Signal Performance Measures (SPM) Manual

Signal Performance Measures
Manual V 1.0

VERSION HISTORY

Rev	By	Date	Comments
1.0	JLitvak	06/08/2021	Preliminary document release

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1. INTRODUCTION

Transparity® Signal Performance Measure (SPM) reports meet and exceed the insights available within the Open Source ATSPM solution. The latest version of the *Transparity* SPM reports delivers significant advancements in the user experience, decision making, security, and extensibility needed to implement effective signal timing improvements. McCain is currently developing additional reports to address specific and prominent objectives within the Transportation and Signal Performance reporting industry. In addition to illustrating the effectiveness of Adaptive Coordination, SPM reports build confidence in the use of other modes of operation such as Fixed Coordination and/or Peer-to-Peer Synchronization.

Each report contains interactive charts which enable users to zoom into chart data for deeper analysis of specific events and/or time frames without resetting chart parameters. Additionally, each report provides options for visualizing additional information and/or statistics; thus, the user is in control of the complexity of data visualized on each report. The reports enable users to compare real-time performance against historical averages or user-selected date/time ranges.

For example, when analyzing the need for signal retiming of a phase, users are provided with a single report containing the following performance measures:

- Phase Termination
- Split Monitor
- Ped Service / Delay
- Split Failure
- GOR / ROR %
- Termination Statistics
- Duration Statistics
- Pedestrian Statistics

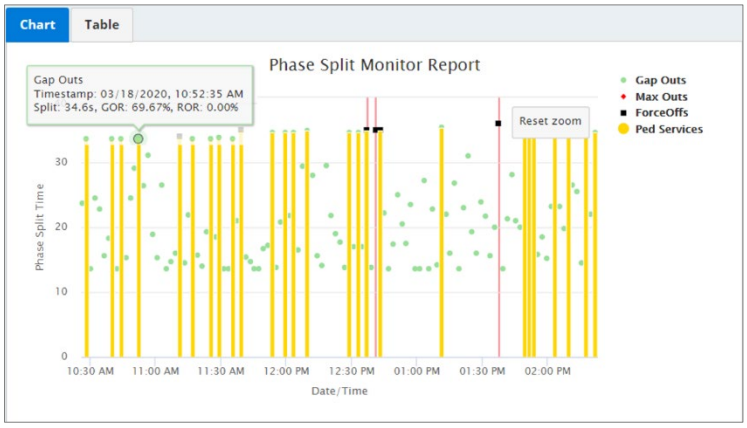

Figure 1-1: Transparity SPM Phase Split Monitor Chart

This approach presents the user with everything needed to properly analyze the demand and performance of a phase split vs the need to review multiple disparate reports.

2. SYSTEM ARCHITECTURE

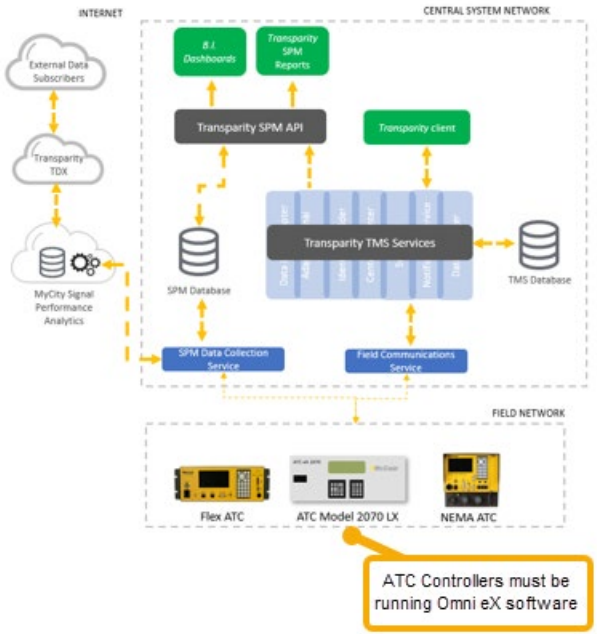

Figure 2-1: System Architecture

3. SYSTEM CONFIGURATION

Transparity SPM uses the capability of the ATC controller to collect high resolution events to display powerful modern metrics for signal performance. High resolution data captures every event at the intersection, including each detector activation and phase state change with 1/10 second accuracy. When High Resolution logging is enabled the controller collects and stores this data in memory. *Transparity* collects this data at a user specified interval and stores it in the central database. In order to take full advantage of the *Transparity* SPM Reports, it is critical to have the system configured properly.

System configuration is done in three steps: First, the system needs to know which controllers to collect from. Second, the system needs to know which detectors to use, and finally, which approach/phase the detectors are associated with.

3.1 Controller Log Configuration

In the controller Timing Editor go to **Unit Configuration > Log Configuration**. Make sure **HiRes Log Mode** is set to Enabled. From the list of events below make sure all events are checked (specifically **Phase, Pedestrian, Barrier/Ring, Phase Control, Overlap, Detector, Preemption, Coordination** and **Cabinet System**).

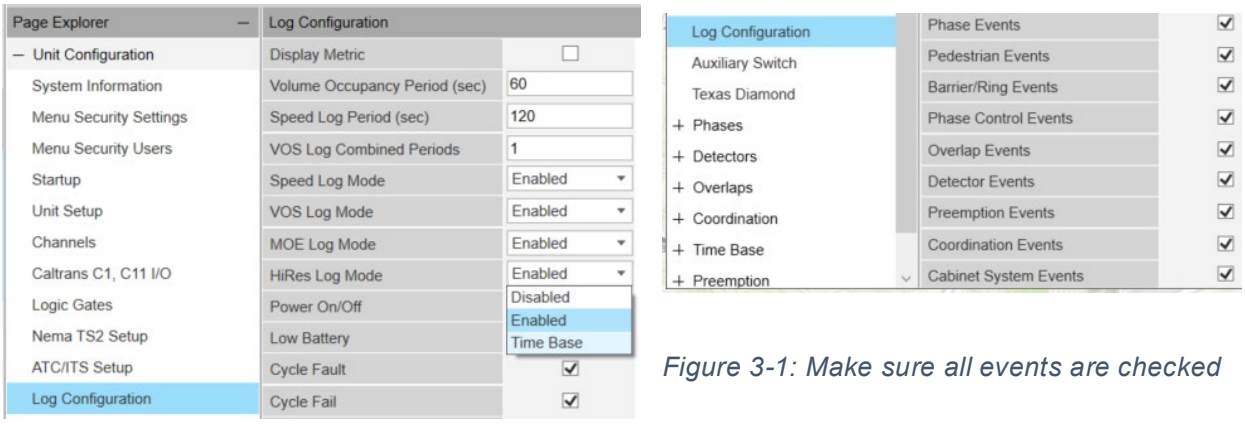

Figure 3-1: Make sure all events are checked

It is critical that the **System ID** in the controller database matches the **System ID** in Transparity.

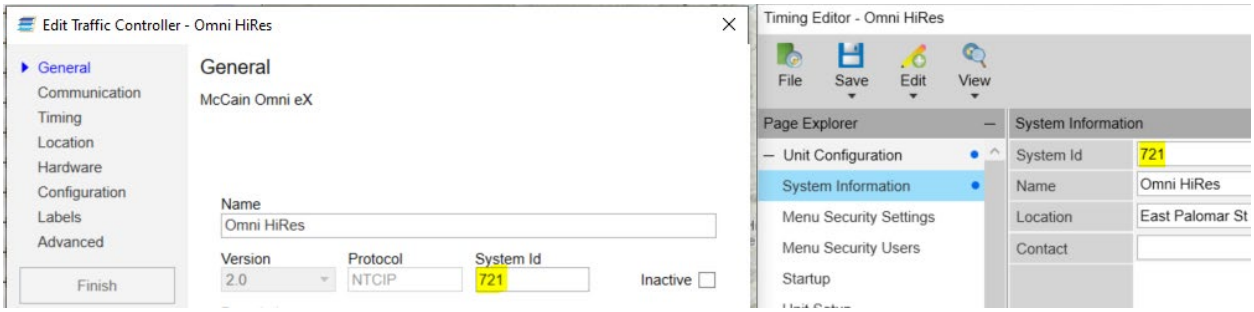

Figure 3-2: System ID in controller DB matches System ID in Transparity

Also, the controller must have **SSH/SCP** enabled. For Omni 2.0 and above, this is disabled by default and must be set in the field. The only way to enable is by going to the **Diagnostics Menu B.4** and going to **(7)Tools > (3)Manage Services**. Make sure **SSH/SCP** is set to **ACTIVE.**

NOTE: The controller will reboot into Diagnostics and the intersection will go into flash.

3.2 SPM Web App System Configuration

Make sure the TransparityWebAppHost service is running on the server. The configuration is done through the SPM web app: https://*SERVERNAME*:5099/ui

Log in with your *Transparity* login. From the home screen, click the **Settings** button in upper right and go to **SPM Configuration**.

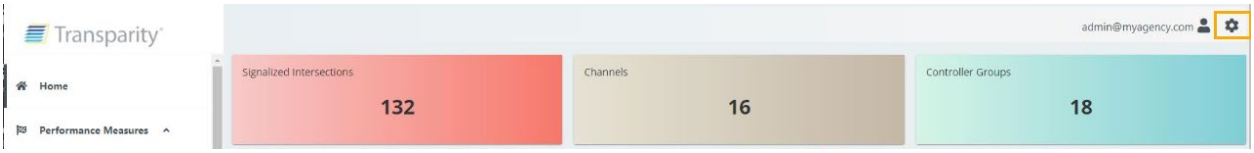

Figure 3-3: SPM Configuration Screen

3.3 SPM CONFIGURATION

Select the **System** tab.

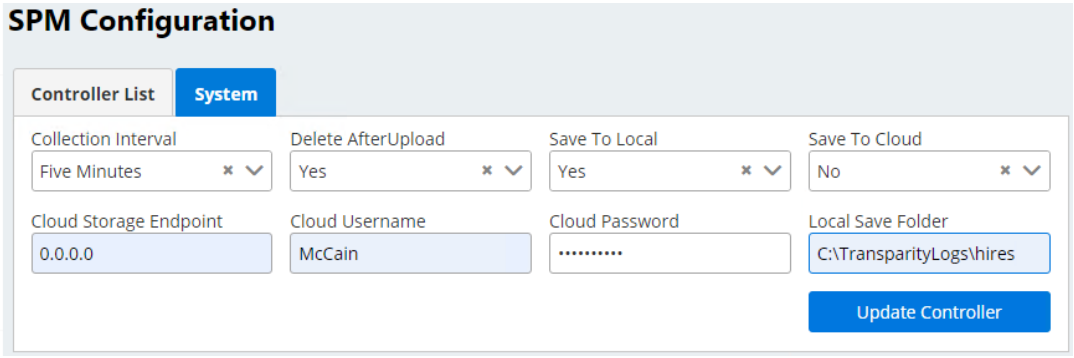

Figure 3-4: SPM Configuration Details Screen

Collection Interval: 5-7 minutes is typical.
Delete After Upload: Deletes the DAT files stored on the controller after a successful upload.
Save to Local: Saves the DAT files to your Local Save Folder.
Save To Cloud, Cloud Storage Endpoint, Cloud Username, Cloud Password: If using cloud storage these parameters will be provided by McCain. For local storage systems set the "Save to Cloud" setting to No, set the cloud endpoint to 0.0.0.0 and cloud username to local.
Local Save Folder: set to *C:\TransparityLogs\hires*.

3.4 CONTROLLER CONFIGURATION

Select **Controller List** tab.

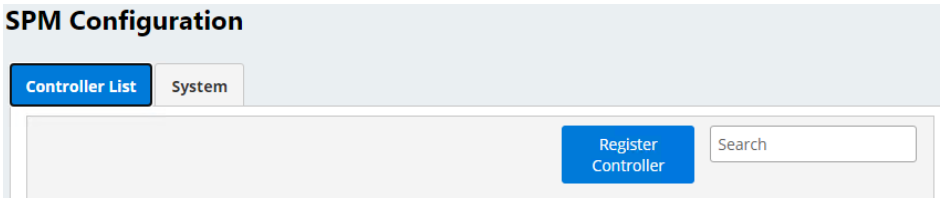

Figure 3-5: SPM Configuration Controller List Screen

Register Controller: Select a device from the list. The list will show all Omni ATC controllers configured Transparity TMS. Versions 1.11 and 2.X are currently supported.

IMPORTANT: The version configured in Transparity must match the actual version in the field.

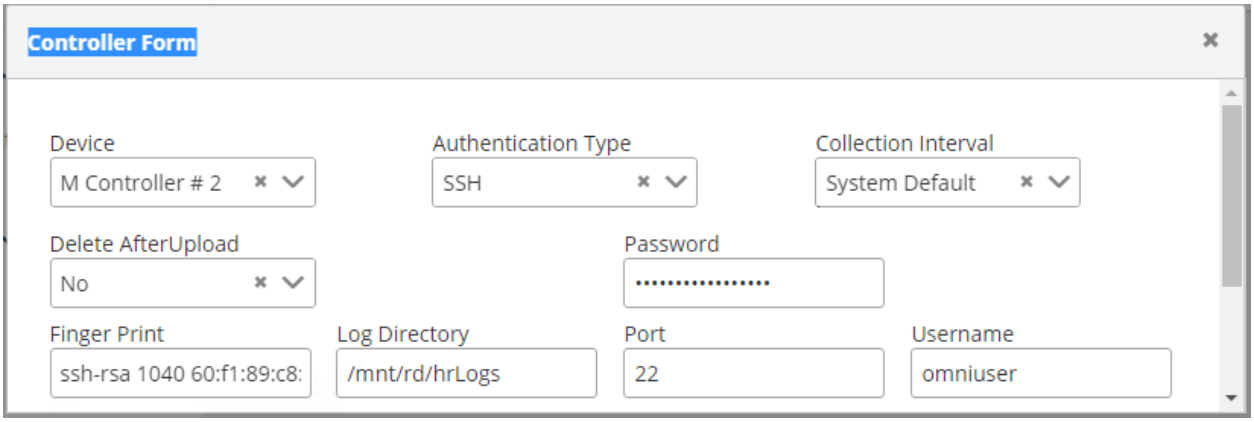

Figure 3-6: Controller Form Screen

Authentication Type: set to SSH.
Collection Interval: can be System Default or User Defined.
Delete After Upload: Deletes DAT files from controller after uploading them. In most cases this can be left to "No."
Fingerprint: (copy and paste the following):
ssh-rsa 1040 60:f1:89:c8:a8:60:d9:36:2f:0c:fd:90:af:a9:6c:c2

NOTE: after the first intersection this information is cached and should be available to auto-populate after clicking the Fingerprint field.

Log Directory: populates automatically with the version specific DAT files location on the controller.
Port: default SSH port 22 Username: omniuser
Password for Omni 1.11: ******** **PW for Omni 2.X:** ********
Once added to the list the SPM Service will attempt to collect from each of these controllers once per interval. The Dat files will be seen accumulating in the *TransparityLogs\hires* folder.

If it doesn't look like data is collecting, make sure the TransparitySPMCollector Service is running. If issues persist, restart the service or call McCain technical support.

3.5 Intersection Phase and Detector Setup

3.5.1 Identify Approach Direction

Reports use approach direction to associate phases and detectors. Each phase must have a Direction designated in the controller configuration. Likewise, each System Detector must have a direction assigned in the detector config. It is the direction which allows the system to be able to associate a detector with a phase at an intersection.

3.5.2 Phase Approach/Direction

This is done through the controller configuration (**Edit Traffic Controller**).

Select **Labels**, and then **Phase**:

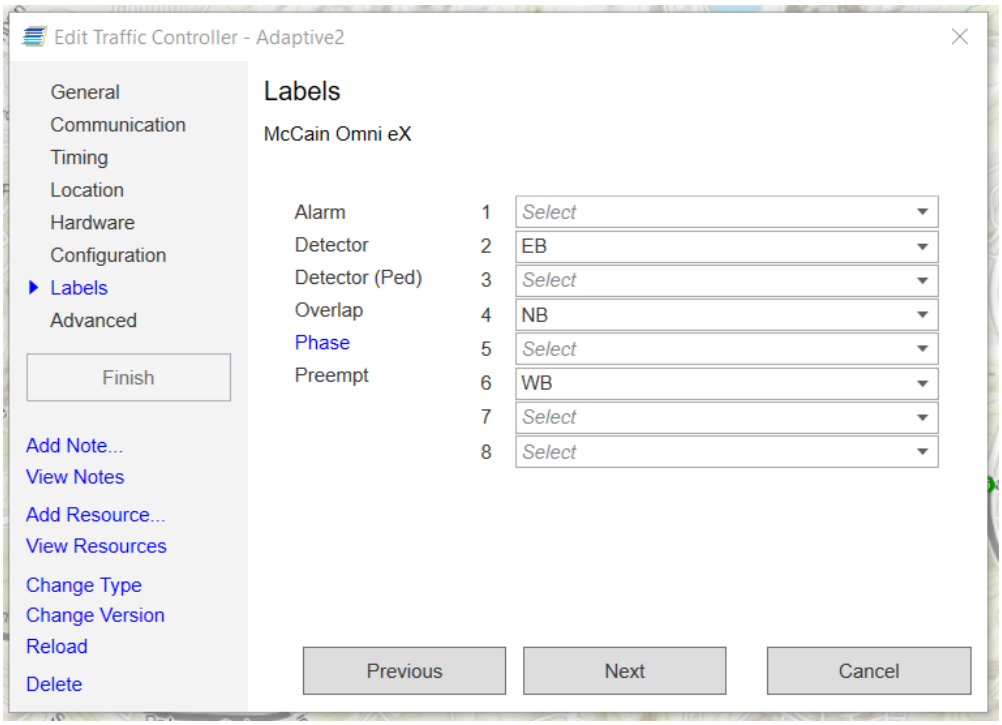

Figure 3-7: Labels Screen

For each phase in the list select the predominant direction of travel for this approach.

3.5.3 Detector Setup

Identify the detectors that will be used to populate the reports. The detectors should be carefully identified by approach and placement (stop bar or advanced). To use these detectors in the reports, they must be configured in *Transparity* as **System Detectors**.

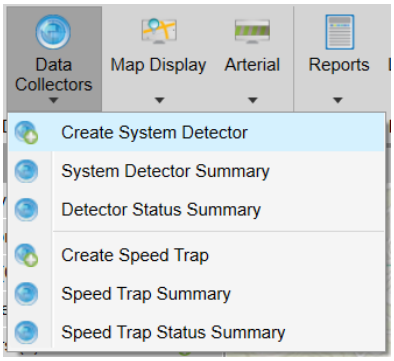

Figure 3-8: Detector Setup Screen

General: Give the detector a **Name** that easily identifies it, i.e. "Test Controller EB Ln1 Adv" and select the **Controller** and **Detector #**. Selecting the "**Disabled**" check box prevents Transparity from attempting to collect traditional VOS data for that detector. This allows the user to configure detectors for use in SPM Reports, without also filling up the database with VOS data.
Location information is for informational purposes only and is not required (can be left blank).
Configuration: The Detector **Movement** and **Direction** should correspond with the Phase Direction specified in Phase Labels in the previous section. Specify the **Lane** # of the detector (select 1 for multi-lane detector zones). The Detector **Placement** should be designated properly for Advanced or Stop Bar. Specific reports will use either **Advanced** or **Stop Bar** detection, depending on the report type (see detector requirements below).

NOTE: All other fields are not used in SPM reports and can be left default.

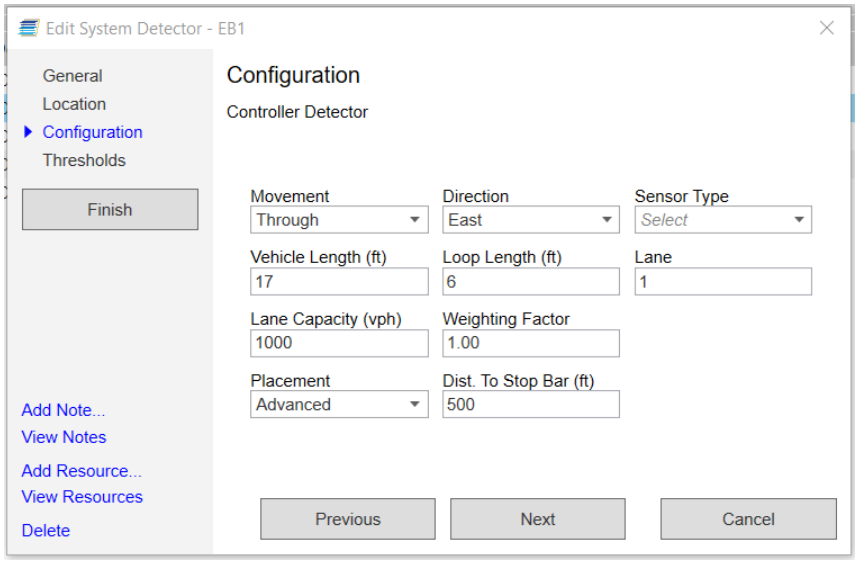

Figure 3-9: Controller Detector Screen

Thresholds are used to exclude unexpected data and can normally be left at default.

3.6 Detector Requirements for Each Report

3.6.1 Performance Measures

Controller Events: nothing required. This report shows all data collected from the controller in a table. Use to verify that data is being collected.
Phase Split Monitor: Detection is not required; however, if you want to be able to view Split Failures you will need a detector configured as "Stop Bar" associated with the Direction of the Phase.
Phase Arrivals: Advanced detectors need to be enabled for the phase.
Phase Idle Time: Stop Bar detectors need to be enabled for the phase.
Purdue Coord Diagram: Advanced detectors must be enabled for the phase. The controller must be running a Pattern (this report does not apply to FREE).
Preemption Details: No detection is required.
Pedestrian Delay: No detection is required.

3.6.2 Traffic Reports: Turning Count Movements and Peak Hour

These reports read from the System Detector Data table in the History database and do not use high resolution data. For these reports to be useful each phase must have associated **System Detectors** configured. These detectors should not be **Disabled** and must be configured for the correct **Direction** and **Movement**.

NOTE: For these reports to be useful it is necessary to identify detectors for each movement that are placed in such a way to count individual vehicles. For most intersections this presents a challenge for counting left turning and right turning vehicles; however, phases with advanced detection may give accurate through volume measurements.

4. SPM Reports

4.1 Performance Measures

4.1.1 Controller Events

Provides users with the ability to review high resolution event data chronologically and with a user- friendly event name.

4.1.1.1 Input Parameters

Name	Description	Notes
Intersection	User selects which intersection to analyze	Filterable selection list
Start Time	User selects the date and time range to start reviewing data.	Calendar Data-Time picker
End Time	User selects the date and time range to end reviewing data.	Calendar Data-Time picker

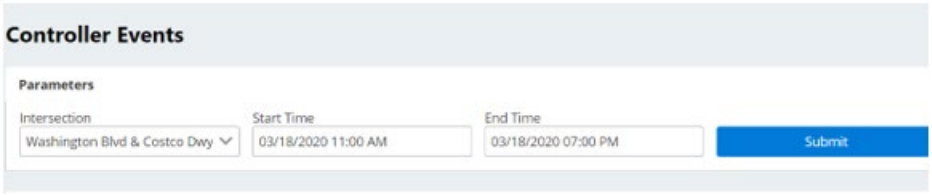

Figure 4-1: Transparity SPM Controller Events Input Screen

4.1.1.2 Output Data

Name	Description	Notes
Timestamp	Calendar Data-Time	
Signal ID	Event ID for each event	
Event Parameter	Event Parameter for each event	
Event Name	Common name of event.	
Pagination and Number of Events	Current page and maximum number of pages and events.	• Users can select number of events per page • Users can modify the event type filer without re-running the report • Users can sort the list via any one of the columns. • Default sorting via timestamp (oldest record on top)

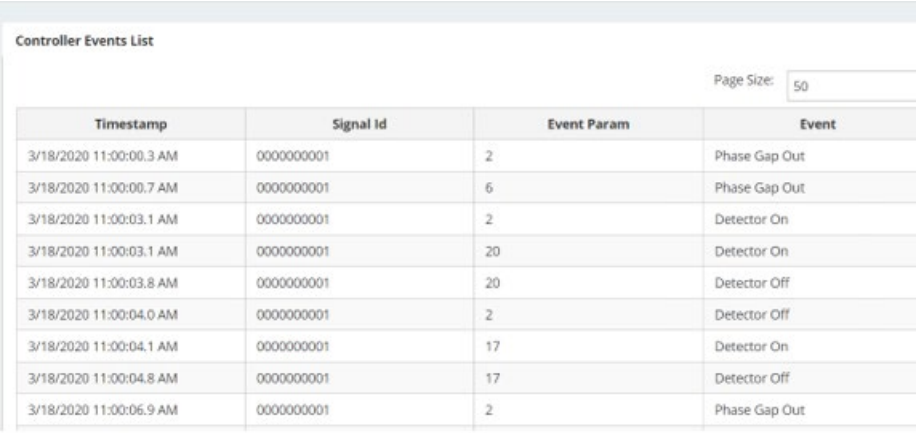

Figure 4-2: Transparity SPM Controller Events Data Screen

4.1.2 Phase Split Monitor Report

The Phase Split Monitor report plots the length of each phase split duration and the reason for phase termination (i.e. Gap Out, Max Out, Force Off). It also plots the pedestrian activity, duration, instances of split failure, and provides the green/red occupancy ratios of each phase service. Phase splits can be analyzed for all operational modes of the controller, such as Coordinated, Free, Peer-to-Peer synchronization and Adaptive. The impact of pedestrians on phase duration and frequency of pedestrian crossings may also be analyzed.

4.1.2.1 Input Parameters

Name	Description	Notes
Intersection	User selects which intersection to analyze	Filterable selection list
Phase Number	User selects an approach/phase for evaluation	
Start Time	User selects the date and time range to start reviewing data.	Calendar Data-Time picker
End Time	User selects the date and time range to end reviewing data.	Calendar Data-Time picker
Compare Data	Compare the Phase Split performance of an alternate intersection, phase, and/or date-time range.	

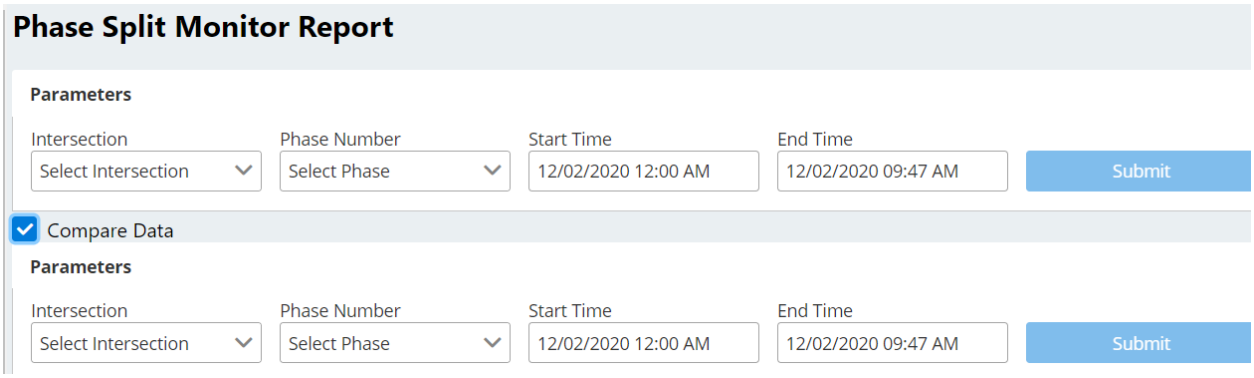

Figure 4-3: Transparity SPM Phase Split Monitor Input Screen

4.1.2.2 Output Data

Name	Description	Notes
X-Axis	Split Fail	
Y-Axis	Phase Duration (Seconds)	

Data Series: Chart, Type, Color	1) Gap Out: scatter, green 2) Max Out: scatter, red 3) Force Off: scatter, dark blue 4) Pedestrian: column, gold 5) Split fail: plotline, red	
Plot Bands	Operational Mode/Pattern number	
Plot Lines	Split Fail	

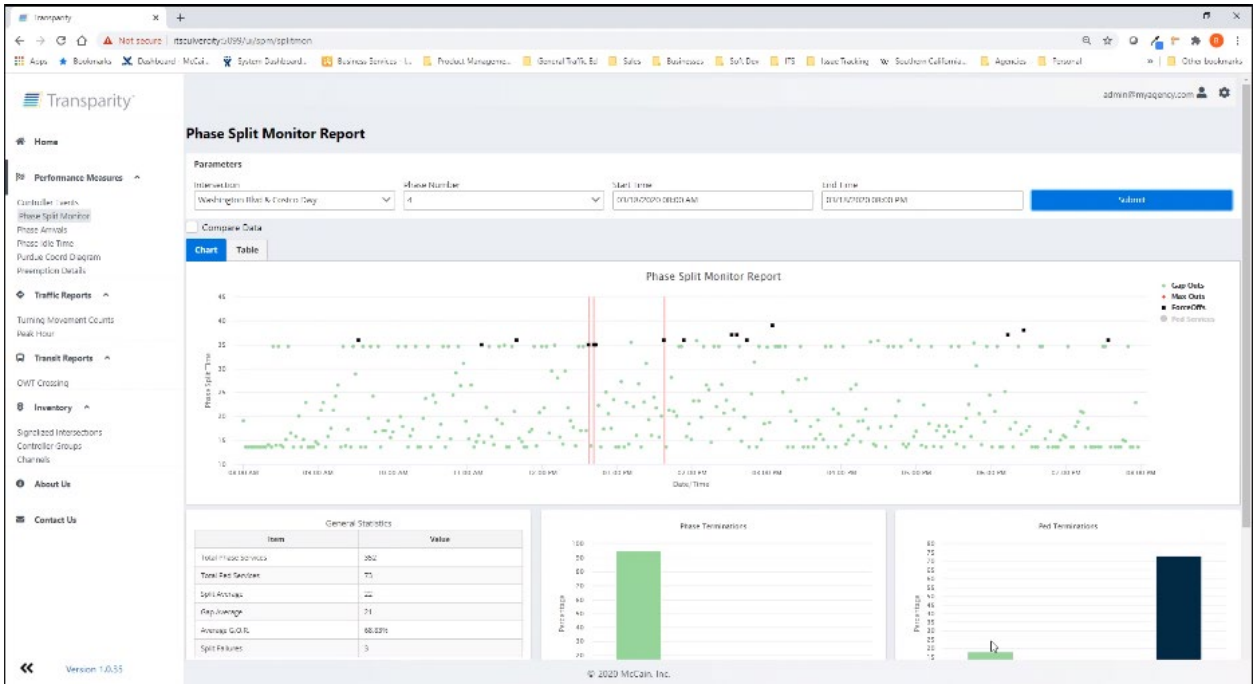

Figure 4-4: Transparity SPM Split Monitor Report

When electing to display Pedestrian Activity, users can easily identify the impact of Pedestrian clearance on phase terminations.

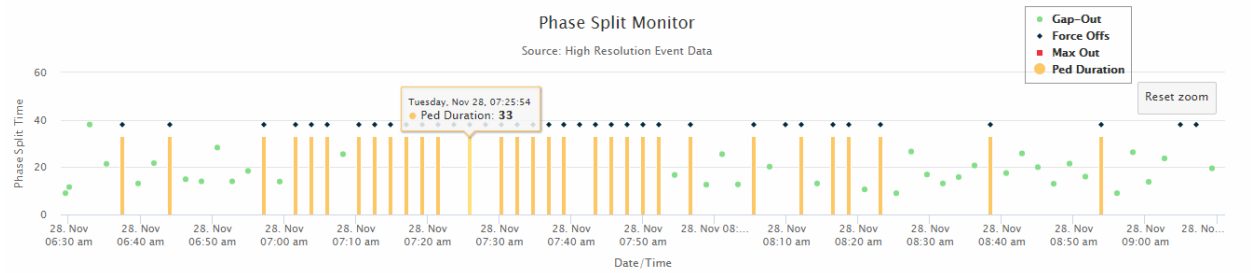

Figure 4-5: Transparity Split Monitor Report w/Pedestrian Activity

Users may choose to display the active plan, pedestrian activity, average split, % of Max Out and Force-off, % Gap Out, and percentage of Pedestrian activity for each reason for

termination.

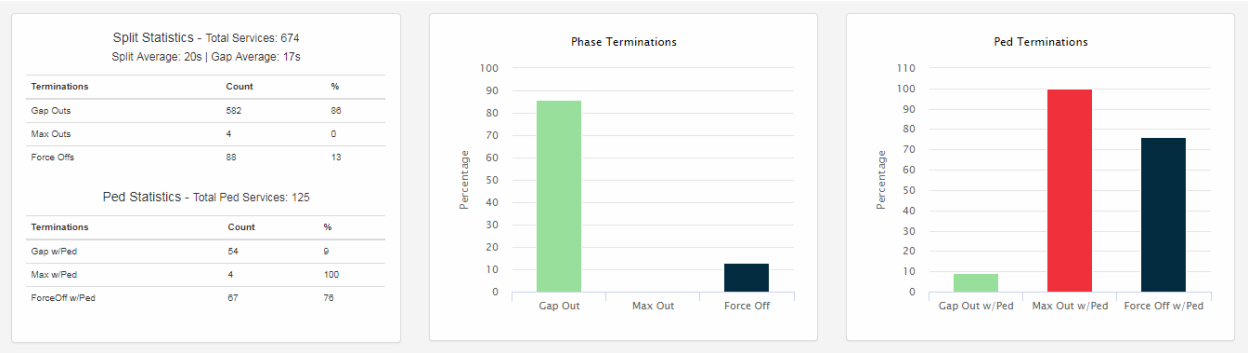

Figure 4-6: Phase Split Monitor Statistics

4.1.3 Phase Arrivals Report

The Phase Arrivals Report compares the volume of vehicles approaching the green interval vs the red interval of select phases. This report provides the total approach volume, Arrivals on Green %, and area chart which illustrates arrivals on green, yellow, and red for each cycle. This is a key report in analyzing the performance of synchronized modes of operation (i.e. Coordination, Adaptive, or Peer-to-Peer synchronization).

4.1.3.1 Input Parameters

Name	Description	Notes
Intersection	User selects which intersection to analyze	Filterable selection list
Phase Number	User selects an approach/phase for evaluation	
Start Time	User selects the date and time range to start reviewing data.	Calendar Data-Time picker
End Time	User selects the date and time range to end reviewing data.	Calendar Data-Time picker
Compare Data	Compare the Phase Split performance of an alternate intersection, phase, and/or date-time range.	

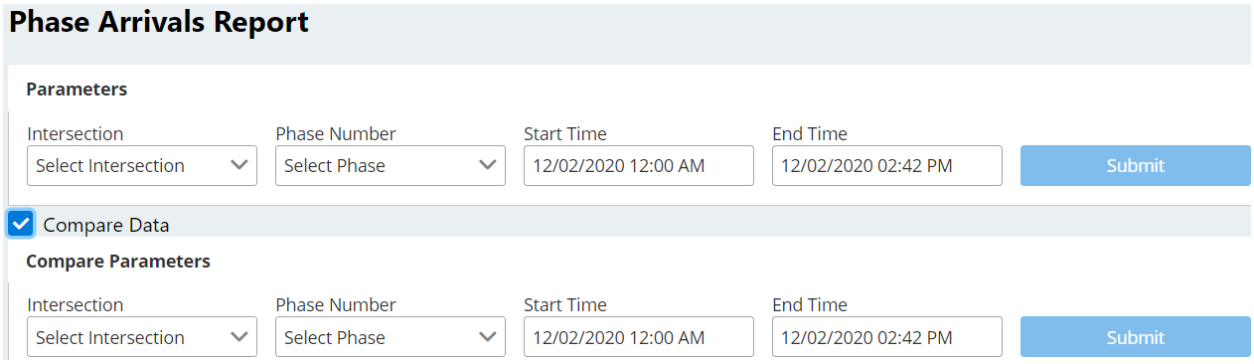

Figure 4-7: Transparity SPM Phase Arrivals Input Screen

4.1.3.2 Output Data

Name	Description	Notes
Total Volume	Total volume of traffic	
Arrivals on Green	Number of arrivals on Green light	
Arrivals on Yellow	Number of arrivals on Yellow light	
Arrivals on Red	Number of arrivals on Red light	

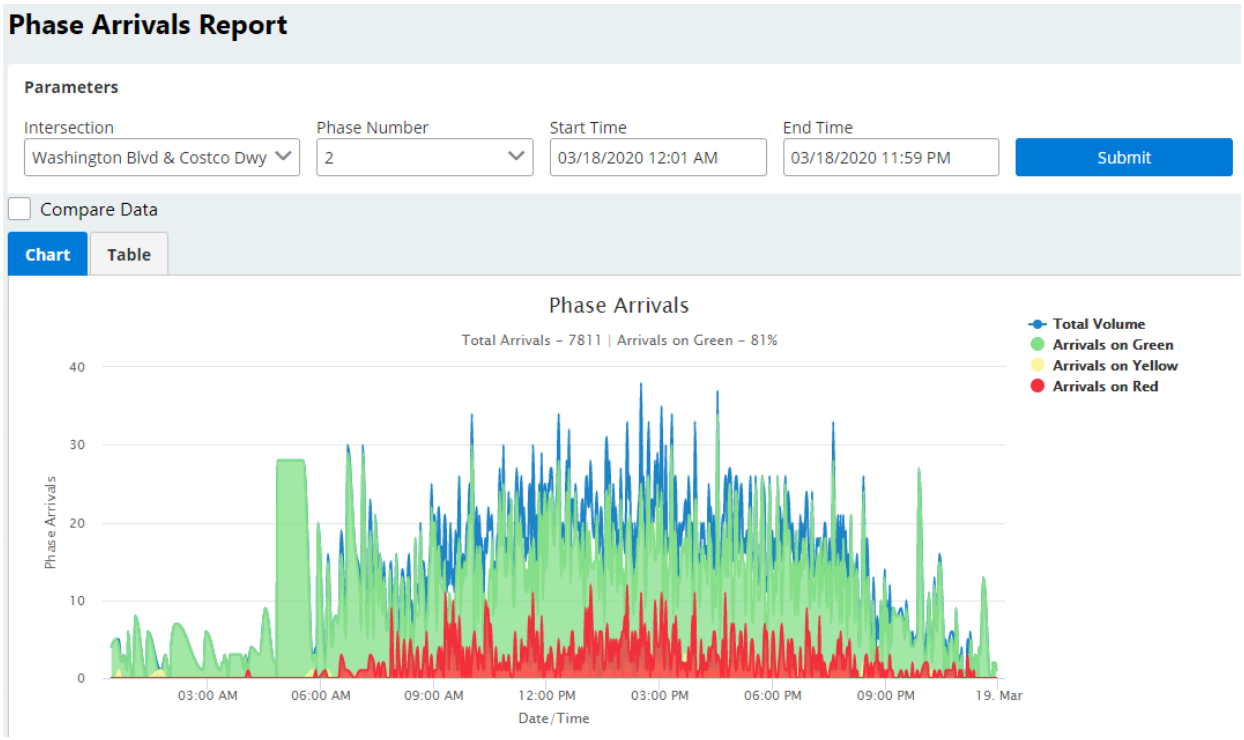

Figure 4-8: Comparative Arrivals on Phase Arrivals Report

4.1.4 **Phase Idle Time Report**

The Phase Idle Time Report illustrates the wait/idle time experienced by the first vehicle to arrive on red before service of the green interval. This report shows, for each cycle along the x-axis, the amount of time that has elapsed from the first detection during the red interval until the phase turns green. This metric is tremendously valuable in understanding the overall performance of signal operations. For instance, a new coordination pattern may demonstrate excellent performance in Arrivals on Green vs Red, while increasing the wait time of non-synchronized phases.

4.1.4.1 Input Parameters

Name	Description	Notes
Intersection	User selects which intersection to analyze	Filterable selection list
Phase Number	User selects an approach/phase for evaluation	
Start Time	User selects the date and time range to start reviewing data.	Calendar Data-Time picker
End Time	User selects the date and time range to end reviewing data.	Calendar Data-Time picker
Compare Data	Compare the Phase Split performance of an alternate intersection, phase, and/or date-time range.	

4.1.4.2 Output Data

Name	Description	Notes
Phase Wait/ Idle Time	Wait time experienced by the first vehicle to arrive on red before service of the green interval.	

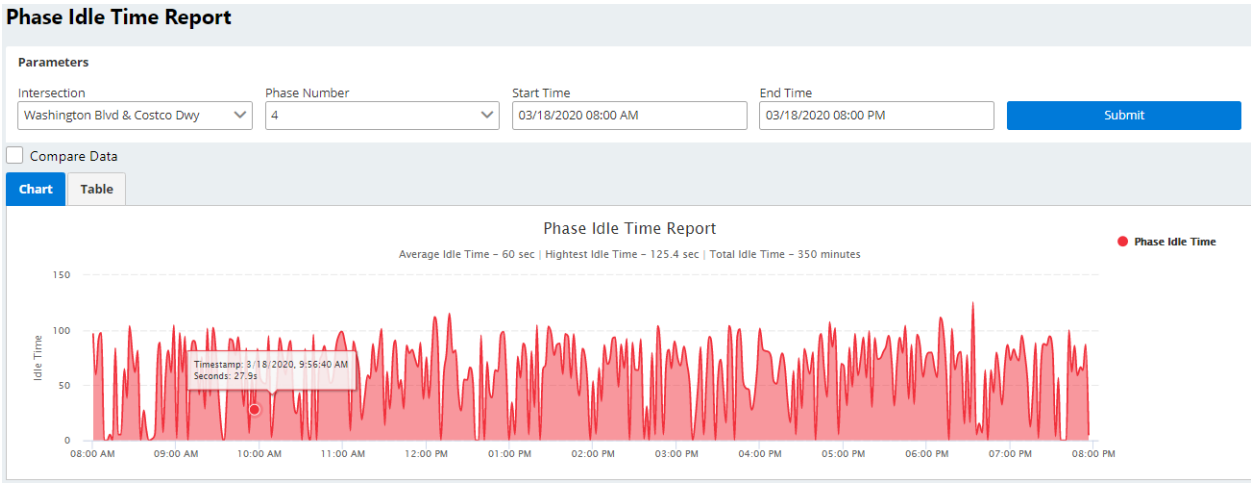

Figure 4-9: Phase Wait/Idle Time Report

As with other reports, the Phase Idle Time Report can compare different data sets, helping users realize “before” and “after” benefits of changes to signal operations.

4.1.5 Purdue Coordination Diagram

The Purdue Coordination Diagram report plots vehicle arrivals against the phase state (green, yellow, or red) as well as the vehicles per hour of the approach. The report includes Arrival on

Green %, bandwidth efficiency % (percentage of the cycle that was green for the given approach), and Platoon Ratio.

4.1.5.1 Input Parameters

Name	Description	Notes
Intersection	User selects which intersection to analyze	Filterable selection list
Phase Number	User selects an approach/phase for evaluation	
Start Time	User selects the date and time range to start reviewing data.	Calendar Data-Time picker
End Time	User selects the date and time range to end reviewing data.	Calendar Data-Time picker
Compare Data	Compare the Phase Split performance of an alternate intersection, phase, and/or date-time range.	

4.1.5.2 Output Data

Name	Description	Notes
X-Axis	Date/ Time	
Y-Axis	Local Cycle Time	
Data Series: Chart, Type, Color	1) Begin green (line) 2) Begin yellow (line) 3) Begin red (line) 4) Cycle end / local zero (line) 5) Detector on (scatter)	

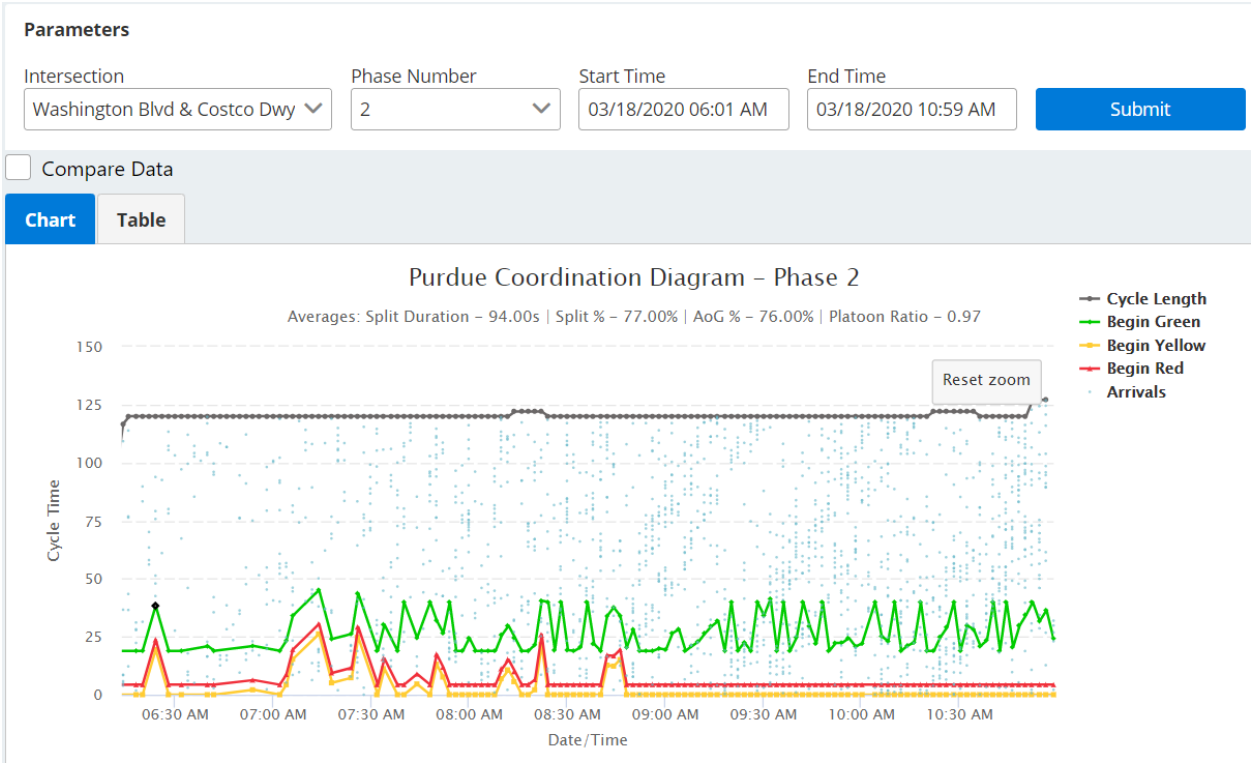

Figure 4-10: Comparative Purdue Coordination Diagrams

The Purdue Coordination Diagrams, above, compare the progression performance of Fixed Coordination (above) against Adaptive Coordination (below). The results of the report illustrate a significant increase in Arrivals on Green (15% increase) and Platoon Ratio (.14 increase). As merely increasing the split timing of the coordinated phase can generate improvements to Arrivals on Green, the increase in Platoon Ratio is significant as it indicates an increase in throughput without dramatically increasing the Split %.

4.1.6 Preemption Details Report

The Preemption Details report plots the times of preempt requests, preempt service and details pertaining to the preemption operation (including time to service, dwell time, entry delay, end call, call max out, track clear, and gate down).

4.1.6.1 Input Parameters

Name	Description	Notes
Intersection	User selects which intersection to analyze	Filterable selection list
Approach/Preemption Number	User selects an approach/preemption number for evaluation	
Start Time	User selects the date and time range to start reviewing data.	Calendar Data-Time picker

End Time	User selects the date and time range to end reviewing data.	Calendar Data-Time picker

4.1.6.2 Output Data

Name	Description	Notes
Dwell Time	The duration of the Preempt Dwell interval of the service phases.	
Time to Service	The time between the preempt input activation and preemption dwell interval.	
Preemption Operation Details	1) Entry delay 2) Gate Down 3) Input Off 4) Input On 5) Track Clear 6) Call Max Out	

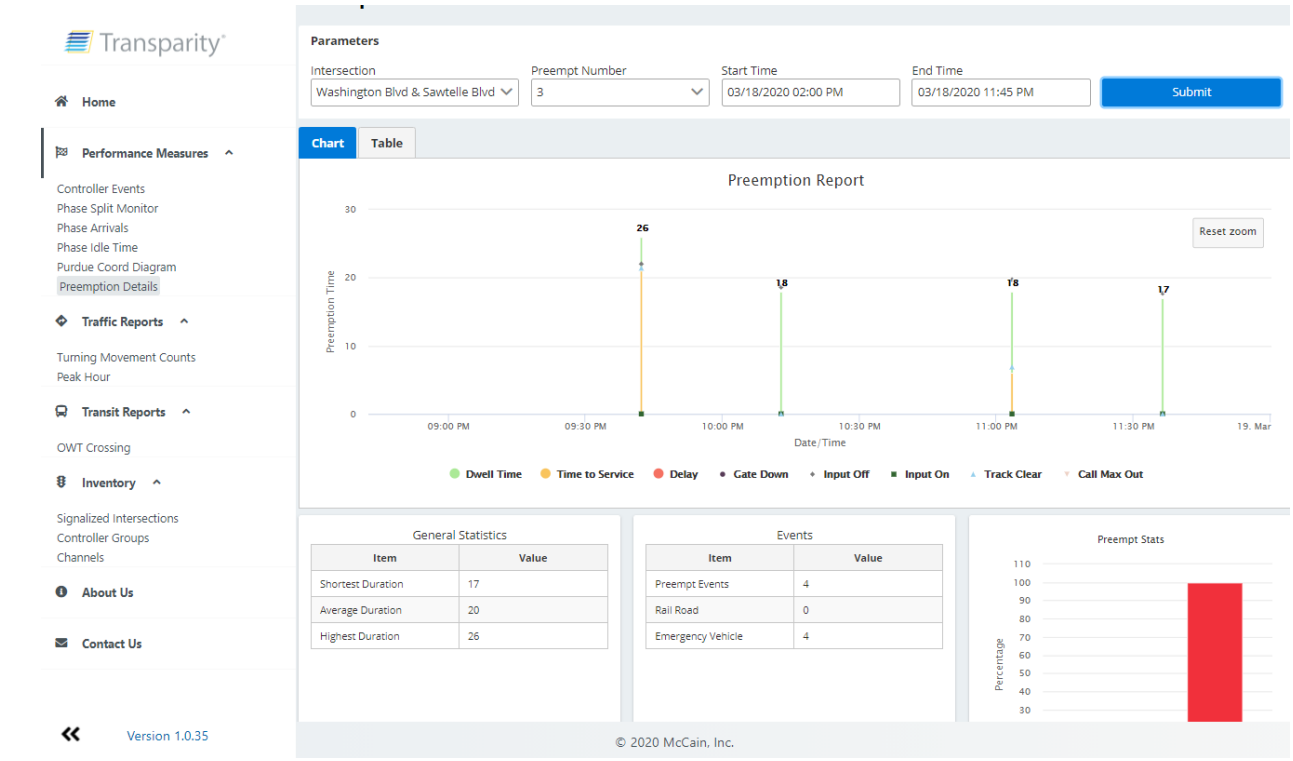

Figure 4-11: Preemption Details Report

4.1.7 **Pedestrian Delay Report**

The Pedestrian Delay Report illustrates the wait/idle time experienced by the first pedestrian to place a pedestrian call before service of the walk interval. This report shows, for each

cycle along the x-axis, the amount of time that has elapsed from the first time the ped push button was pressed until the ped walk signal comes on.

4.1.7.1 Input Parameters

Name	Description	Notes
Intersection	User selects which intersection to analyze	Filterable selection list
Approach/Preemption Number	User selects an approach/preemption number for evaluation	
Start Time	User selects the date and time range to start reviewing data.	Calendar Data-Time picker
End Time	User selects the date and time range to end reviewing data.	Calendar Data-Time picker

4.1.7.2 Output Data

Name	Description	Notes
Pedestrian Delay	Wait time experienced by the first pedestrian to place a call before service of the walk interval.	

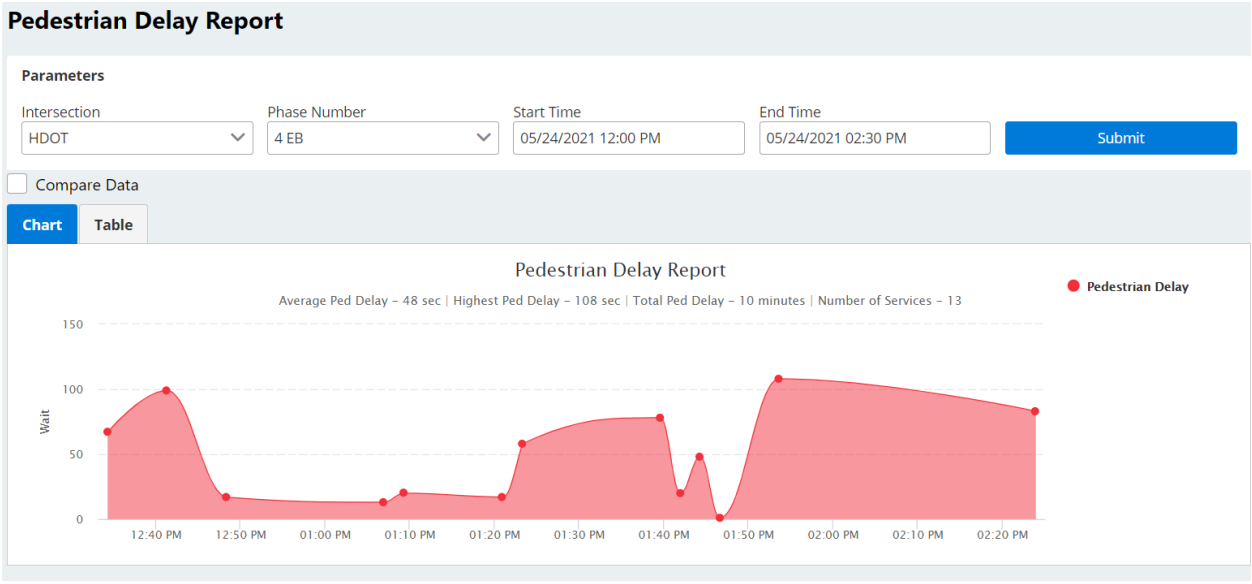

Figure 4-12: Pedestrian Delay Report

4.2 Traffic Reports

4.2.1 Turning Movement Counts Report

The Turning Movement Counts report plots the volume of each approach including through movements. Users may elect to display the lane volume and/or total volume (all lanes).

4.2.2 Peak Hour Counts Report

The Peak Hour Counts Report automatically determines the A.M., Midday, and P.M. peak hours. The report includes peak hour volume, peak hour factor, approach LOS, intersection LOS.

4.3 Transit Reports

4.3.1 OWT Crossing

This Report is a custom report for a One-Way Transit Bridge and is not intended for general use. For more details contact McCain Support.

4.4 Inventory

4.4.1 Signalized Intersections

Provides a list of all Signalized Intersections currently configured in *Transparity*.

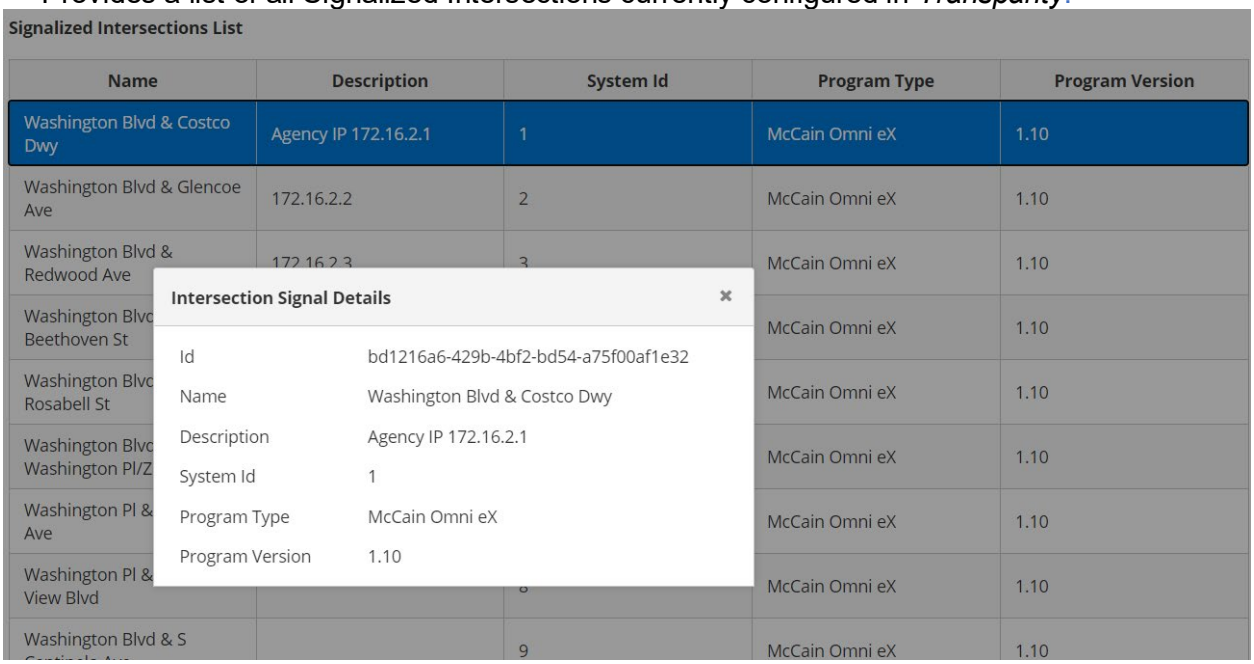

Figure 4-13: Signalized Intersections Report

4.4.2 Controller Groups

Provides a list of all Controller Groups currently configured in *Transparity*.

Controller Groups

Click on any record for details.

Controller Group List

Name	Description	Type	Manual Override Enabled	
Corridor 01 - Washington Blvd Far West		Adaptive Group	false	Details
Corridor 02 - Washington Blvd West		Adaptive Group	false	Details
Corridor 03 - Washington Blvd Central		Adaptive Group	false	Details
Corridor 04 - Washington Blvd East (no National)		Adaptive Group	false	Details
Corridor 12 - Sepulveda Blvd North		Adaptive Group	false	Details
Corridor 09 - Jefferson Blvd North		Adaptive Group	false	Details

Figure 4-14: Controller Groups Report

Controller Group Details

Name: Corridor 01 - Washington Blvd Far West
Description:
Type: Adaptive Group
Manual Override Enabled: false
Members:

Device	Manual Override Pattern
05cb56ee-6f50-41de-971d-a75f00afca77	0
bd1216a6-429b-4bf2-bd54-a75f00af1e32	0
8c3f34cf-0577-4a37-90ee-a75f00af6827	0
dfd7273e-63e0-4616-af16-a75f00af7ba6	0
72d51330-c77c-4d37-937f-a75f00af8d1e	0
84251a72-c7e1-4ad2-86d0-a75f00af4fd5	0

Back

Figure 4-15: Controller Groups Details Report

4.4.3 **Channels**

Provides a list of all Communications Channels currently configured in *Transparity*.

Channels

Click on any record for details.

Channel List

Name	Type	First Byte Time	
Washington Far West (9001)	UDP	250	Details
Washington West (9002)	UDP	300	Details
Washington Central (9003)	UDP	250	Details
Washington East (9004)	UDP	350	Details
Sepulveda Blvd South (9005)	UDP	350	Details
Jefferson Blvd West (9008)	UDP	250	Details
Sepulveda Blvd North (9006)	UDP	250	Details

Figure 4-16: Channel List Report