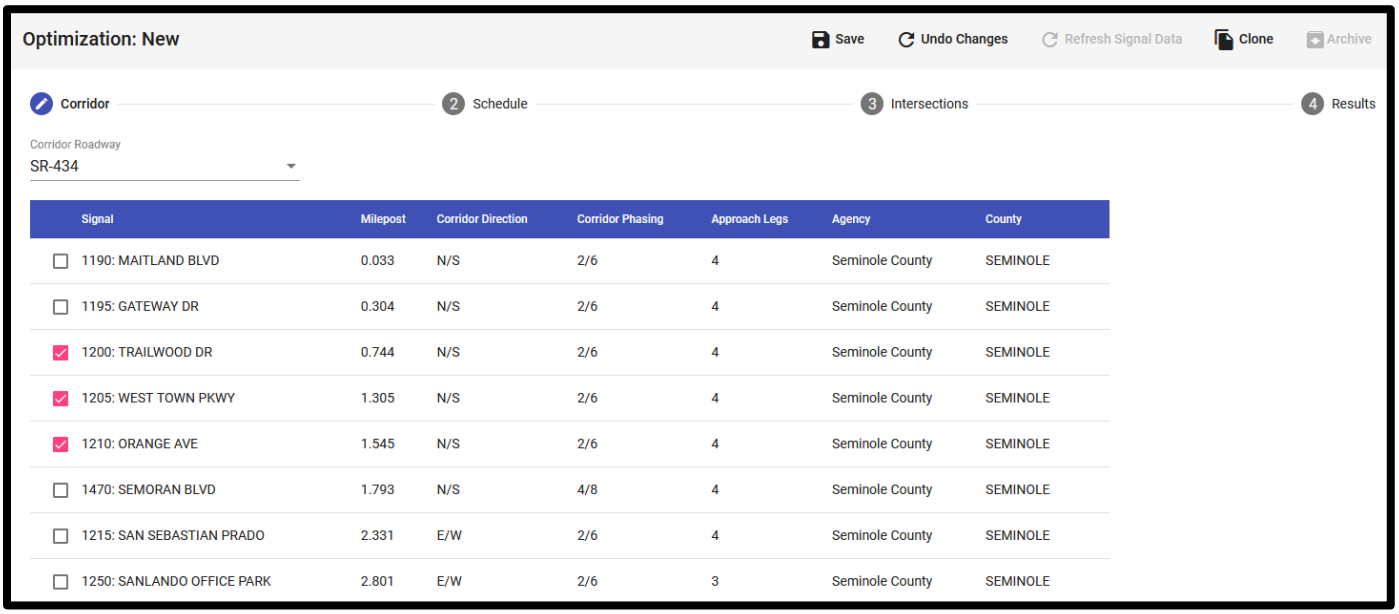
    - Set historical traffic date range and settings for optimization
    - Set initial intersection and timing pattern settings
- Optimize timing patterns and simulate corridor
- Optional, export data into Synchro/TruTraffic for analysis
- Optional, modify splits and/or offsets, re-run simulation
- Request agency review and approval to deploy in-field
- Signal agency approvals granted
- Download signal timing plan set
- In-field deployment, this is done outside the R-ICMS in a signal ATMS or on signal controllers
    - Optional, modify splits and/or offsets to match in-field tweaks
    - Optional, add or modify signal and corridor comments
- Upload signed signal timing plan set
- Mark corridor as deployed
- Clone corridor, configure monthly recurring optimizations using the previous month of traffic data
- Retire original corridor when a recurring monthly optimization is reviewed and approved
- Archive original corridor to remove it from SOT list default view

The remainder of this section will focus on SOT corridor configuration details and the workflow required to implement the typical corridor life cycle. A new corridor configuration may be started using the SOT list “Add New” button, or by using the “Clone” button on viewing an existing corridor.

6.3 Step 1: Corridor

The first step in corridor configuration is to select a main roadway and contiguous set of traffic signals as shown below. When selecting a set of signals:

- Select the first signal for the corridor.
- For a multi-intersection corridor, select the last intersection for the corridor. All signals between will be automatically included.
- The following rules are enforced per limitations of HCS7 Streets:
    - Corridor Phasing for all signals must be 2/6
    - Corridor Direction for all signals must be the same
    - Signals with more than 4 approach legs not allowed
    - Signals with exclusive pedestrian restrictions may not be in multi-signal corridors

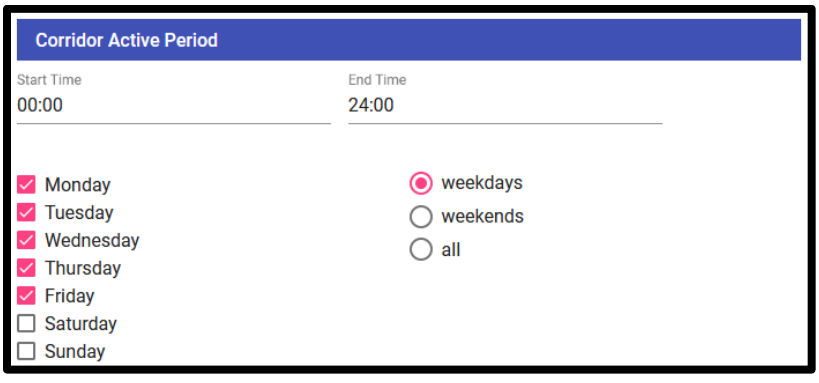


6.4 Step 2: Schedule

Corridor schedule configuration is broken into subsections, which are described in detail below.

6.4.1 Active Period

The Active Period configures the days of week and times of day the the user wishes to coordinate. Within the overall Active Period multiple timing patterns may be configured using the **Time of Day Schedule**.

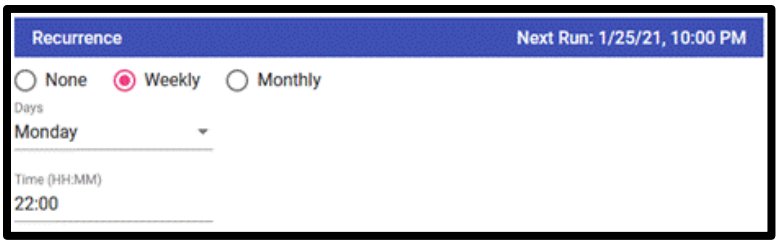


6.4.2 Recurrence

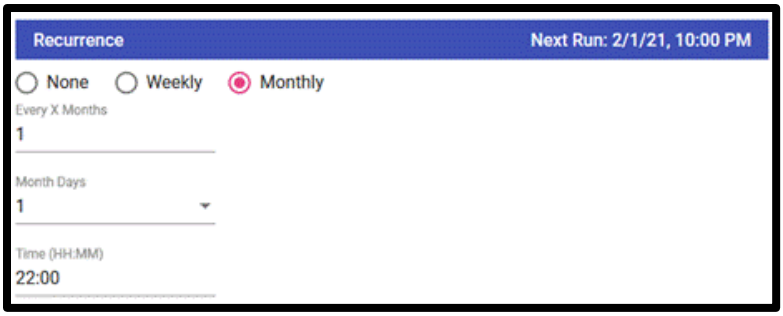
Recurrence settings allow SOT user to configure automatic re-optimization of a corridor on a periodic basis. Users should manually run optimizations and simulations to produce viable results before attempting to enable automated recurrence. For this reason, the default corridor configuration recurrence setting is “None”.

Once a corridor has been configured to produce viable results, recurrence may be configured on a weekly or monthly basis. On these days and times, a new corridor will be created as a clone of this configuration, then the optimization and simulation process will be started using data from the **Historical Traffic Period** and the cloned initial timing plans.

For weekly settings, one or more days of week and a time of day may be selected. Next Run information is displayed in relation to the current date and time.

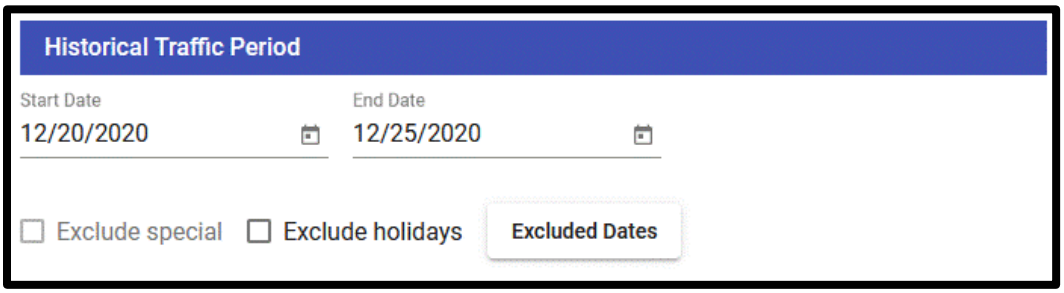


For monthly settings, set the gap between recurrences, e.g. “Every 1 months”; one or more days of month, e.g., “on the 1st and 15th”; and the time of day. Next Run information is displayed in relation to the current date and time.

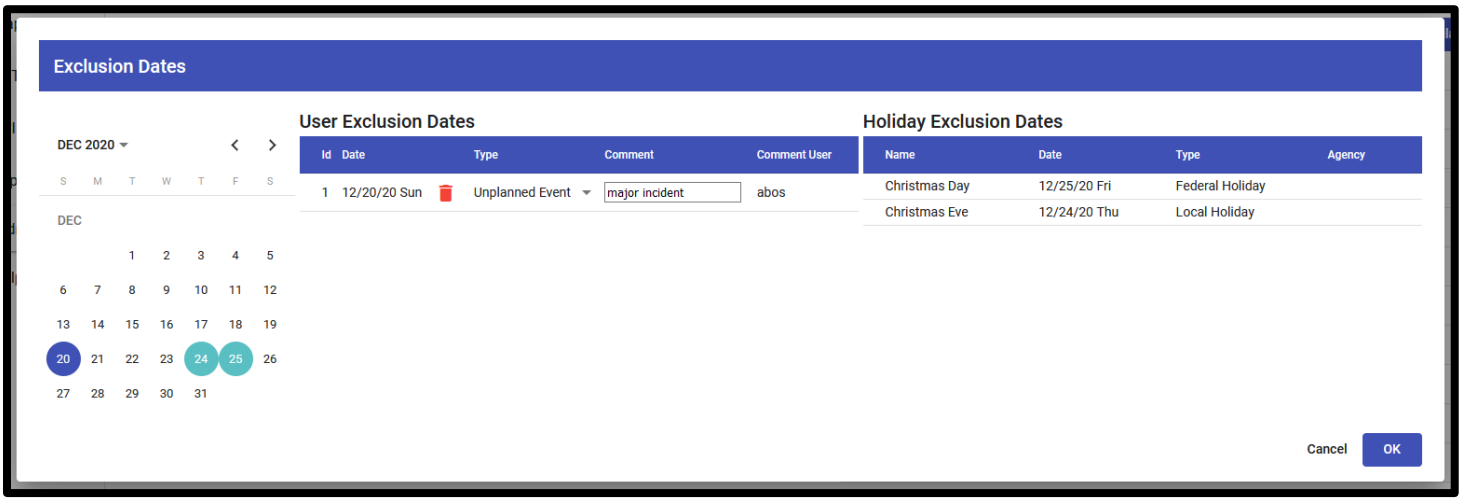


6.4.3 Historical Traffic Period

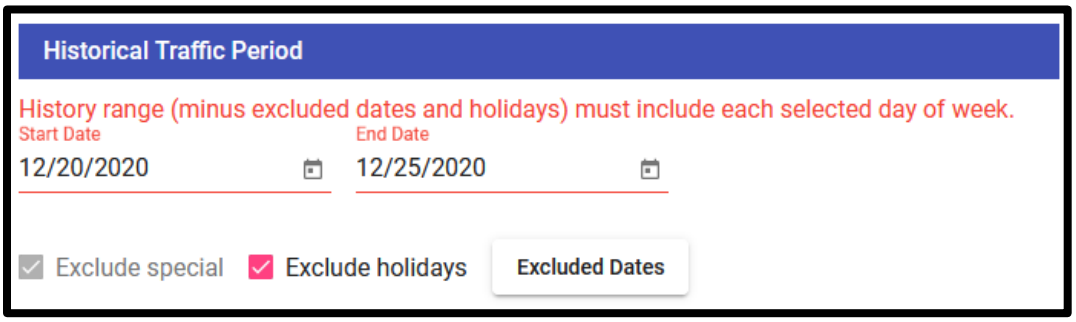
The Historical Traffic Period specifies a date range from which recorded intersection turn counts will be used optimize and simulate signal timing plans.



To exclude data from pre-configured holidays, enable the “Exclude holidays” option. To view the excluded holidays or add user specified exclusion dates, use the “Excluded Dates” button to launch the dialog shown below. Dates selected using the calendar date-picker will be added to the list of user exclusions, where a type and comment may optionally be added.



Each day of the week in the **Active Period** must be represented at least once in the date range. When exclusion dates prevent this, an error message is displayed. This can be resolved by expanding the date range or disabling the exclusion dates.

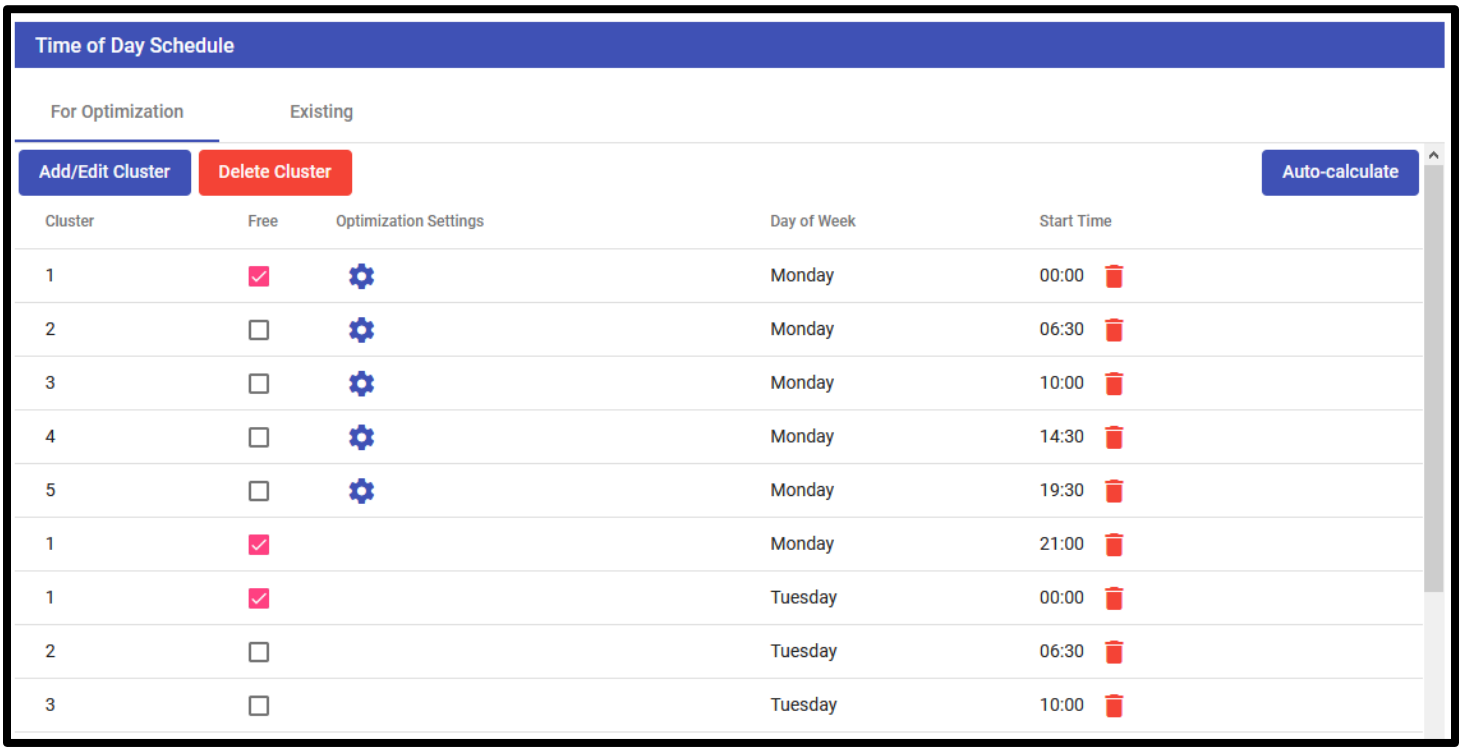


6.4.4 Time of Day Schedule

The Time of Day Schedule "For Optimization" tab sets scheduled days and times when a reusable timing-patterns should be activated for the corridor. The "Existing" tab shows day-plans currently programmed on each signal, including the actual timing pattern IDs. There are three main ways to set the schedule, which are described in the following sections: Manual, Copy Existing, and Auto-calculate.

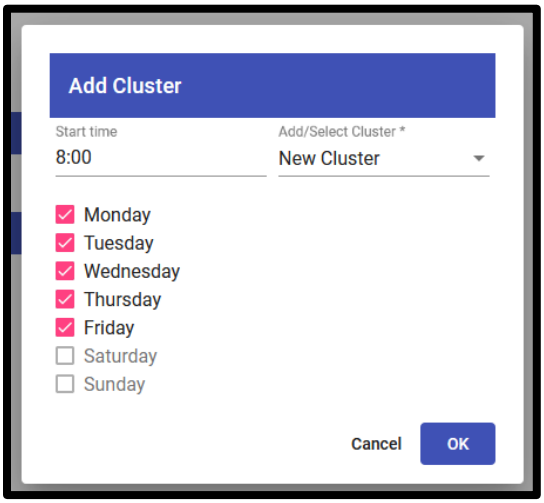
Schedules for optimization are broken into clusters of days and times, which represent hypothetical timing-patterns to be implemented on corridor signals. For example, cluster 2 timing pattern may be applied as pattern 2 on signal-A and pattern 14 on signal-B. Signals can also be scheduled to operate in a free (uncoordinated) mode during a time cluster. Typically, free mode occurs at the start and end of each day in a 24-hour corridor, which is represented by cluster 1. Clusters are automatically renumbered as the schedule is edited.

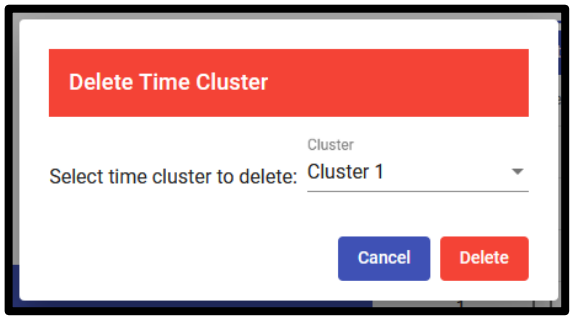
In the sample schedule below, there are four timing patterns repeating on weekdays at 6:30 am, 10 am, 2:30 pm, and 7:30pm. The signals operate in free mode from 9 pm until the following day at 6:30 am.



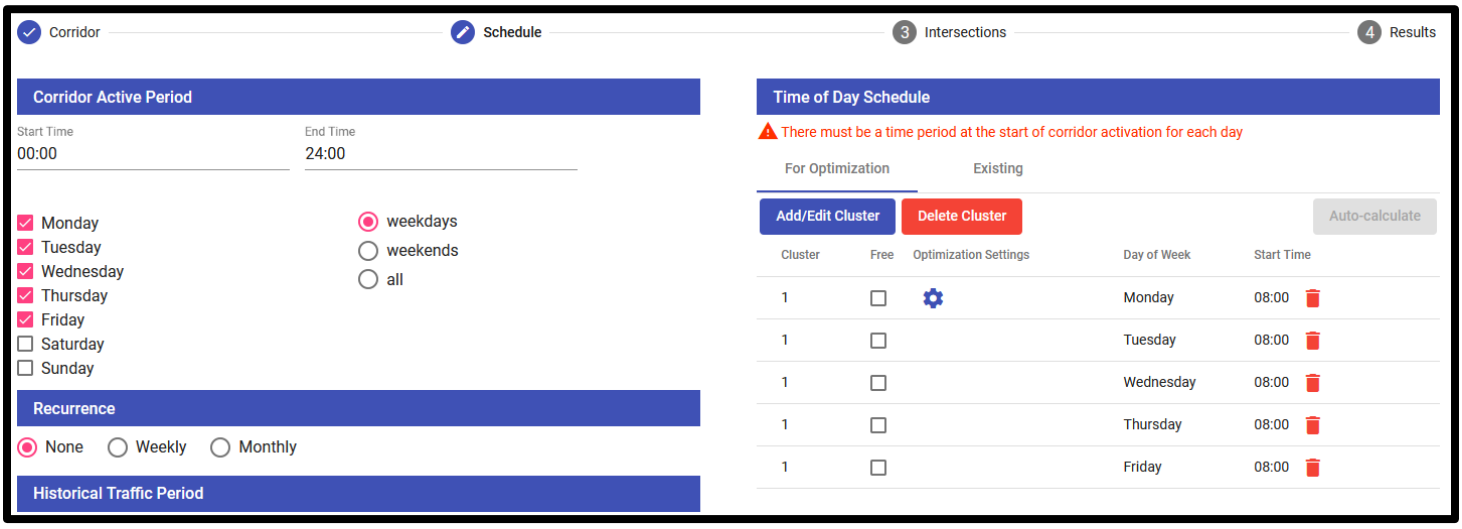
6.4.4.1 Manual

The day-plan schedule for a corridor may be created manually using the "Add/Edit Cluster" button. To add a cluster, select the days of week and start time, which will be added to the day-plan. To edit an existing cluster, do the same but also select a cluster to modify. Use the "Delete Cluster" button to completely remove a cluster from schedule. Individual time periods may be removed from a cluster using the trash-can icon button on any scheduled item.



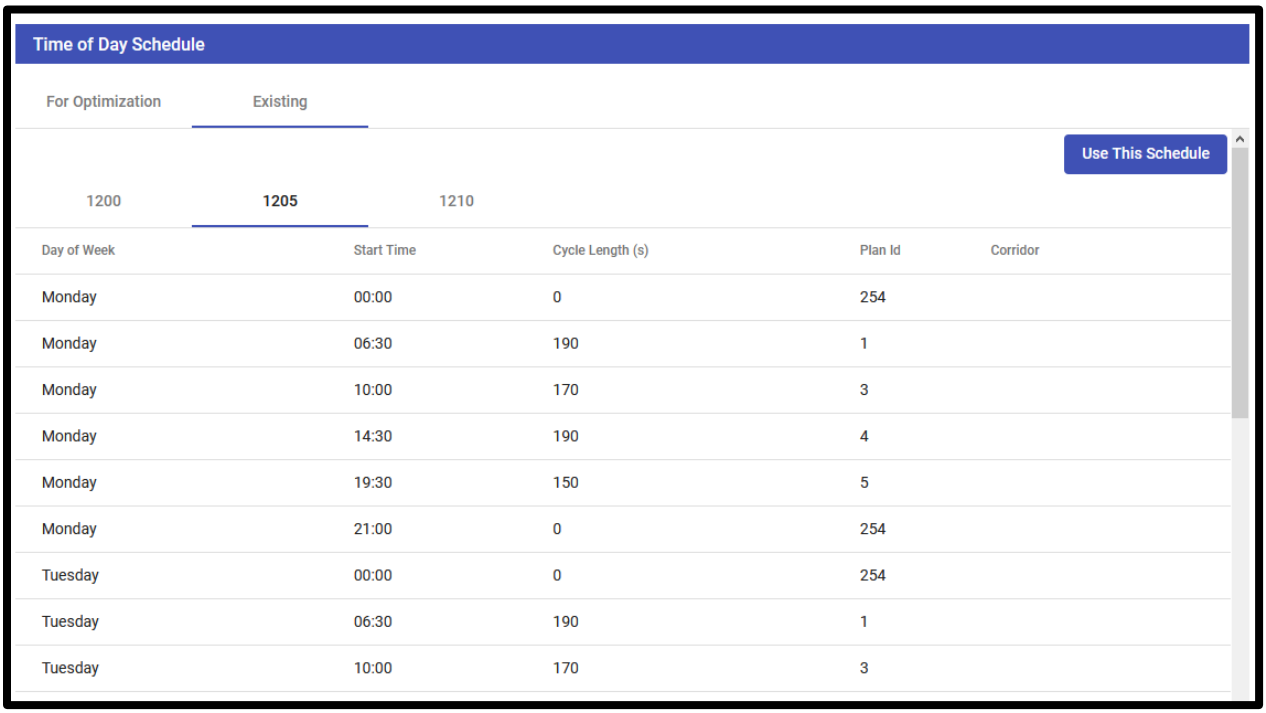


All time periods within the **Active Period** must be covered by the schedule, or the error message below is shown. End times are not entered, and each pattern is assumed to run until the next pattern for each day starts or the active period end time, whichever comes first.



6.4.4.2 Copy Existing

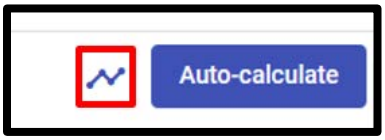
Day-plans currently programmed on corridor signals can be viewed on the "Existing" tab by selecting a signal sub-tab. You can pre-populate the corridor schedule for optimization with the "Use This Schedule" button to copy from any signal. After copying an existing schedule, it can be edited as described in the **Manual** section.

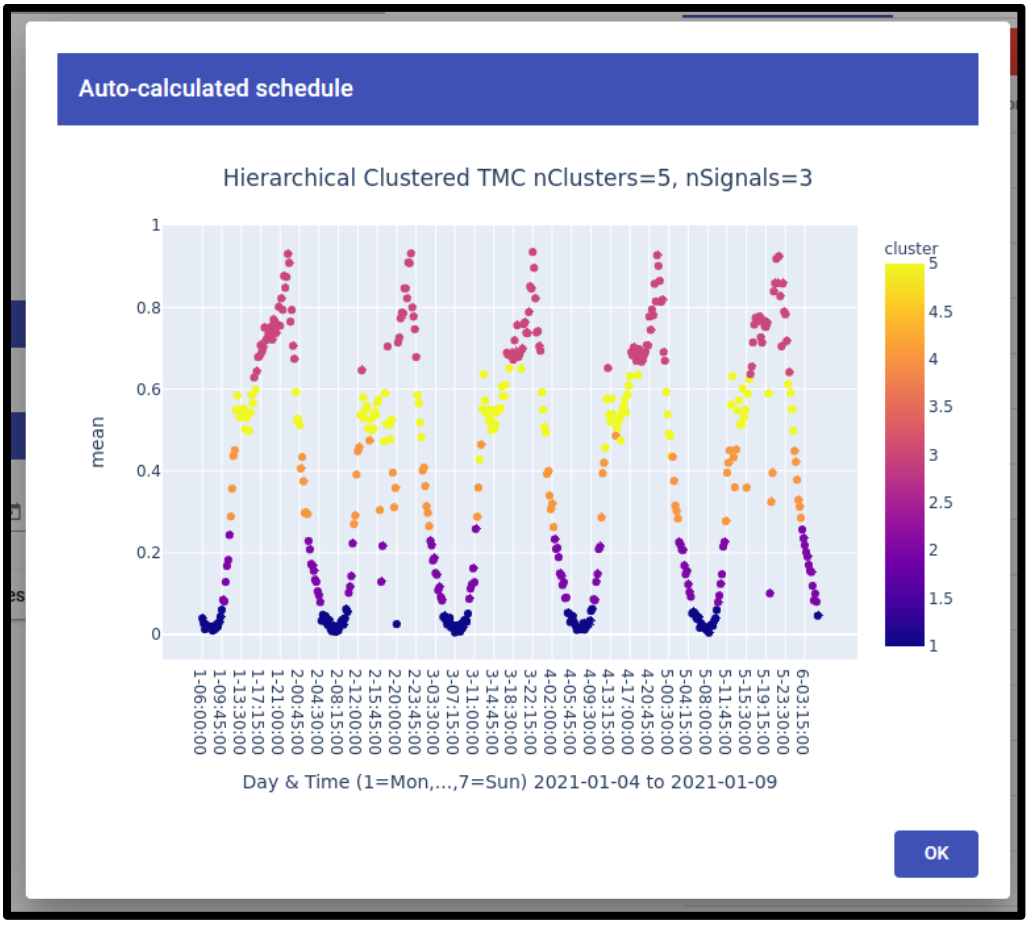


6.4.4.3 Auto-calculate

Valid **Historical Traffic Period** input dates are required to enable the "Auto-calculate" button on the Time of Day Schedule, which fetches the historical traffic data and clusters them to pre-populate the schedule for optimization. A loading spinner and information messages will be displayed while clustering of historical traffic data takes place, as this can be a long running operation, with longer runtimes for wider date ranges.

After auto-calculating, users are strongly encouraged to review and edit the schedule as described in the **Manual** section. This is a new feature that is intended to give a general idea of suggested similar traffic periods but is not guaranteed to generate viable schedules. The resulting schedule may have errors which must be corrected by users, especially if missing data prevents generation of a good schedule. After clustering is completed, the plot-icon button can be used to display a plot of the clustered results.



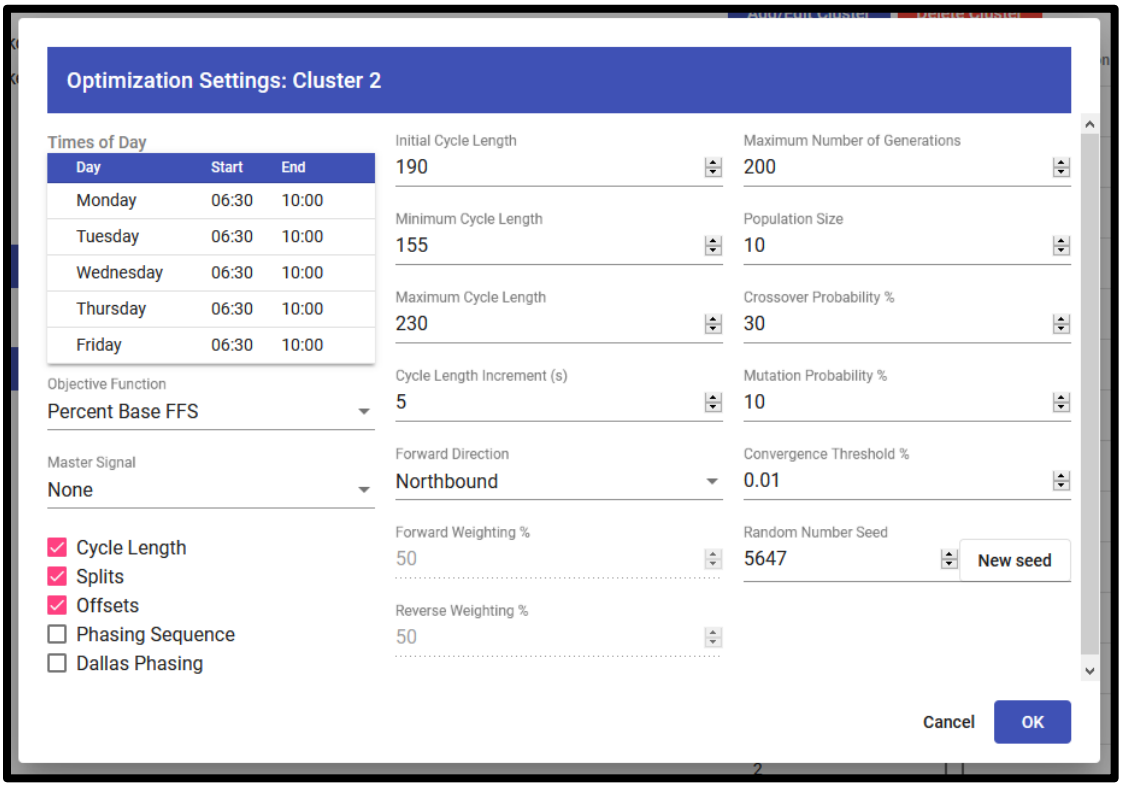


6.4.4.4 Optimization Settings

Optimization Settings are set using the gear-icon button associated with each scheduled cluster. For convenience, applicable days and times are displayed on the settings screen. When an existing schedule is copied, initial, minimum, and maximum cycle length values are initially populated using the average cycle length active on corridor signals during the appliable days and times +/- 20%. Otherwise, defaults are 120 seconds +/- 20%.

For more information on optimization settings, please refer to the HCS7 Streets 7.8.5 User Guide and see the **HCS7 Streets Restrictions** section. The PDF will be included in the application download. Running the optimization process,

described in section **Step 4: Results**, performs a multi-period optimization for each cluster using traffic data from the **Historical Traffic Period** to simulate queue build-up and dissipation.

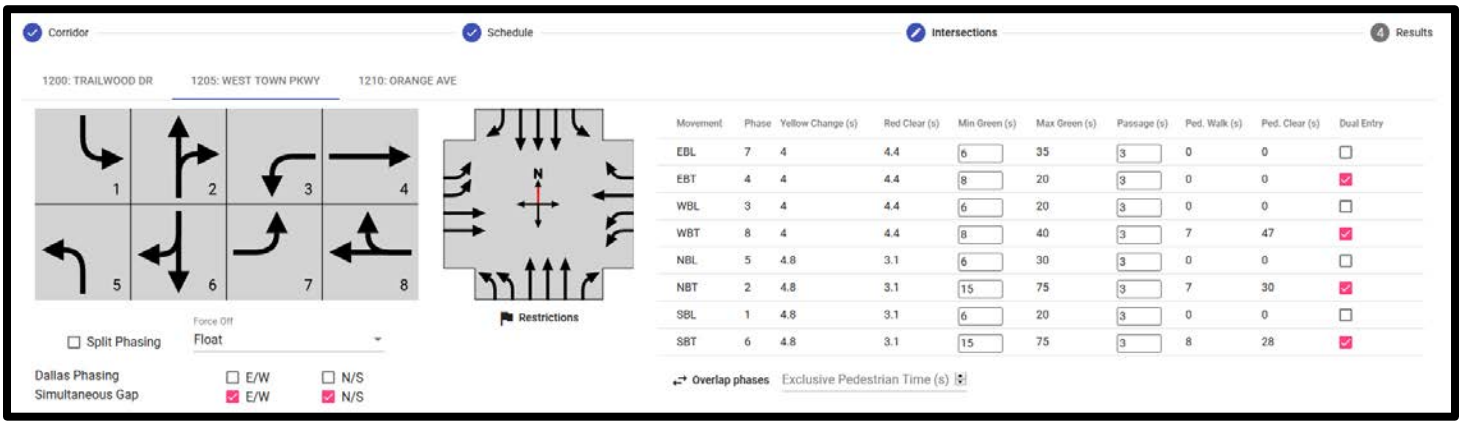


6.5 Step 3: Intersections

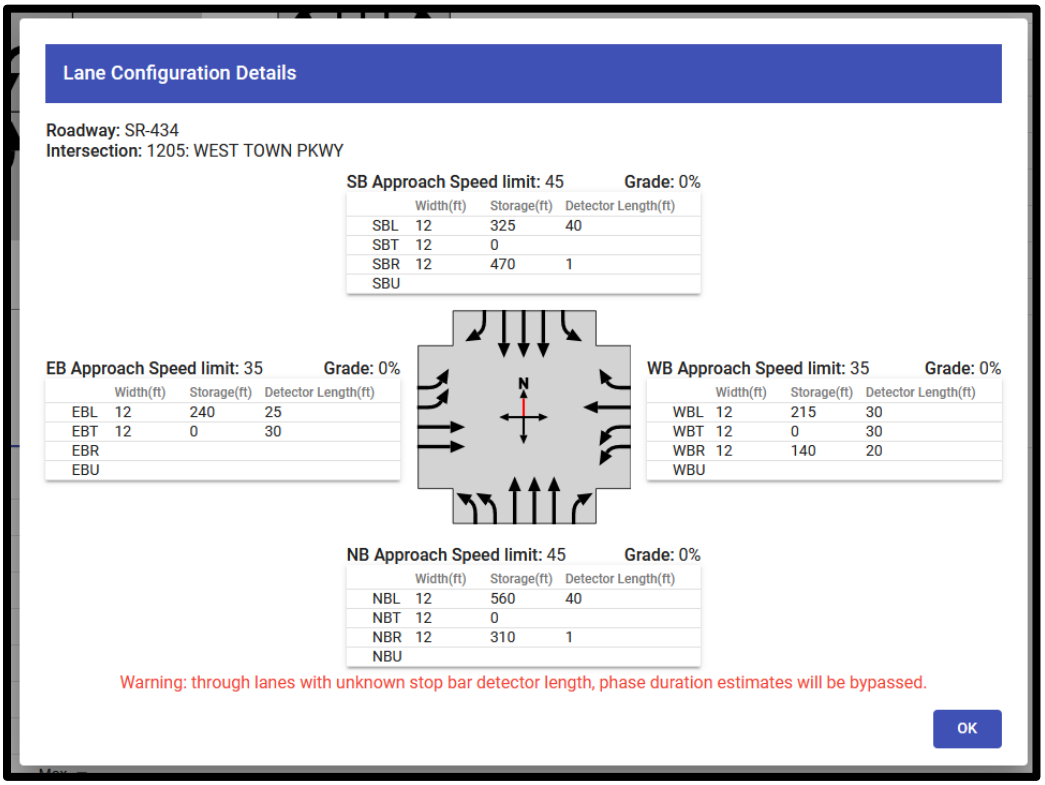
Intersection configurations include settings that apply to signals at all times of day and those that apply only during specific timing clusters or patterns.

6.5.1 Intersection Settings

Each corridor intersection has a tab for settings which do not change throughout the day. This includes basic signal timing parameters, such as minimum and maximum green, yellow change, and red clearance time. Initial values are populated by a combination of SunGuide signal timing pattern information (via TMDD signal vendor feeds) and default values.



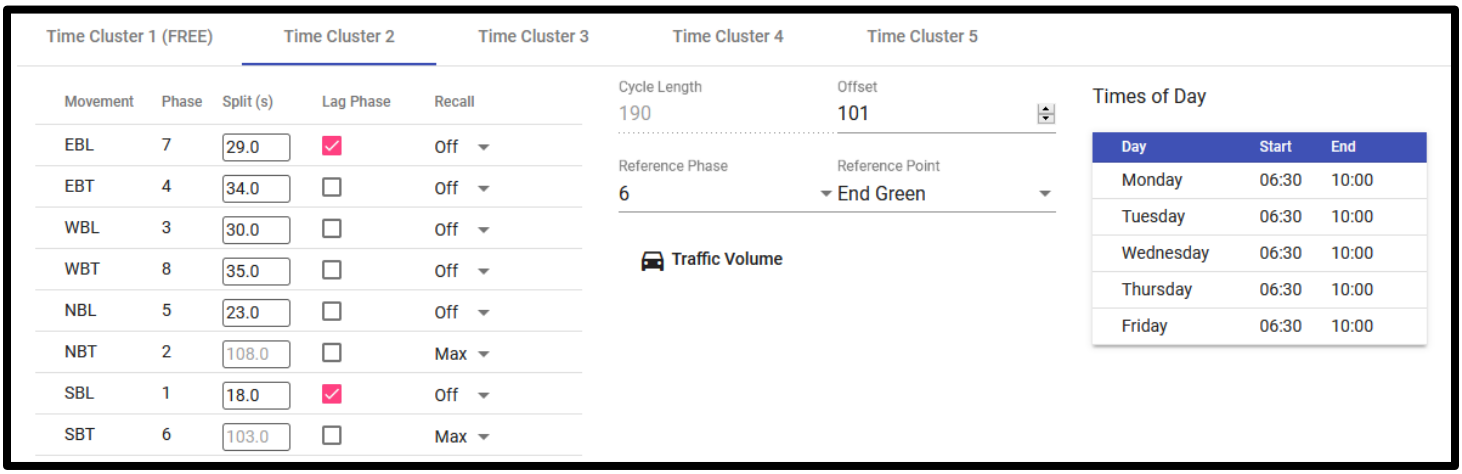
Clicking the lane diagram shows additional lane configuration details, which are used by the HCS7 Streets optimization process. Detailed dialogs for signal restrictions and overlap phases may be launched using their respective buttons. Restrictions and warning messages are described in detailed in section 6.6.2. Overlap phases are displayed as loaded from TMDD signal feeds.



6.5.2 Time Cluster Settings

Each corridor intersection has a set of time cluster tabs, which configure the options for specific timing patterns. Cluster numbers are analogous with hypothetical timing pattern numbers, but actual timing pattern numbers as deployed on signal controllers may differ. This tab shows the times of day when the pattern will be activated, the phase splits, lags, and recall, and the pattern cycle length and offset for a signal. Values shown here may be optimized using HCS7 Streets

back-end, after which the display values are updated to reflect optimization results. The Traffic Volume dialog is described in the next section.

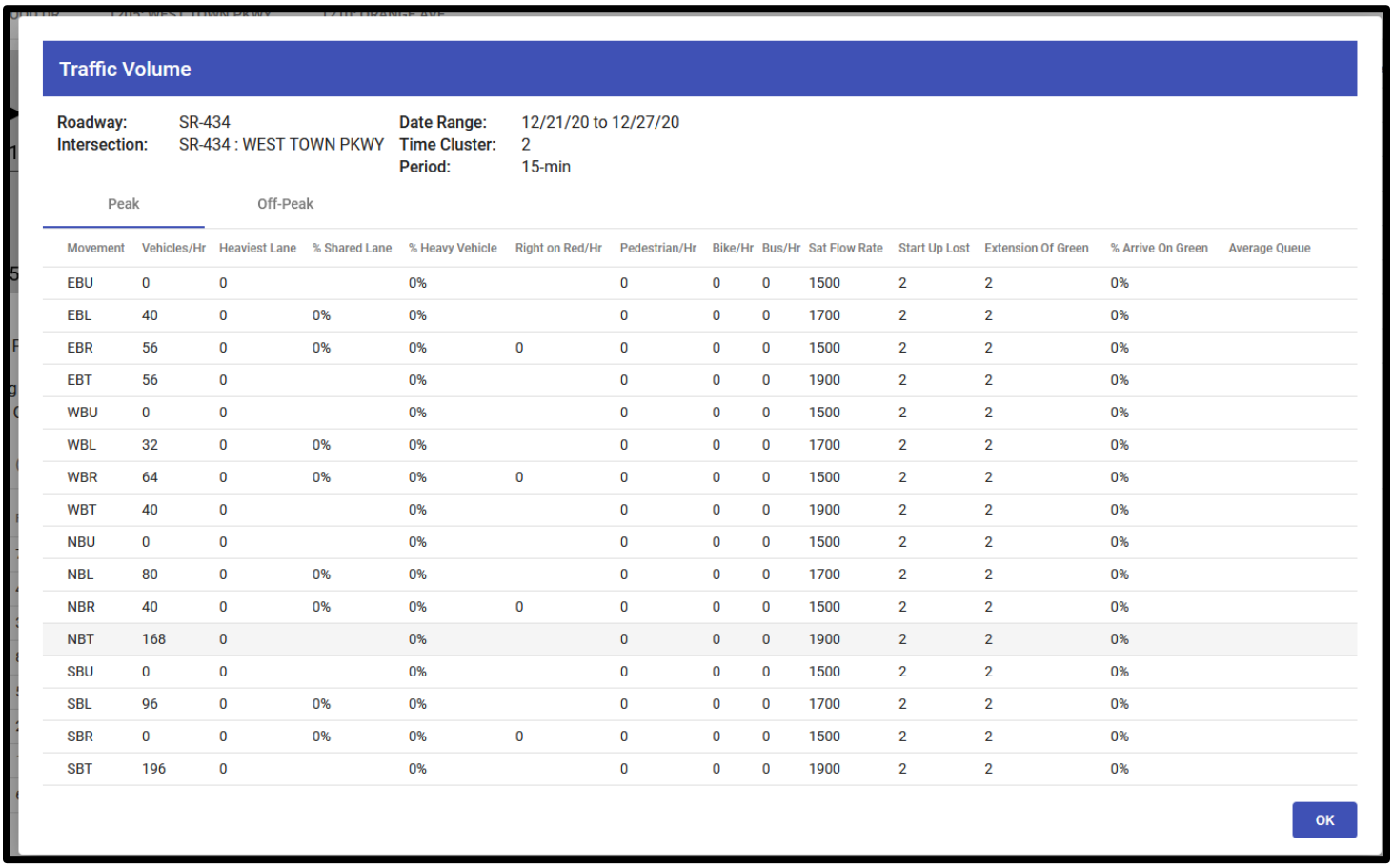


When a signal timing optimization does not converge, it may yield invalid phase splits with error messages in the UI. Users can correct these issues manually, but often is preferable change the optimization settings and re-run the optimization using the initial phase split input. The Refresh Signal Data button allows a user to re-fetch data on **Step 3: Intersections** to facilitate an iterative re-optimization.

6.5.3 Traffic Volume

The Traffic Volume dialog shows detailed turn movement counts for an intersection and time cluster. Turn movement counts for the **Historical Traffic Period** are aggregated in 15-minute intervals, and each time cluster has a peak interval identified as having the 80th percentile turn movement volume across all intersections. This dialog shows turn counts for the peak interval, and off-peak turn counts calculated using averages across non-peak intervals. To account for unserved queue build-up and dissipation, HCS7 Streets optimizations triggered by SOT perform a three-period analysis using off-peak, peak, off-peak turn counts; see the HCS7 Streets User Guide for more information on multi-period analysis.

Currently, vehicles per hour and percent share lane are collected from a real-time data source. Everything else is defaulted to a value recommended by the district.



Traffic Volume

Roadway: SR-434 **Date Range:** 12/21/20 to 12/27/20
Intersection: SR-434 : WEST TOWN PKWY **Time Cluster:** 2
Period: 15-min

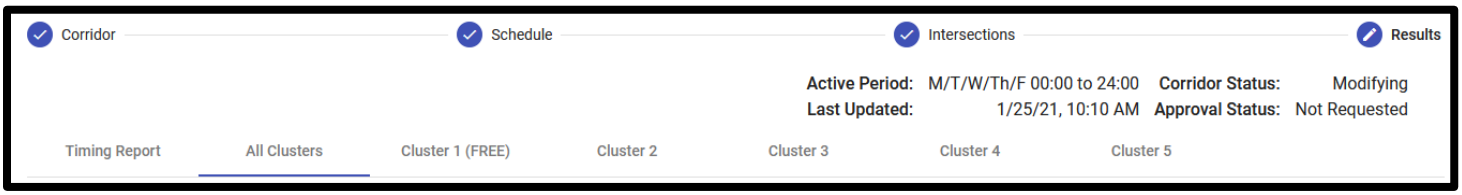
Peak | Off-Peak

Movement	Vehicles/Hr	Heaviest Lane	% Shared Lane	% Heavy Vehicle	Right on Red/Hr	Pedestrian/Hr	Bike/Hr	Bus/Hr	Sat Flow Rate	Start Up Lost	Extension Of Green	% Arrive On Green	Average Queue
EBU	0	0		0%		0	0	0	1500	2	2	0%	
EBL	40	0	0%	0%		0	0	0	1700	2	2	0%	
EBR	56	0	0%	0%	0	0	0	0	1500	2	2	0%	
EBT	56	0		0%		0	0	0	1900	2	2	0%	
WBU	0	0		0%		0	0	0	1500	2	2	0%	
WBL	32	0	0%	0%		0	0	0	1700	2	2	0%	
WBR	64	0	0%	0%	0	0	0	0	1500	2	2	0%	
WBT	40	0		0%		0	0	0	1900	2	2	0%	
NBU	0	0		0%		0	0	0	1500	2	2	0%	
NBL	80	0	0%	0%		0	0	0	1700	2	2	0%	
NBR	40	0	0%	0%	0	0	0	0	1500	2	2	0%	
NBT	168	0		0%		0	0	0	1900	2	2	0%	
SBU	0	0		0%		0	0	0	1500	2	2	0%	
SBL	96	0	0%	0%		0	0	0	1700	2	2	0%	
SBR	0	0	0%	0%	0	0	0	0	1500	2	2	0%	
SBT	196	0		0%		0	0	0	1900	2	2	0%	

OK

6.6 Step 4: Results

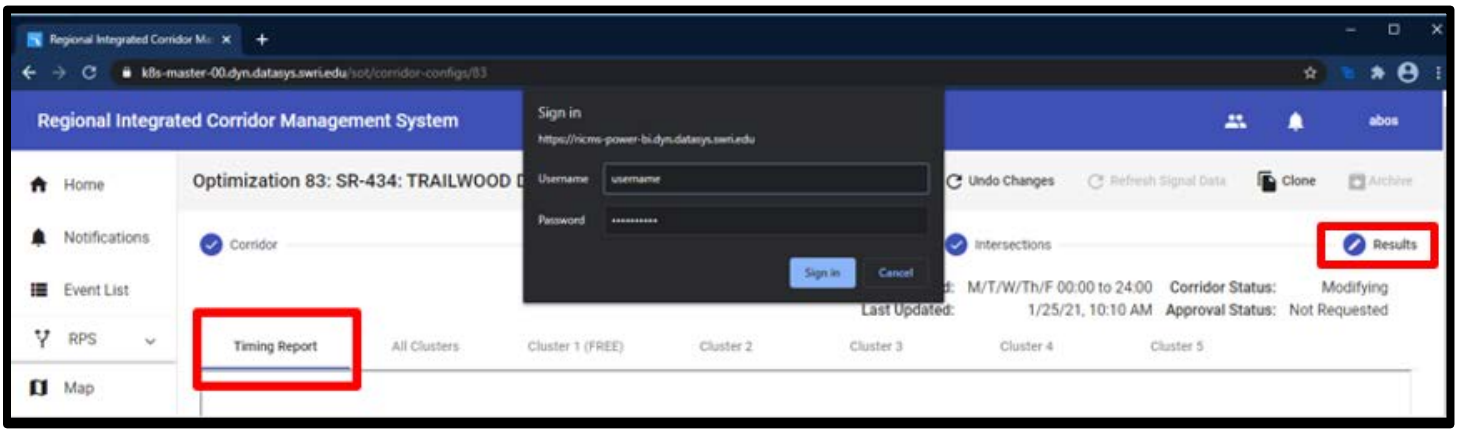
The Results step is used to view and manage corridor optimization results and stages in the corridor life cycle. A set of labels on top shows summary corridor info, including overall status and approval statuses. The main view is a set of tabs, described in the following sub-sections, that allow users to optimize, simulate, and review signal timing plans, request agency approval and deployment of timing plans, upload signed timing plan sets, and export data and reports.



6.6.1 Timing Report

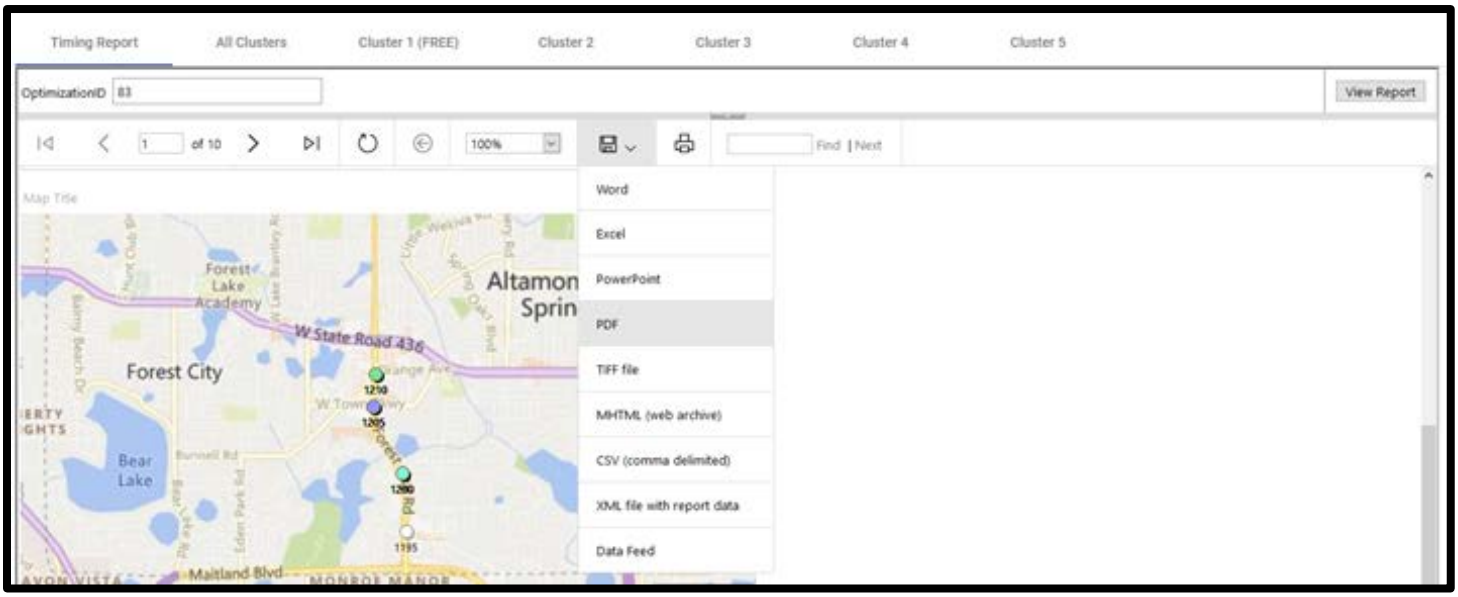
The Timing Report includes timing pattern and schedule details required to deploy a corridor timing plans onto signal controllers. It also includes corridor summary information, a placeholder for a traffic engineer's signature and seal, intersection geometry details, and summary statistics for optimization and simulations if applicable.

To view the report, a Power-BI login is required. The login may look different depending on the web browser used. An example using Chrome 87.0 is shown below.



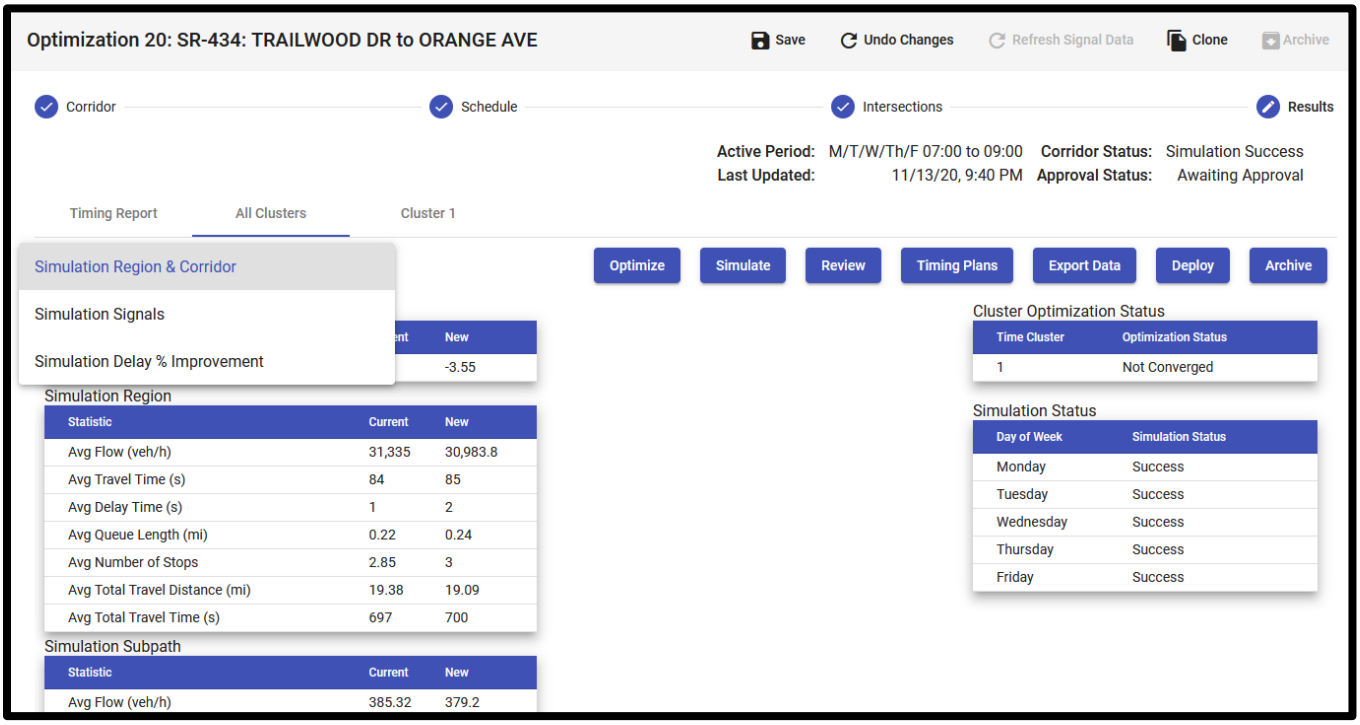
After successful Power-BI login, enter the corridor/optimization ID and click the “View Report” button.

To save a report to a local workstation, use the save icon button as pictured below, and select a format such as pdf.



6.6.2 All Clusters

The “All Clusters” tab shows summarized results of corridor optimizations per-cluster and simulations per day-of-week. A row of buttons provides corridor management functionality described in the following sections. The left side shows a drop-down menu to view statistics aggregated across all corridor simulations, if available. The right side shows completion status for each optimization and simulation, whether success or error. For optimizations, this also indicates whether the results converged. To achieve optimal timing plans, it is recommended to modify the settings and re-optimize non converged results.

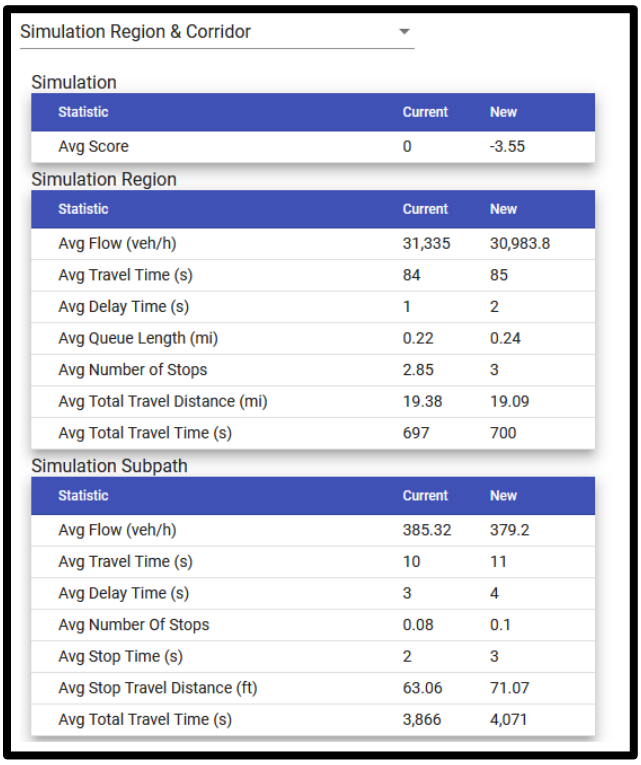


6.6.2.1 Simulation Statistics

Each corridor simulation request triggers a set of Aimsun mesoscopic simulations per day-of-week in the corridor **Active Period**. These perform hybrid microscopic simulations of the sub-path comprised of signals and connecting roadway segments along with macroscopic simulations of a dynamically calculated surrounding region. The All-Cluster statistics shows averages across all corridor day-of-week simulations. Detailed information about the statistics can be found in the Aimsun output data dictionary.

6.6.2.1.1 Simulation Region & Corridor

An example of average simulation scores, region and corridor sub-path statistics is shown below.



Simulation Region & Corridor

Simulation

Statistic	Current	New
Avg Score	0	-3.55

Simulation Region

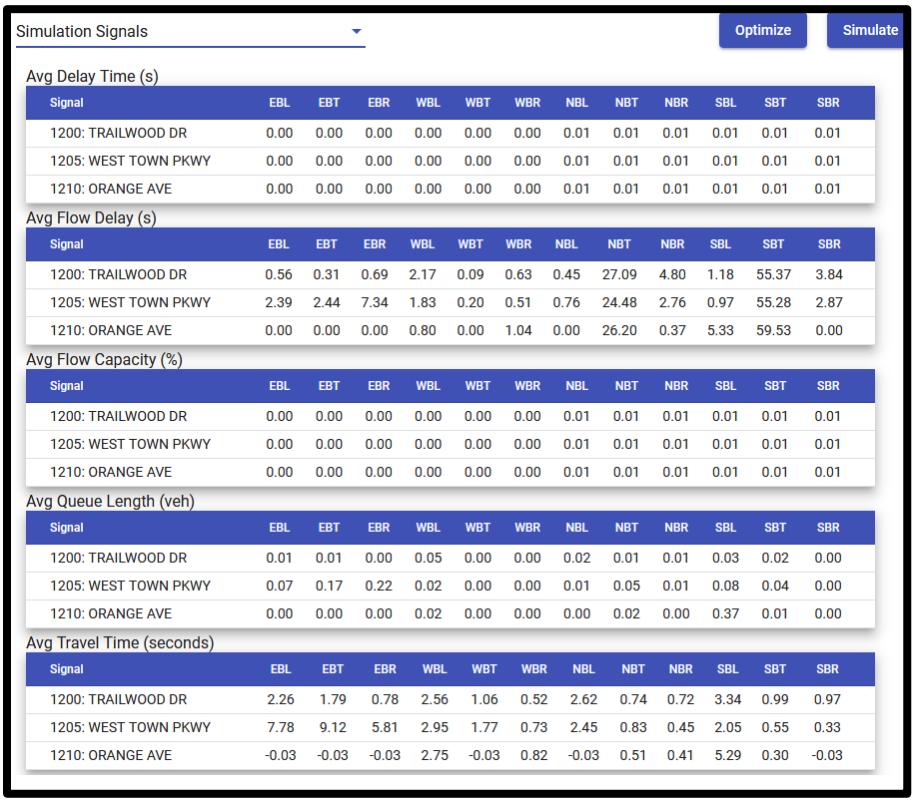
Statistic	Current	New
Avg Flow (veh/h)	31,335	30,983.8
Avg Travel Time (s)	84	85
Avg Delay Time (s)	1	2
Avg Queue Length (mi)	0.22	0.24
Avg Number of Stops	2.85	3
Avg Total Travel Distance (mi)	19.38	19.09
Avg Total Travel Time (s)	697	700

Simulation Subpath

Statistic	Current	New
Avg Flow (veh/h)	385.32	379.2
Avg Travel Time (s)	10	11
Avg Delay Time (s)	3	4
Avg Number Of Stops	0.08	0.1
Avg Stop Time (s)	2	3
Avg Stop Travel Distance (ft)	63.06	71.07
Avg Total Travel Time (s)	3,866	4,071

6.6.2.1.2 Simulation Signals

An example of average signals statistics is shown below.



Simulation Signals — Optimize — Simulate

Avg Delay Time (s)

Signal	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
1200: TRAILWOOD DR	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01
1205: WEST TOWN PKWY	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01
1210: ORANGE AVE	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01

Avg Flow Delay (s)

Signal	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
1200: TRAILWOOD DR	0.56	0.31	0.69	2.17	0.09	0.63	0.45	27.09	4.80	1.18	55.37	3.84
1205: WEST TOWN PKWY	2.39	2.44	7.34	1.83	0.20	0.51	0.76	24.48	2.76	0.97	55.28	2.87
1210: ORANGE AVE	0.00	0.00	0.00	0.80	0.00	1.04	0.00	26.20	0.37	5.33	59.53	0.00

Avg Flow Capacity (%)

Signal	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
1200: TRAILWOOD DR	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01
1205: WEST TOWN PKWY	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01
1210: ORANGE AVE	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01

Avg Queue Length (veh)

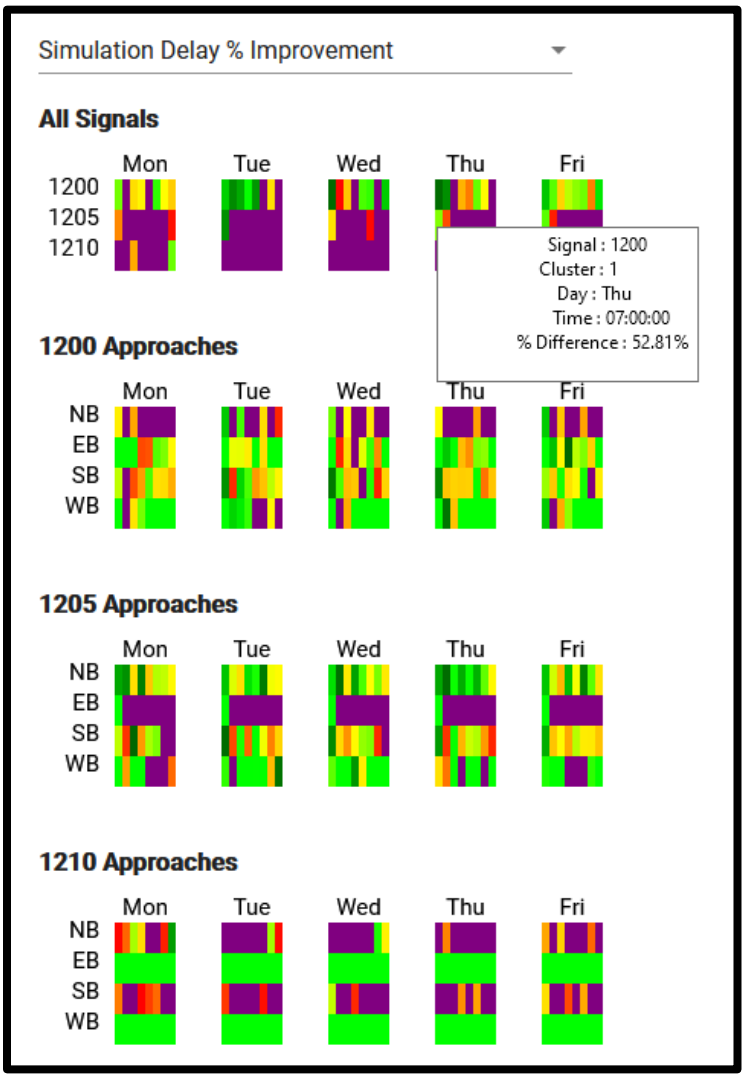
Signal	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
1200: TRAILWOOD DR	0.01	0.01	0.00	0.05	0.00	0.00	0.02	0.01	0.01	0.03	0.02	0.00
1205: WEST TOWN PKWY	0.07	0.17	0.22	0.02	0.00	0.00	0.01	0.05	0.01	0.08	0.04	0.00
1210: ORANGE AVE	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.02	0.00	0.37	0.01	0.00

Avg Travel Time (seconds)

Signal	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
1200: TRAILWOOD DR	2.26	1.79	0.78	2.56	1.06	0.52	2.62	0.74	0.72	3.34	0.99	0.97
1205: WEST TOWN PKWY	7.78	9.12	5.81	2.95	1.77	0.73	2.45	0.83	0.45	2.05	0.55	0.33
1210: ORANGE AVE	-0.03	-0.03	-0.03	2.75	-0.03	0.82	-0.03	0.51	0.41	5.29	0.30	-0.03

6.6.2.1.3 Simulation Delay % Improvement

An example of section delay percent improvement heatmaps is shown below. Heatmaps are shown for all-signals and per signal-approach. Each day of week contains detailed information on 15-minute intervals, which can be viewed as a mouse-over tool tip. The example below shows a break between days, because the **Active Period** includes breaks between days, i.e., is not 24 hours a day.



6.6.2.2 Optimize

The “Optimize” button triggers a set of HCS7 Streets optimizations, one for each time cluster. These long running tasks are submitted to a computing cluster for concurrent processing. Users are redirected to the **Error! Reference source not found.**, which shows corridor status changes throughout the process, and they may perform other tasks or logout of the R-ICMS in the meantime. When all optimizations complete successfully, corridor simulations are automatically started.

While a corridor is optimized and simulated, it cannot be modified. Note that optimized values are updated in both the Intersections and Results views. When simulations are finished, users receive popup and email notifications for results that meet a designated improvement threshold. See the **Cluster X** tab for resulting optimization statistics.

6.6.2.3 Simulate

The "Simulate" button triggers a set of Aimsun simulations, one for each day-of-week in the corridor **Active Period**. These long running tasks are submitted for concurrent processing. Users are redirected to the **Error! Reference source not found.**, which shows corridor status changes throughout the process, and they may perform other tasks or logout of the R-ICMS in the meantime. While a corridor is simulated, it cannot be modified.

When simulations are finished, users receive popup and email notifications for results that meet a designated improvement threshold. Resulting simulation statistics are aggregated for the overall corridor on the **All Clusters** tab and for each time cluster on the **Cluster X** tab.

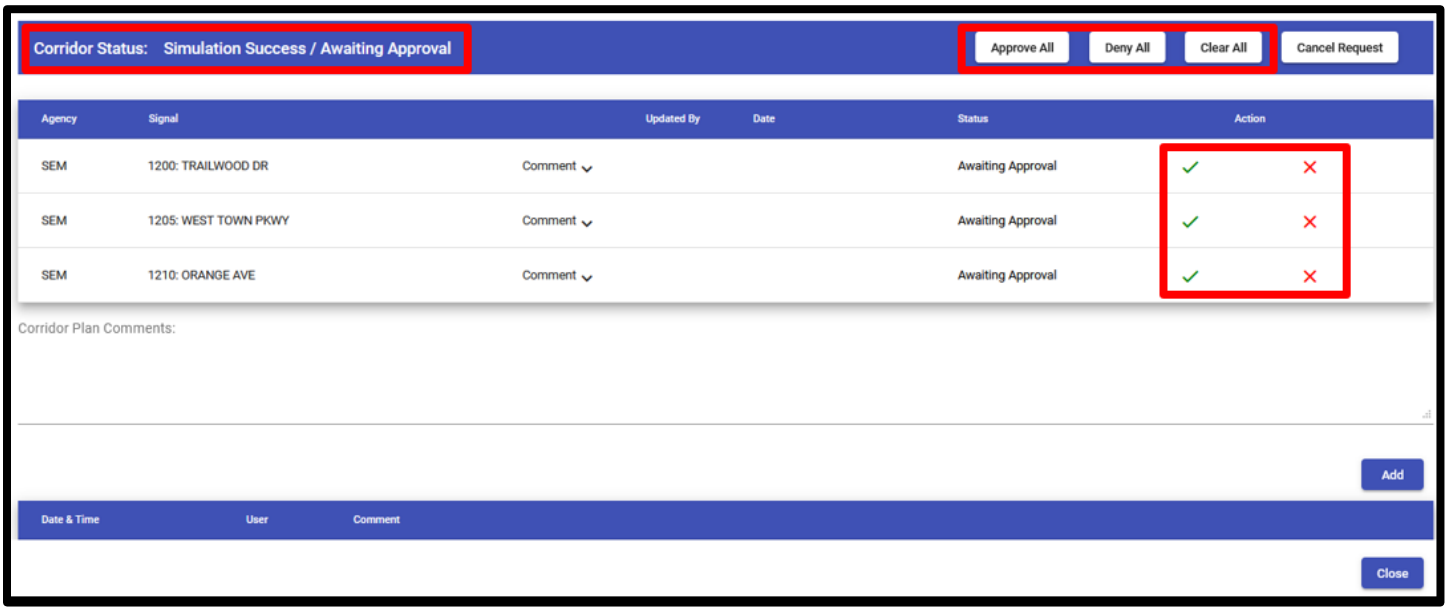
6.6.2.4 Review

The Review button launches a dialog allowing users to request agency review and approval of corridor timing plans. Here users can add comments to corridor timing plan sets or individual signal timing plans. All comments are included in the **Timing Report**.

6.6.2.4.1 Review Requests and Approvals

To request a review, users must have an assigned role with "ApproveSotDevices" permission and group membership in any corridor signal agency. When a review request is made, popup and email notifications are sent to all users in the signal agency groups with this permission.

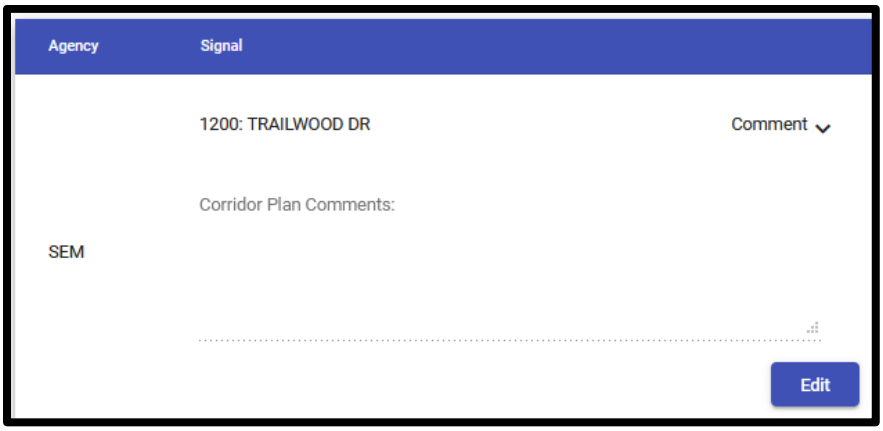
Users with this permission may approve or deny timing plans for signals in the agency groups to which they belong using the buttons highlighted in the screenshot below. The corridor approval status updates based on the status of approval signals in the corridor. When any signal is denied, the corridor status is denied. When all signals are approved, the corridor status is approved.



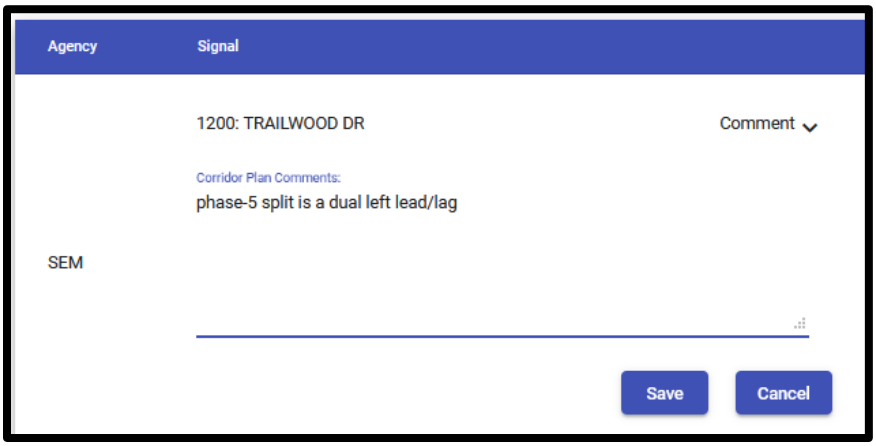
Canceling a review request resets all signal and corridor approval statuses to “Not Requested”. This functionality is available to same users who can request approval for a corridor.

6.6.2.4.2 Signal Comments

All comments are included in the **Timing Report**. To add or modify a signal timing plan comment, expand the “Comment” box, and use the “Edit” button as shown below.



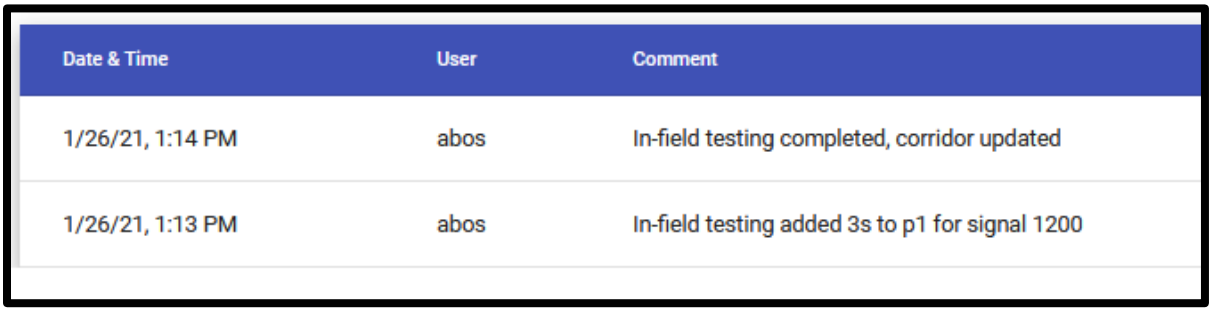
Add or modify the timing plan comment in the text area and “Save” or “Cancel” as shown below.



6.6.2.4.3 Corridor Comments

Corridor comments are add-only and cannot be modified. To enter a corridor comment, use the "Corridor Plan Comments" text area, as shown below, and click the "Add" button.

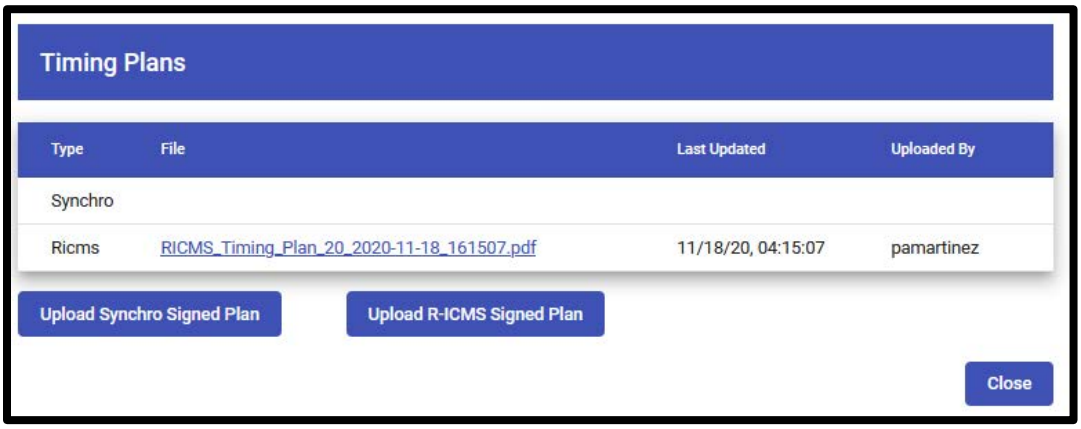
Corridor comments are shown below and listed in reverse date order, with the most recent on top. All comments are included in the **Timing Report**.



Date & Time	User	Comment
1/26/21, 1:14 PM	abos	In-field testing completed, corridor updated
1/26/21, 1:13 PM	abos	In-field testing added 3s to p1 for signal 1200

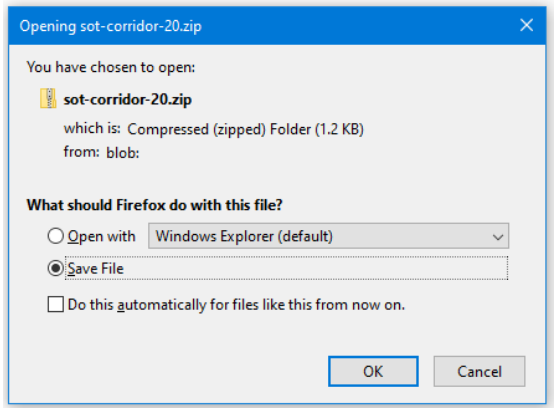
6.6.2.5 Timing Plans

The Timing Plans button launches a dialog allowing users to upload and download signed, sealed timing plan sets for a corridor. Users must have a role with the "AddSotSignatures" permission to upload plans using the buttons shown below, but all users can download plans by clicking a file name link. Timing plans are signed and sealed outside the R-ICMS, however they can be sourced from the R-ICMS or the external Synchro application. R-ICMS timing plans are signed and sealed versions of an exported **Timing Report**. A signed, sealed plan set of either type must be uploaded before a SOT corridor can be marked as deployed. Users can overwrite plan sets by uploading a new version, however older version are not stored and accessible.



6.6.2.6 Export Data

The Export Data button allows users to save the corridor information as a zipped set of comma-separated-value (csv) files via a file system save dialog like the one shown below. The csv files described in the following sub-sections are designed for use in external signal analysis tools, such as Synchro and TruTraffic.



6.6.2.6.1 Corridor phasing.csv

This csv file contains phasing data for one or more intersections. The example below shows data for signal 1001.

```
RECORDNAME,INTID,D1,D2,D3,D4,D5,D6,D7,D8
BRP,1001,112,111,211,212,121,122,221,222
MinGreen,1001,5,15,5,7,5,15,5,7
MaxGreen,1001,10,92.4,31.1,54.4,11.9,91.5,42.3,43.6
VehExt,1001,3,4,3,3,3,4,3,3
TimeBeforeReduce,1001,0,0,0,0,0,0,0,0
TimeToReduce,1001,0,0,0,0,0,0,0,0
MinGap,1001,3,4,3,3,3,4,3,3
Yellow,1001,5,4.1,5,4.2,4.1,5,4.2,5
AllRed,1001,3,3.5,3.9,3.4,2,3.5,3.5,3.4
Recall,1001,0,3,0,0,0,3,0,0
Walk,1001,,7,,,,7,,
DontWalk,1001,,26,,,,28,,
PedCalls,1001,,0,,,,0,,
MinSplit,1001,13,40.6,13.9,39.6,11.1,43.5,12.7,46.4
DualEntry,1001,0,0,0,1,0,0,0,1
```

Field details:

- INTID, intersection/signal identifier, represented as a string with an agency prefix in R-ICMS, other analysis tools ***may require conversion of this field to an integer***
- D1-D8, data columns for phase numbers
- BRP represented as: BRP,1200,112,111,211,212,121,122,221,222
    - Because phase 1 (D1) is in barrier 1, ring 1, position 2 given the standard barriers and rings shown below

```
          B1:          B2:
Ring 1:  P1  P2   |   P1   P2
         ------------------
Ring 2:  P1  P2   |   P1   P2
```

- MinGreen, set to SOT/TMDD min green
- MaxGreen, set to TMDD max green
- VehExt, set to SOT passage time
- TimeBeforeReduce, defaulted to 0
- TimeToReduce, defaulted to 0
- MinGap, set to SOT passage time
- Yellow, set to SOT/TMDD yellow time
- AllRed, set to SOT/TMDD red time

- Walk, set to SOT/TMDD pedestrian walk
- DontWalk, set to SOT/TMDD pedestrian clearance
- PedCalls, defaulted to 0 or omitted
    - Omitted value means the ped calls are disabled in the model, a zero value means that the ped calls are enabled by the count was not available. Typical models have 0 value for D2 and D6 with the other values omitted.
- MinSplit, minimum split for a phase. It is the maximum of the following:
    - addition of yellow, red, and minimum green
    - addition of yellow, red, and walk and flash-don't-walk
- DualEntry, set to SOT/TMDD min green

6.6.2.6.2 Corridor timing.csv

This csv file contains timing plans for one or more intersections, including multiple plans per intersection. The example below shows cluster-1 timing plans for signals 1200, 1205, and 1210.

```
PLANID,INTID,S1,S2,S3,S4,S5,S6,S7,S8,CL,OFF,LD,REF,CLR
cluster-1,1200,48,100,0,27,18,130,0,27,175,75,124568,2-,4.8
cluster-1,1205,25,118,15,17,15,128,15,17,175,3,12345678,6-,4.8
cluster-1,1210,19,105,19,32,80,44,21,30,175,53,12345678,2-,4.8
```

Field details:

- INTID, intersection/signal identifier, represented as a string with an agency prefix in R-ICMS, other analysis tools
- S1-S8, phase split in seconds
- CL, cycle length in seconds
- OFF, offset in seconds
- LD, header for the leading phases, which is a non-delimited string of the first phase between each barrier, e.g., 2357 is the leading phases for (2 1 | 3 4) / (5 6 | 7 8) in the example below
- REF, the reference point, a dash indicates the end of the reference (phases 2 and 6 in example below)
- CLR, clearance time (yellow + red) for the leading reference phase (phase 2 in the example below)

```
PLANID,INTID,S1,S2,S3,S4,S5,S6,S7,S8,CL,OFF,LD,REF,CLR
PM PEAK,1001,18,100,40,62,18,100,50,52,220,187,2357,26-,7.6
```

6.6.2.6.3 Corridor turn-count.csv

This csv file contains vehicles-per-hour turn counts for one or more intersections during the indicated date and time. The example below shows data for multiple signals and time periods. Peak **Traffic Volume** for each signal in each cluster is included.

```
Turning Movement Count,,,,,,,,,,,,,
60 Minute Counts,,,,,,,,,,,,,
DATE,TIME,INTID,NBU,NBL,NBT,NBR,SBU,SBL,SBT,SBR,EBU,EBL,EBT,EBR,WBU,WBL,WBT,WBR
12/21/2020,0630,1200,0,100,220,8,0,92,152,0,0,12,24,0,0,12,24,0
12/21/2020,0630,1205,0,80,168,40,0,96,196,0,0,40,56,56,0,32,40,64
12/21/2020,0630,1210,0,100,180,0,0,112,188,8,0,24,0,0,0,16,20,0
12/21/2020,1000,1200,0,116,220,0,0,120,220,24,0,20,28,8,0,20,36,4
12/21/2020,1000,1205,0,112,272,60,0,132,240,4,0,40,52,60,0,48,96,60
12/21/2020,1000,1210,0,132,256,0,0,156,280,16,0,16,4,0,0,0,20,0
12/21/2020,1430,1200,0,124,228,0,0,80,160,4,0,8,16,4,0,8,16,4
12/21/2020,1430,1205,0,104,232,24,0,100,180,0,0,32,36,44,0,32,60,56
12/21/2020,1430,1210,0,120,224,0,0,108,212,0,0,0,8,0,0,0,8,0
12/22/2020,1930,1200,0,120,208,0,0,72,140,0,0,20,44,0,0,8,16,4
12/22/2020,1930,1205,0,96,184,8,0,88,172,4,0,8,40,20,0,32,28,16
12/22/2020,1930,1210,0,88,168,0,0,88,140,0,0,0,4,0,0,0,24,0
```

Field details:

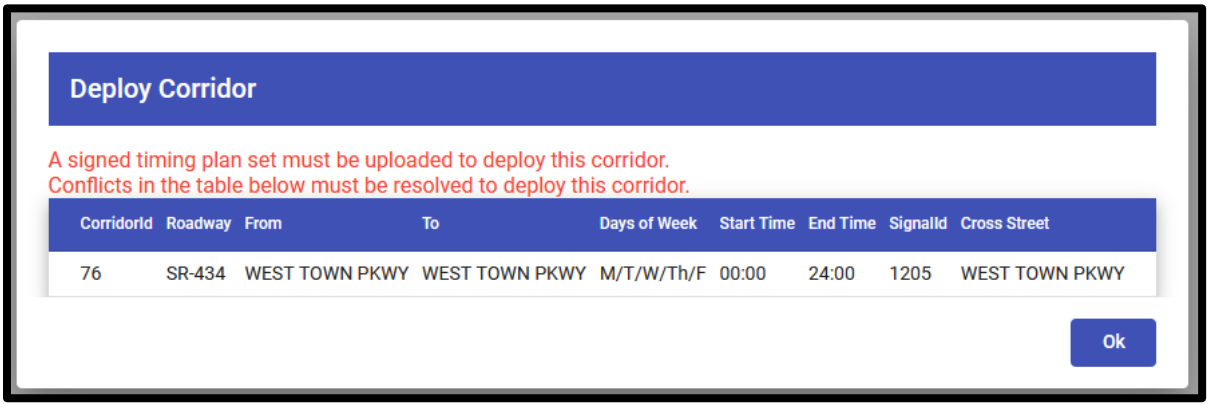
- DATE, mm/dd/yyyy for the first time period in a cluster
- TIME, military time hours and minutes
- INTID, intersection/signal identifier, represented as a string with an agency prefix in R-ICMS, other analysis tools
- NBU, northbound U-turn count
- NBL, northbound left-turn count
- NBT, northbound through count
- NBR, northbound right-turn count

6.6.2.7 Deploy, Retire, Archive

The Deploy, Retire, and Archive buttons allow users set overall corridor statuses for high-level management of signal corridors. Corridors should me marked as Deployed after in-field deployment, which happens outside the R-ICMS, and in-field corridor timing plans are not validated to match SOT plans. Users are encouraged to modify SOT timing plans to match in-field adjustments before uploading the signed timing plan set for a deployed corridor.

A traffic signal may not be in more than one deployed corridor with overlapping days and times. This restriction is enforced by the SOT system. However, overlaps are allowed in non-deployed corridor configurations. After deployment, a corridor can be marked as Retired, which prevents conflicts when deploying the same signals in other corridors.

When marking a SOT corridor as deployed, conflicts with existing deployed corridors will be displayed and prevent completion of the action. Conflicts can be resolved by retiring the conflicting corridor. Additionally, each deployed corridor is required to have a signed timing plan set uploaded into the system, as described in the Timing Plans section. Below is a sample corridor deployment dialog where conflicts and timing plan requirements must be resolved.

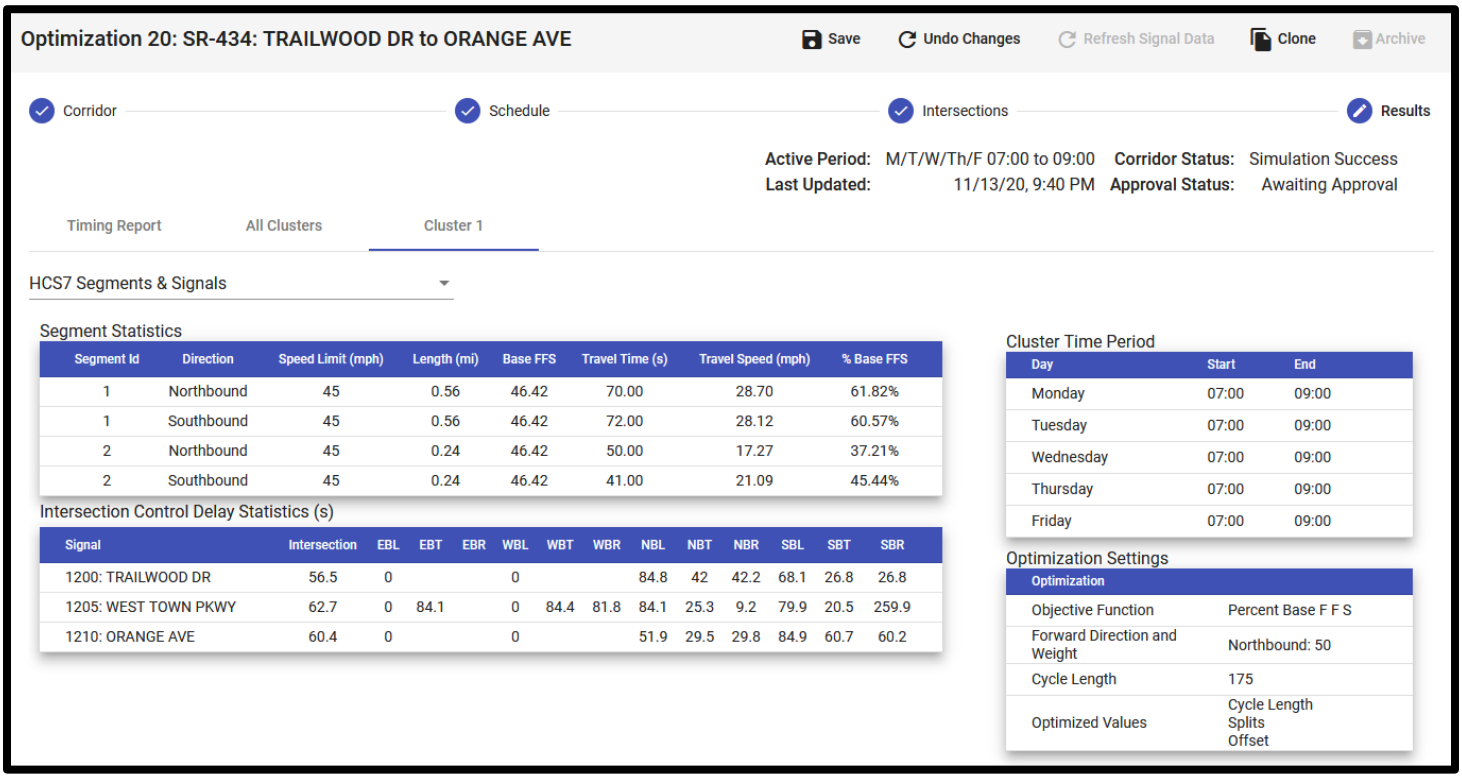


Corridors that are not deployed can be marked as Archived, which are filtered out of view by default on the **Error! Reference source not found.**. Archived status provides a way to hide retired corridors, as well as test corridors and periodic optimized corridors that do not qualify for approval and deployment.

Corridors that are deployed, retired, and archived cannot be modified.

6.6.3 Cluster X

Each cluster tab shows summarized results of corridor optimizations and simulations. The left side shows a drop-down menu to view statistics for the cluster optimization and simulations if available. Simulation results are filtered and aggregated for time periods in the cluster. The right side shows a summary of cluster time periods and optimization settings.

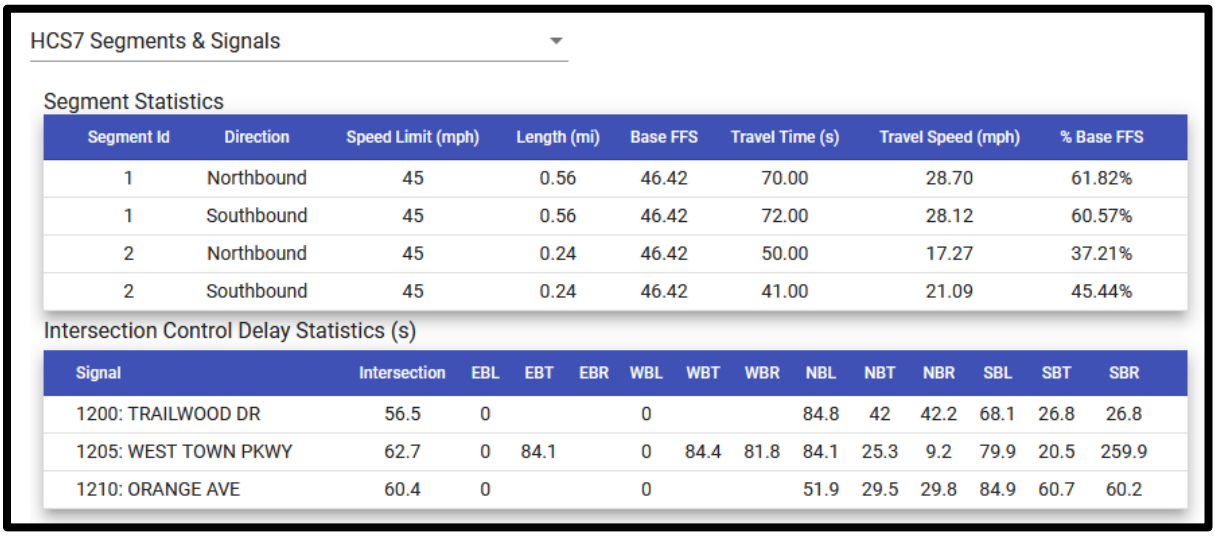


6.6.3.1 Optimization Statistics

Optimization statistics for a time-cluster optimization are described below.

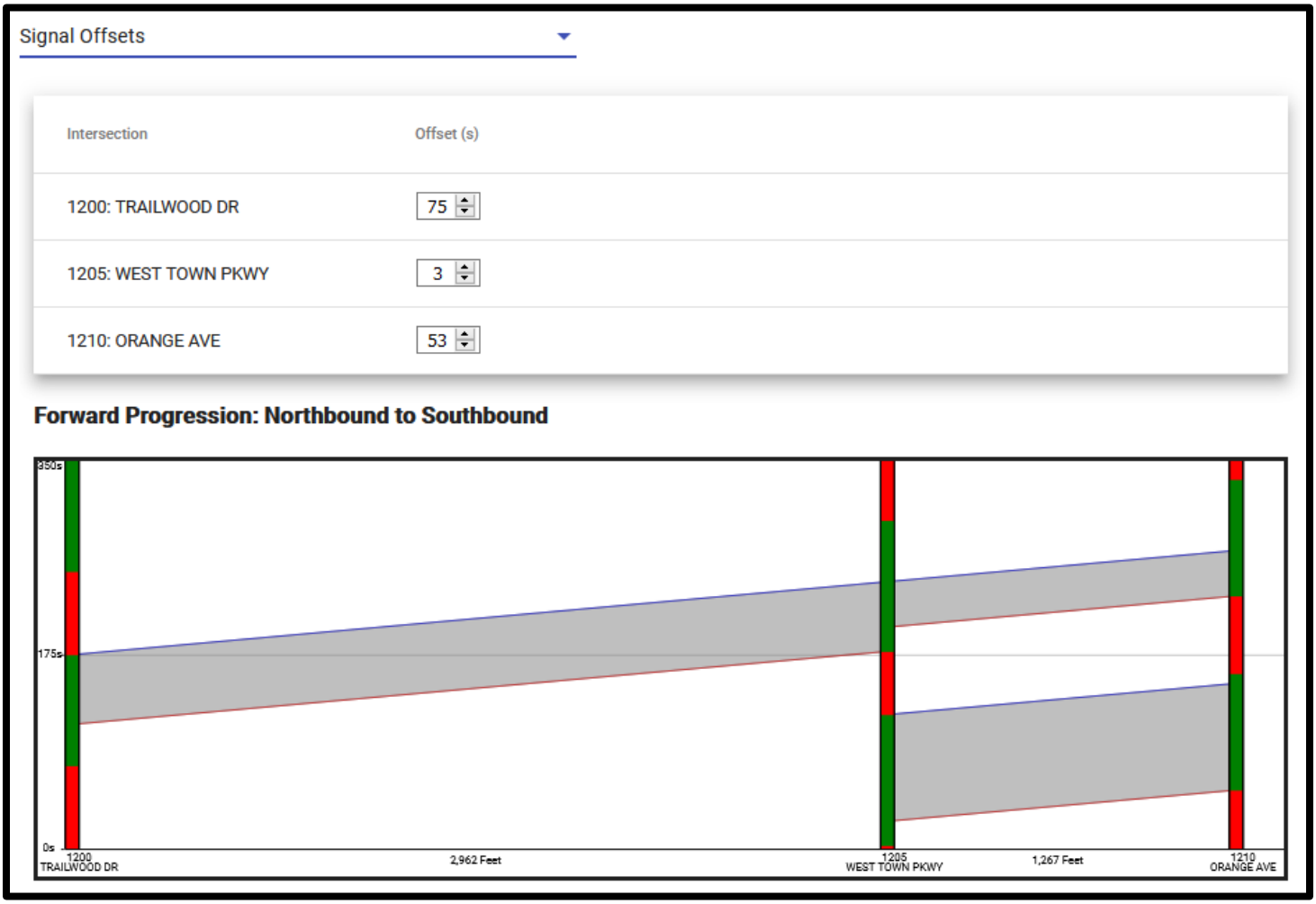
6.6.3.1.1 HCS7 Segments & Signals

An example of HCS7 optimization results for roadway segments and signals is shown below.



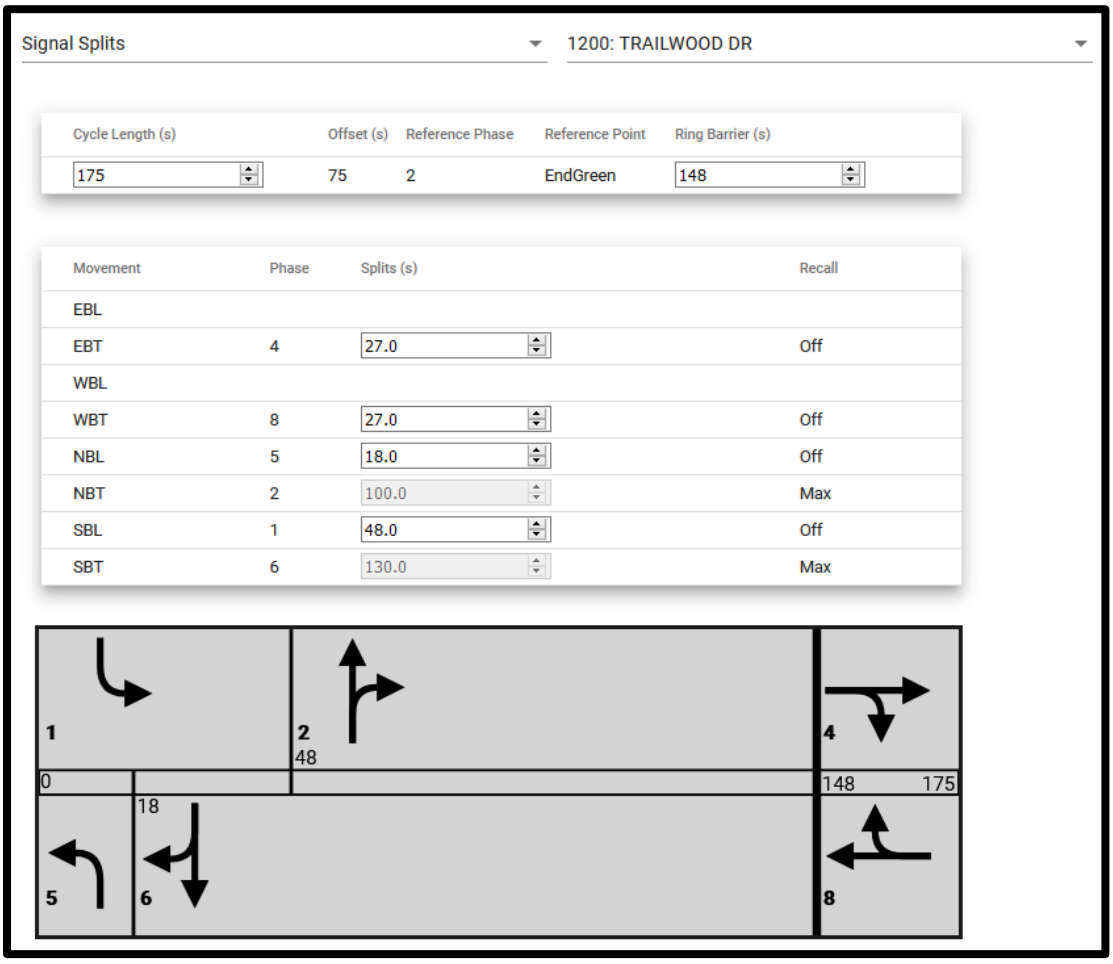
6.6.3.1.2 Signal Offsets

The Signal Offsets view shows time-space diagrams for forward and reverse progression bands of vehicles traversing the corridor. Diagrams update automatically to reflect modifications to signal offsets. Note that any modifications will also update the Intersections view.



6.6.3.1.3 Signal Splits

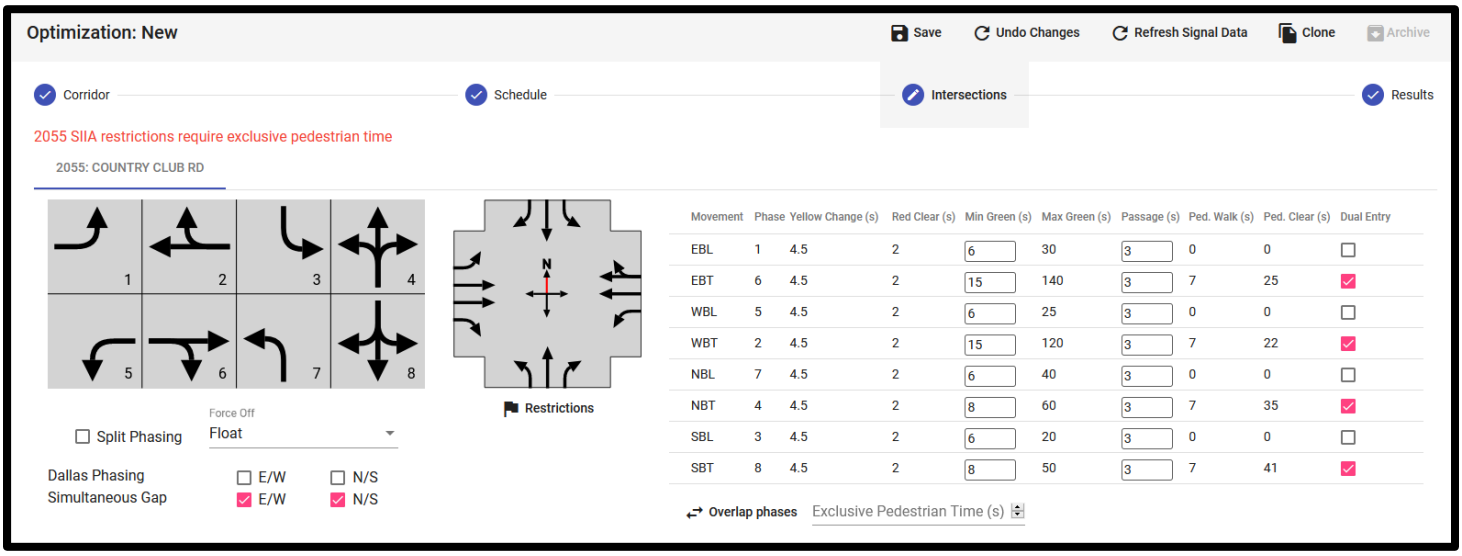
The Signal Splits view shows phase split diagrams for each corridor signal. Diagrams update automatically to reflect modifications to cycle length, ring-barrier, or phase splits. Note that any modifications will also update the Intersections view.



6.7 Configuration Errors

6.7.1 Resolved by Users

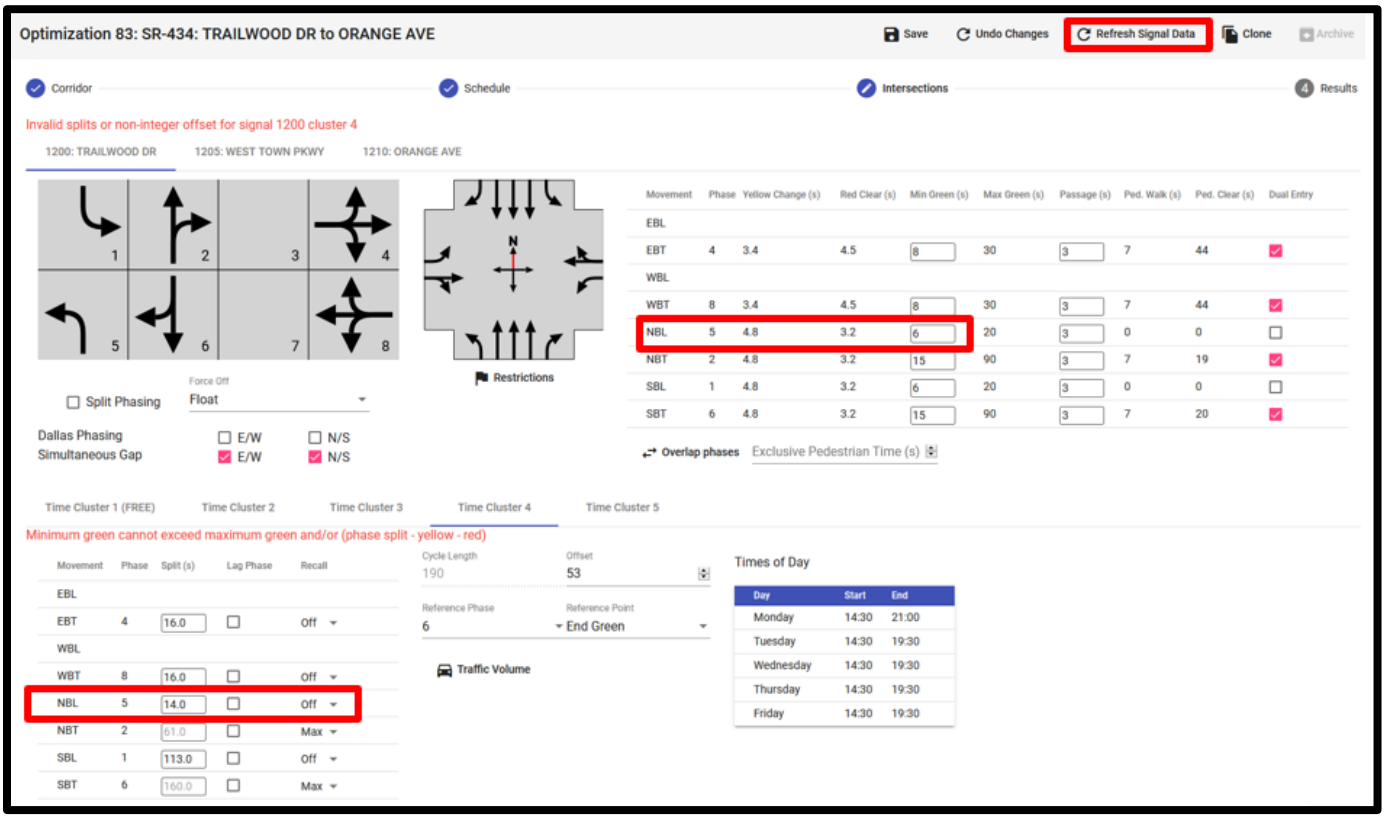
Throughout the corridor configuration process, user input and fetched data combinations may lead to invalid configurations. Invalid configuration messages are displayed in red text for each step. In the example below, the issue can be resolved by entering a non-zero value for exclusive pedestrian time.



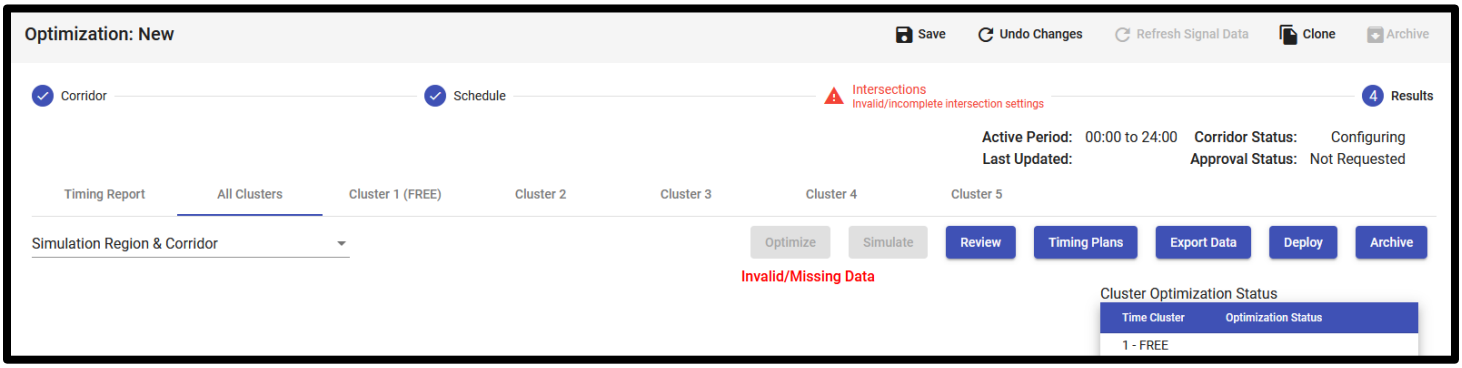
In the example below, a message indicates the problem and the signal and time cluster to which it applies. Looking at the details for that signal and cluster shows a more specific error message. In this case, there is a conflict between the minimum green value and the split time for a movement for signal 1205 and cluster 2. It can be corrected several ways:

- Decrease minimum green
- Increase phase split
- Refresh signal data, which reloads all step 3 intersection data from the DFE

Note that when editing phase splits, remaining green time is automatically allocated to main street through phases (2 and 6). However, users will be directed to correct inequality in side street ring sums.



As shown below, step titles indicate when a step the user is not currently viewing should be revisited to correct errors. Users are prevented from attempting to optimize and simulate invalid configurations by disabled buttons with the message shown below. All configuration issues must be corrected to enable optimization and simulation.



6.7.2 Not Resolved by Users

Some issues are not resolvable by SOT users. Typically, these issues are caused by R-ICMS system configuration issues or invalid/missing data. These errors are displayed in a pop-up dialogs, as in the examples below, which shows a permissions error is preventing a SOT user from retrieving data required by the SOT user interface. This issue should be reported to the R-ICMS administration and support team.

Errors that should be reported to the R-ICMS support:

- Permission errors
- Error fetching SOT corridors
- Error fetching SIIA roadways
- Error fetching SIIA roadway signals <ROADWAY-NAME>
- Error fetching SIIA signal details
- Error fetching holidays
- Error fetching SunGuide signal schedules
- Error fetching SunGuide signal timing
- Error fetching ITSIQA-TMC data

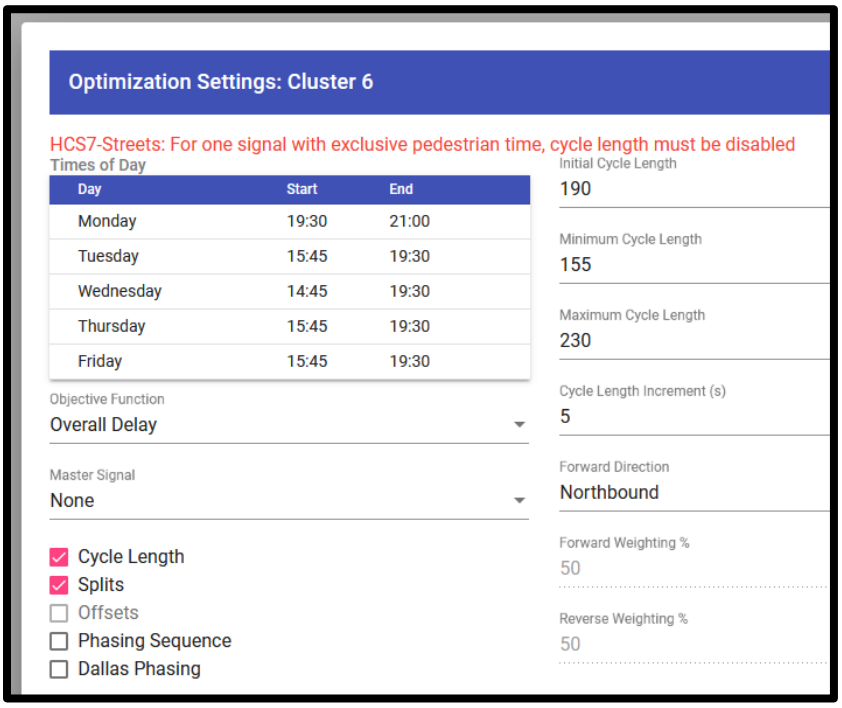
6.8 Configuration Restrictions

6.8.1 HCS7 Streets Restrictions

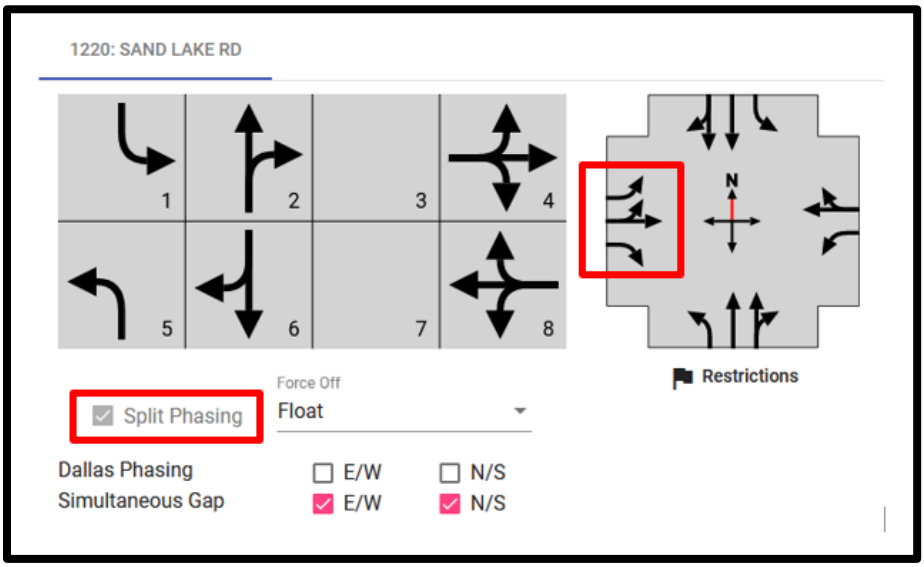
When configuring an SOT corridor, some input validation is applied to prevent invalid HCS7 Streets input. Most of these restrictions are applied to the Optimization Settings dialog for cluster timing plans, part of the corridor schedule configuration.

Optimization Settings Error Messages	Notes
HCS7-Streets: If cycle length enabled, then both splits and offsets must be enabled	
HCS7-Streets: For multi-signals, either splits or offsets or phasing must be enabled	
HCS7-Streets: For one signal, the objective must be Overall Delay or Balanced Delay	
HCS7-Streets: For one signal with exclusive pedestrian time, cycle length must be disabled	Applies to signals with SIIA exclusive pedestrian restriction
HCS7-Streets: For one signal, if cycle length enabled, then splits must be enabled	
HCS7-Streets: For one signal, either splits or phasing must be enabled	

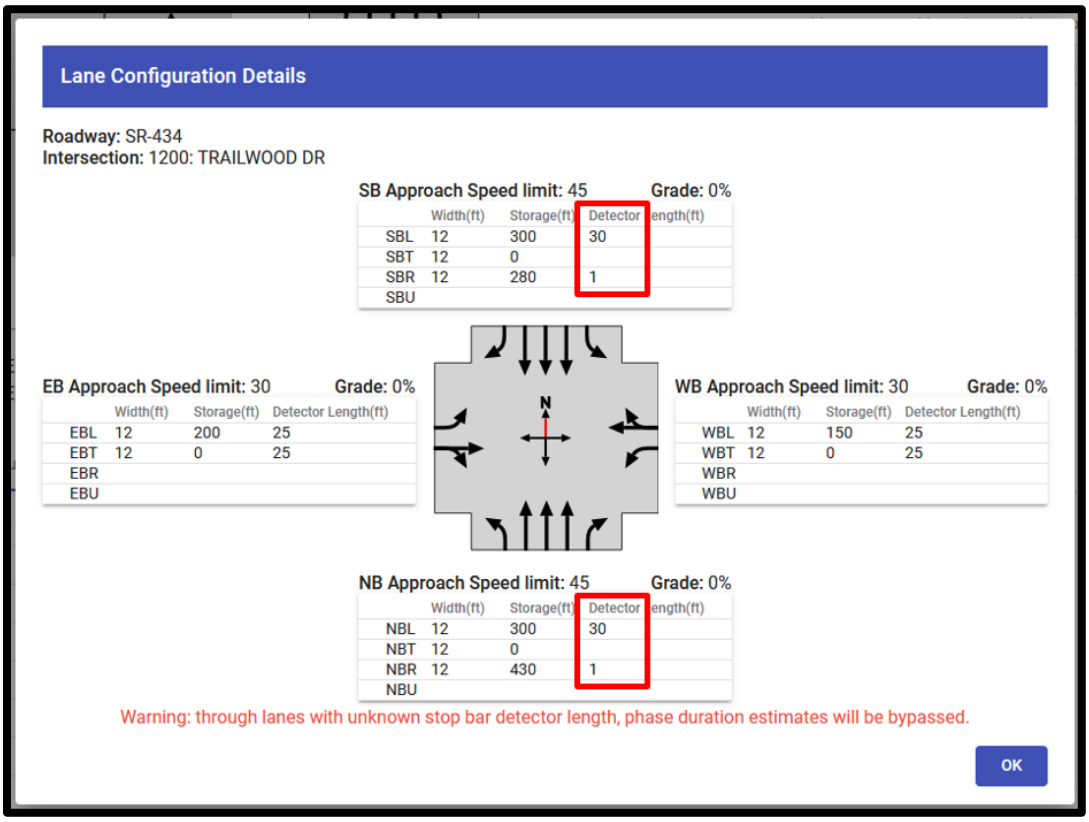
These issues are resolvable by changing the user input. The example below shows an optimization settings error that can be resolved by disabling the cycle length option.



HCS7 Streets requires split phasing for intersections with both an exclusive and shared-left turn on the same approach. When configuring SOT intersections, the split phasing option will be set and locked, as in the example below where east-bound left is both shared and exclusive.

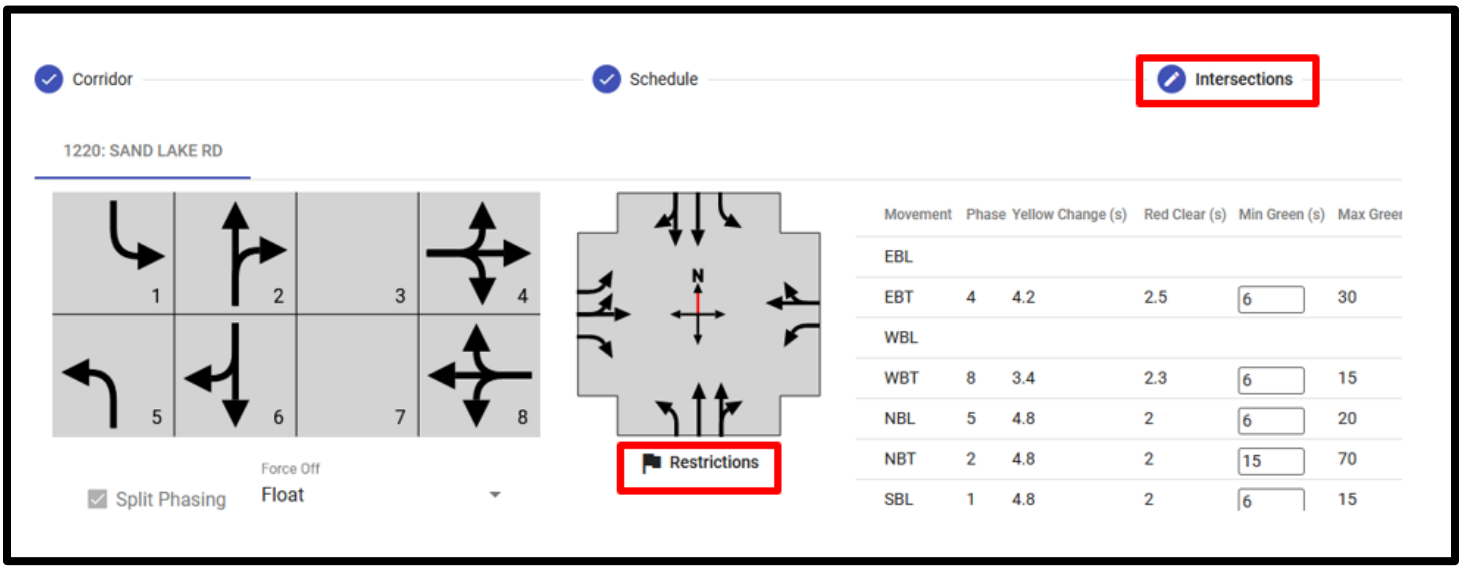


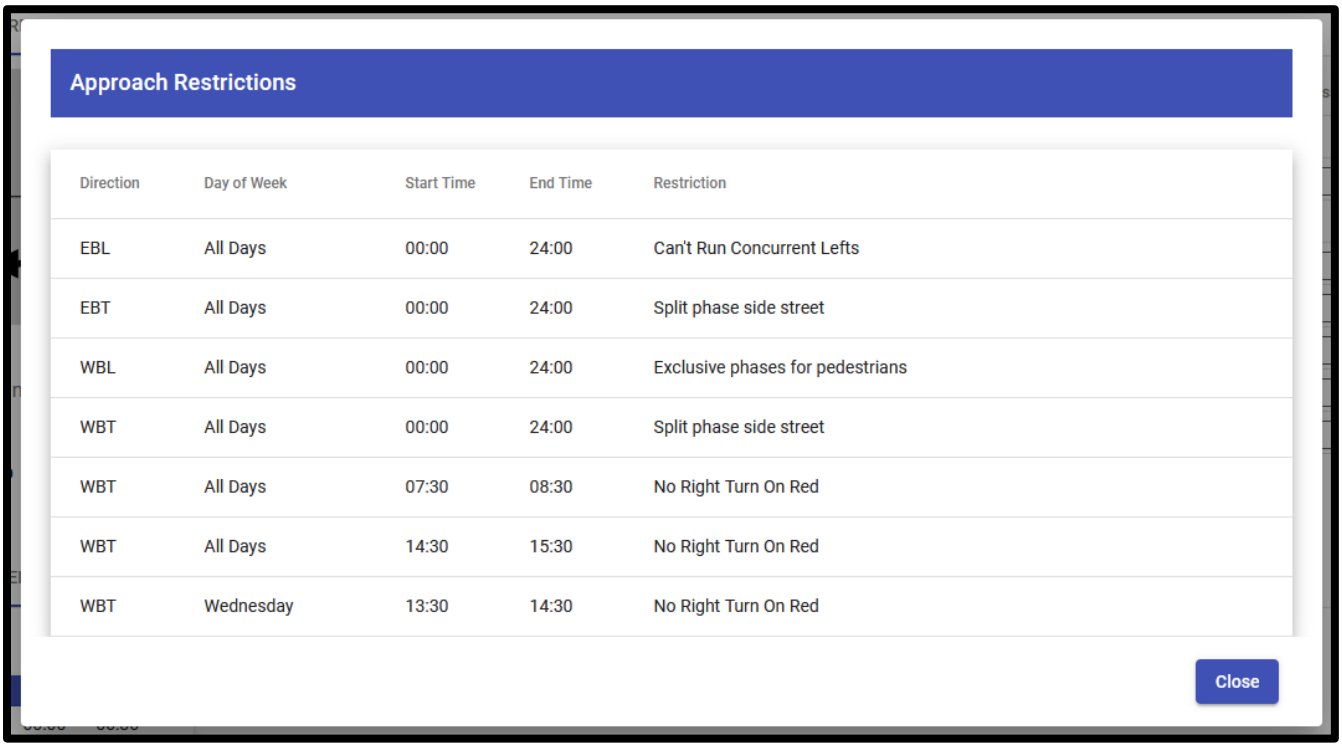
HCS7 Streets uses intersection stop-bar detector information to estimate phase durations prior to optimization. If this data is unavailable, SOT will inform HCS7 to use “field measured phase times” instead of performing the initial calculation. This is not a user setting, but a warning message will be displayed in the dialog that is opened by clicking the intersection lane diagram, as shown below.



6.8.2 SIIA Restrictions

Traffic signal restrictions in the SIIA system are applied at a lane-level and for specific days and times. These can be viewed in the SOT intersection configuration step using the “Restrictions” button below an intersection.

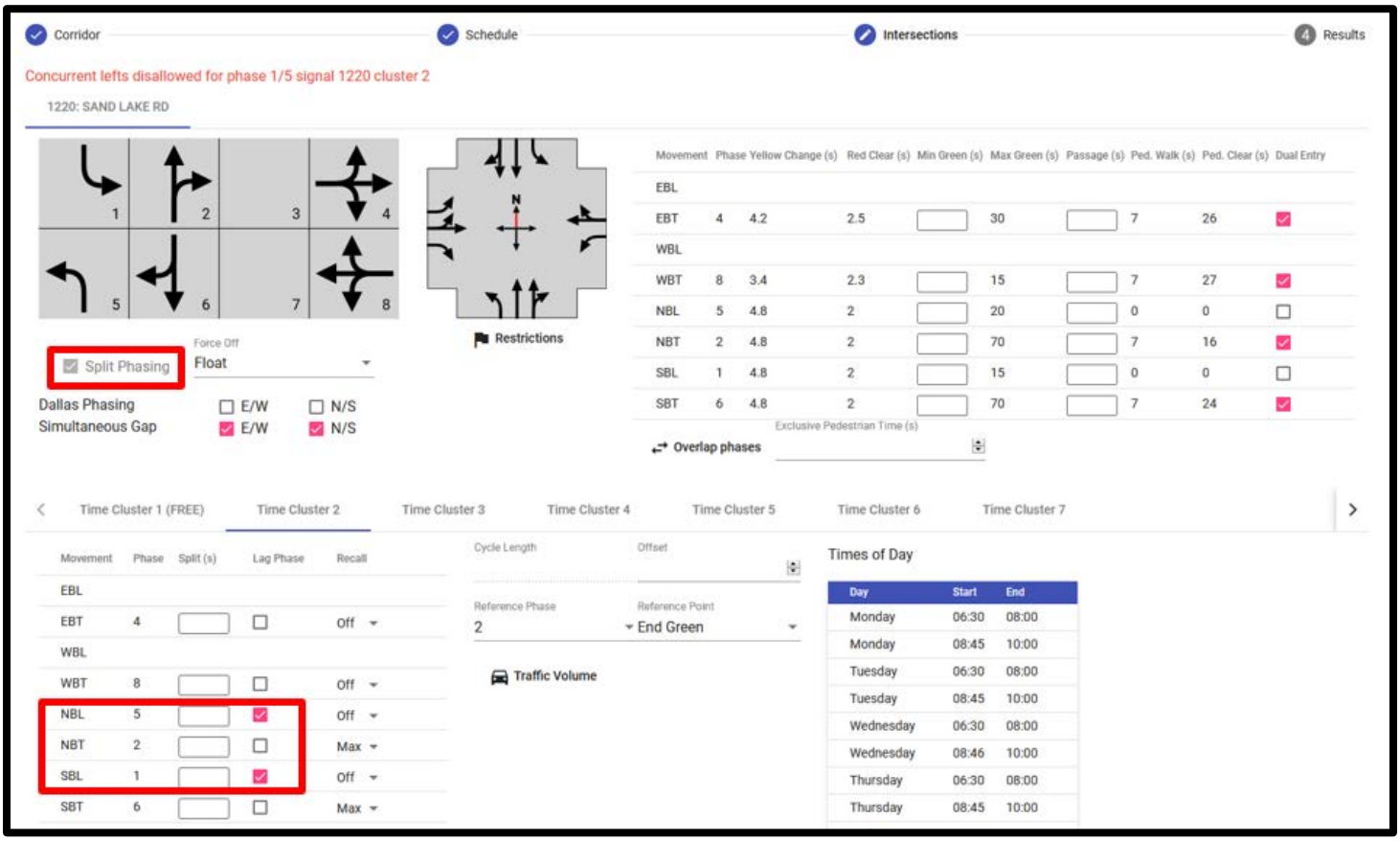




SIIA restrictions are applied to SOT configurations at the corridor, intersection, and intersection-approach levels as described in the table below. SIIA restrictions days and times which overlap any SOT cluster times of day are applied to the entire cluster, which represents a single timing pattern.

SIIA Restriction	Impact on SOT UI	Sample UI Messages	Notes
"Can't Lag Left"	Intersections: Left lag phase for approach is disabled and locked		
"Can't Run Concurrent Lefts"	Intersections: One of the opposing lefts must be lagged	Concurrent lefts disallowed for phase 1/5 Concurrent lefts disallowed for phase 3/7	
"Exclusive phases for pedestrians"	Corridor: Signal cannot be part of a multi-signal corridor configuration Intersections: Exclusive pedestrian greater than 0 seconds is required	<SIGNAL> cannot be coordinated due to exclusive pe destrian restriction <SIGNAL> SIIA restrictions require exclusive pedestrian time	HCS7 reserves cycle time where main vehicle phases are all red, except potentially protected right turn overlaps.
"Split phase side street"	Intersections: Intersection split-phasing is enabled and locked		

The example below shows both "Split phase side street" and "Can't Run Concurrent Lefts" restrictions applied in the SOT intersection configuration screen. Split phasing is enabled and locked, and an error message is displayed because NBL and SBL phases are not staggered. To correct the error, exactly one of the two phases should have lag enabled.

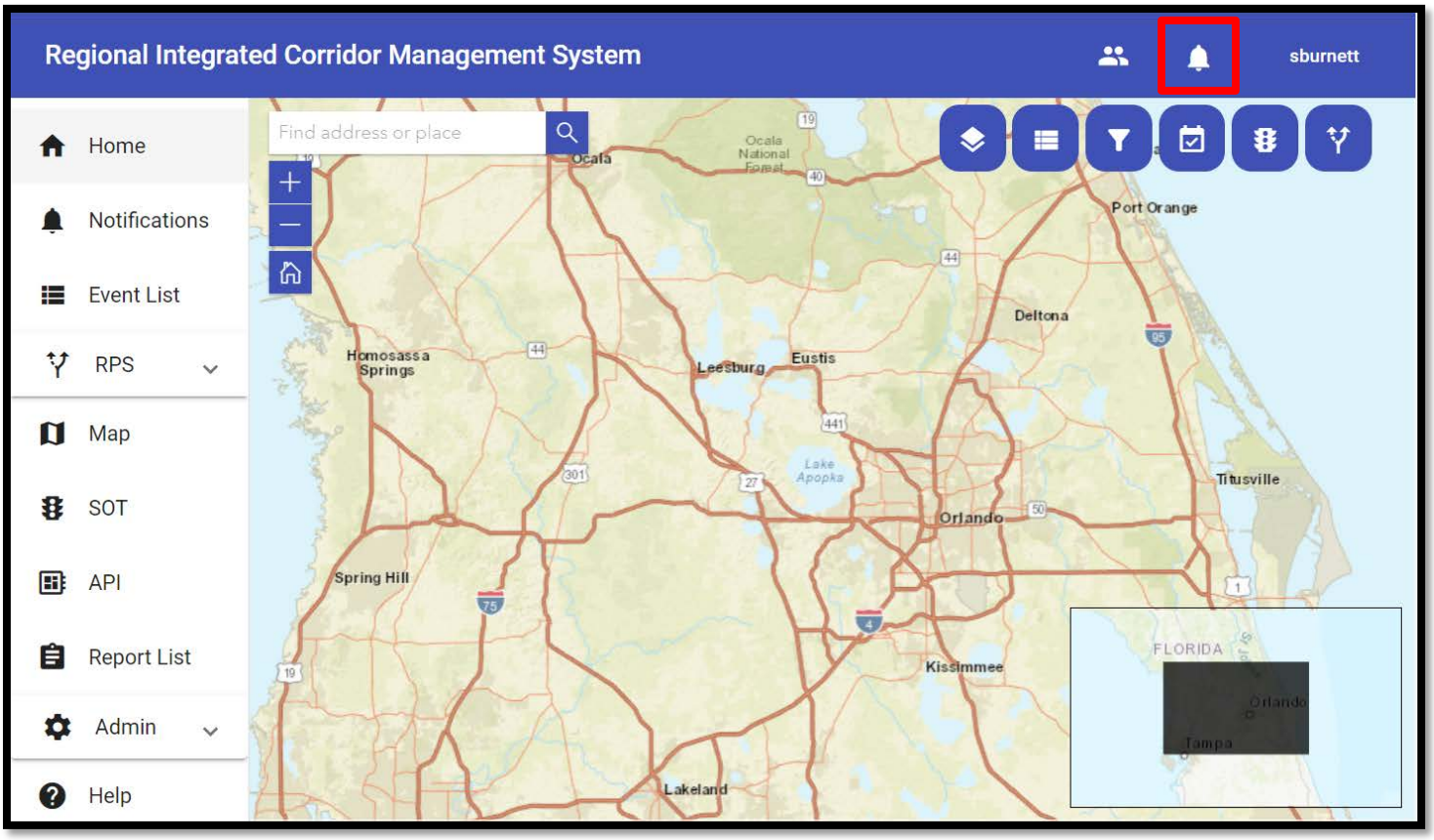

Corridor
Schedule
Intersections
4 Results
Concurrent lefts disallowed for phase 1/5 signal 1220 cluster 2
1220: SAND LAKE RD
Movement Phase Yellow Change (s) Red Clear (s) Min Green (s) Max Green (s) Passage (s) Ped. Walk (s) Ped. Clear (s) Dual Entry
EBL
EBT 4 4.2 2.5 30 7 26
WBL
WBT 8 3.4 2.3 15 7 27
NBL 5 4.8 2 20 0 0
NBT 2 4.8 2 70 7 16
SBL 1 4.8 2 15 0 0
SBT 6 4.8 2 70 7 24
Restrictions
Force Off
Float
Split Phasing
Dallas Phasing
Simultaneous Gap
E/W
N/S
Exclusive Pedestrian Time (s)
Overlap phases
Time Cluster 1 (FREE)
Time Cluster 2
Time Cluster 3
Time Cluster 4
Time Cluster 5
Time Cluster 6
Time Cluster 7
Movement Phase Split (s) Lag Phase Recall
EBL
EBT 4 Off
WBL
WBT 8 Off
NBL 5 Off
NBT 2 Max
SBL 1 Off
SBT 6 Max
Cycle Length
Offset
Reference Phase
2
Reference Point
End Green
Traffic Volume
Times of Day
Day Start End
Monday 06:30 08:00
Monday 08:45 10:00
Tuesday 06:30 08:00
Tuesday 08:45 10:00
Wednesday 06:30 08:00
Wednesday 08:46 10:00
Thursday 06:30 08:00
Thursday 08:45 10:00

7 Notifications

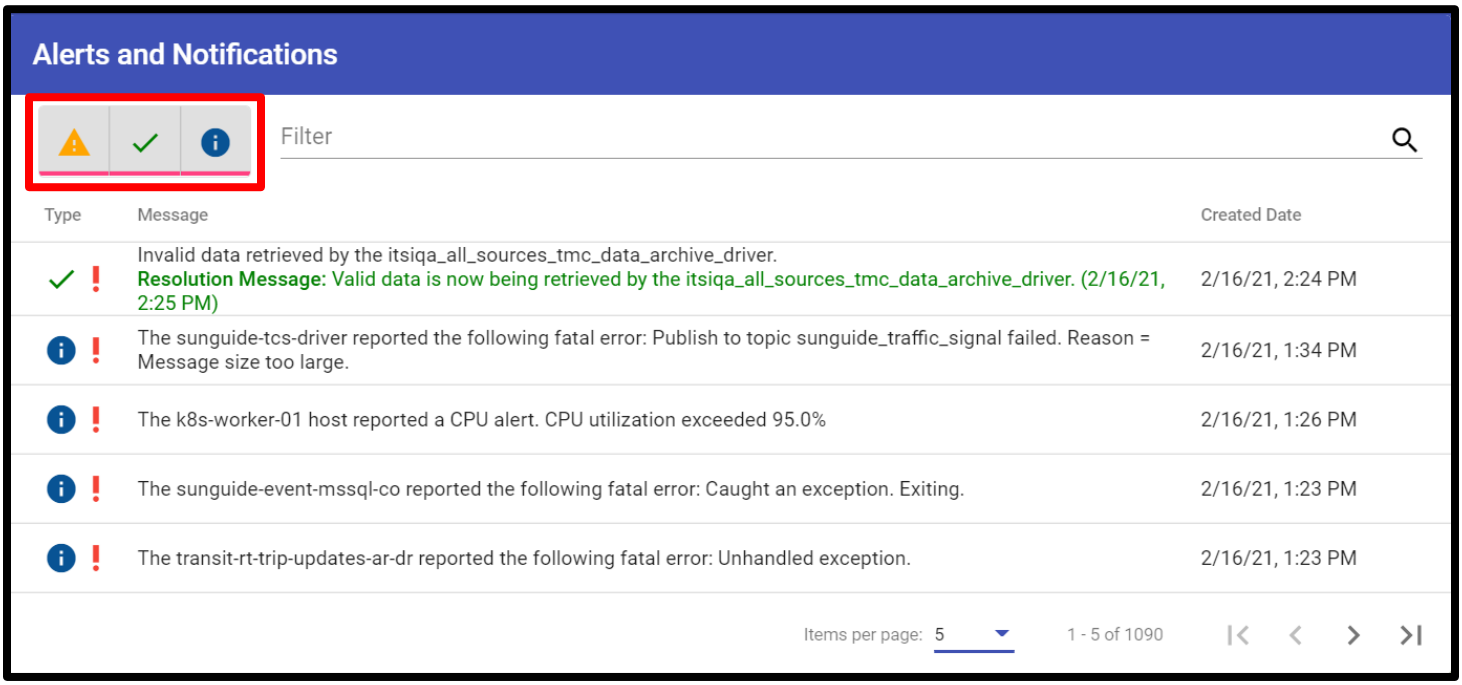
Notifications in the RR-ICMS are used to inform users about the health of the system, the status of data drivers, and events of the system that require user attention.

7.1 Notification Feed

To view the list of notifications you have received, click the notification bell located in the right-hand side of the website header banner.



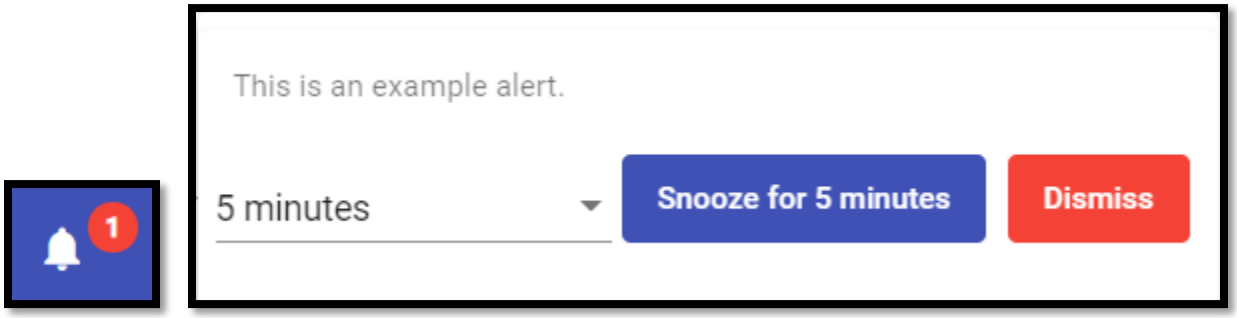
Once the notification bell is clicked, the **Alerts and Notifications** feed popup will appear.



Notifications can be filtered using the search filter located at the top or the three buttons outlined in red in the top right-hand side of the "**Alerts and Notifications**" feed. Once one of the buttons is clicked, it will toggle the corresponding alert type in the feed. The images used on these buttons are also used in the "**Type**" column of the "**Alerts and Notifications**" table. The first filter button's image represents unresolved alerts. A resolvable alert is an alert whose status can change based on a user's action or event. The second filter button's image represents a resolved alert. The last filter button's image represents an informational (non-resolvable) alert.

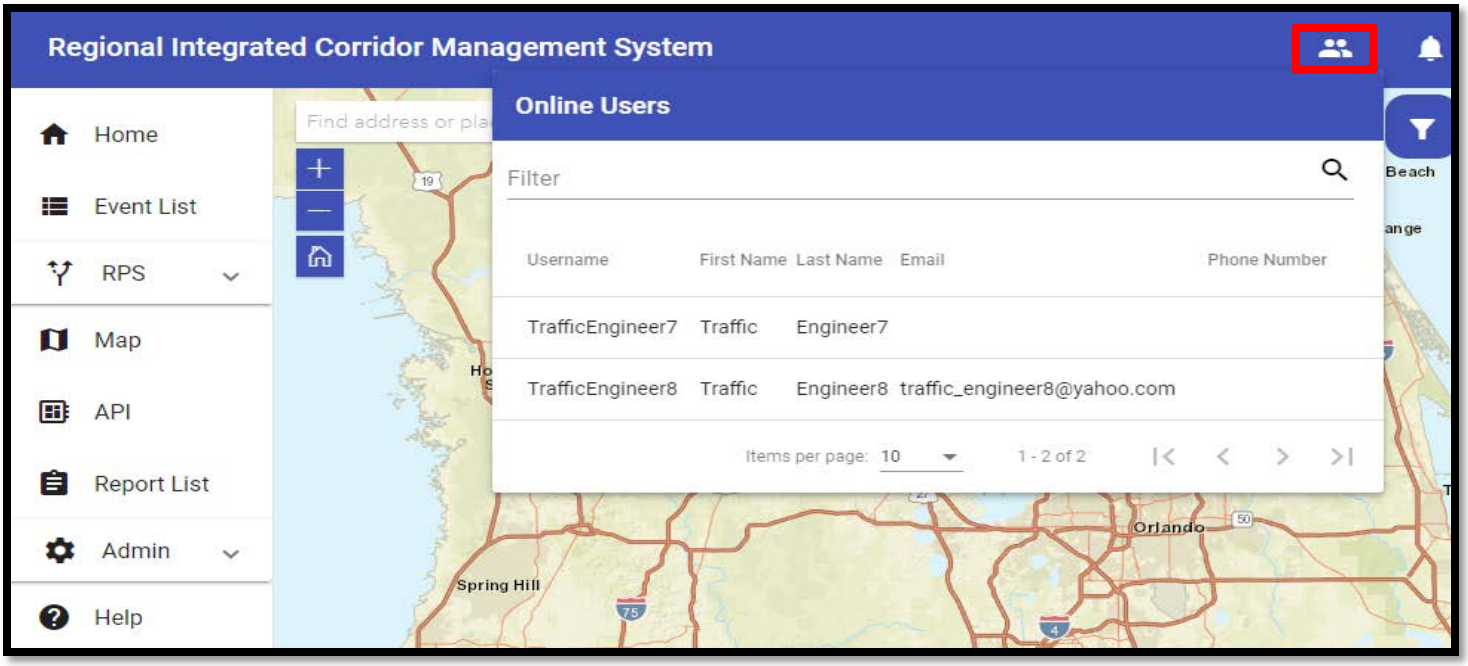
An alert also has a criticality. If an alert is considered "Critical", the alert will have a red exclamation point following the alert type.

When a user receives a new alert/notification, the notification bell will light up with the number of unread notifications. Additionally, if the notification is configured to create a popup, a popup will appear in the bottom right-hand side of the screen.



7.2 ROnline Users

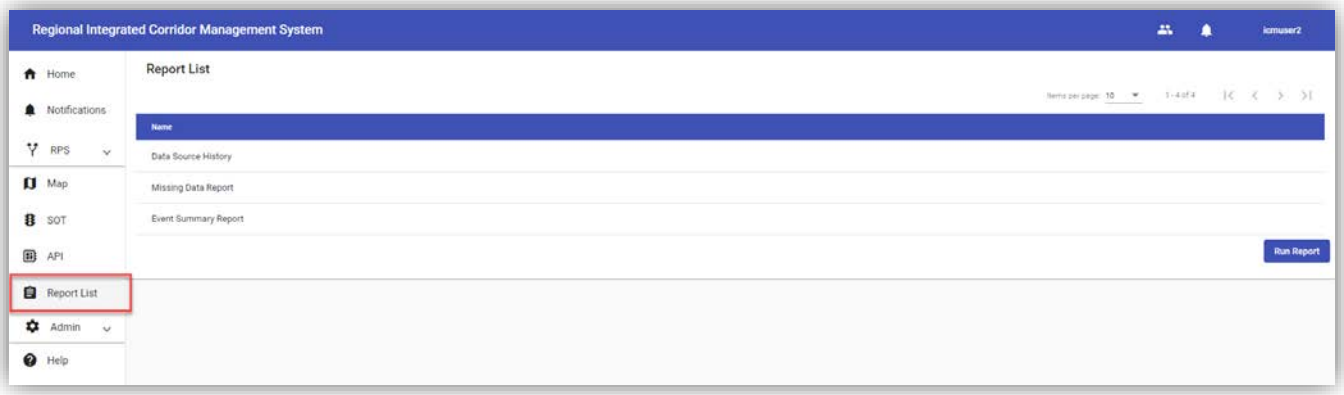
To view the list of online users, a user can click the “Users” icon located in the right-hand side of the website header banner.



This table display contact information for each user that is online. Note that an email address and phone number are optional.

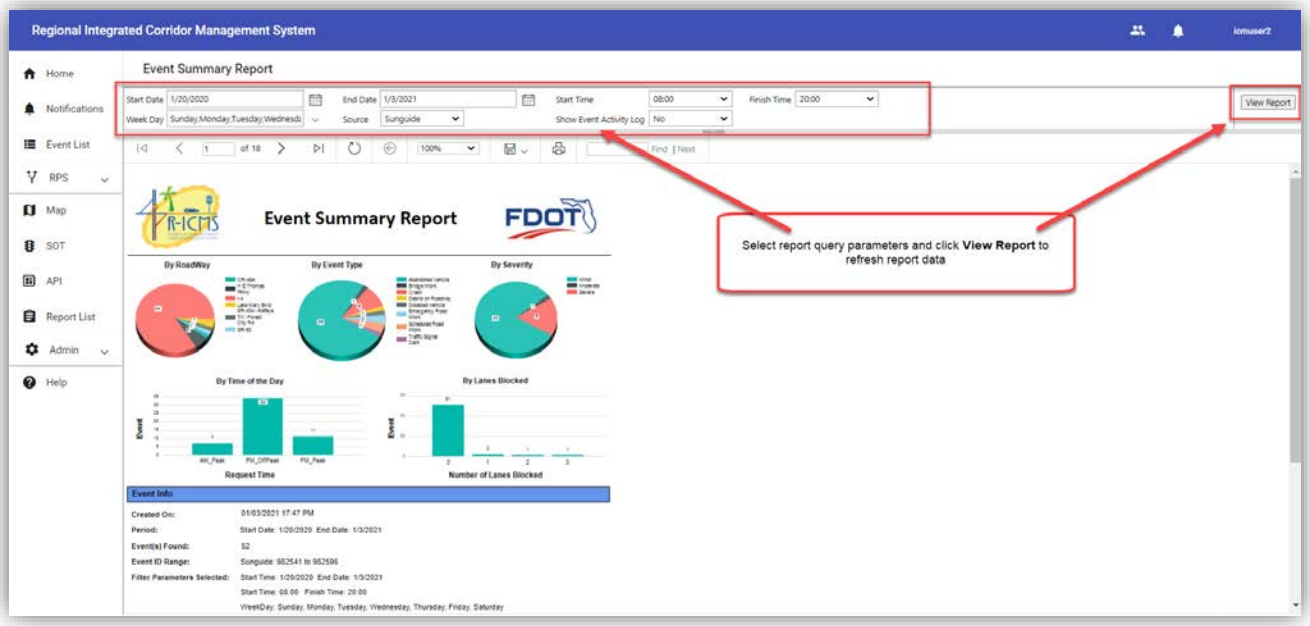
8 Reports

The Reports module supports the ability for users to access available reports to perform queries and export the data in multiple formats. The Reports module is available from the left navigation pane. The system displays the list of available reports for users to select to define report query parameters.



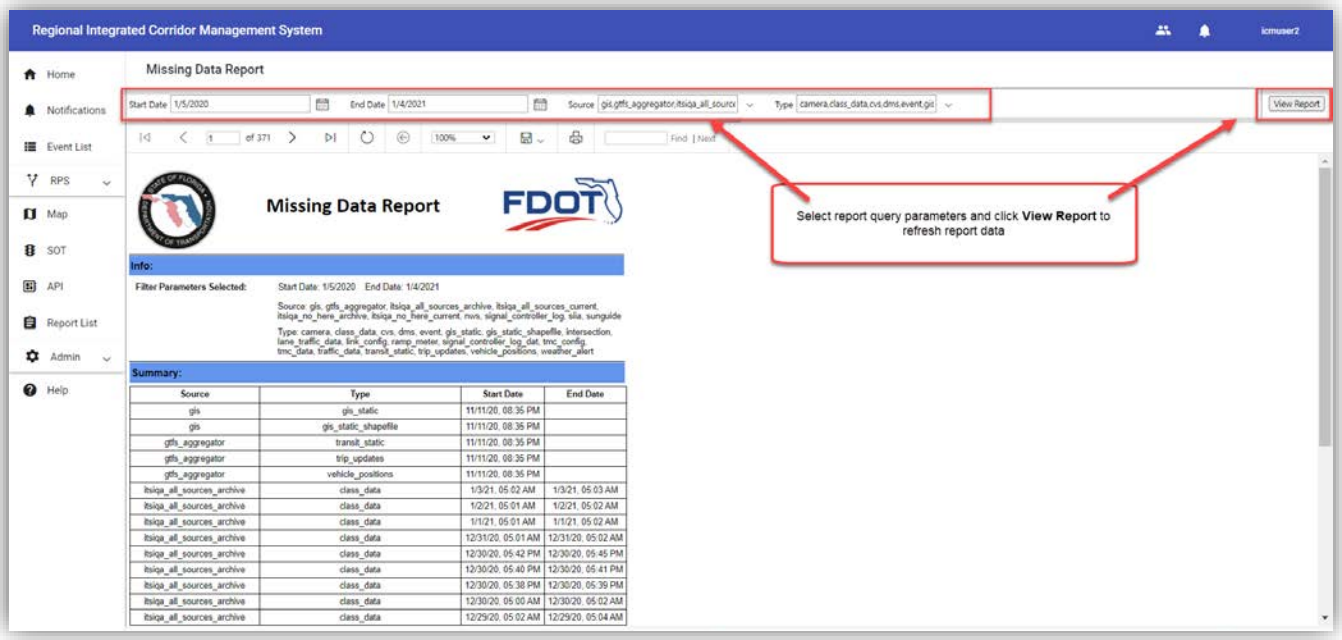
8.1 Event Summary Report

The Event Summary report is a graphical view of event data and optional event log based on user selected parameters. The report shows event data summarized by Roadway, Event Type, Severity, Time of Day and Lanes Blocked. By default, no data will be displayed initially. Once the user selects their desired report query parameters and clicks the View Report button, the system will refresh the available graphs and charts and event details. Users can print or download the report data to PDF or Excel.



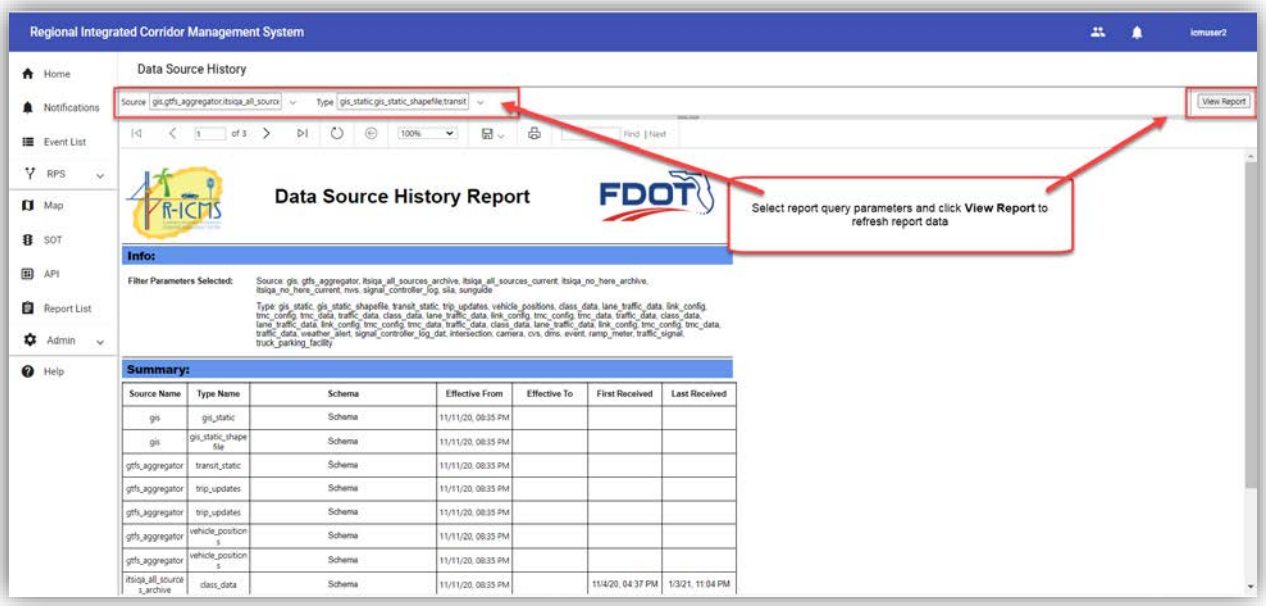
8.2 Missing Data Report

The Missing Data report is a tabular log of gaps in information received for a selected date range by data source and data type. Once the user selects their desired report query parameters and clicks the View Report button, the system will refresh the available data. Users must select the data source values to populate the data type values. Users can print or download the report data to PDF or Excel.



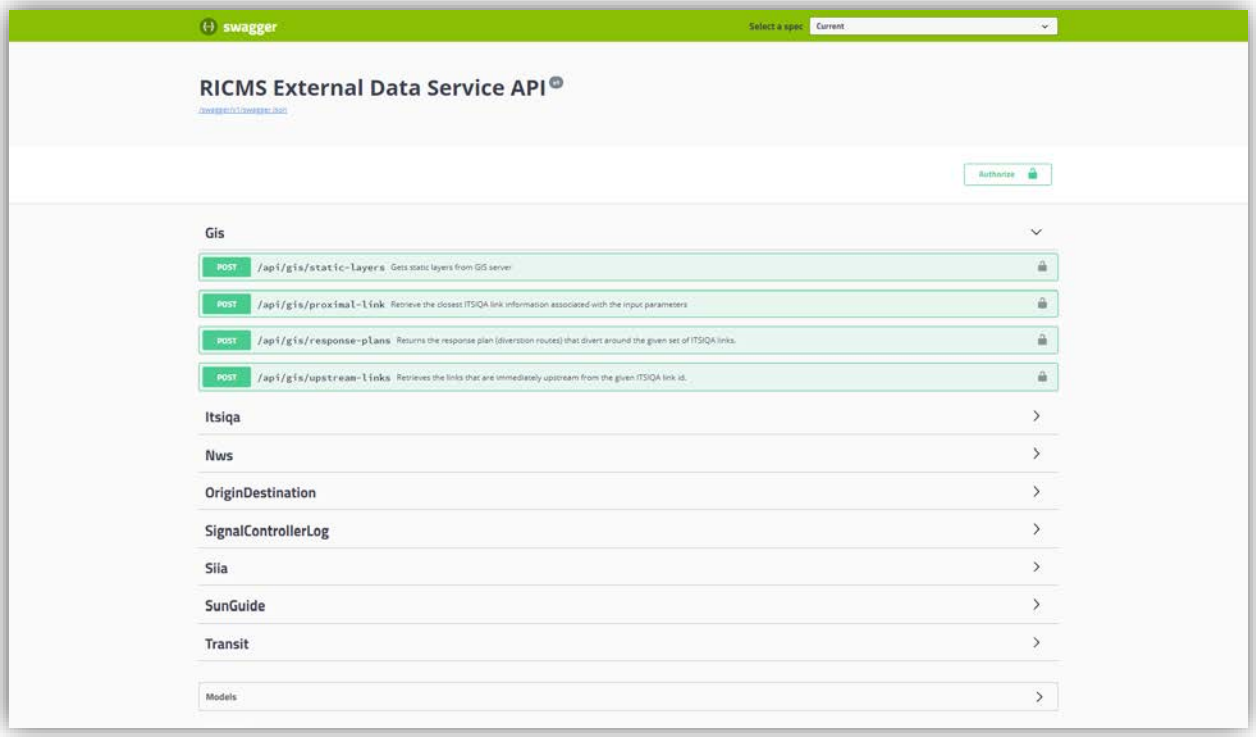
8.3 Data Source History Report

The Data Source History report is a tabular log of all information received for selected data source and data type. Once the user selects their desired report query parameters and clicks the View Report button, the system will refresh the available data. Users must select the data source values to populate the data type values. Users can print or download the report data to PDF or Excel.



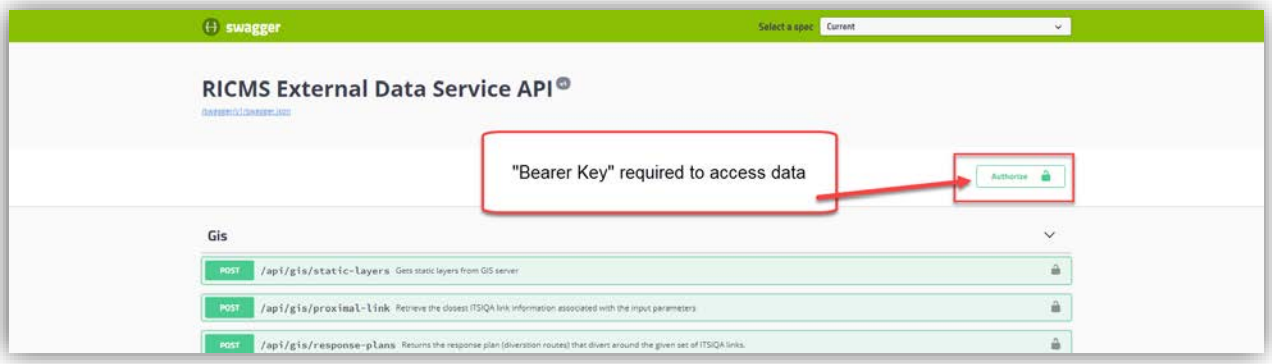
9 API

The API provides access to the R-ICMS data sources to external data consumers. The API is accessible through the application from the left navigation bar. The link takes user to the list of available data sources and is hosted by Swagger, an industry available platform. Each data source can be expanded to see the available data topics.



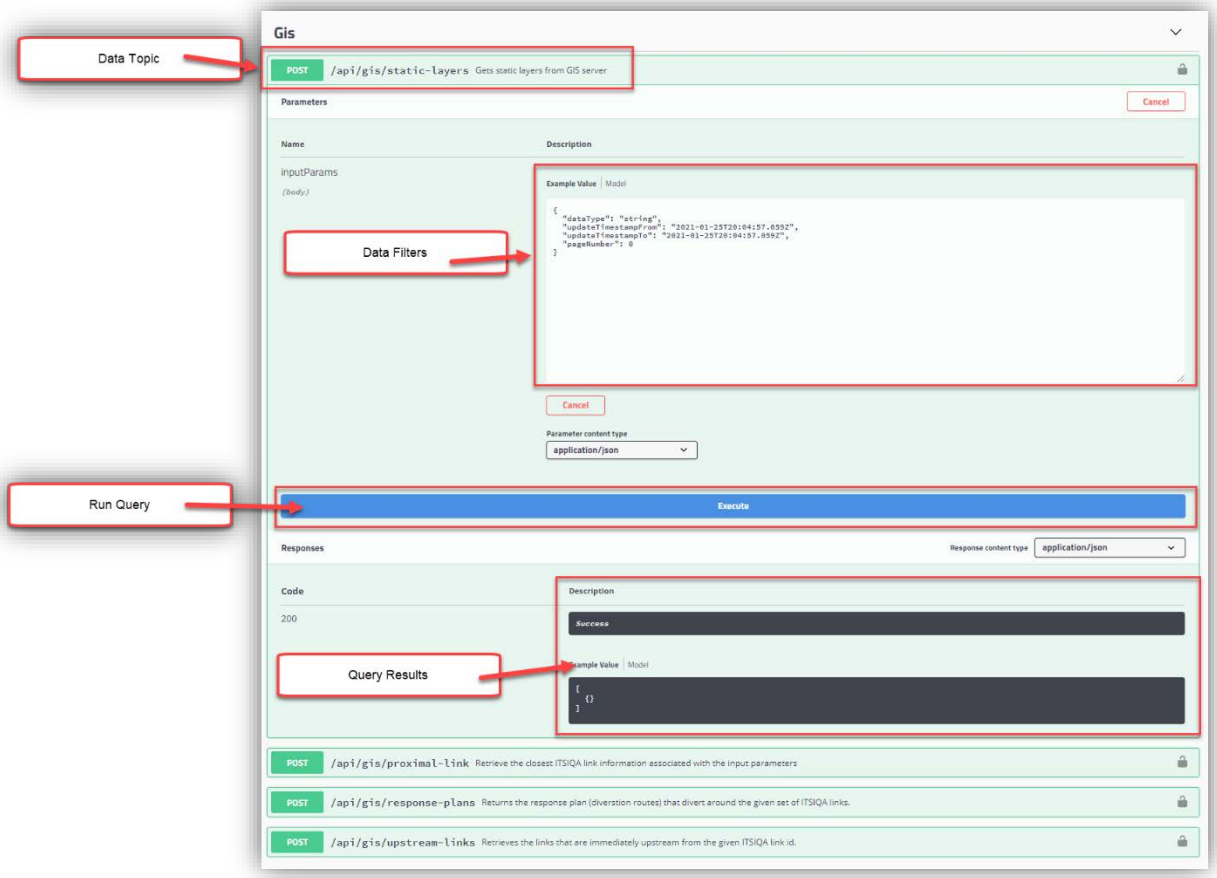
9.1.1 Access the API

To access the API data and filter parameters, user must have the Authorization code or “Bearer Key”. Please contact FDOT IT to request appropriate access.



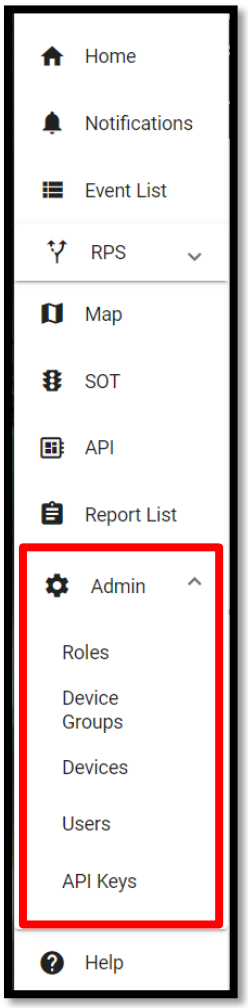
9.1.2 Query an API

Each data topic has a unique set of available filter parameters to perform a query. Users can select Post from the data topic to view and edit the available filter parameters and select Execute to run the query. The system will show an excerpt of the results and the user can download the data when satisfied with the results.



10Administration

The Administrative related features are located under the "**Admin**" dropdown on the main navigation pane. These features allow administrators to view and manage permission groups, approval profiles, users, and API keys.



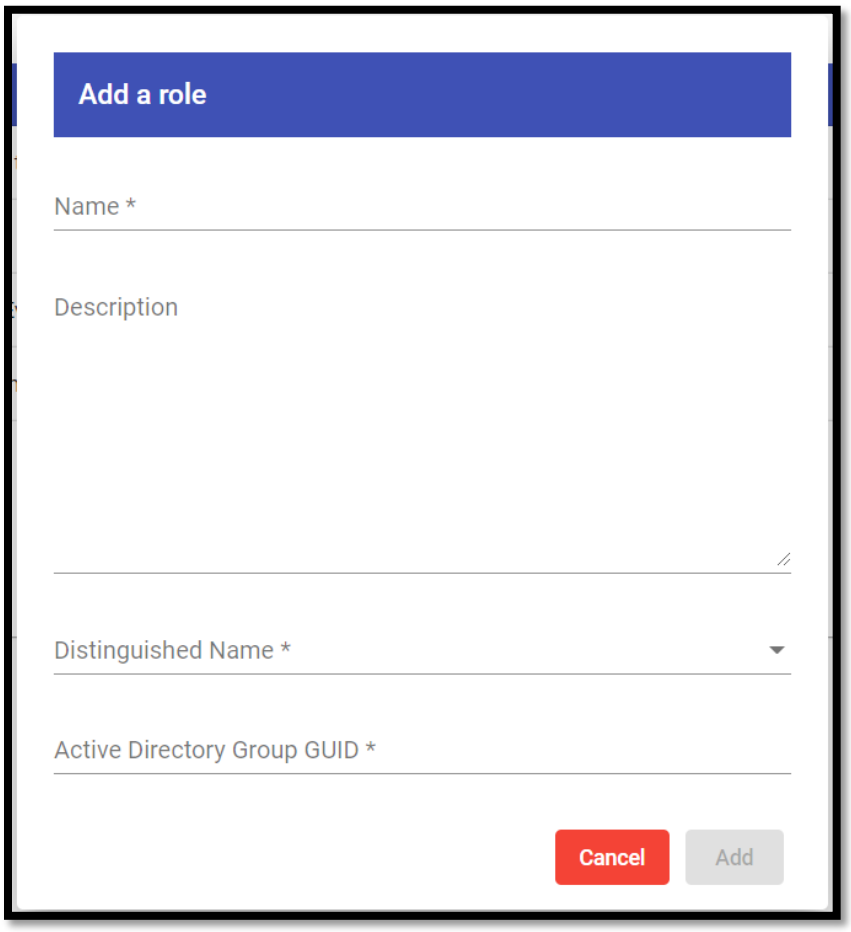
10.1 Roles

A role is a RR-ICMS representation of an Active Directory group. A role is used to group permissions and give users access to specific areas and features of the system. If a user is a member of the role's Active Directory group, the user will have all the role's permissions. To view the list of existing roles, click the "**Roles**" option in the "**Admin**" dropdown.

The **Roles** table displays the name and description of each role, as well as the associated Active Directory group's Globally Unique Identifier (GUID) and Distinguished Name (DN).

10.1.1 Add a Role

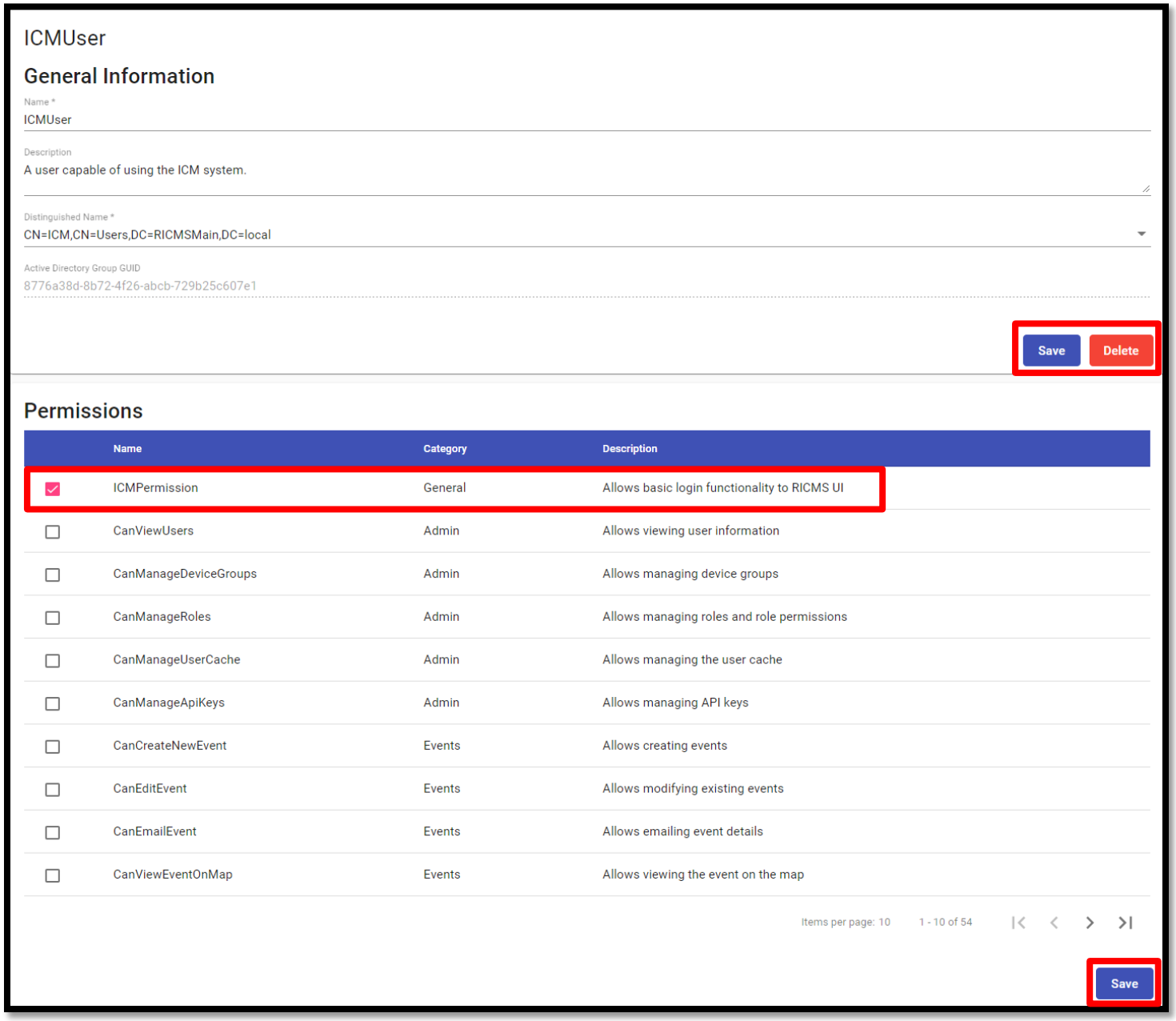
To add a role, click the "**Add**" button in the bottom righthand side of the **Roles** screen and the "**Add a role**" dialog will popup.



Input the name, optional description, and the associated Active Directory distinguished name. Once the distinguished name is selected, the "**Active Directory Group GUID**" field will be populated. Once all required fields are filled, the "**Add**" button will be enabled.

10.1.2 Role Details

To view the details of an existing role, click the role's row in the table.



The role details page is broken up into 2 sections. The "**General Information**" section is located in the top half of the page. This section holds the same fields located in the "**Add a role**" dialog. When a user is done editing the fields in this

section, they can save those changes by clicking the "**Save**" button located in the bottom right-hand side of the section. If a user decides to delete a role, they can click the "**Delete**" button next to the "**Save**" button.

The second section of the role details page is the "**Permissions**" table. In this table, a user can add/remove permission to a role. If a permission is a member of the role, the checkbox in the left-hand side of the row will be checked. To add or remove a permission, simply click the checkbox of permission's row. To save the changes made in this section, click the "Save" button in the bottom right-hand side of the page.

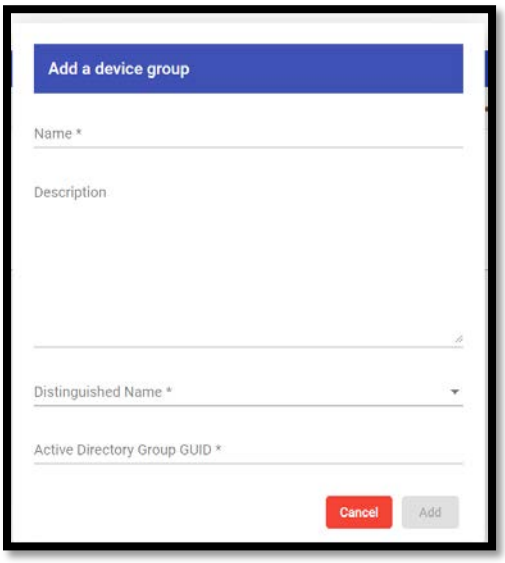
10.2 Device Groups

A device group is like a role in that it is a RR-ICMS representation of an Active Directory group. However, instead of it consisting of permissions, a device group is made up of devices. Some actions in the RR-ICMS require access to specific devices. In order for a user to have permission for a specified device, they must be a member of the corresponding device group. To view the list of existing device groups, click the "**Device Groups**" option in the "**Admin**" dropdown.

The **Device Groups** table displays the same information as the **Roles** table.

10.2.1 Add a New Device

To add a new device group, click on the "**Add**" button in the bottom right-hand side of the screen.

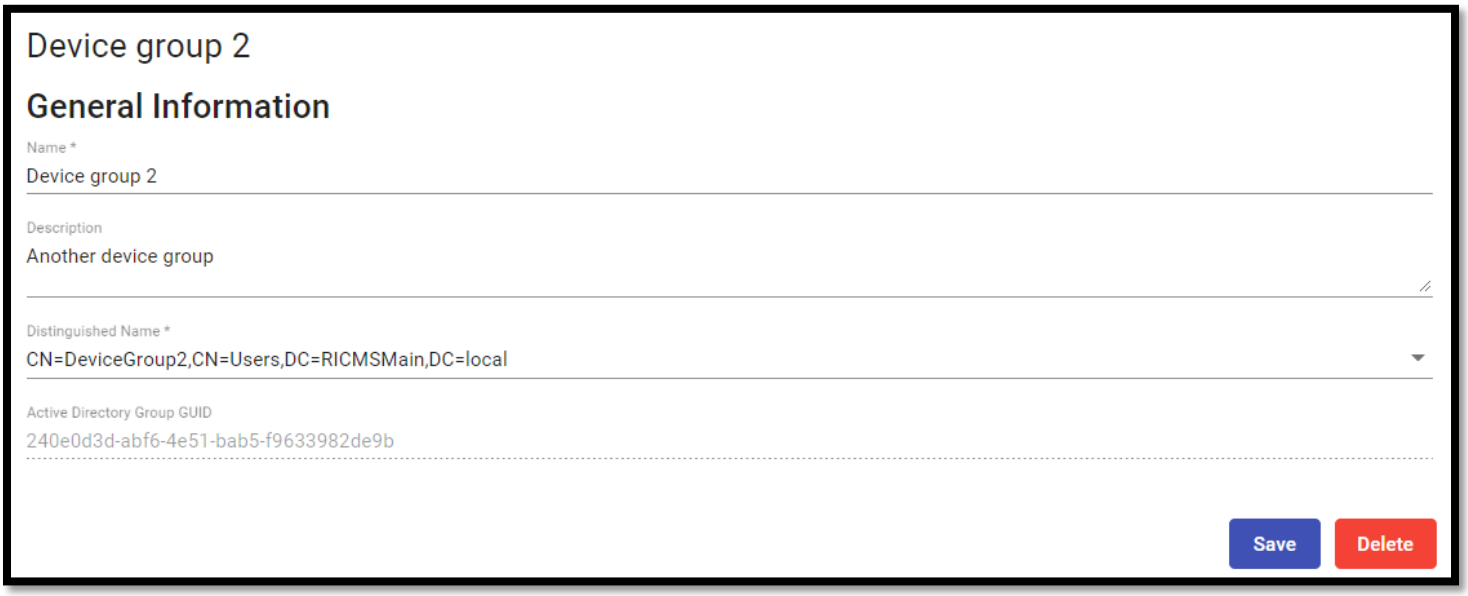


Adding a new device group is the same process as adding a new Role.

10.2.2 Edit Device Group Information

To view the details of an existing device group, click the device group's row in the table. The device group details page is broken up into 4 different sections. The first section is the "**General Information**" section.

10.2.2.1 General Information



This section has the same information and features as the "**General Information**" section on the **Role Details** page.

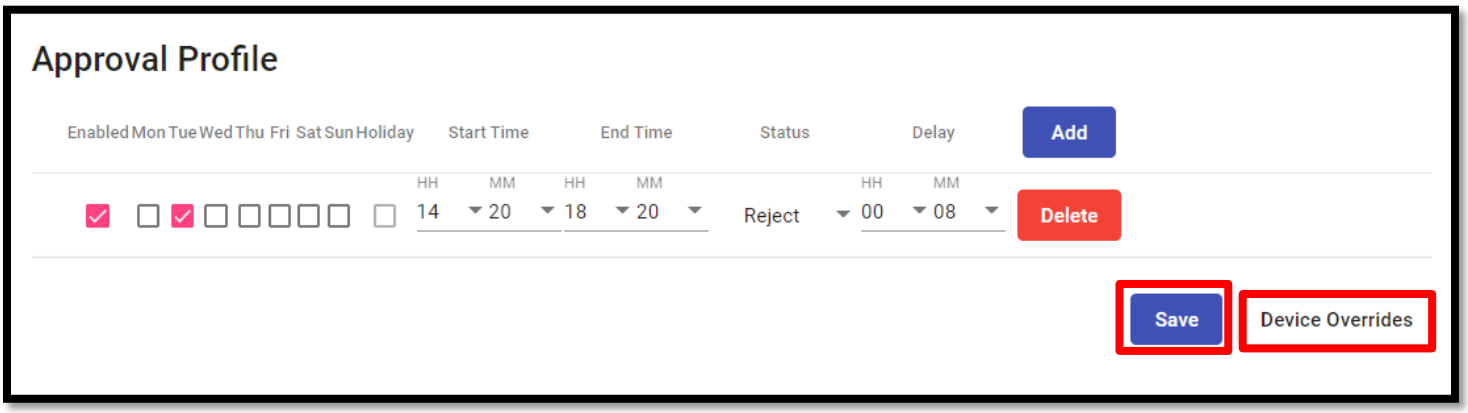
10.2.2.2 Contact Information

The second section of the device group details page is the "**Contact Information**" section.

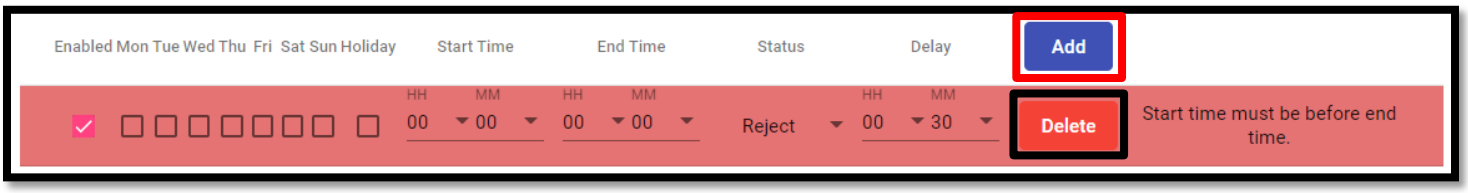
This section contains 3 optional fields. The purpose of this section is to list the contact information of the device group's manager or a representative of the agency associated with the device group. To save changes in this section, press the "Save" button in the bottom right-hand side of the section.

10.2.2.3 Approval Profile

The third section of the Device Group details page is the "**Approval Profile**" section. An Approval Profile is a way to automatically set the approval status of a device for a Response Plan Evaluation.



This section is essentially a complex table made up of Approval Profiles for the device group. In the image above, the Device Group has 1 Approval Profile. To save any changes made in this section, click the "**Save**" button in the bottom right-hand side of the section. The "**Device Overrides**" button will bring you to a prefiltered "**Devices**" page containing only devices who are a member of this page's device group. The "**Devices**" page is discussed further in section 6.3.



To add a new Approval Profile for this device group, click the "**Add**" button located at the end of the column headers. This will add a new, blank Approval Profile row. Before any changes are made, the row will be highlighted red and an

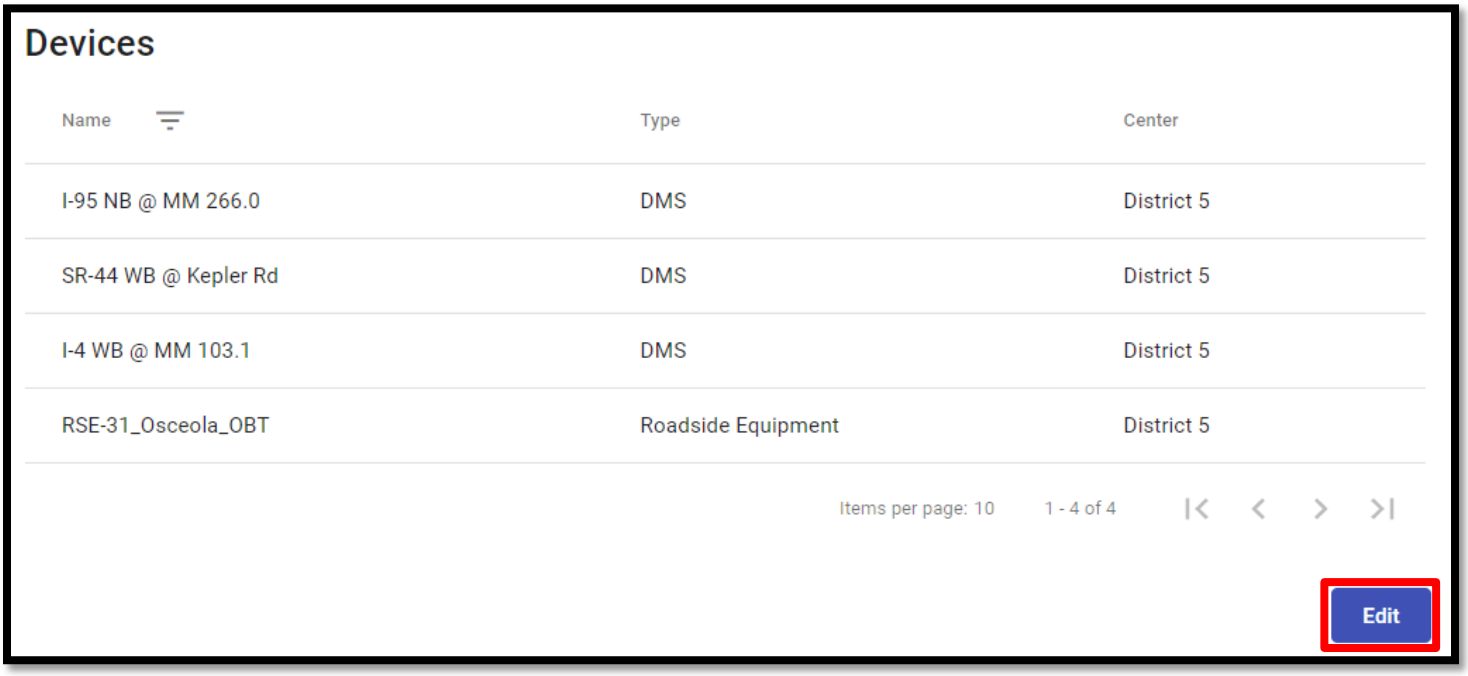
error message will appear at the end of the row. Once all errors are addressed, the message and the red highlight will go away.
Each column of the table acts as a setting for the Approval Profile.

- Enabled – The Approval Profile is enabled when checked.
- Mon, Tues, …, Sun – The day of the week the Approval Profile is active.
- Start Time/End Time – The Approval Profile is applied to a Response Plan Evaluation if the device approval process takes place during these times.
- Status – The approval status to be applied to the group's devices.
- Delay – The time before the approval status is applied.

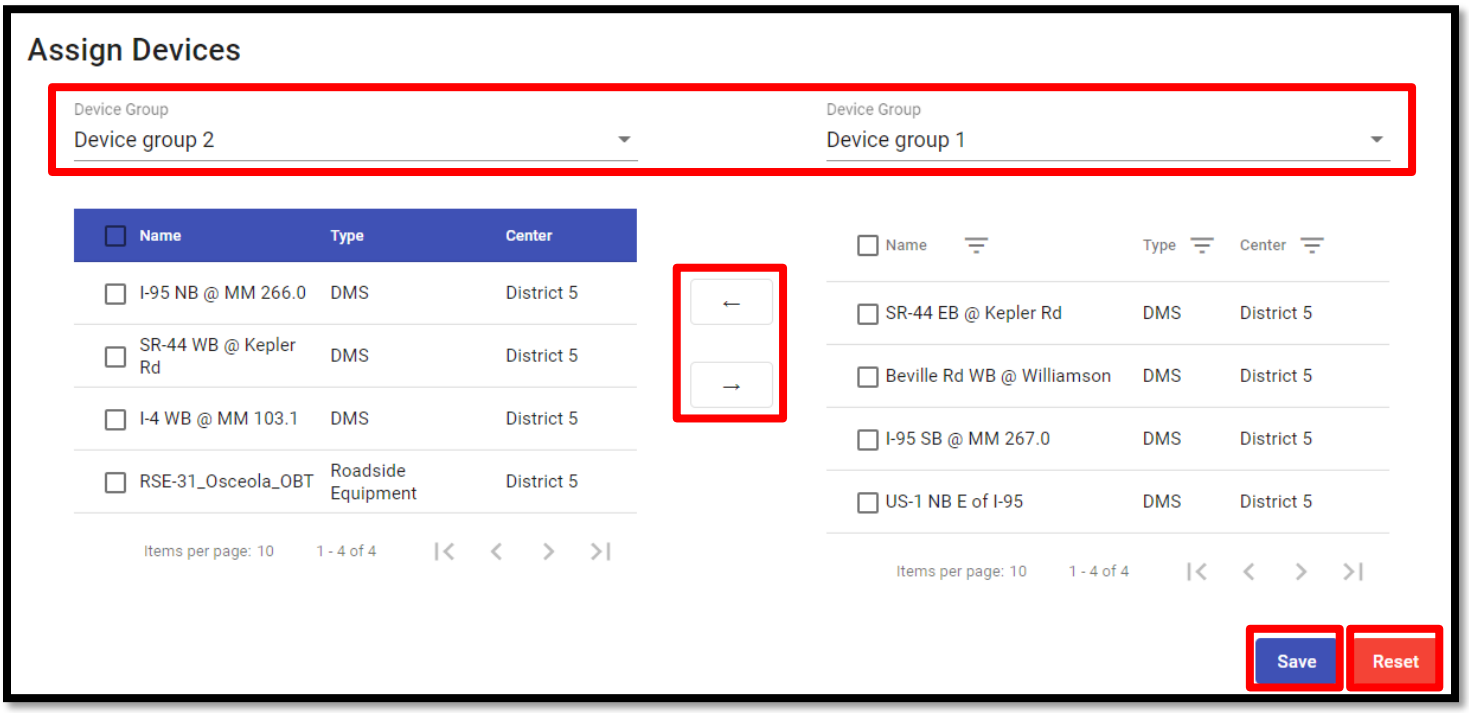
To remove an Approval Profile, click the "**Delete**" button (outlined in black) on the row you wish to delete.

10.2.2.4 Devices

The final section of the Device Group page is the "**Devices**" section.



This section displays the list of devices who are a member of the device group. To manage the devices of the device group, click the "**Edit**" button in the bottom right-hand side of the section.

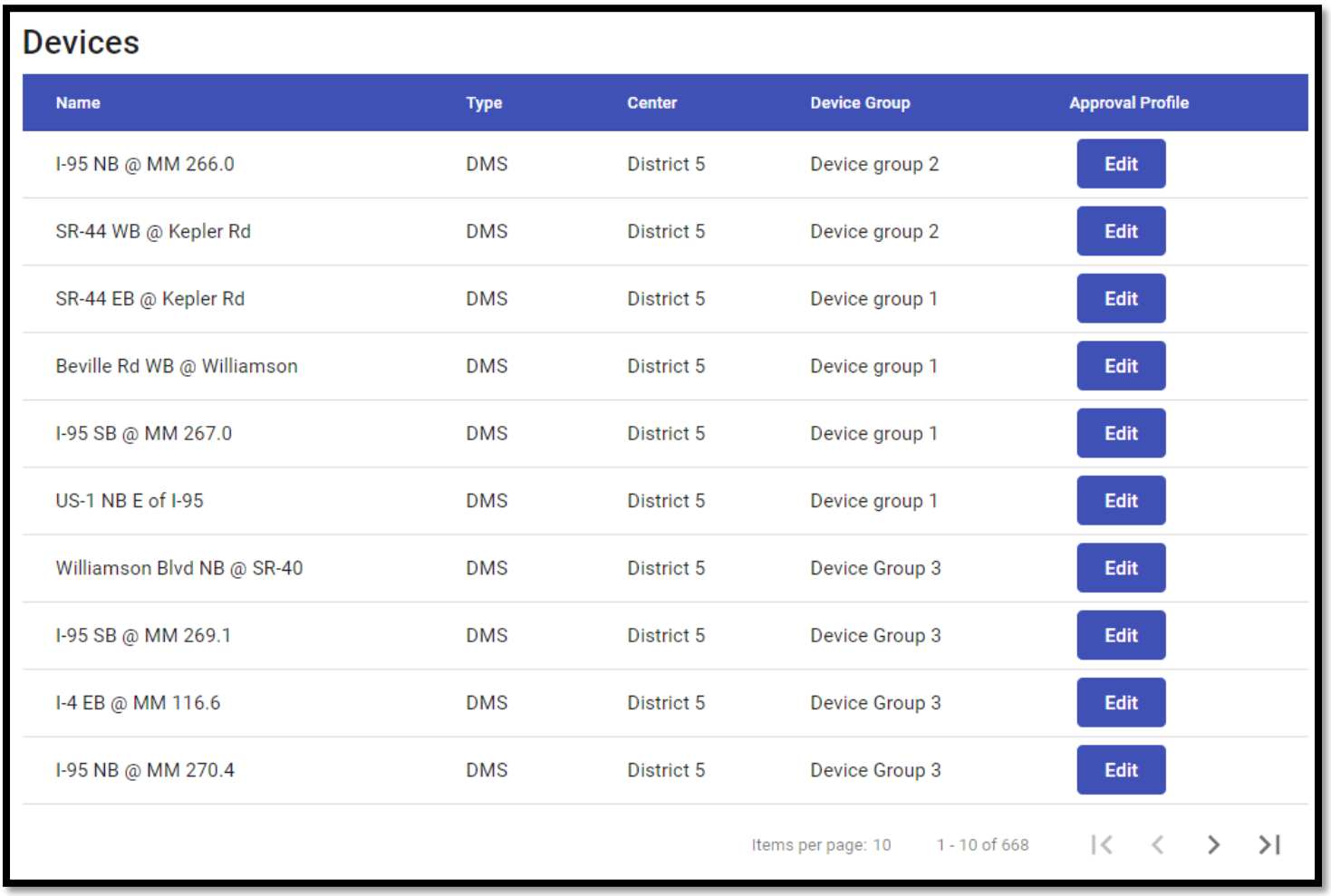


Once clicked, the user will be navigated to the "Assign Devices" page. This page is broken up into two sections. The left half of the page is the device group of the previous page. The right half of the page is a device group of your choosing. The device groups for both sections can be changed using the drop downs outlined in red at the top of the page. The table below both device group dropdowns contain the device members of the group.

To move a device to a different group, select the checkbox of the device's row and click the arrow button for the direction you want to move the device. To save changes made on this page, click the "**Save**" button located in the bottom right-hand side of the page. If a user decides to discard any changes, they can click the "**Reset**" button located to the right of the "**Save**" button.

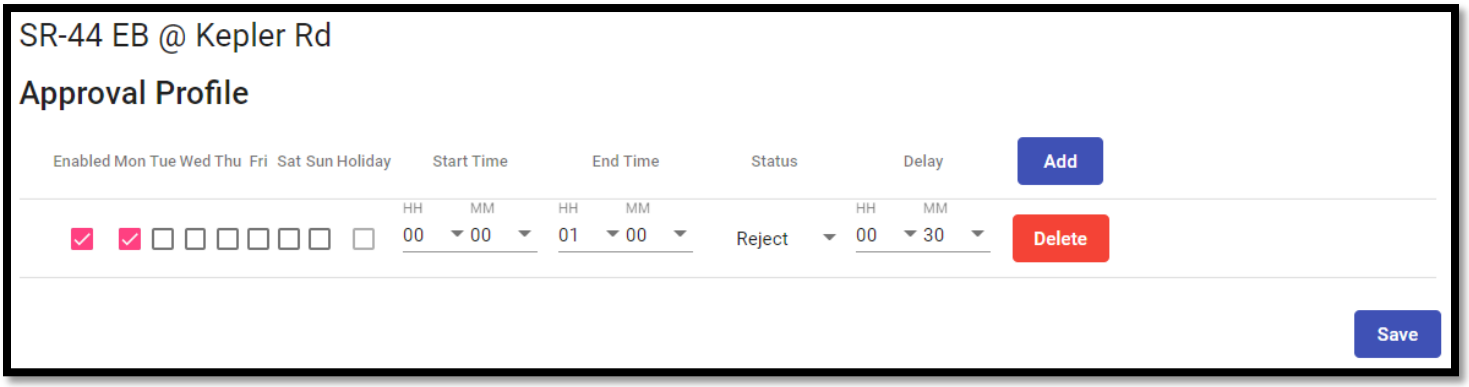
10.3 Devices

To view the list of devices, click the "**Devices**" option in the "**Admin**" dropdown.



10.3.1 Edit Approval Profile

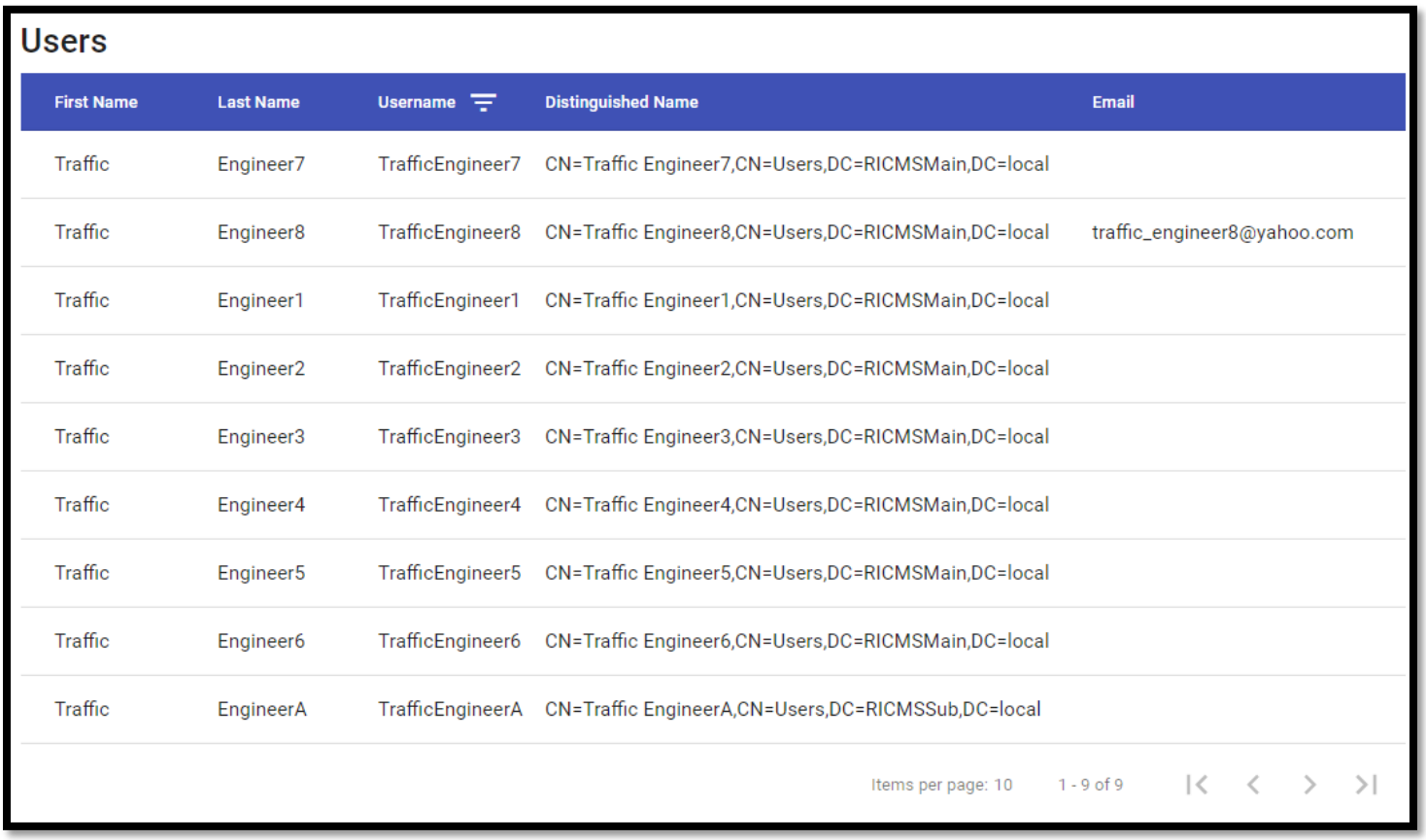
To edit the approval profile for a device, click the "**Edit**" button on the device's row.



The "Edit" button will bring you to the "Approval Profile" page of the selected device. The management of approval profiles on this page is handled the same way described in section 6.2.2.3. Both device groups and devices themselves can have an approval profile. However, a device's approval profile will override its device group's approval profile.

10.4 Users

To view the list of users in the RR-ICMS, click the "**Users**" option in the "**Admin**" dropdown.

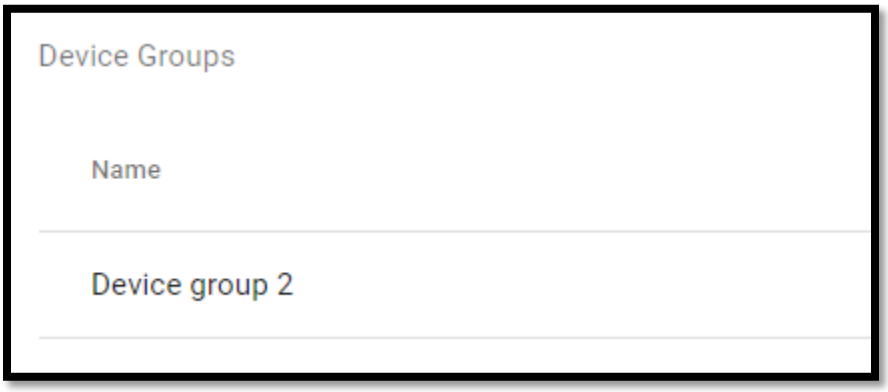


10.4.1 User Details

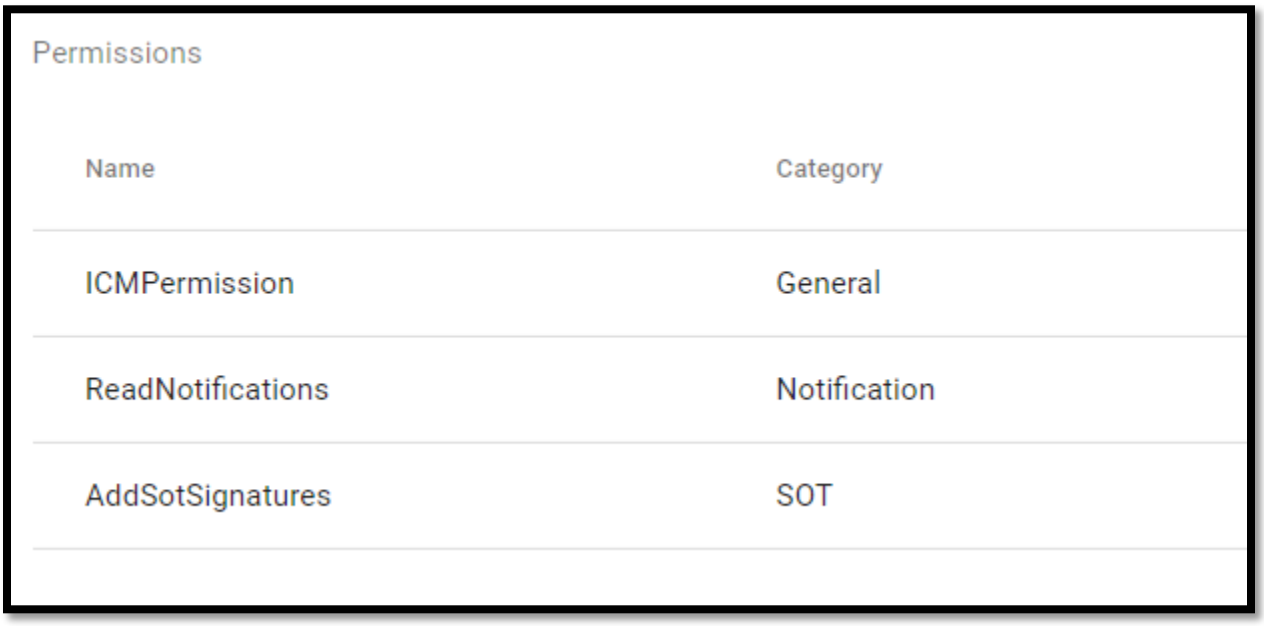
To view the details of a user, click the user's role. This action will navigate you to the User Details page. This page is broken up into several sections.

The first section displays the user's username, Active Directory Distinguished Name, and an optional email.

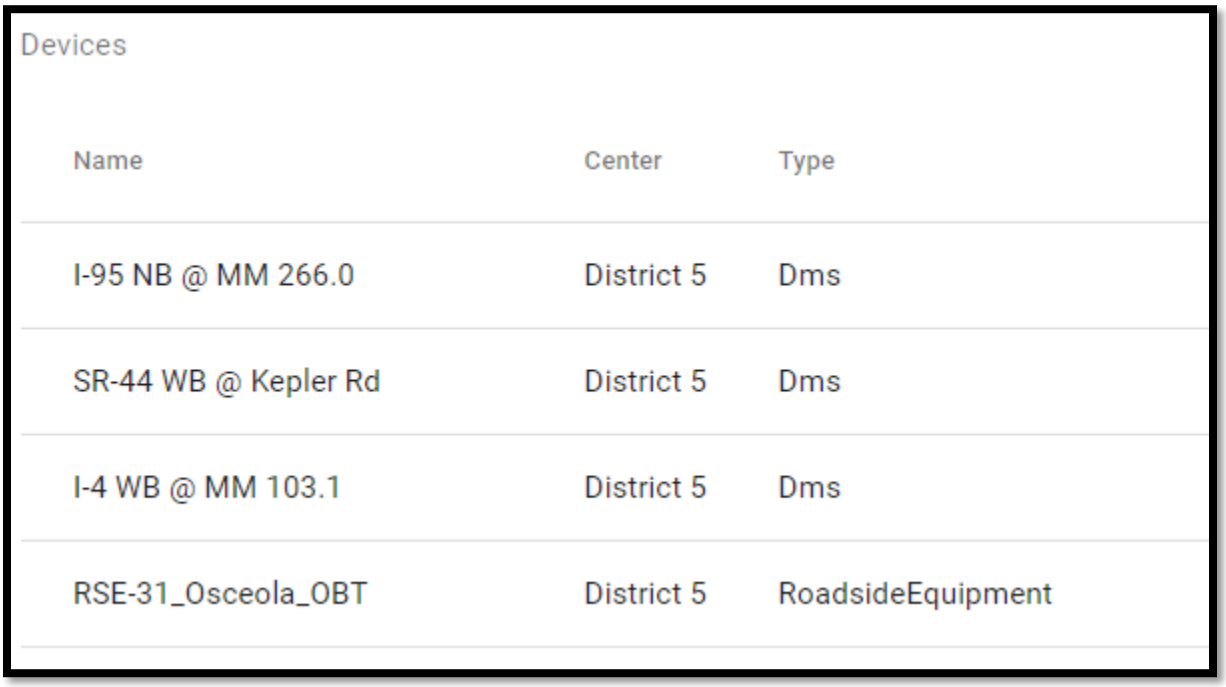
The second section displays the list of roles the user is a member of.



The third section displays the list of device groups the user is a member of.



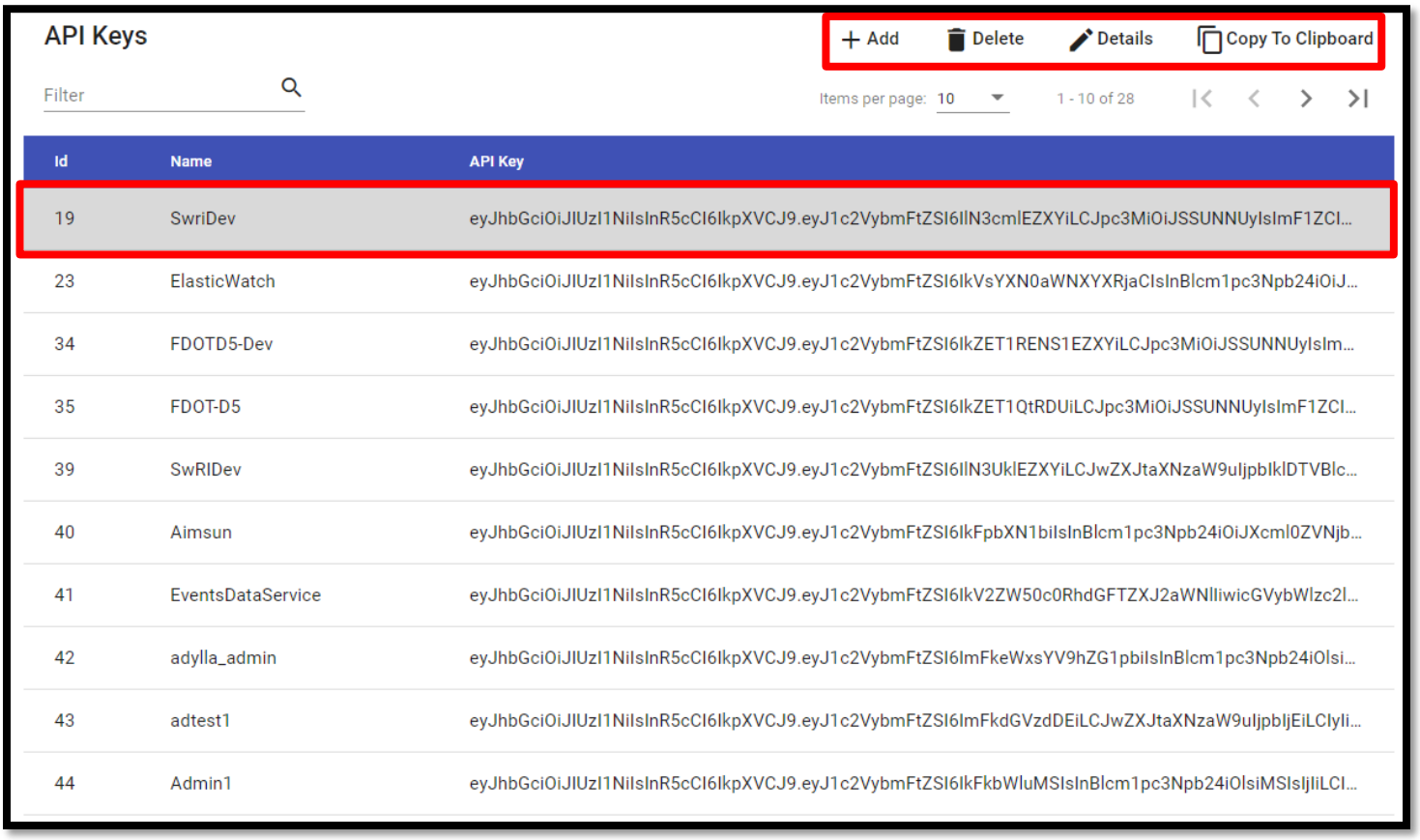
The fourth section displays the set of permissions the user has based on their role memberships.



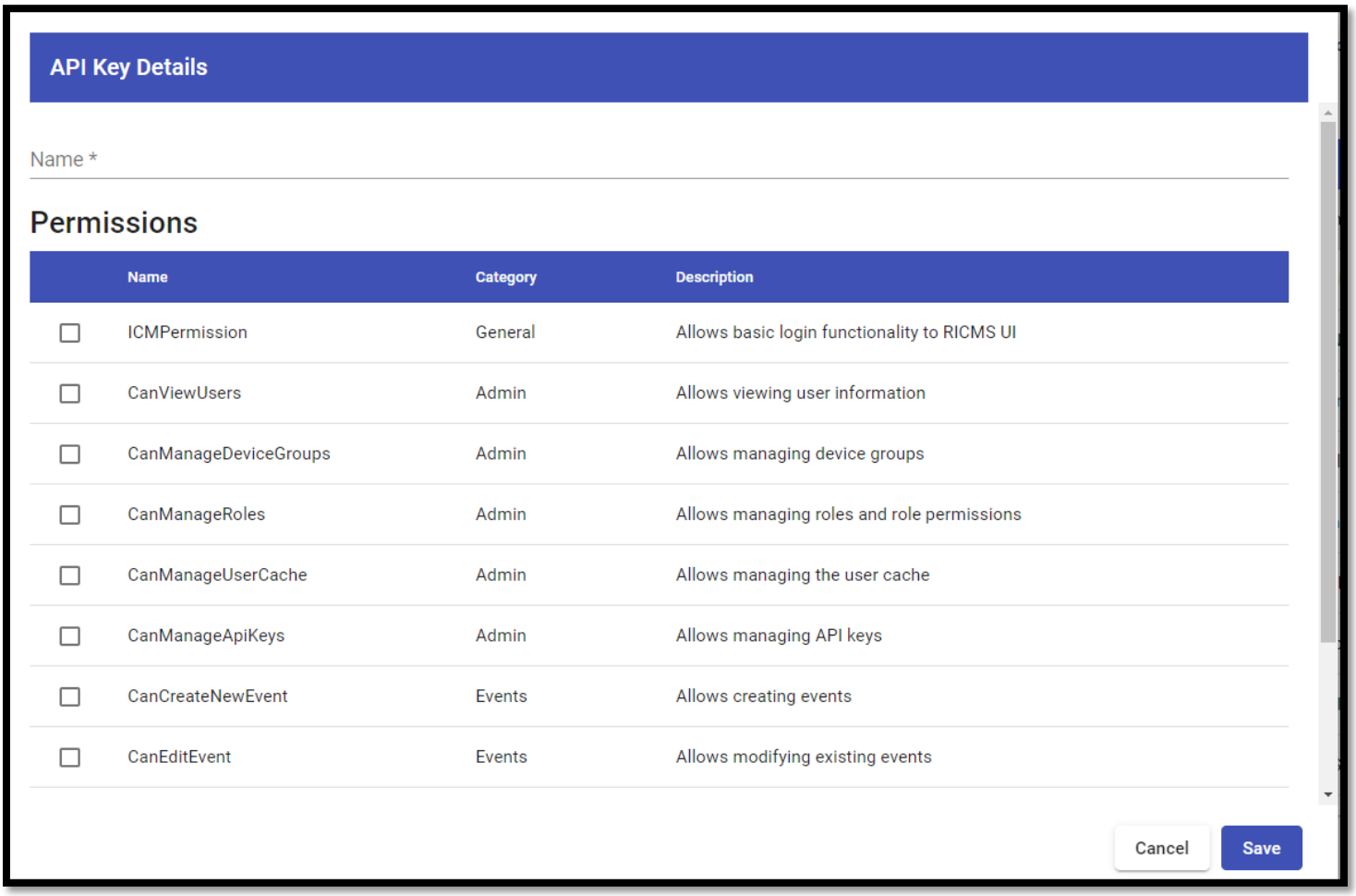
The fifth and final section displays the set of devices the user has permission to based on their device group memberships.

10.5 API Keys

An API key is a security measured used to give a service or user access to a RR-ICMS related API. To view the list of existing API keys, click the “API Keys” option under the “Admin” dropdown.



The table provides information about an API key's Id, name, and a preview of the of the API keys itself. To add a new API key, click the "**Add**" button located in the top right-hand side of the page.



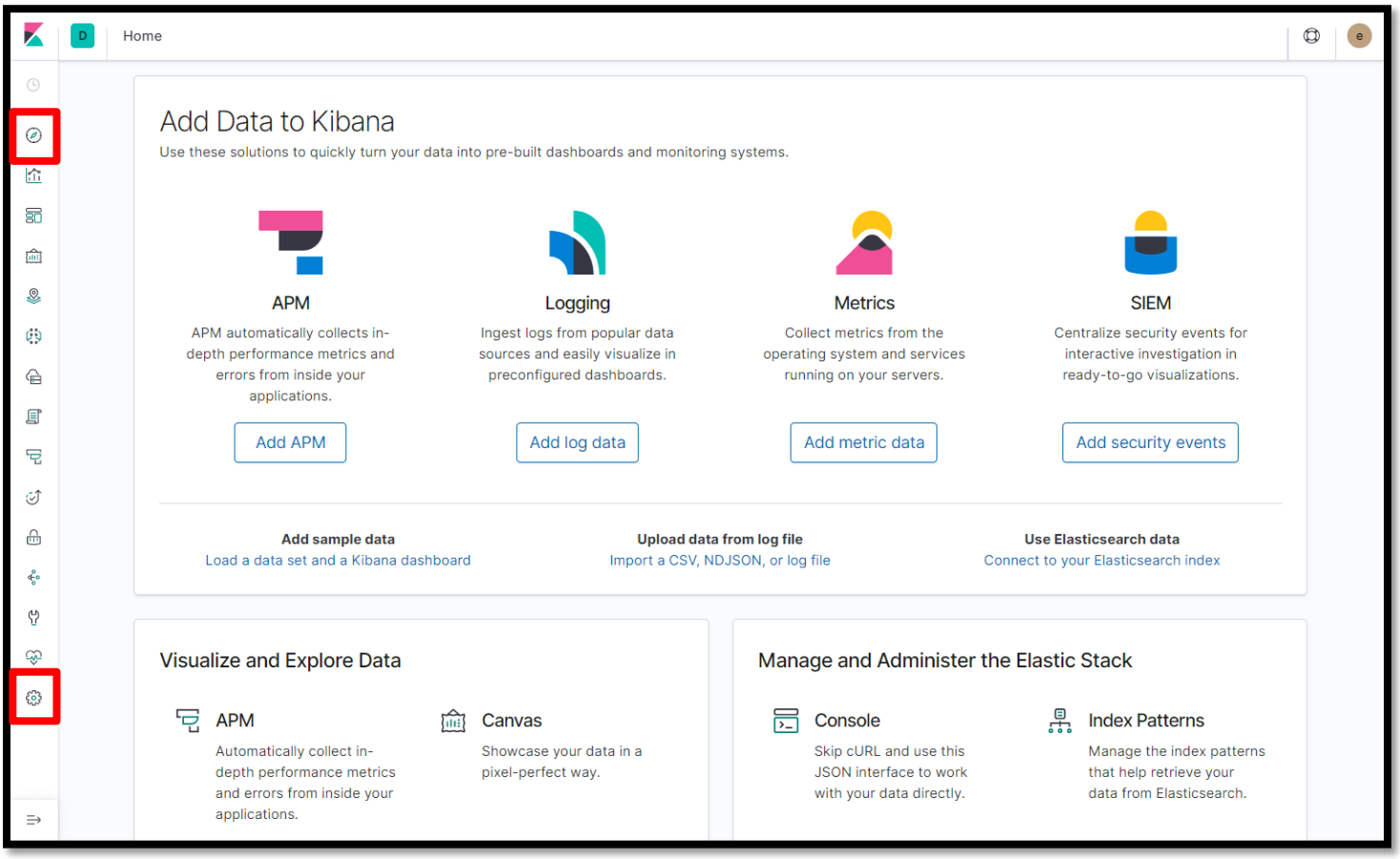
This action will pop up the "**API Key Details**" dialog. The user must first provide a name for the API key. Then, they can choose the set of permissions that the API key will have. When finished, click the "**Save**" button to save the new API key.

When a user selects a row in the API Key table, 3 other actions will be enabled. The user can choose to delete the selected API key by pressing the "**Delete**" button. The user can edit the selected API key by double clicking the row or clicking the "**Details**" button. This view is very similar to the "**API Key Details**" dialog described above. However, the details dialog of an existing API key will display the API key itself along with the ability to copy the key to the user's clipboard. The user can also copy a key to their clipboard from the list view by selecting the desired row and clicking the "**Copy To Clipboard**" button.

Keep in mind that if an API key's permission set or name is edited and saved, the previously generated API key will be invalidated.

10.6 Logging

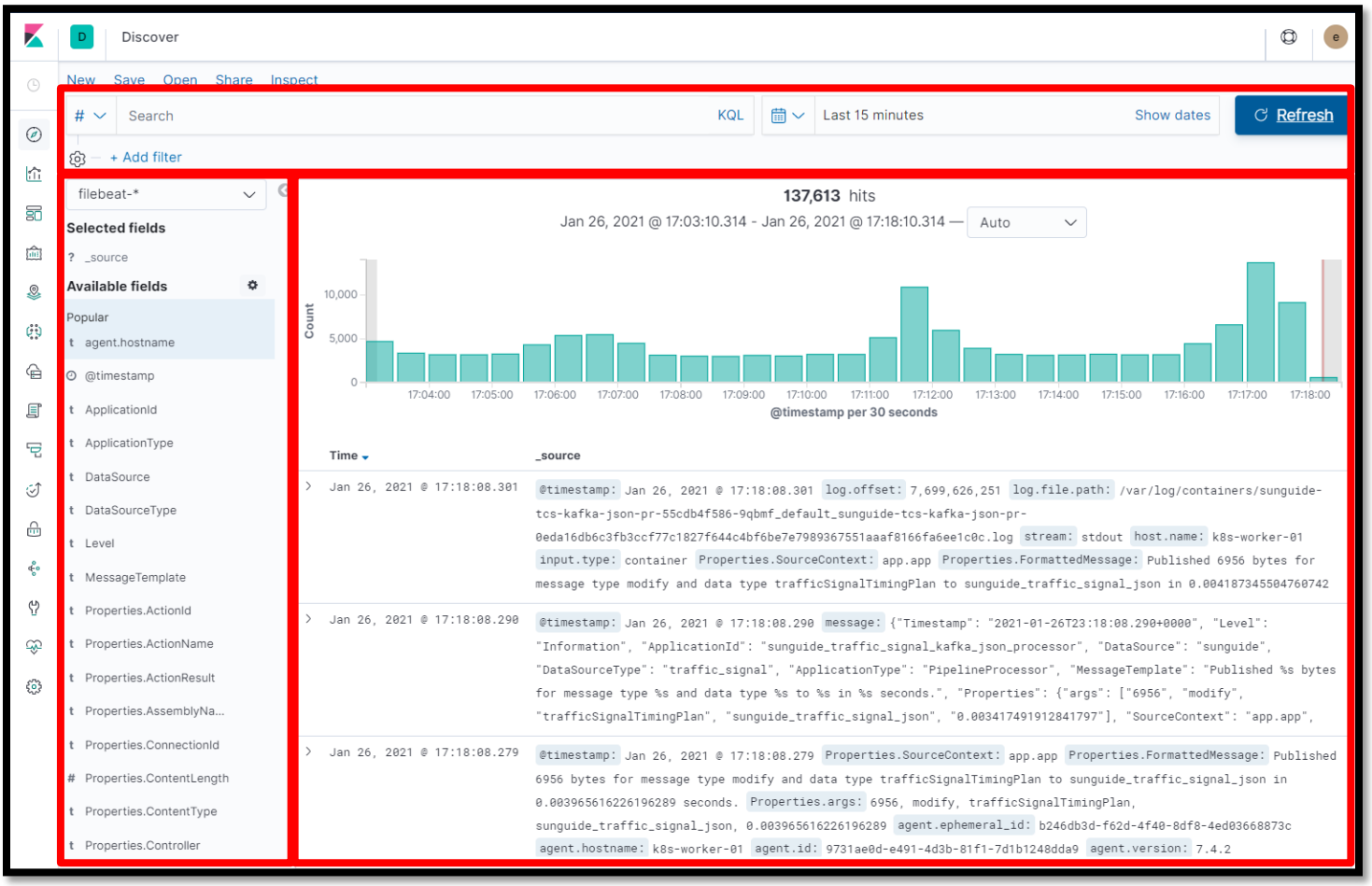
Elasticsearch is a 3rd party application used by the R-ICMS to store, search, and monitor logs that are generated by R-ICMS applications. Kibana is the user interface Rfor Elasticsearch that provides a way to interact with these logs. Navigate to the R-ICMS's Kibana page and log in. After logging in, the user will be navigated to the home page.



The main navigation pane is located on the left hand-side of the screen. There are many different features of Kibana, but the main two that will be used are outlined in red. The first highlighted option will bring you to the "**Discover**" tab.

10.6.1 Discovery

The "**Discovery**" tab is the main feature used in Kibana. On this page a user can view and search all RR-ICMS related logs.



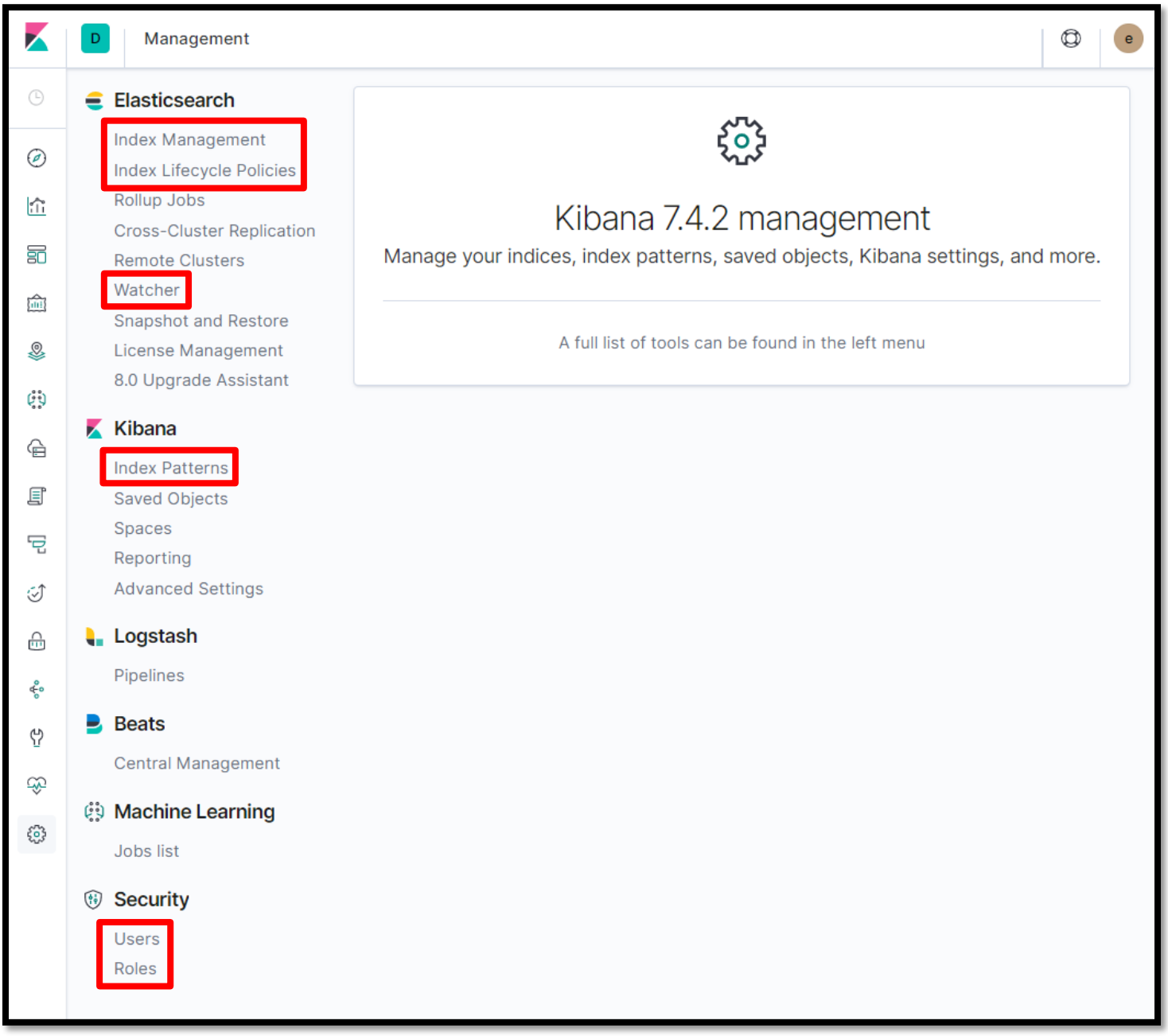
The top section outlined in red contains the main search/filter features of the Discover tab. In this section a user can do a simple keyword search, create complex queries using the Kibana Query Language, add filters based on log fields, set a date range, and refresh the search results.

The left-most section outlined in red contains the index pattern for the current page and the list of available fields. An index pattern is a bucket of similar data sources with shared fields. The index pattern acts as the default set of data for the **Discover** tab. Below the index pattern is the "**Selected fields**" and "**Available fields**" sections. In these sections, users can change what columns are displayed in the results section.

The right-most section outlined in red contains the logs results. View the entire contents of a log in an organized fashion, clip the dropdown arrow of the log's row.

10.6.2 Management

The "Management" tab is located at the bottom of the main navigation pane.



The main management tools that will be used are outlined in red.

- Index Management – View and manage the Elasticsearch indices.
- Index Lifecycle Policies – View and manage the Index Lifecycle Policies. Lifecycle policies are used to determine when index rollover takes place and when it is safe to delete an old index.
- Watcher – View and manage the list of available Watchers. On this management page Watchers can be edited, added, and disabled/enabled.
- Index Patterns – View and manage index pattern configurations.
- Users – View and manage the list of users who have access to Kibana.
- Roles – View and manage the list of roles in Kibana. Roles are used to manage user access in Kibana.

11 Help

The Help module provides online access to the RR-ICMS User Manual