Attachment to the Western Systems Purchase Order

1. Overview

1.1. The City of Seattle is purchasing data as a service. Western Systems owns, operates, and is responsible for maintenance and replacement of the hardware used to gather the data, per the terms outlined below.

1.2. The City has tested the performance of this data service and is satisfied with the ability for this data service to deliver travel time, delay, analytics and other data and data services, as compared to the City's existing approaches to gathering and analyzing the same data. However, this service has not been widely deployed, and there is little in-service data available to understand the overall performance of the service. Therefore, the first year of the deployment should be considered a trial period. During this period, the City will develop a data service performance measurement approach, and associated contractual terms that will be applies to subsequent years, if the data service is continued past the first year.

2. Terms – First Year of the Contract

2.1. These terms will be reevaluated and may be modified if subsequent years of service are purchased. If these terms are not explicitly modified, they will remain in force over any subsequent years of purchasing.

2.2. The City intends to monitor the performance of the individual devices using the analytics tool. Specific performance measures to be monitored have yet to be determined. As an example, a performance monitor may be tracking match rates over time to ensure a particular site maintains performance.

2.3. Devices.

2.3.1. If, in the City's sole discretion, a device is not performing adequately, Western Systems shall replace the device within 2 working days of notification of inadequate device performance (replacement time is contingent on the availability of SDOT crew support). If upon replacement, the device site continues to perform inadequately, the City will no longer pay for that site until it is repaired to the satisfaction of the City.

2.3.2. The total number of device sites replaced based on the City's sole discretion shall not exceed 20% of the total devices installed.

2.3.3. If more than 20% of the total devices installed are, per the City's discretion, not performing adequately, the City will no longer pay for any portion of the system, and will notify Western Systems to remove the system, and the field devices, and the contract will be terminated.

2.4. Analytic Software

2.4.1. If the City, in their sole discretion, determines that the analytics software is producing unacceptable travel time and delay metrics to such an extent that the City will not use the data for public information or their own analysis purposes, the City will notify Western Systems of the issue. Within 3 days, Western Systems must test the software and respond with a remediation plan and schedule to resolve the issue. If the issue is not resolved within the Contractor-stated time period, or if the issue lasts longer than 3 calendar months, the City will no longer pay for any portion of the system, and will notify Western Systems to remove the system, and the field devices, and the contract will be terminated.

2.5. Data Security

2.5.1. It is the understanding of the City that the data gathered are encrypted to fully eliminate the possibility of identifying individuals or vehicles. In no event shall City or Western Systems and its subcontractors make any use of the data gathered by the devices for any purpose that would identify the individuals or vehicles included in the data.

2.6. Ownership and Licensure of Data

2.6.1. Nothing in this Purchase Order precludes the parties from negotiating future changes to the data ownership and licensure terms, specifically with respect to reselling of the data.

2.7. Installation, and Ongoing Operations and Maintenance

2.7.1. Devices under this Purchase Order are intended to be installed inside SDOT-owned traffic signal controller cabinets. Power to the devices will be supplied by SDOT. Western Systems will not be charged for the privilege of placing the device in SDOT cabinets, or for the power to each device.

2.7.2. Western systems will not be charged for any SDOT labor required for the initial installation and configuration of the devices included in this deployment. Western Systems will provide all devices, including antennas and required cables, seals and attachment hardware to SDOT. SDOT shall install all required devices. Western Systems shall provide SDOT with procedures, sketches, requirements, or instructions to ensure proper device installation. Western Systems is responsible for ensuring that the devices are installed to their own satisfaction.

2.7.3. After the initial deployment, any costs incurred by SDOT related to maintenance or removal of devices from cabinets will be borne by Western Systems. SDOT will charge Western Systems their normal costs for such work. SDOT will respond to Western Systems request for access to a cabinet within 2 working days.

2.7.4. SDOT assumes no responsibility for any devices that are damaged due to SDOT or third party actions. All costs for replacement of damaged devices, damaged for any reason, will be borne by Western Systems.

2.7.5. If SDOT replaces a cabinet, or if a cabinet has been removed due to a crash, SDOT will inform Western Systems no less than 2 days prior to cabinet replacement, so that new devices can be supplied to SDOT for installation.

2.7.6. If SDOT-owned equipment is damaged due to the device, or its installation, including water intrusion from cabinet penetrations made for the purpose of installing the device, Western Systems is wholly responsible for paying for the replacement of the damaged equipment.

STATE OF WASHINGTON OFFICE OF THE SECRETARY OF STATE DIVISION OF ARCHIVES & RECORDS MANAGEMENT LOCAL RECORDS COMMITTEE PER RCW 40.14	PUBLIC RECORDS RETENTION SCHEDULE & DESTRUCTION AUTHORIZATION	OSOSF-002 (Formerly SSA-24)

1. AGENCY TITLE City of Seattle	2. DEPARTMENT/DIVISION TITLE Seattle Department of Transportation (SDOT)	3. OFFICE/SECTION TITLE Traffic Management (19.04.00)	4. DATE SUBMITTED June 24, 2002

5. ADDRESS (PO Box or Street, City, and Zip Code) 600 4th Ave., Fl. 3 P.O. Box 94728 Seattle, Wa. 98124-4728	6a. RECORDS MANAGER NAME (TYPE OR PRINT) Jennifer Winkler	
	6b. RECORDS MANAGER TELEPHONE (206) 684-8154	6c. RECORDS MANAGER E-MAIL Jennifer.winkler@seattle.gov

7. RECORDS MANAGER SIGNATURE (Required)
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SIGNATURE __Jennifer Winkler_____

8. LIST OF RECORDS SERIES

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	TRAFFIC MANAGEMENT MAIN							
1.	**Traffic Management Location History Files** Files document the history of traffic management issues, problems and solutions on City of Seattle owned and maintained streets and intersections. May include citizen complaints, responses and supporting documentation, claims, traffic control requests, documentation of traffic incidents specifically for that street, correspondence, etc. Files are maintained by street name or number.	OFM			End of Calendar Year	10 Years	05-02-0293	
2.	**Traffic Management Issue Files** Files document traffic management related issues regarding one specific topic (pedestrians, channelization lines, etc.) or areas where issues relate to a several block radius (Pike Place Market, Westlake Center, etc). May include citizen complaints and responses, traffic control requests, newsclippings and additional reference material on traffic management related issues, etc.	OFM			End of Calendar Year	10 Years	05-02-0294	Potentially Archival

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See original for signature _____ For the Attorney General	See original for signature _____ For the State Auditor	See original for signature _____ For the State Archivist

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3.	**Daily Maintenance Activity Records/Crew Reports** Used to document actual work performed. May include number of labor hours, date, time and location of each job, materials and/or equipment used, task numbers for charge back or other project tracking purposes and management cost codes.	OFM			End of Calendar Year	6 Years	GS50-04B-29	Records located in the following divisions: Signal Shop, Signs and Markings Maintenance
4.	**Traffic Management Work Instructions** Documents a variety of traffic control maintenance requests including installation, inspection, testing, repair or replacement of non-electrical traffic control signs, markings, parking meters, etc. Work instructions may be generated from public complaints or from other local government agencies. Includes work location, name of person requesting service, problem statement, inspection summary and maintenance recommendations.	OFM			Project Completion	10 Years	GS50-18-24	Records located in the following divisions: Parking Meter Maintenance and Sign Records
	SIGNAL OPERATIONS							
5.	**Functional Test Logs** Files are used to document routine testing and maintenance activities of traffic signals. Includes date, time and location of signal being tested.	OFM			End of Calendar Year	3 Years	GS50-18-41	

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6.	**Intersection Registers** Documents city crew visits to signal box sites. Registers include employee name, date, time and purpose of the visit. Used to document and track signal maintenance. Registers are located in the signal box.	OFM			Life of Equipment	3 Years	GS50-18-39	
7.	**Signal History Cards** Cards contain documentation of current equipment in signal boxes and of equipment replacements. Used for maintenance and repair purposes.	OFM			Life of Equipment	3 Years	GS50-18-41	
8.	**Signal Inventory** Files document the location of all city-operated traffic signals. Indicates location, type of equipment, installation date and similar information.	OFM			Upon Revision	1 Year	GS50-18-35	

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9.	**Signal Studies (Unwarranted Installations)** Files contain documentation of signal projects that do not meet warrant requirements. May include citizen requests, petitions, drawings and diagrams, traffic studies, volume counts, sketches and warrant determinations.	OFM			Completion of Study	10 Years	GS50-18-10	
10.	**Signal Studies (Warranted Installations)** Records used to determine if installation of a traffic signal at a particular location is warranted. May include citizen requests, drawings and diagrams, petitions, traffic studies, volume counts, sketches and warrant determinations.	OPR			<u>Signal installed</u>: life of signal <u>Not installed</u>: completion of study	10 Years	GS50-18-10	
11.	**Signalized Intersection History Files** Files document the installation, maintenance history and removal of all signalized traffic control devices including crosswalk signals and traffic lights. May include intersection diagrams, work instructions, copies of timing plans, dial cards, traffic signal investigation requests and citizen complaints. Records are used to support claims and schedule preventative maintenance.	OFM			Removal of Signal	10 Years	GS50-18-39	

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12.	**Traffic Signal Timing Plans** Records consist of timing plans for traffic signals. May include plans for timing changes due to special events, optimization projects and new installations. Information includes signal location, date, time and name of person making timing adjustments. Used to document compliance with safety guidelines and to develop maintenance schedules.	OFM			Upon Revision	10 Years	GS50-18-41	
	TRAFFIC CONTROL - BICYCLE & PEDESTRIAN PROGRAM							
13.	**Bicycle & Pedestrian Safety Project Files (Approved)** Files are used to document the approval, construction and removal of pedestrian, bicyclist and school zone safety projects including curb ramps, crossing signs, crosswalks, curb bulbs, bike racks, etc. May include citizen requests, traffic control request forms, traffic and pedestrian count reports and copies of accident reports, community meeting agendas and minutes, construction requests and reports, plans and designs, field notes and photographs.	OPR			Removal of Device	10 Years	GS50-18-27	

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PUBLIC RECORDS RETENTION SCHEDULE & DESTRUCTION AUTHORIZATION

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14.	**Bicycle & Pedestrian Safety Project Files (Unapproved)** Files contain documentation of projects not selected for construction or implementation. May include citizen requests, traffic control requests, traffic count and accident reports and decision letters and memoranda.	OFM			Project Determination Made	10 Years	GS50-18-27	
15.	**Crosswalk Inventory** Files document location of all crosswalks maintained by the City. Includes crosswalk location, date of installation and similar data. Used to develop maintenance schedules and write work instructions.	OFM			Upon Revision	1 Year	05-02-0295	
16.	**School Walking Route Maps** Files contain annual updates and revisions to school-walking route maps created for the City's public elementary schools. Updated information is provided to Seattle Public Utilities (SPU) for maintenance of the GIS data set that is used to provide mapping services to the public.	OFM			Upon Revision	1 Year	GS50-01-32	

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1. AGENCY TITLE	2. DEPARTMENT/DIVISION TITLE	3. OFFICE/SECTION TITLE	4. DATE SUBMITTED
City of Seattle	Seattle Department of Transportation (SDOT)	Traffic Management (19.04.00)	December 4, 2007

5. ADDRESS (PO Box or Street, City, and Zip Code)	6a. RECORDS MANAGER NAME (TYPE OR PRINT)
600 4th Ave., Fl. 3 P.O. Box 94728 Seattle, Wa. 98124-4728	Jennifer Winkler

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	TRAFFIC CONTROL - CARPOOL PROGRAM							
17.	**Carpool Certification Lists** Listing of qualified carpool applicants participating in programs established through legal agreements with private building owners and property managers. Commuter Services administers the application process and provides lists of certified carpoolers to private building contacts who collect fees and issue permits. Certification listings are updated quarterly and organized by building name. (Revision of 12/2007 reduces retention from 3 years)	OFM			End of Quarter	1 Years	GS50-01-02	
18.	**Carpool Program Permit Files** Files document the selection and administration process of the carpool parking permit program. Files consist of permit applications and related correspondence. Records filed by carpool area then permit number. Permits are renewed quarterly.	OFM			End of Quarter	3 Years	GS59-01-02	

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19.	**Permit Tracking Database** Access database used to log in requests for carpool permits and track permit issuance process. Data is obtained from Carpool Program Permit Files and includes name of permit applicants, date of application, location of carpool area and date permit was issued. (Revision of 12/2007 changes cut-off from System Replacement and reduces retention from 3 years).	OFM			Termination of Permit	1 Year	GS50-01-02	
	TRAFFIC CONTROL - CONSTRUCTION, DETOURS, SPECIAL EVENTS							
20.	**Special Event Traffic Control Plans** Files contain traffic control plans developed for Special Event Permits (i.e., film crews, races, parades). Includes diagram of location or route, detour plan, event date, time and description.	OFM	Parks & Recreation: parades & races OED: films		Plan Completion	3 Years	GS50-01-02	

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SIGNATURE ___Jennifer Winkler_____

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21.	**Temporary Traffic Control Files** Files document the use of temporary traffic and parking controls (i.e. detours, traffic cones, street markings) to manage the flow of traffic during construction projects and City maintenance projects. Files may include channelization sketches, work instructions, diagrams and comments.	OPR			Project Completion	6 Years	GS50-01-39	
22.	**Traffic Management Plans** Files document development and implementation of traffic management plans required under the land use code. May include Memorandum of Agreements (MOAs) between the City and private buildings and/or sporting venues, correspondence, traffic count and pedestrian studies, traffic re-routing plans, carpool compliance reports, surveys and copies of Master Use Permits.	OPR			Expiration of Agreement or Permit	6 Years	GS50-11-05(s)	Potentially Archival
23.	**Traffic Specification Standards** Files document the development of specifications for street and/or lane closures related to construction projects and street maintenance. May include channelization diagrams, traffic count reports and guidelines documenting the approved times for lane closures, required channelization markings, correspondence and supporting documentation.	OPR			Upon Revision	6 Years	GS50-01-32	

AGENCY MANAGER SIGNATURE: Robert Miller | **AGENCY ARCHIVIST SIGNATURE:** Scott Cline

FOR RECORDS MANAGEMENT SECTION USE ONLY - *DO NOT FILL IN BEYOND THIS POINT*

Initials of Records Management Section Analyst: __SAA – NO LRC APPROVAL NECESSARY_____

LOCAL RECORDS COMMITTEE ACTION: ☐ Approved as Submitted-DATE: _____ ☑ Approved as Amended-DATE: _02/25/2005_____ ☐ Returned Unprocessed-DATE: _____

_____
For the Attorney General

_____
For the State Auditor

_____
For the State Archivist

| | STATE OF WASHINGTON
OFFICE OF THE SECRETARY OF STATE
DIVISION OF ARCHIVES & RECORDS MANAGEMENT
LOCAL RECORDS COMMITTEE
PER RCW 40.14 | **PUBLIC RECORDS RETENTION SCHEDULE &
DESTRUCTION AUTHORIZATION** | *OSOSF-002 (Formerly SSA-24)* |

1. AGENCY TITLE City of Seattle	2. DEPARTMENT/DIVISION TITLE Seattle Department of Transportation (SDOT)	3. OFFICE/SECTION TITLE Traffic Management (19.04.00)	4. DATE SUBMITTED June 24, 2002

5. ADDRESS (PO Box or Street, City, and Zip Code) 600 4th Ave., Fl. 3 P.O. Box 94728 Seattle, Wa. 98124-4728	6a. RECORDS MANAGER NAME (TYPE OR PRINT) Jennifer Winkler

| 6b. RECORDS MANAGER TELEPHONE
(206) 684-8154 | 6c. RECORDS MANAGER E-MAIL
Jennifer.winkler@seattle.gov |

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	TRAFFIC CONTROL - CURB SPACE MANAGEMENT							
24.	**Bus Stop Change Files** Files document issues related to temporary changes to Metro Transit bus stops due to construction issues or permanent location changes prompted from a citizen's request. May include safety inspection report, field notes, correspondence, citizen complaints, work instructions and recommendations for relocations.	OFM			Project Completion	6 Years	GS50-01-39	
25.	**Parking Device Inventory** Files document location of all current parking meters, signs and other parking control devices. Includes information on location, type of equipment, date of installation and similar device data. Used to develop maintenance schedules and write work instructions.	OFM			Upon Revision	1 Year	GS50-18-35	

AGENCY MANAGER SIGNATURE: Robert Miller	AGENCY ARCHIVIST SIGNATURE: Scott Cline

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Initials of Records Management Section Analyst: _____

LOCAL RECORDS COMMITTEE ACTION: ☑ Approved as Submitted-DATE: ___09/30/2004____ ☐ Approved as Amended-DATE: _____ ☐ Returned Unprocessed-DATE: _____

☑ No approval by Local Records Committee necessary; State Archives review of schedules verifies all series meet requirements of Local Government General Records Retention Schedules. Signature of State Archives representative: ___JMM 09/30/2004_____

STATE OF WASHINGTON
OFFICE OF THE SECRETARY OF STATE
DIVISION OF ARCHIVES & RECORDS MANAGEMENT
LOCAL RECORDS COMMITTEE
PER RCW 40.14

PUBLIC RECORDS RETENTION SCHEDULE & DESTRUCTION AUTHORIZATION

OSOSF-002 (Formerly SSA-24)

Page 11 of 17

1. AGENCY TITLE	2. DEPARTMENT/DIVISION TITLE	3. OFFICE/SECTION TITLE	4. DATE SUBMITTED
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26.	**Residential Parking Zone Establishment Files (Approved)** Files document the process of selecting and establishing neighborhood residential parking zones. May include citizen petitions, correspondence, field check notes, parking usage reports, community meeting materials, review notes from design committee and work requests.	OPR			Zone Establishment	10 Years	04-10-0288	Potentially Archival
27.	**Residential Parking Zone Establishment Files (Unapproved)** Files contain documentation of unapproved applications for establishment of neighborhood residential parking zones. May include citizen petitions, correspondence, field check notes, parking usage reports, community meeting materials, review notes from design committee and work requests.	OFM			Project Determination Made	3 Years	04-10-0289	

AGENCY MANAGER SIGNATURE: Robert Miller

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See original for signature	See original for signature	See original for signature
_____	_____	_____
For the Attorney General	For the State Auditor	For the State Archivist

STATE OF WASHINGTON
OFFICE OF THE SECRETARY OF STATE
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PER RCW 40.14

PUBLIC RECORDS RETENTION SCHEDULE & DESTRUCTION AUTHORIZATION

OSOSF-002 (Formerly SSA-24)

Page 12 of 17

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Seattle, Wa. 98124-4728

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	TRAFFIC CONTROL - PARKING METER MAINTENANCE							
28.	**Parking Meter Hood Sheets** Files document requests for installation, replacement or removal of Parking Meter Hoods. They include meter location, name of person requesting service, date and time of installation and removal.	OPR			End of Calendar Year	6 Years	GS55-05H-05	
29.	**Parking Meter Maintenance Cards** Cards show the type and frequency of repairs for each parking meter. The cards are used for preventive maintenance and to verify parking ticket complaints and claim investigations. They include meter location, date and time of installation and type of repair.	OFM			End of Calendar Year	6 Years	GS55-05H-05	

AGENCY MANAGER SIGNATURE: Robert Miller	AGENCY ARCHIVIST SIGNATURE: Scott Cline

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LOCAL RECORDS COMMITTEE ACTION: ☑ Approved as Submitted-DATE: __11/16/2004_____ ☐ Approved as Amended-DATE: _____ ☐ Returned Unprocessed-DATE: _____

N/A
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For the Attorney General

N/A
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For the State Auditor

N/A
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For the State Archivist

STATE OF WASHINGTON
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PUBLIC RECORDS RETENTION SCHEDULE & DESTRUCTION AUTHORIZATION

OSOSF-002 (Formerly SSA-24)

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	TRAFFIC CONTROL - PERMITS & ENFORCEMENT							
30.	**Parking Citations** Documents the issuance of a citation and a fine for violating parking regulations in commercial load zones. Files contain photos, citations that include citation number, auto license number and state, type of parking violation, date, time and location of violation and supporting documentation. Contested citations are pulled from these files and transferred to the Municipal Court.	OFM			End of Calendar Year	3 Years	L07-01-06	
31.	**Traffic Permits** Files document the issuance of annual, short-term and temporary permits for special parking, parking meter hoods, over-legal vehicles, building moves, etc. May include permit applications, copies of permits, vehicle registration information and proof of residency.	OFM			Permit Expiration	3 Years	GS50-12D-10	

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STATE OF WASHINGTON **OFFICE OF THE SECRETARY OF STATE** **DIVISION OF ARCHIVES & RECORDS MANAGEMENT** **LOCAL RECORDS COMMITTEE** **PER RCW 40.14**	**PUBLIC RECORDS RETENTION SCHEDULE &** **DESTRUCTION AUTHORIZATION**

1. AGENCY TITLE City of Seattle	2. DEPARTMENT/DIVISION TITLE Seattle Department of Transportation (SDOT)	3. OFFICE/SECTION TITLE Traffic Management (19.04.00)	4. DATE SUBMITTED June 24, 2002

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	TRAFFIC MANAGEMENT - COLLISION RECORDS							
32.	**Traffic Collision Database** Database system (Hansen) tracks information contained on collision reports such as participant name, collision date, location and diagram codes. Database is used to determine improvements to traffic conditions, evaluate collision trends and plan safety projects. Also serves as a finding aid to Traffic Collision Files.	OFM			End of Calendar Year	6 Years	05-02-0296	
33.	**Traffic Collision Files** Files consist of copies of collision reports provided by the Seattle Police Department, Washington State Patrol, University of Washington and private citizens. Files are used to evaluate fatalities, identify potential damage to City property, plan and evaluate traffic safety projects and support claim investigations.	OFM	WA State Patrol		End of Calendar Year	6 Years	GS50-18-32	
34.	**Traffic Collision Summary Reports** Various reports, including mandated annual report (SMC 11.16.220), containing information on traffic conditions, traffic collisions, number of persons killed and injured and other traffic collision data and traffic trends throughout the City. Files are used to identify and evaluate traffic hazards, monitor and evaluate safety improvements and programs, apply for safety grants, respond to citizen concerns and support investigations.	OPR			End of Calendar Year	10 Years	04-10-0291	Potentially Archival

AGENCY MANAGER SIGNATURE: Robert Miller	AGENCY ARCHIVIST SIGNATURE: Scott Cline

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	STATE OF WASHINGTON OFFICE OF THE SECRETARY OF STATE DIVISION OF ARCHIVES & RECORDS MANAGEMENT LOCAL RECORDS COMMITTEE PER RCW 40.14	PUBLIC RECORDS RETENTION SCHEDULE & DESTRUCTION AUTHORIZATION	*OSOSF-002 (Formerly SSA-24)* Page 15 of 17

1. AGENCY TITLE City of Seattle	2. DEPARTMENT/DIVISION TITLE Seattle Department of Transportation (SDOT)	3. OFFICE/SECTION TITLE Traffic Management (19.04.00)	4. DATE SUBMITTED June 24, 2002

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	TRAFFIC OPERATIONS - CHANNELIZATION							
35.	**Channelization Device Inventory** Inventory listing of channelization devices throughout the City includes location and maintenance history information for crosswalks, neighborhood traffic circles, roadway markings, etc. Used to prepare maintenance schedules and write work instructions.	OFM			Upon Revision	1 Year	05-02-0297	
36.	**Channelization Layout Drawings** Files document the design and location of channelization devices on arterial streets including roadway markings, pavement buttons and signs related to traffic control. Filed by intersection and/or road name. Used to replace markings and develop street maintenance schedule.	OFM			Upon Revision	6 Years	04-10-0292	

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OSOSF-002 (Formerly SSA-24)

Page 16 of 17

1. AGENCY TITLE	2. DEPARTMENT/DIVISION TITLE	3. OFFICE/SECTION TITLE	4. DATE SUBMITTED
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37.	**Channelization History Files** Chronological history of the installation, removal or maintenance of channelization devices. Records consist of device drawings with location information, notes indicating type of work to be performed, date of work instruction request and date work completed by maintenance crew.	OFM			End of Calendar Year	10 Years	GS50-18-24	
	TRAFFIC OPERATIONS - SIGN SHOP							
38.	**Sign Production Files** Files contain documentation of orders and billings for signs. May include work orders, sign type, material and labor expense sheets and work instructions.	OFM	Resource Management		End of Calendar Year	3 Years	GS50-03A-02	
39.	**Sign Design System** Traffic Cad system used to create and track sign designs. May include information on sign specifications such as size, color, shape and materials used.	OFM			End of Use	1 Year	GS50-01-02	

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	TRAFFIC OPERATIONS - TRAFFIC COUNTS							
40.	**Arterial Street Films** Films (35 millimeter) taken of arterial streets to document changes to the street system over time. Files are used to support investigations and for post construction restoration projects.	OFM			Project Completion	10 Years	05-02-0298	
41.	**Traffic Management Database** Database system used to track data collected during traffic count, vehicle classification and speed studies. Data is used to generate traffic study reports.	OFM			End of Calendar Year	10 Years	052-02-0299	
42.	**Traffic Study Reports** Documentation of various types of traffic studies including; traffic counts, turning movement counts, pedestrian studies, parking usage, vehicle classification, speed studies, travel time delays, origin and destination studies, ball bank and occupancy studies. Files may include work requests, data field sheets, schematics, maps and data compilations. Used to support investigations, traffic control projects and seasonal count reporting.	OFM			End of Year or Upon Revision Whichever is Later	10 Years	GS50-18-34	Potentially Archival

AGENCY MANAGER SIGNATURE: Robert Miller	AGENCY ARCHIVIST SIGNATURE: Scott Cline

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AT Section 101

Attest Engagements

Source: SSAE No. 10; SSAE No. 11; SSAE No. 12; SSAE No. 14.

See section 9101 for interpretations of this section.

Effective when the subject matter or assertion is as of or for a period ending on or after June 1, 2001, unless otherwise indicated.

Applicability

.01 This section applies to engagements, except for those services discussed in paragraph .04, in which a certified public accountant in public practice[1] (hereinafter referred to as a *practitioner*) is engaged to issue or does issue an examination, a review, or an agreed-upon procedures report on subject matter, or an assertion about the subject matter (hereafter referred to as *the assertion*), that is the responsibility of another party.[2] [Revised, January 2015, to reflect conforming changes necessary due to the issuance of the revised AICPA Code of Professional Conduct, effective December 15, 2014.]

.02 This section establishes a framework for attest[3] engagements performed by practitioners and for the ongoing development of related standards. For certain subject matter, specific attestation standards have been developed to provide additional requirements for engagement performance and reporting.

.03 When a practitioner undertakes an attest engagement for the benefit of a government body or agency and agrees to follow specified government standards, guides, procedures, statutes, rules, and regulations, the practitioner is obliged to follow those governmental requirements as well as the applicable attestation standards.

.04 Professional services provided by practitioners that are not covered by this SSAE include the following:

a.   Services performed in accordance with Statements on Auditing Standards (SASs)
b.   Services performed in accordance with Statements on Standards for Accounting and Review Services (SSARSs)
c.   Services performed in accordance with the Statement on Standards for Consulting Services (SSCS), such as engagements in which the practitioner's role is solely to assist the client (for example, acting as the company accountant in preparing information other than financial

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[1] For a definition of the term *public practice*, see ET section 0.400, *Definitions*. [Footnote revised, January 2015, to reflect conforming changes necessary due to the issuance of the revised AICPA Code of Professional Conduct, effective December 15, 2014.]

[2] See paragraph .02 of section 301, *Financial Forecasts and Projections*, for additional guidance on applicability when engaged to provide an attest service on a financial forecast or projection.

[3] The term *attest* and its variants, such as *attesting* and *attestation,* are used in a number of state accountancy laws, and in regulations issued by state boards of accountancy under such laws, for different purposes and with different meanings from those intended by this section. Consequently, the definition of *attest engagements* set out in paragraph .01, and the attendant meaning of *attest* and *attestation* as used throughout the section, should not be understood as defining these terms and similar terms, as they are used in any law or regulation, nor as embodying a common understanding of the terms which may also be reflected in such laws or regulations.

statements), or engagements in which a practitioner is engaged to testify as an expert witness in accounting, auditing, taxation, or other matters, given certain stipulated facts

    d.   Engagements in which the practitioner is engaged to advocate a client's position—for example, tax matters being reviewed by the Internal Revenue Service

    e.   Tax engagements in which a practitioner is engaged to prepare tax returns or provide tax advice

.05   An attest engagement may be part of a larger engagement, for example, a feasibility study or business acquisition study may also include an examination of prospective financial information. In such circumstances, these standards apply only to the attest portion of the engagement.

.06   Any professional service resulting in the expression of assurance must be performed under AICPA professional standards that provide for the expression of such assurance. Reports issued by a practitioner in connection with other professional standards should be written to be clearly distinguishable from and not to be confused with attest reports. For example, a practitioner performing an engagement which is intended solely to assist an organization in improving its controls over the privacy of client data should not issue a report as a result of that engagement expressing assurance as to the effectiveness of such controls. Additionally, a report that merely excludes the words, " ...was conducted in accordance with attestation standards established by the American Institute of Certified Public Accountants..." but is otherwise similar to an examination, a review or an agreed-upon procedures attest report may be inferred to be an attest report.

Definitions and Underlying Concepts

Subject Matter

.07   The subject matter of an attest engagement may take many forms, including the following:

    a.   Historical or prospective performance or condition (for example, historical or prospective financial information, performance measurements, and backlog data)

    b.   Physical characteristics (for example, narrative descriptions, square footage of facilities)

    c.   Historical events (for example, the price of a market basket of goods on a certain date)

    d.   Analyses (for example, break-even analyses)

    e.   Systems and processes (for example, internal control)

    f.   Behavior (for example, corporate governance, compliance with laws and regulations, and human resource practices)

The subject matter may be as of a point in time or for a period of time.

Assertion

.08   An assertion is any declaration or set of declarations about whether the subject matter is based on or in conformity with the criteria selected.

.09   A practitioner may report on a written assertion or may report directly on the subject matter. In either case, the practitioner should ordinarily obtain a written assertion in an examination or a review engagement. A written assertion may be presented to a practitioner in a number of ways, such

as in a narrative description, within a schedule, or as part of a representation letter appropriately identifying what is being presented and the point in time or period of time covered.

.10 When a written assertion has not been obtained, a practitioner may still report on the subject matter; however, the form of the report will vary depending on the circumstances and its use should be restricted.[4] In this section, see paragraphs .58 and .60 on gathering sufficient evidence and paragraphs .73–.75 and .78–.80 for reporting guidance.

Responsible Party

.11 The *responsible party* is defined as the person or persons, either as individuals or representatives of the entity, responsible for the subject matter. If the nature of the subject matter is such that no such party exists, a party who has a reasonable basis for making a written assertion about the subject matter may provide such an assertion (hereinafter referred to as the *responsible party*).

.12 The practitioner may be engaged to gather information to enable the responsible party to evaluate the subject matter in connection with providing a written assertion. Regardless of the procedures performed by the practitioner, the responsible party must accept responsibility for its assertion and the subject matter and must not base its assertion solely on the practitioner's procedures.[5]

.13 Because the practitioner's role in an attest engagement is that of an *attester*, the practitioner should not take on the role of the responsible party in an attest engagement. Therefore, the need to clearly identify a responsible party is a prerequisite for an attest engagement. A practitioner may accept an engagement to perform an examination, a review or an agreed-upon procedures engagement on subject matter or an assertion related thereto provided that one of the following conditions is met.

a. The party wishing to engage the practitioner is responsible for the subject matter, or has a reasonable basis for providing a written assertion about the subject matter if the nature of the subject matter is such that a responsible party does not otherwise exist.

b. The party wishing to engage the practitioner is not responsible for the subject matter but is able to provide the practitioner, or have a third party who is responsible for the subject matter provide the practitioner, with evidence of the third party's responsibility for the subject matter.

.14 The practitioner should obtain written acknowledgment or other evidence of the responsible party's responsibility for the subject matter, or the written assertion, as it relates to the objective of the engagement. The responsible party can acknowledge that responsibility in a number of ways, for example, in an engagement letter, a representation letter, or the presentation of the subject matter, including the notes thereto, or the written assertion. If the practitioner is not able to directly obtain written acknowledgment, the practitioner should obtain other evidence of the responsible party's responsibility for the subject matter (for example, by reference to legislation, a regulation, or a contract).

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[4] When the practitioner is unable to perform the inquiry and analytical or other procedures that he or she considers necessary to achieve the limited assurance contemplated by a review, or when the client is the responsible party and does not provide the practitioner with a written assertion, the review will be incomplete. A review that is incomplete is not an adequate basis for issuing a review report and, accordingly, the practitioner should withdraw from the engagement.

[5] See paragraph .112 regarding the practitioner's assistance in developing subject matter or criteria.

Applicability to Agreed-Upon Procedures Engagements

.15 An agreed-upon procedures attest engagement is one in which a practitioner is engaged to issue a report of findings based on specific procedures performed on subject matter. The general, fieldwork, and reporting standards for attest engagements set forth in this section are applicable to agreed-upon procedures engagements. Because the application of these standards to agreed-upon procedures engagements is discussed in section 201, *Agreed-Upon Procedures Engagements*, such engagements are not discussed further in this section.

The Relationship of Attestation Standards to Quality Control Standards

.16 The practitioner is responsible for compliance with the American Institute of Certified Public Accountants' (AICPA's) Statements on Standards for Attestation Engagements (SSAEs) in an attest engagement. The "Compliance With Standards Rule" (ET sec. 1.310.001) of the AICPA Code of Professional Conduct requires members to comply with such standards when conducting professional services. [Revised, January 2015, to reflect conforming changes necessary due to the issuance of the revised AICPA Code of Professional Conduct, effective December 15, 2014.]

.17 A firm of practitioners has a responsibility to adopt a system of quality control in the conduct of a firm's attest practice.[6] Thus, a firm should establish quality control policies and procedures to provide it with reasonable assurance that its personnel comply with the attestation standards in its attest engagements. The nature and extent of a firm's quality control policies and procedures depend on factors such as its size, the degree of operating autonomy allowed its personnel and its practice offices, the nature of its practice, its organization, and appropriate cost-benefit considerations. [As amended, effective September 2002, by SSAE No. 12.]

.18 Attestation standards relate to the conduct of individual attest engagements; quality control standards relate to the conduct of a firm's attest practice as a whole. Thus, attestation standards and quality control standards are related and the quality control policies and procedures that a firm adopts may affect both the conduct of individual attest engagements and the conduct of a firm's attest practice as a whole. However, deficiencies in or instances of noncompliance with a firm's quality control policies and procedures do not, in and of themselves, indicate that a particular engagement was not performed in accordance with attestation standards. [As amended, effective September 2002, by SSAE No. 12.]

General Standards

Training and Proficiency

.19 The first general standard is—*The practitioner must have adequate technical training and proficiency to perform the attestation engagement.* [As

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[6] The elements of a system of quality control are identified in Statement on Quality Control Standards (SQCS) No. 8, *A Firm's System of Quality Control* (QC sec. 10). A system of quality control consists of policies designed to provide the firm with reasonable assurance that the firm and its personnel comply with professional standards and applicable legal and regulatory requirements and that reports issued by the firm are appropriate in the circumstances, and the procedures necessary to implement and monitor compliance with those policies. [As amended, effective September 2002, by SSAE No. 12. Footnote amended due to the issuance of SQCS No. 7, December 2008.]

amended, effective when the subject matter or assertion is as of or for a period ending on or after December 15, 2006, by SSAE No. 14.]

.20 Performing attest services is different from preparing and presenting subject matter or an assertion. The latter involves collecting, classifying, summarizing, and communicating information; this usually entails reducing a mass of detailed data to a manageable and understandable form. On the other hand, performing attest services involves gathering evidence to support the subject matter or the assertion and objectively assessing the measurements and communications of the responsible party. Thus, attest services are analytical, critical, investigative, and are concerned with the basis and support for the subject matter or the assertion.

Adequate Knowledge of Subject Matter

.21 The second general standard is—*The practitioner must have adequate knowledge of the subject matter.* [As amended, effective when the subject matter or assertion is as of or for a period ending on or after December 15, 2006, by SSAE No. 14.]

.22 A practitioner may obtain adequate knowledge of the subject matter through formal or continuing education, including self-study, or through practical experience. However, this standard does not necessarily require a practitioner to personally acquire all of the necessary knowledge in the subject matter to be qualified to express a conclusion. This knowledge requirement may be met, in part, through the use of one or more specialists on a particular attest engagement if the practitioner has sufficient knowledge of the subject matter (*a*) to communicate to the specialist the objectives of the work and (*b*) to evaluate the specialist's work to determine if the objectives were achieved.

Suitability and Availability of Criteria

.23 The third general standard is—*The practitioner must have reason to believe that the subject matter is capable of evaluation against criteria that are suitable and available to users.* [As amended, effective when the subject matter or assertion is as of or for a period ending on or after December 15, 2006, by SSAE No. 14.]

Suitability of Criteria

.24 Criteria are the standards or benchmarks used to measure and present the subject matter and against which the practitioner evaluates the subject matter.[*] Suitable criteria must have each of the following attributes:

- *Objectivity*—Criteria should be free from bias.

- *Measurability*—Criteria should permit reasonably consistent measurements, qualitative or quantitative, of subject matter.

- *Completeness*—Criteria should be sufficiently complete so that those relevant factors that would alter a conclusion about subject matter are not omitted.

- *Relevance*—Criteria should be relevant to the subject matter.

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[*] An example of suitable criteria are the Trust Services criteria developed by the AICPA's Assurance Services Executive Committee. These criteria may be used when the subject matter of the engagement is the security, availability, or processing integrity of a system, or the confidentiality or privacy of the information processed or stored by that system. The Trust Services criteria are presented in TSP sections 100 and 200 of the AICPA's *Trust Services Principles and Criteria*. [Footnote added by the Assurance Services Executive Committee, January 2003. Footnote revised, May 2006, to reflect conforming changes necessary due to the issuance of Generally Accepted Privacy Principles.]

.25 Criteria that are established or developed by groups composed of experts that follow due process procedures, including exposure of the proposed criteria for public comment, ordinarily should be considered suitable. Criteria promulgated by a body designated by the AICPA Governing Council under the AICPA Code of Professional Conduct are, by definition, considered to be suitable.

.26 Criteria may be established or developed by the client, the responsible party, industry associations, or other groups that do not follow due process procedures or do not as clearly represent. the public interest. To determine whether these criteria are suitable, the practitioner should evaluate them based on the attributes described in paragraph .24.

.27 Regardless of who establishes or develops the criteria, the responsible party or the client is responsible for selecting the criteria and the client is responsible for determining that such criteria are appropriate for its purposes.

.28 The use of suitable criteria does not presume that all persons or groups would be expected to select the same criteria in evaluating the same subject matter. There may be more than one set of suitable criteria for a given subject matter. For example, in an engagement to express assurance about customer satisfaction, a responsible party may select as a criterion for customer satisfaction that all customer complaints are resolved to the satisfaction of the customer. In other cases, another responsible party may select a different criterion, such as the number of repeat purchases in the three months following the initial purchase.

.29 In evaluating the measurability attribute as described in paragraph .24, the practitioner should consider whether the criteria are sufficiently precise to permit people having competence in and using the same measurement criterion to be able to ordinarily obtain materially similar measurements. Consequently, practitioners should not perform an engagement when the criteria are so subjective or vague that reasonably consistent measurements, qualitative or quantitative, of subject matter cannot ordinarily be obtained. However, practitioners will not always reach the same conclusion because such evaluations often require the exercise of considerable professional judgment.

.30 For the purpose of assessing whether the use of particular criteria can be expected to yield reasonably consistent measurement and evaluation, consideration should be given to the nature of the subject matter. For example, *soft information*, such as forecasts or projections, would be expected to have a wider range of reasonable estimates than *hard* data, such as the calculated investment performance of a defined portfolio of managed investment products.

.31 Some criteria may be appropriate for only a limited number of parties who either participated in their establishment or can be presumed to have an adequate understanding of the criteria. For instance, criteria set forth in a lease agreement for override payments may be appropriate only for reporting to the parties to the agreement because of the likelihood that such criteria would be misunderstood or misinterpreted by parties other than those who have specifically agreed to the criteria. Such criteria can be agreed upon directly by the parties or through a designated representative. If a practitioner determines that such criteria are appropriate only for a limited number of parties, the use of the report should be restricted to those specified parties who either participated in their establishment or can be presumed to have an adequate understanding of the criteria.

.32 The third general standard in paragraph .23 applies equally regardless of the level of the attest service to be provided. Consequently, it is inappropriate to perform a review engagement if the practitioner concludes that an

examination cannot be performed because competent persons using the same criteria would not be able to obtain materially similar evaluations.

Availability of Criteria

.33 The criteria should be available to users in one or more of the following ways:

a. Available publicly

b. Available to all users through inclusion in a clear manner in the presentation of the subject matter or in the assertion

c. Available to all users through inclusion in a clear manner in the practitioner's report

d. Well understood by most users, although not formally available (for example, "The distance between points A and B is twenty feet;" the criterion of distance measured in feet is considered to be well understood)

e. Available only to specified parties; for example, terms of a contract or criteria issued by an industry association that are available only to those in the industry

.34 If criteria are only available to specified parties, the practitioner's report should be restricted to those parties who have access to the criteria as described in paragraphs .78 and .80.

Independence

.35 The fourth general standard is—*The practitioner must maintain independence in mental attitude in all matters relating to the engagement.*[7] [As amended, effective when the subject matter or assertion is as of or for a period ending on or after December 15, 2006, by SSAE No. 14.]

.36 The practitioner should maintain the intellectual honesty and impartiality necessary to reach an unbiased conclusion about the subject matter or the assertion. This is a cornerstone of the attest function.

.37 In the final analysis, independence in mental attitude means objective consideration of facts, unbiased judgments, and honest neutrality on the part of the practitioner in forming and expressing conclusions. It implies not the attitude of an advocate or an adversary but an impartiality that recognizes an obligation for fairness. Independence in mental attitude presumes an undeviating concern for an unbiased conclusion about the subject matter or an assertion no matter what the subject matter or the assertion may be.

.38 The profession has established, through the AICPA's Code of Professional Conduct, precepts to guard against the *presumption* of loss of independence. Presumption is stressed because the possession of intrinsic independence is a matter of personal quality rather than of rules that formulate certain objective tests. Insofar as these precepts have been incorporated in the

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[7] The practitioner performing an attest engagement should be independent pursuant to "Independence Rule" (ET sec. 1.200.001) of the AICPA Code of Professional Conduct. The "Independence Standards for Engagements Performed in Accordance With Statements on Standards for Attestation Engagements" subtopic (ET sec. 1.297) provides guidance about its application to certain attest engagements. [Footnote revised, December 2012, to reflect conforming changes necessary due to the revision of Ethics Interpretation 101-11. Footnote revised, January 2015, to reflect conforming changes necessary due to the issuance of the revised AICPA Code of Professional Conduct, effective December 15, 2014.]

profession's code, they have the force of professional law for the independent practitioner.

Due Professional Care

.39   The fifth general standard is—*The practitioner must exercise due professional care in the planning and performance of the engagement and the preparation of the report.* [As amended, effective when the subject matter or assertion is as of or for a period ending on or after December 15, 2006, by SSAE No. 14.]

.40   Due professional care imposes a responsibility on each practitioner involved with the engagement to observe each of the attestation standards. Exercise of due professional care requires critical review at every level of supervision of the work done and the judgment exercised by those assisting in the engagement, including the preparation of the report.

.41   *Cooley on Torts*, a legal treatise, describes the obligation for due care as follows:

> Every man who offers his services to another and is employed assumes the duty to exercise in the employment such skill as he possesses with reasonable care and diligence. In all these employments where peculiar skill is requisite, if one offers his services, he is understood as holding himself out to the public as possessing the degree of skill commonly possessed by others in the same employment, and if his pretentions are unfounded, he commits a species of fraud upon every man who employs him in reliance on his public profession. But no man, whether skilled or unskilled, undertakes that the task he assumes shall be performed successfully, and without fault or error; he undertakes for good faith and integrity, but not for infallibility, and he is liable to his employer for negligence, bad faith, or dishonesty, but not for losses consequent upon mere errors of judgment.[8]

Standards of Fieldwork

Planning and Supervision

.42   The first standard of fieldwork is—*The practitioner must adequately plan the work and must properly supervise any assistants.* [As amended, effective when the subject matter or assertion is as of or for a period ending on or after December 15, 2006, by SSAE No. 14.]

.43   Proper planning and supervision contribute to the effectiveness of attest procedures. Proper planning directly influences the selection of appropriate procedures and the timeliness of their application, and proper supervision helps ensure that planned procedures are appropriately applied.

.44   Planning an attest engagement involves developing an overall strategy for the expected conduct and scope of the engagement. To develop such a strategy, practitioners need to have sufficient knowledge to enable them to understand adequately the events, transactions, and practices that, in their judgment, have a significant effect on the subject matter or the assertion.

.45   Factors to be considered by the practitioner in planning an attest engagement include the following:

a.   The criteria to be used

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[8]   D. Haggard, *Cooley on Torts*, 472 (4th ed., 1932).

b. Preliminary judgments about attestation risk[9] and materiality for attest purposes

c. The nature of the subject matter or the items within the assertion that are likely to require revision or adjustment

d. Conditions that may require extension or modification of attest procedures

e. The nature of the report expected to be issued

.46 The practitioner should establish an understanding with the client regarding the services to be performed for each engagement.[10] Such an understanding reduces the risk that either the practitioner or the client may misinterpret the needs or expectations of the other party. For example, it reduces the risk that the client may inappropriately rely on the practitioner to protect the entity against certain risks or to perform certain functions that are the client's responsibility. The understanding should include the objectives of the engagement, management's responsibilities, the practitioner's responsibilities, and limitations of the engagement. The practitioner should document the understanding in the working papers, preferably through a written communication with the client. If the practitioner believes an understanding with the client has not been established, he or she should decline to accept or perform the engagement.

.47 The nature, extent, and timing of planning will vary with the nature and complexity of the subject matter or the assertion and the practitioner's prior experience with management. As part of the planning process, the practitioner should consider the nature, extent, and timing of the work to be performed to accomplish the objectives of the attest engagement. Nevertheless, as the attest engagement progresses, changed conditions may make it necessary to modify planned procedures.

.48 Supervision involves directing the efforts of assistants who participate in accomplishing the objectives of the attest engagement and determining whether those objectives were accomplished. Elements of supervision include instructing assistants, staying informed of significant problems encountered, reviewing the work performed, and dealing with differences of opinion among personnel. The extent of supervision appropriate in a given instance depends on many factors, including the nature and complexity of the subject matter and the qualifications of the persons performing the work.

.49 Assistants should be informed of their responsibilities, including the objectives of the procedures that they are to perform and matters that may affect the nature, extent, and timing of such procedures. The practitioner with final responsibility for the engagement should direct assistants to bring to his or her attention significant questions raised during the attest engagement so that their significance may be assessed.

.50 The work performed by each assistant should be reviewed to determine whether it was adequately performed and to evaluate whether the results are consistent with the conclusion to be presented in the practitioner's report.

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[9] *Attestation risk* is the risk that the practitioner may unknowingly fail to appropriately modify his or her attest report on the subject matter or an assertion that is materially misstated. It consists of (*a*) the risk (consisting of *inherent risk* and *control risk*) that the subject matter or assertion contains deviations or misstatements that could be material and (*b*) the risk that the practitioner will not detect such deviations or misstatements (*detection risk*).

[10] See paragraph 29 of SQCS No. 8. [Footnote amended due to the issuance of SQCS No. 7, December 2008. Footnote revised, December 2012, due to the issuance of SQCS No. 8.]

Obtaining Sufficient Evidence

.51   The second standard of fieldwork is—*The practitioner must obtain sufficient evidence to provide a reasonable basis for the conclusion that is expressed in the report.* [As amended, effective when the subject matter or assertion is as of or for a period ending on or after December 15, 2006, by SSAE No. 14.]

.52   Selecting and applying procedures that will accumulate evidence that is sufficient in the circumstances to provide a reasonable basis for the level of assurance to be expressed in the attest report requires the careful exercise of professional judgment. A broad array of available procedures may be applied in an attest engagement. In establishing a proper combination of procedures to appropriately restrict attestation risk, the practitioner should consider the following presumptions, bearing in mind that they are not mutually exclusive and may be subject to important exceptions.

  a.   Evidence obtained from independent sources outside an entity provides greater assurance about the subject matter or the assertion than evidence secured solely from within the entity.

  b.   Information obtained from the independent attester's direct personal knowledge (such as through physical examination, observation, computation, operating tests, or inspection) is more persuasive than information obtained indirectly.

  c.   The more effective the controls over the subject matter, the more assurance they provide about the subject matter or the assertion.

.53   Thus, in the hierarchy of available attest procedures, those that involve search and verification (for example, inspection, confirmation, or observation), particularly when using independent sources outside the entity, are generally more effective in restricting attestation risk than those involving internal inquiries and comparisons of internal information (for example, analytical procedures and discussions with individuals responsible for the subject matter or the assertion). On the other hand, the latter are generally less costly to apply.

.54   In an attest engagement designed to provide a high level of assurance (referred to as an *examination*), the practitioner's objective is to accumulate sufficient evidence to restrict attestation risk to a level that is, in the practitioner's professional judgment, appropriately low for the high level of assurance that may be imparted by his or her report. In such an engagement, a practitioner should select from all available procedures—that is, procedures that assess inherent and control risk and restrict detection risk—any combination that can restrict attestation risk to such an appropriately low level.

.55   In an attest engagement designed to provide a moderate level of assurance (referred to as a *review*), the objective is to accumulate sufficient evidence to restrict attestation risk to a moderate level. To accomplish this, the types of procedures performed generally are limited to inquiries and analytical procedures (rather than also including search and verification procedures).

.56   Nevertheless, there will be circumstances in which inquiry and analytical procedures (*a*) cannot be performed, (*b*) are deemed less efficient than other procedures, or (*c*) yield evidence indicating that the subject matter or the assertion may be incomplete or inaccurate. In the first circumstance, the practitioner should perform other procedures that he or she believes can provide him or her with a level of assurance equivalent to that which inquiries and analytical procedures would have provided. In the second circumstance,

the practitioner may perform other procedures that he or she believes would be more efficient to provide him or her with a level of assurance equivalent to that which inquiries and analytical procedures would provide. In the third circumstance, the practitioner should perform additional procedures.

.57 The extent to which attestation procedures will be performed should be based on the level of assurance to be provided and the practitioner's consideration of (*a*) the nature and materiality of the information to be tested to the subject matter or the assertion taken as a whole, (*b*) the likelihood of misstatements, (*c*) knowledge obtained during current and previous engagements, (*d*) the responsible party's competence in the subject matter, (*e*) the extent to which the information is affected by the asserter's judgment, and (*f*) inadequacies in the responsible party's underlying data.

.58 As part of the attestation procedures, the practitioner considers the written assertion ordinarily provided by the responsible party. If a written assertion cannot be obtained from the responsible party, the practitioner should consider the effects on his or her ability to obtain sufficient evidence to form a conclusion about the subject matter. When the practitioner's client is the responsible party, a failure to obtain a written assertion should result in the practitioner concluding that a scope limitation exists.[11] When the practitioner's client is not the responsible party and a written assertion is not provided, the practitioner may be able to conclude that he or she has sufficient evidence to form a conclusion about the subject matter.

Representation Letter

.59 During an attest engagement, the responsible party makes many representations to the practitioner, both oral and written, in response to specific inquiries or through the presentation of subject matter or an assertion. Such representations from the responsible party are part of the evidential matter the practitioner obtains.

.60 Written representations from the responsible party ordinarily confirm representations explicitly or implicitly given to the practitioner, indicate and document the continuing appropriateness of such representations, and reduce the possibility of misunderstanding concerning the matters that are the subject of the representations. Accordingly, in an examination or a review engagement, a practitioner should consider obtaining a representation letter from the responsible party. Examples of matters that might appear in such a representation letter include the following:[12]

a. A statement acknowledging responsibility for the subject matter and, when applicable, the assertion

b. A statement acknowledging responsibility for selecting the criteria, where applicable

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[11] When the client is the responsible party, it is presumed that the client will be capable of providing the practitioner with a written assertion regarding the subject matter. Failure to provide the written assertion in this circumstance is a client-imposed limitation on the practitioner's evidence-gathering efforts. In an examination, the practitioner should modify the report for the scope limitation. In a review engagement, such a scope limitation results in an incomplete review and the practitioner should withdraw from the engagement.

[12] Specific written representations will depend on the circumstances of the engagement (for example, whether the client is the responsible party) and the nature of the subject matter and the criteria. For example, when the client is not the responsible party but has selected the criteria, the practitioner might obtain the representation regarding responsibility for selection of the criteria from the client rather than the responsible party (see paragraph .61).

    c.   A statement acknowledging responsibility for determining that such criteria are appropriate for its purposes, where the responsible party is the client

    d.   The assertion about the subject matter based on the criteria selected

    e.   A statement that all known matters contradicting the assertion and any communication from regulatory agencies affecting the subject matter or the assertion have been disclosed to the practitioner

    f.   Availability of all records relevant to the subject matter

    g.   A statement that any known events subsequent to the period (or point in time) of the subject matter being reported on that would have a material effect on the subject matter (or, if applicable, the assertion) have been disclosed to the practitioner

    h.   Other matters as the practitioner deems appropriate

    .61   When the client is not the responsible party, the practitioner should consider obtaining a letter of written representations from the client as part of the attest engagement. Examples of matters that might appear in such a representation letter include the following:

    a.   A statement that any known events subsequent to the period (or point in time) of the subject matter being reported on that would have a material effect on the subject matter (or, if applicable, the assertion) have been disclosed to the practitioner

    b.   A statement acknowledging the client's responsibility for selecting the criteria, where applicable

    c.   A statement acknowledging the client's responsibility for determining that such criteria are appropriate for its purposes

    d.   Other matters as the practitioner deems appropriate

    .62   If the responsible party or the client refuses to furnish all written representations that the practitioner deems necessary, the practitioner should consider the effects of such a refusal on his or her ability to issue a conclusion about the subject matter. If the practitioner believes that the representation letter is necessary to obtain sufficient evidence to issue a report, the responsible party's or the client's refusal to furnish such evidence in the form of written representations constitutes a limitation on the scope of an examination sufficient to preclude an unqualified opinion and is ordinarily sufficient to cause the practitioner to disclaim an opinion or withdraw from an examination engagement. However, based on the nature of the representations not obtained or the circumstances of the refusal, the practitioner may conclude, in an examination engagement, that a qualified opinion is appropriate. Further, the practitioner should consider the effects of the refusal on his or her ability to rely on other representations. When a scope limitation exists in a review engagement, the practitioner should withdraw from the engagement. (See paragraph .75.)

Standards of Reporting[13]

    .63   The first standard of reporting is—*The practitioner must identify the subject matter or the assertion being reported on and state the character of the engagement in the report.* [As amended, effective when the subject matter or assertion is as of or for a period ending on or after December 15, 2006, by SSAE No. 14.]

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    [13]   The reporting standards apply only when the practitioner issues a report. [Footnote added, effective when the subject matter or assertion is as of or for a period ending on or after December 15, 2006, by SSAE No. 14.]

.64 The practitioner who accepts an attest engagement should issue a report on the subject matter or the assertion or withdraw from the attest engagement. If the practitioner is reporting on the assertion, the assertion should be bound with or accompany the practitioner's report or the assertion should be clearly stated in the practitioner's report.[14]

.65 The statement of the character of an attest engagement includes the following two elements: (*a*) a description of the nature and scope of the work performed and (*b*) a reference to the professional standards governing the engagement. The terms *examination* and *review* should be used to describe engagements to provide, respectively, a high level and a moderate level of assurance. The reference to professional standards should be accomplished by referring to "attestation standards established by the American Institute of Certified Public Accountants."

.66 The second standard of reporting is—*The practitioner must state the practitioner's conclusion about the subject matter or the assertion in relation to the criteria against which the subject matter was evaluated in the report.* However, if conditions exist that, individually or in combination, result in one or more material misstatements or deviations from the criteria, the practitioner should modify the report and, to most effectively communicate with the reader of the report, should ordinarily express his or her conclusion directly on the subject matter,[15] not on the assertion. [As amended, effective when the subject matter or assertion is as of or for a period ending on or after December 15, 2006, by SSAE No. 14.]

.67 The practitioner should consider the concept of materiality in applying this standard. In expressing a conclusion, the practitioner should consider an omission or a misstatement to be material if the omission or misstatement— individually or when aggregated with others—is such that a reasonable person would be influenced by the omission or misstatement. The practitioner should consider both qualitative and quantitative aspects of omissions and misstatements.

.68 The term *general use* applies to attest reports that are not restricted to specified parties. General-use attest reports should be limited to two levels of assurance: one based on a restriction of attestation risk to an appropriately low level (an *examination*) and the other based on a restriction of attestation risk to a moderate level (a *review*). In an engagement to achieve a high level of assurance (an *examination*), the practitioner's conclusion should be expressed in the form of an opinion. When attestation risk has been restricted only to a moderate level (a *review*), the conclusion should be expressed in the form of negative assurance.

.69 A practitioner may report on subject matter or an assertion at multiple dates or covering multiple periods during which criteria have changed (for example, a report on comparative information). In those circumstances, the practitioner should determine whether the criteria are clearly stated or described for each of the dates or periods, and whether the changes have been adequately disclosed.

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[14] The use of a "hot link" within the practitioner's report to management's assertion, such as might be used in a WebTrust[SM] report, would meet this requirement. [Footnote renumbered by the issuance of SSAE No. 14, November 2006.]

[15] Specific standards may require that the practitioner express his or her conclusion directly on the subject matter. For example, if management states in its assertion that a material weakness exists in the entity's internal control over financial reporting, the practitioner should state his or her opinion directly on the effectiveness of internal control, not on management's assertion related thereto. [Footnote renumbered by the issuance of SSAE No. 14, November 2006.]

.70   If the criteria used for the subject matter for the current date or period differ from those criteria used for the subject matter for a preceding date or period and the subject matter for the prior date or period is not presented, the practitioner should consider whether the changes in criteria are likely to be significant to users of the report. If so, the practitioner should determine whether the criteria are clearly stated or described and the fact that the criteria have changed is disclosed. (See paragraphs .76–.77.)

.71   The third standard of reporting is—*The practitioner must state all of the practitioner's significant reservations about the engagement, the subject matter, and, if applicable, the assertion related thereto in the report.* [As amended, effective when the subject matter or assertion is as of or for a period ending on or after December 15, 2006, by SSAE No. 14.]

.72   *Reservations about the engagement* refers to any unresolved problem that the practitioner had in complying with these attestation standards, interpretive standards, or the specific procedures agreed to by the specified parties. The practitioner should not express an unqualified conclusion unless the engagement has been conducted in accordance with the attestation standards. Such standards will not have been complied with if the practitioner has been unable to apply all the procedures that he or she considers necessary in the circumstances.

.73   Restrictions on the scope of an engagement, whether imposed by the client or by such other circumstances as the timing of the work or the inability to obtain sufficient evidence, may require the practitioner to qualify the assurance provided, to disclaim any assurance, or to withdraw from the engagement. For example, if the practitioner's client is the responsible party, a failure to obtain a written assertion should result in the practitioner concluding that a scope limitation exists. (See paragraph .58.)

.74   The practitioner's decision to provide a qualified opinion, to disclaim an opinion, or to withdraw because of a scope limitation in an examination engagement depends on an assessment of the effect of the omitted procedure(s) on his or her ability to express assurance. This assessment will be affected by the nature and magnitude of the potential effects of the matters in question, and by their significance to the subject matter or the assertion. If the potential effects are pervasive to the subject matter or the assertion, a disclaimer or withdrawal is more likely to be appropriate. When restrictions that significantly limit the scope of the engagement are imposed by the client or the responsible party, the practitioner generally should disclaim an opinion or withdraw from the engagement. The reasons for a qualification or disclaimer should be described in the practitioner's report.

.75   In a review engagement, when the practitioner is unable to perform the inquiry and analytical or other procedures he or she considers necessary to achieve the limited assurance contemplated by a review, or when the client is the responsible party and does not provide the practitioner with a written assertion, the review will be incomplete. A review that is incomplete is not an adequate basis for issuing a review report and, accordingly, the practitioner should withdraw from the engagement.

.76   *Reservations about the subject matter or the assertion* refers to any unresolved reservation about the assertion or about the conformity of the subject matter with the criteria, including the adequacy of the disclosure of material matters. They can result in either a qualified or an adverse opinion, depending on the materiality of the departure from the criteria against which the subject

matter or the assertion was evaluated, or a modified conclusion in a review engagement.

.77 Reservations about the subject matter or the assertion may relate to the measurement, form, arrangement, content, or underlying judgments and assumptions applicable to the subject matter or the assertion and its appended notes, including, for example, the terminology used, the amount of detail given, the classification of items, and the bases of amounts set forth. The practitioner considers whether a particular reservation should affect the report given the circumstances and facts of which he or she is aware at the time.

.78 The fourth standard of reporting is—*The practitioner must state in the report that the report is intended solely for the information and use of the specified parties under the following circumstances:*

- *When the criteria used to evaluate the subject matter are determined by the practitioner to be appropriate only for a limited number of parties who either participated in their establishment or can be presumed to have an adequate understanding of the criteria*

- *When the criteria used to evaluate the subject matter are available only to specified parties*

- *When reporting on subject matter and a written assertion has not been provided by the responsible party*

- *When the report is on an attestation engagement to apply agreed-upon procedures to the subject matter*

[As amended, effective when the subject matter or assertion is as of or for a period ending on or after December 15, 2006, by SSAE No. 14.]

.79 The need for restriction on the use of a report may result from a number of circumstances, including the purpose of the report, the criteria used in preparation of the subject matter, the extent to which the procedures performed are known or understood, and the potential for the report to be misunderstood when taken out of the context in which it was intended to be used. A practitioner should consider informing his or her client that restricted-use reports are not intended for distribution to nonspecified parties, regardless of whether they are included in a document containing a separate general-use report.[16,17] However, a practitioner is not responsible for controlling a client's distribution of restricted-use reports. Accordingly, a restricted-use report should alert readers to the restriction on the use of the report by indicating that the report is not intended to be and should not be used by anyone other than the specified parties.

.80 An attest report that is restricted as to use should contain a separate paragraph at the end of the report that includes the following elements:

a. A statement indicating that the report is intended solely for the information and use of the specified parties

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[16] In some cases, restricted-use reports filed with regulatory agencies are required by law or regulation to be made available to the public as a matter of public record. Also, a regulatory agency as part of its oversight responsibility for an entity may require access to restricted-use reports in which they are not named as a specified party. [Footnote renumbered by the issuance of SSAE No. 14, November 2006.]

[17] This section does not preclude the practitioner, in connection with establishing the terms of the engagement, from reaching an understanding with the client that the intended use of the report will be restricted, and from obtaining the client's agreement that the client and the specified parties will not distribute the report to parties other than those identified in the report. [Footnote renumbered by the issuance of SSAE No. 14, November 2006.]

    b.   An identification of the specified parties to whom use is restricted

    c.   A statement that the report is not intended to be and should not be used by anyone other than the specified parties

An example of such a paragraph is the following.

> This report is intended solely for the information and use of [*the specified parties*] and is not intended to be and should not be used by anyone other than these specified parties.

.81 Other attestation standards may specify situations that require restricted reports such as the following:

    a.   A review report on management's discussion and analysis

    b.   A report on prospective financial information when the report is intended for use by the responsible party alone, or by the responsible party and third parties with whom the responsible party is negotiating directly, as described in paragraph .10 of section 301, *Financial Forecasts and Projections*.

Furthermore, nothing in this section precludes a practitioner from restricting the use of any report.

.82 If a practitioner issues a single combined report covering both (*a*) subject matter or presentations that require a restriction on use to specified parties and (*b*) subject matter or presentations that ordinarily do not require such a restriction, the use of such a single combined report should be restricted to the specified parties.

.83 In some instances, a separate restricted-use report may be included in a document that also contains a general-use report. The inclusion of a separate restricted-use report in a document that contains a general-use report does not affect the intended use of either report. The restricted-use report remains restricted as to use, and the general-use report continues to be for general use.

Examination Reports

.84 When expressing an opinion, the practitioner should clearly state whether, in his or her opinion, (*a*) the subject matter is based on (or in conformity with) the criteria in all material respects or (*b*) the assertion is presented (or fairly stated), in all material respects, based on the criteria. Reports expressing an opinion may be qualified or modified for some aspect of the subject matter, the assertion or the engagement (see the third reporting standard). However, as stated in paragraph .66, if conditions exist that, individually or in combination, result in one or more material misstatements or deviations from the criteria, the practitioner should modify the report and, to most effectively communicate with the reader of the report, should ordinarily express his or her conclusion directly on the subject matter, not on the assertion. In addition, such reports may emphasize certain matters relating to the attest engagement, the subject matter, or the assertion. The form of the practitioner's report will depend on whether the practitioner opines on the subject matter or the assertion.

.85 The practitioner's examination report on subject matter should include the following:

    a.   A title that includes the word *independent*

    b.   An identification of the subject matter and the responsible party

    c.   A statement that the subject matter is the responsibility of the responsible party

d. A statement that the practitioner's responsibility is to express an opinion on the subject matter based on his or her examination

e. A statement that the examination was conducted in accordance with attestation standards established by the American Institute of Certified Public Accountants, and, accordingly, included procedures that the practitioner considered necessary in the circumstances

f. A statement that the practitioner believes the examination provides a reasonable basis for his or her opinion

g. The practitioner's opinion on whether the subject matter is based on (or in conformity with) the criteria in all material respects

h. A statement restricting the use of the report to specified parties under the following circumstances (see paragraphs .78–.83):

   (1) When the criteria used to evaluate the subject matter are determined by the practitioner to be appropriate only for a limited number of parties who either participated in their establishment or can be presumed to have an adequate understanding of the criteria

   (2) When the criteria used to evaluate the subject matter are available only to the specified parties

   (3) When a written assertion has not been provided by the responsible party (The practitioner should also include a statement to that effect in the introductory paragraph of the report.)

i. The manual or printed signature of the practitioner's firm

j. The date of the examination report

Appendix A [paragraph .114], *Examination Reports*, includes a standard examination report on subject matter. (See example 1.)

.86 The practitioner's examination report on an assertion should include the following:

a. A title that includes the word *independent*

b. An identification of the assertion and the responsible party (When the assertion does not accompany the practitioner's report, the first paragraph of the report should also contain a statement of the assertion.)

c. A statement that the assertion is the responsibility of the responsible party

d. A statement that the practitioner's responsibility is to express an opinion on the assertion based on his or her examination

e. A statement that the examination was conducted in accordance with attestation standards established by the American Institute of Certified Public Accountants, and, accordingly, included procedures that the practitioner considered necessary in the circumstances

f. A statement that the practitioner believes the examination provides a reasonable basis for his or her opinion

g. The practitioner's opinion on whether the assertion is presented (or fairly stated), in all material respects, based on the criteria (However, see paragraph .66.)

h. A statement restricting the use of the report to specified parties under the following circumstances (see paragraphs .78–.83):

   (1) When the criteria used to evaluate the subject matter are determined by the practitioner to be appropriate only for a limited number of parties who either participated in their establishment

or can be presumed to have an adequate understanding of the criteria

(2) When the criteria used to evaluate the subject matter are available only to the specified parties

i. The manual or printed signature of the practitioner's firm

j. The date of the examination report

Appendix A [paragraph .114] includes a standard examination report on an assertion. (See example 2.)

.87 Nothing precludes the practitioner from examining an assertion but opining directly on the subject matter. (See Appendix A [paragraph .114], example 3.)

Review Reports

.88 In a review report, the practitioner's conclusion should state whether any information came to the practitioner's attention on the basis of the work performed that indicates that (*a*) the subject matter is not based on (or in conformity with) the criteria or (*b*) the assertion is not presented (or fairly stated) in all material respects based on the criteria. (As discussed more fully in the commentary to the third reporting standard, if the subject matter or the assertion is not modified to correct for any such information that comes to the practitioner's attention, such information should be described in the practitioner's report.)

.89 The practitioner's review report on subject matter should include the following:

a. A title that includes the word *independent*

b. An identification of the subject matter and the responsible party

c. A statement that the subject matter is the responsibility of the responsible party

d. A statement that the review was conducted in accordance with attestation standards established by the American Institute of Certified Public Accountants

e. A statement that a review is substantially less in scope than an examination, the objective of which is an expression of opinion on the subject matter, and accordingly, no such opinion is expressed

f. A statement about whether the practitioner is aware of any material modifications that should be made to the subject matter in order for it to be based on (or in conformity with), in all material respects, the criteria, other than those modifications, if any, indicated in his or her report

g. A statement restricting the use of the report to specified parties under the following circumstances (see paragraphs .78–.83):

(1) When the criteria used to evaluate the subject matter are determined by the practitioner to be appropriate only for a limited number of parties who either participated in their establishment or can be presumed to have an adequate understanding of the criteria

(2) When the criteria used to evaluate the subject matter are available only to the specified parties

(3) When a written assertion has not been provided by the responsible party and the responsible party is not the client (The practitioner should also include a statement to that effect in the introductory paragraph of the report.)

h. The manual or printed signature of the practitioner's firm

i. The date of the review report

Appendix B [paragraph .115] *Review Reports*, includes a standard review report on subject matter. (See example 1.) Appendix B [paragraph .115] also includes a review report on subject matter that is the responsibility of a party other than client; the report is restricted as to use because a written assertion has not been provided by the responsible party. (See example 2.)

.90 The practitioner's review report on an assertion should include the following:

a. A title that includes the word *independent*

b. An identification of the assertion and the responsible party (When the assertion does not accompany the practitioner's report, the first paragraph of the report should also contain a statement of the assertion.)

c. A statement that the assertion is the responsibility of the responsible party

d. A statement that the review was conducted in accordance with attestation standards established by the American Institute of Certified Public Accountants

e. A statement that a review is substantially less in scope than an examination, the objective of which is an expression of opinion on the assertion, and accordingly, no such opinion is expressed

f. A statement about whether the practitioner is aware of any material modifications that should be made to the assertion in order for it to be presented (or fairly stated), in all material respects, based on (or in conformity with) the criteria, other than those modifications, if any, indicated in his or her report (However, see paragraph .66.)

g. A statement restricting the use of the report to specified parties under the following circumstances (see paragraphs .78–.83):

(1) When the criteria used to evaluate the subject matter are determined by the practitioner to be appropriate only for a limited number of parties who either participated in their establishment or can be presumed to have an adequate understanding of the criteria

(2) When the criteria used to evaluate the subject matter are available only to the specified parties

h. The manual or printed signature of the practitioner's firm

i. The date of the review report

Appendix B [paragraph .115] includes a review report on an assertion that is restricted as to use because the criteria are available only to the specified parties. (See example 3.)

Other Information in a Client-Prepared Document Containing the Practitioner's Attest Report[18]

.91 A client may publish various documents that contain information (hereinafter referred to as *other information*) in addition to the practitioner's attest report on subject matter (or on an assertion related thereto). Paragraphs .92–.94 provide guidance to the practitioner when the other information is contained in (*a*) annual reports to holders of securities or beneficial interests, annual reports of organizations for charitable or philanthropic purposes distributed to the public, and annual reports filed with regulatory authorities under the Securities Exchange Act of 1934 or (*b*) other documents to which the practitioner, at the client's request, devotes attention. These paragraphs are not applicable when an attest report appears in a registration statement filed under the Securities Act of 1933. (See AU-C section 920, *Letters for Underwriters and Certain Other Requesting Parties*, and AU-C section 925, *Filings With the U.S. Securities and Exchange Commission Under the Securities Act of 1933*.) Also, these paragraphs are not applicable to other information on which the practitioner or another practitioner is engaged to issue an opinion. [Revised, December 2012, to reflect conforming changes necessary due to the issuance of SAS Nos. 122–126.]

.92 The practitioner's responsibility with respect to other information in such a document does not extend beyond the information identified in his or her report, and the practitioner has no obligation to perform any procedures to corroborate any other information contained in the document. However, the practitioner should read the other information not covered by the practitioner's report or by the report of the other practitioner and consider whether it, or the manner of its presentation, is materially inconsistent with the information appearing in the practitioner's report. If the practitioner believes that the other information is inconsistent with the information appearing in the practitioner's report, he or she should consider whether the practitioner's report requires revision. If the practitioner concludes that the report does not require revision, he or she should request the client to revise the other information. If the other information is not revised to eliminate the material inconsistency, the practitioner should consider other actions, such as revising his or her report to include an explanatory paragraph describing the material inconsistency, withholding the use of his or her report in the document, or withdrawing from the engagement.

.93 If, while reading the other information for the reasons set forth in paragraph .92, the practitioner becomes aware of information that he or she believes is a material misstatement of fact that is not a material inconsistency as described in paragraph .92, he or she should discuss the matter with the client. In connection with this discussion, the practitioner should consider that he or she may not have the expertise to assess the validity of the statement, that there may be no standards by which to assess its presentation, and that there may be valid differences of judgment or opinion. If the practitioner concludes he or she has a valid basis for concern, the practitioner should propose that the client consult with some other party whose advice may be useful, such as the entity's legal counsel.

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[18] Such guidance pertains only to other information in a client-prepared document. The practitioner has no responsibility to read information contained in documents of nonclients. Further, the practitioner is not required to read information contained in electronic sites, or to consider the consistency of other information in electronic sites with the original documents since electronic sites are a means of distributing information and are not "documents" as that term is used in this section. Practitioners may be asked by their clients to render attest services with respect to information in electronic sites, in which case, other attest standards may apply to those services. [Footnote renumbered by the issuance of SSAE No. 14, November 2006.]

.94 If, after discussing the matter, the practitioner concludes that a material misstatement of fact remains, the action taken will depend on his or her judgment in the circumstances. The practitioner should consider steps such as notifying the client's management and audit committee in writing of his or her views concerning the information and consulting his or her legal counsel about further action appropriate in the circumstances.[19]

Consideration of Subsequent Events in an Attest Engagement

.95 Events or transactions sometimes occur subsequent to the point in time or period of time of the subject matter being tested but prior to the date of the practitioner's report that have a material effect on the subject matter and therefore require adjustment or disclosure in the presentation of the subject matter or assertion. These occurrences are referred to as *subsequent events*. In performing an attest engagement, a practitioner should consider information about subsequent events that comes to his or her attention. Two types of subsequent events require consideration by the practitioner.

.96 The first type consists of events that provide additional information with respect to conditions that existed at the point in time or during the period of time of the subject matter being tested. This information should be used by the practitioner in considering whether the subject matter is presented in conformity with the criteria and may affect the presentation of the subject matter, the assertion, or the practitioner's report.

.97 The second type consists of those events that provide information with respect to conditions that arose subsequent to the point in time or period of time of the subject matter being tested that are of such a nature and significance that their disclosure is necessary to keep the subject matter from being misleading. This type of information will not normally affect the practitioner's report if the information is appropriately disclosed.

.98 While the practitioner has no responsibility to detect subsequent events, the practitioner should inquire of the responsible party (and his or her client if the client is not the responsible party) as to whether they are aware of any subsequent events, through the date of the practitioner's report, that would have a material effect on the subject matter or assertion.[20] If the practitioner has decided to obtain a representation letter, the letter ordinarily would include a representation concerning subsequent events. (See paragraphs .60–.61.)

.99 The practitioner has no responsibility to keep informed of events subsequent to the date of his or her report; however, the practitioner may later become aware of conditions that existed at that date that might have affected the practitioner's report had he or she been aware of them. In such circumstances, the practitioner may wish to consider the guidance in AU-C section

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[19] If the client does not have an audit committee, the practitioner should communicate with individuals whose authority and responsibility are equivalent to those of an audit committee, such as the board of directors, the board of trustees, an owner in a owner-managed entity, or those who engaged the practitioner. [Footnote renumbered by the issuance of Statement on SSAE No. 14, November 2006.]

[20] For certain subject matter, specific subsequent event standards have been developed to provide additional requirements for engagement performance and reporting. Additionally, a practitioner engaged to examine the design or effectiveness of internal control over items not covered by section 501, *An Examination of an Entity's Internal Control Over Financial Reporting That Is Integrated With an Audit of Its Financial Statements*, or section 601, *Compliance Attestation*, should consider the subsequent events guidance set forth in paragraphs .129–.134 of section 501 and paragraphs .50–.52 of section 601. [Footnote renumbered by the issuance of SSAE No. 14, November 2006.]

560, *Subsequent Events and Subsequently Discovered Facts*. [Revised, December 2012, to reflect conforming changes necessary due to the issuance of SAS Nos. 122–126.]

Attest Documentation[21]

.100   The practitioner should prepare and maintain attest documentation, the form and content of which should be designed to meet the circumstances of the particular attest engagement.[22] Attest documentation is the principal record of attest procedures applied, information obtained, and conclusions or findings reached by the practitioner in the engagement. The quantity, type, and content of attest documentation are matters of the practitioner's professional judgment. [As amended, effective for attest engagements when the subject matter or assertion is as of or for a period ending on or after December 15, 2002, by SSAE No. 11.]

.101   Attest documentation serves mainly to:

a.   Provide the principal support for the practitioner's report, including the representation regarding observance of the standards of fieldwork, which is implicit in the reference in the report to attestation standards.[23]

b.   Aid the practitioner in the conduct and supervision of the attest engagement.

For examinations of prospective financial statements, attest documentation ordinarily should indicate that the process by which the entity develops its prospective financial statements was considered in determining the scope of the examination. [Paragraph added, effective for attest engagements when the subject matter or assertion is as of or for a period ending on or after December 15, 2002, by SSAE No. 11.]

.102   Examples of attest documentation are work programs, analyses, memoranda, letters of confirmation and representation, abstracts or copies of entity documents, and schedules or commentaries prepared or obtained by the practitioner. Attest documentation may be in paper form, electronic form, or other media. [Paragraph renumbered and amended, effective for attest engagements when the subject matter or assertion is as of or for a period ending on or after December 15, 2002, by SSAE No. 11.]

.103   Attest documentation should be sufficient to (*a*) enable members of the engagement team with supervision and review responsibilities to understand the nature, timing, extent, and results of attest procedures performed,

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[21] *Attest documentation* also may be referred to as *working papers*. [Footnote added, effective for attest engagements when the subject matter or assertion is as of or for a period ending on or after December 15, 2002, by SSAE No. 11. Footnote renumbered by the issuance of SSAE No. 14, November 2006.]

[22] [Footnote renumbered and deleted by the issuance of SSAE No. 11, January 2002. Footnote subsequently renumbered by the issuance of SSAE No. 14, November 2006.]

[23] However, there is no intention to imply that the practitioner would be precluded from supporting his or her report by other means in addition to attest documentation. [Footnote added, effective for attest engagements when the subject matter or assertion is as of or for a period ending on or after December 15, 2002, by SSAE No. 11. Footnote renumbered by the issuance of SSAE No. 14, November 2006.]

and the information obtained [24] and (*b*) indicate the engagement team member(s) who performed and reviewed the work. [Paragraph added, effective for attest engagements when the subject matter or assertion is as of or for a period ending on or after December 15, 2002, by SSAE No. 11.]

.104 Attest documentation is the property of the practitioner, and some states recognize this right of ownership in their statutes. The practitioner should adopt reasonable procedures to retain attest documentation for a period of time sufficient to meet the needs of his or her practice and to satisfy any applicable legal or regulatory requirements for records retention.[25], [26] [Paragraph renumbered and amended, effective for attest engagements when the subject matter or assertion is as of or for a period ending on or after December 15, 2002, by SSAE No. 11.]

.105 The practitioner has an ethical, and in some situations a legal, obligation to maintain the confidentiality of client information or information of the responsible party.[27] Because attest documentation often contains confidential information, the practitioner should adopt reasonable procedures to maintain the confidentiality of that information.[†] [Paragraph added, effective for attest engagements when the subject matter or assertion is as of or for a period ending on or after December 15, 2002, by SSAE No. 11.]

.106 The practitioner also should adopt reasonable procedures to prevent unauthorized access to attest documentation. [Paragraph added, effective for attest engagements when the subject matter or assertion is as of or for a period ending on or after December 15, 2002, by SSAE No. 11.]

.107 Certain attest documentation may sometimes serve as a useful reference source for the client, but it should not be regarded as a part of, or a substitute for, the client's records. [Paragraph renumbered and amended, effective for attest engagements when the subject matter or assertion is as of or for a period ending on or after December 15, 2002, by SSAE No. 11.]

[.108] [Paragraph renumbered and deleted by the issuance of SSAE No. 11, January 2002.]

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[24] A firm of practitioners has a responsibility to adopt a system of quality control policies and procedures to provide the firm with reasonable assurance that its personnel comply with applicable professional standards, including attestation standards, and the firm's standards of quality in conducting individual attest engagements. Review of attest documentation and discussions with engagement team members are among the procedures a firm performs when monitoring compliance with the quality control policies and procedures that it has established. (Also, see paragraphs .17–.18.) [Footnote added, effective for attest engagements when the subject matter or assertion is as of or for a period ending on or after December 15, 2002, by SSAE No. 11. Footnote renumbered by the issuance of SSAE No. 14, November 2006.]

[25] The procedures should enable the practitioner to access electronic attest documentation throughout the retention period. [Footnote added, effective for attest engagements when the subject matter or assertion is as of or for a period ending on or after December 15, 2002, by SSAE No. 11. Footnote renumbered by the issuance of SSAE No. 14, November 2006.]

[26] [Footnote renumbered and deleted by the issuance of SSAE No. 11, January 2002. Footnote subsequently renumbered by the issuance of SSAE No. 14, November 2006.]

[27] Also, see the "Confidential Client Information Rule" (ET sec. 1.700.001) of the AICPA Code of Professional Conduct. [Footnote added, effective for attest engagements when the subject matter or assertion is as of or for a period ending on or after December 15, 2002, by SSAE No. 11. Footnote renumbered by the issuance of SSAE No. 14, November 2006. Footnote revised, January 2015, to reflect conforming changes necessary due to the issuance of the revised AICPA Code of Professional Conduct, effective December 15, 2014.]

[†] ***Note:*** See Interpretation No. 4, "Providing Access to or Copies of Attest Documentation to a Regulator," of section 101 (sec. 9101 par. .43–.46).

Attest Services Related to Consulting Service Engagements

Attest Services as Part of a Consulting Service Engagement

.109 When a practitioner provides an attest service (as defined in this section) as part of a consulting service engagement, this SSAE applies only to the attest service. The SSCS applies to the balance of the consulting service engagement. [Paragraph renumbered by the issuance of SSAE No. 11, January 2002.]

.110 When the practitioner determines that an attest service is to be provided as part of a consulting service engagement, the practitioner should inform the client of the relevant differences between the two types of services and obtain concurrence that the attest service is to be performed in accordance with the appropriate professional requirements. The practitioner should take such actions because the professional requirements for an attest service differ from those for a consulting service engagement. [Paragraph renumbered by the issuance of SSAE No. 11, January 2002.]

.111 The practitioner should issue separate reports on the attest engagement and the consulting service engagement and, if presented in a common binder, the report on the attest engagement or service should be clearly identified and segregated from the report on the consulting service engagement. [Paragraph renumbered by the issuance of SSAE No. 11, January 2002.]

Subject Matter, Assertions, Criteria, and Evidence

.112 An attest service may involve subject matter, an assertion, criteria, or evidential matter developed during a concurrent or prior consulting service engagement. Subject matter or an assertion developed with the practitioner's advice and assistance as the result of such consulting services engagement may be the subject of an attest engagement, provided the responsible party accepts and acknowledges responsibility for the subject matter or assertion. (See paragraph .12.) Criteria developed with the practitioner's assistance may be used to evaluate subject matter in an attest engagement, provided such criteria meet the requirements of this section. Relevant information obtained in the course of a concurrent or prior consulting service engagement may be used as evidential matter in an attest engagement, provided the information satisfies the requirements of this section. [Paragraph renumbered by the issuance of SSAE No. 11, January 2002.]

Effective Date

.113 This section is effective when the subject matter or assertion is as of or for a period ending on or after June 1, 2001. Early application is permitted. [Paragraph renumbered by the issuance of SSAE No. 11, January 2002.]

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Appendix A

Examination Reports

Example 1

This is a standard examination report on subject matter for general use. This report pertains to subject matter for which suitable criteria exist and are available to all users through inclusion in a clear manner in the presentation of the subject matter. (See paragraphs .78–.83 for guidance on restricting the use of the report when criteria are available only to specified parties; see Example 4 for an illustration of such a report.) A written assertion has been obtained from the responsible party.

<div align="center">Independent Accountant's Report</div>

We have examined the [*identify the subject matter—for example, the accompanying schedule of investment returns of XYZ Company for the year ended December 31, 20XX*]. XYZ Company's management is responsible for the schedule of investment returns. Our responsibility is to express an opinion based on our examination.

Our examination was conducted in accordance with attestation standards established by the American Institute of Certified Public Accountants and, accordingly, included examining, on a test basis, evidence supporting [*identify the subject matter—for example, XYZ Company's schedule of investment returns*] and performing such other procedures as we considered necessary in the circumstances. We believe that our examination provides a reasonable basis for our opinion.

[*Additional paragraph(s) may be added to emphasize certain matters relating to the attest engagement or the subject matter.*]

In our opinion, the schedule referred to above presents, in all material respects, [*identify the subject matter—for example, the investment returns of XYZ Company for the year ended December 31, 20XX*] based on [*identify criteria—for example, the ABC criteria set forth in Note 1*].

[*Signature*]

[*Date*]

Example 2

This report is a standard examination report on an assertion for general use. The report pertains to subject matter for which suitable criteria exist and are available to all users through inclusion in a clear manner in the presentation of the subject matter. (See paragraphs .78–.83 for guidance on restricting the use of the report when criteria are available only to specified parties.) A written assertion has been obtained from the responsible party.

<div align="center">Independent Accountant's Report</div>

We have examined management's assertion that [*identify the assertion—for example, the accompanying schedule of investment returns of XYZ Company for the year ended December 31, 20XX is presented in accordance with ABC criteria set forth in Note 1*]. XYZ Company's management is responsible for the assertion. Our responsibility is to express an opinion on the assertion based on our examination.

AT §101.114

Our examination was conducted in accordance with attestation standards established by the American Institute of Certified Public Accountants and, accordingly, included examining, on a test basis, evidence supporting management's assertion and performing such other procedures as we considered necessary in the circumstances. We believe that our examination provides a reasonable basis for our opinion.

[*Additional paragraph(s) may be added to emphasize certain matters relating to the attest engagement or the assertion.*]

In our opinion, management's assertion referred to above is fairly stated, in all material respects, based on [*identify established or stated criteria—for example, the ABC criteria set forth in Note 1*].

[*Signature*]

[*Date*]

Example 3

This is an examination report for general use; the introductory paragraph states the practitioner has examined management's assertion but the practitioner opines directly on the subject matter (see paragraph .87). The report pertains to subject matter for which suitable criteria exist and are available to all users through inclusion in a clear manner in the presentation of the subject matter. (See paragraphs .78–.83 for guidance on restricting the use of the report when criteria are available only to specified parties.) A written assertion has been obtained from the responsible party.

<p align="center">Independent Accountant's Report</p>

We have examined management's assertion that [*identify the assertion—for example, the accompanying schedule of investment returns of XYZ Company for the year ended December 31, 20XX is presented in accordance with the ABC criteria set forth in Note 1*]. XYZ Company's management is responsible for the assertion. Our responsibility is to express an opinion based on our examination.

Our examination was conducted in accordance with attestation standards established by the American Institute of Certified Public Accountants and, accordingly, included examining, on a test basis, evidence supporting [*identify the subject matter—for example, XYZ Company's schedule of investment returns*] and performing such other procedures as we considered necessary in the circumstances. We believe that our examination provides a reasonable basis for our opinion.

[*Additional paragraph(s) may be added to emphasize certain matters relating to the attest engagement or the assertion.*]

In our opinion, the schedule referred to above, presents, in all material respects, [*identify the subject matter—for example, the investment returns of XYZ Company for the year ended December 31, 20XX*] based on [*identify criteria—for example, the ABC criteria set forth in Note 1*].

[*Signature*]

[*Date*]

Example 4

This is an examination report on subject matter. Although suitable criteria exist, use of the report is restricted because the criteria are available only to specified parties. (See paragraph .34.) A written assertion has been obtained from the responsible party.

<u>Independent Accountant's Report</u>

We have examined the accompanying schedule of investment returns of XYZ Company for the year ended December 31, 20XX. XYZ Company's management is responsible for the schedule of investment returns. Our responsibility is to express an opinion based on our examination.

Our examination was conducted in accordance with attestation standards established by the American Institute of Certified Public Accountants and, accordingly, included examining, on a test basis, evidence supporting [*identify the subject matter—for example, XYZ Company's schedule of investment returns*] and performing such other procedures as we considered necessary in the circumstances. We believe that our examination provides a reasonable basis for our opinion.

[*Additional paragraph(s) may be added to emphasize certain matters relating to the attest engagement or the assertion.*]

In our opinion, the schedule referred to above, presents, in all material respects, [*identify the subject matter—for example, the investment returns of XYZ Company for the year ended December 31, 20XX*] based on the ABC criteria referred to in the investment management agreement between XYZ Company and DEF Investment Managers, Ltd., dated November 15, 20X1.

This report is intended solely for the information and use of XYZ Company and [*identify other specified parties—for example, DEF Investment Managers, Ltd.*] and is not intended to be and should not be used by anyone other than these specified parties.

[*Signature*]

[*Date*]

Example 5

This is an examination report with a qualified opinion because conditions exist that, individually or in combination, result in one or more material misstatements or deviations from the criteria; the report is for general use. The report pertains to subject matter for which suitable criteria exist and are available to all users through inclusion in a clear manner in the presentation of the subject matter. (See paragraphs .78–.83 for guidance on restricting the use of the report when criteria are available only to specified parties.) A written assertion has been obtained from the responsible party.

<u>Independent Accountant's Report</u>

We have examined the accompanying schedule of investment returns of XYZ Company for the year ended December 31, 20XX. XYZ Company's management is responsible for the schedule of investment returns. Our responsibility is to express an opinion based on our examination.

Our examination was conducted in accordance with attestation standards established by the American Institute of Certified Public Accountants and, accordingly, included examining, on a test basis, evidence supporting [*identify the subject matter—for example, XYZ Company's schedule of investment returns*] and performing such other procedures as we considered necessary in the circumstances. We believe that our examination provides a reasonable basis for our opinion.

Our examination disclosed the following [*describe condition(s) that, individually or in the aggregate, resulted in a material misstatement or deviation from the criteria*].

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In our opinion, except for the material misstatement [*or deviation from the criteria*] described in the preceding paragraph, the schedule referred to above, presents, in all material respects, [*identify the subject matter—for example, the investment returns of XYZ Company for the year ended December 31, 20XX*] based on [*identify criteria—for example, the ABC criteria set forth in Note 1*].

[*Signature*]

[*Date*]

Example 6

This is an examination report that contains a disclaimer of opinion because of a scope restriction. (See paragraph .74 for reporting guidance when there is a scope restriction.) The report pertains to subject matter for which suitable criteria exist and are available to all users through inclusion in a clear manner in the presentation of the subject matter.

<div align="center">Independent Accountant's Report</div>

We were engaged to examine the accompanying schedule of investment returns of XYZ Company for the year ended December 31, 20XX. XYZ Company's management is responsible for the schedule of investment returns.

<div align="center">[*Scope paragraph should be omitted.*]</div>

<div align="center">[*Include paragraph to describe scope restrictions.*]</div>

Because of the restriction on the scope of our examination discussed in the preceding paragraph, the scope of our work was not sufficient to enable us to express, and we do not express, an opinion on whether the schedule referred to above presents, in all material respects, [*identify the subject matter—for example, the investment returns of XYZ Company for the year ended December 31, 20XX*] based on [*identify criteria—for example, the ABC criteria set forth in Note 1*].

[*Signature*]

[*Date*]

Example 7

This is an examination report on subject matter that is the responsibility of a party other than the client. The report is restricted as to use since a written assertion has not been provided by the responsible party. (See paragraph .78.) The subject matter pertains to criteria that are suitable and are available to the client.

<div align="center">Independent Accountant's Report</div>

To the Board of Directors

DEF Company:

We have examined the [*identify the subject matter—for example, the accompanying schedule of investment returns of XYZ Company for the year ended December 31, 20XX*]. XYZ Company's management is responsible for the schedule of investment returns. XYZ management did not provide us a written assertion about their schedule of investment returns for the year ended December 31, 20XX. Our responsibility is to express an opinion based on our examination.

Our examination was conducted in accordance with attestation standards established by the American Institute of Certified Public Accountants and, accordingly, included examining, on a test basis, evidence supporting [*identify the subject matter—for example, XYZ Company's schedule of investment returns*] and performing such other procedures as we considered necessary in the circumstances. We believe that our examination provides a reasonable basis for our opinion.

[*Additional paragraph(s) may be added to emphasize certain matters relating to the attest engagement or the subject matter.*]

In our opinion, the schedule referred to above presents, in all material respects, [*identify the subject matter—for example, the investment returns of XYZ Company for the year ended December 31, 20XX*] based on [*identify criteria—for example, the ABC criteria set forth in Note 1*].

This report is intended solely for the information and use of the management and board of directors of DEF Company and is not intended to be and should not be used by anyone other than these specified parties.

[*Signature*]

[*Date*]

[Paragraph renumbered by the issuance of SSAE No. 11, January 2002.]

.115

Appendix B

Review Reports

Example 1

This is a standard review report on subject matter for general use. The report pertains to subject matter for which suitable criteria exist and are available to all users through inclusion in a clear manner in the presentation of the subject matter. (See paragraphs .78–.83 for guidance on restricting the use of the report when criteria are available only to specified parties.) A written assertion has been obtained from the responsible party.

<div align="center">Independent Accountant's Report</div>

We have reviewed the [*identify the subject matter—for example, the accompanying schedule of investment returns of XYZ Company for the year ended December 31, 20XX*]. XYZ Company's management is responsible for the schedule of investment returns.

Our review was conducted in accordance with attestation standards established by the American Institute of Certified Public Accountants. A review is substantially less in scope than an examination, the objective of which is the expression of an opinion on [*identify the subject matter—for example, XYZ Company's schedule of investment returns*]. Accordingly, we do not express such an opinion.

[*Additional paragraph(s) may be added to emphasize certain matters relating to the attest engagement or the subject matter.*]

Based on our review, nothing came to our attention that caused us to believe that the [*identify the subject matter—for example, schedule of investment returns of XYZ Company for the year ended December 31, 20XX*] is not presented, in all material respects, in conformity with [*identify the criteria—for example, the ABC criteria set forth in Note 1*].

[*Signature*]

[*Date*]

Example 2

This is a review report on subject matter that is the responsibility of a party other than the client. This review report is restricted as to use since a written assertion has not been provided by the responsible party. (See paragraph .78.) The subject matter pertains to criteria that are suitable and are available to the client.

<div align="center">Independent Accountant's Report</div>

To the Board of Directors

DEF Company:

We have reviewed [*identify the subject matter—for example, the accompanying schedule of investment returns of XYZ Company for the year ended December 31, 20XX*]. XYZ Company's management is responsible for the schedule of investment returns. XYZ Company's management did not provide us a written assertion about their schedule of investment returns for the year ended December 31, 20XX.

AT §101.115   **©2016, AICPA**

Our review was conducted in accordance with attestation standards established by the American Institute of Certified Public Accountants. A review is substantially less in scope than an examination, the objective of which is the expression of an opinion on [*identify the subject matter—for example, XYZ Company's schedule of investment returns*]. Accordingly, we do not express such an opinion.

[*Additional paragraph(s) may be added to emphasize certain matters relating to the attest engagement or the subject matter.*]

Based on our review, nothing came to our attention that caused us to believe that [*identify the subject matter—for example, the schedule of investment returns of XYZ Company for the year ended December 31, 20XX*] is not presented, in all material respects, in conformity with [*identify the criteria—for example, the ABC criteria set forth in Note 1*].

This report is intended solely for the information and use of the management and board of directors of DEF Company and is not intended to be and should not be used by anyone other than these specified parties.

[*Signature*]

[*Date*]

Example 3

This is a review report on an assertion. Although suitable criteria exist for the subject matter, the report is restricted as to use since the criteria are available only to specified parties; if the criteria are available as described in paragraph .33(*a*)–(*d*), the paragraph restricting the use of the report would be omitted. A written assertion has been obtained from the responsible party.

<u>Independent Accountant's Report</u>

We have reviewed management's assertion that [*identify the assertion—for example, the accompanying schedule of investment returns of XYZ Company for the year ended December 31, 20XX is presented in accordance with the ABC criteria referred to in Note 1*]. XYZ Company's management is responsible for the assertion.

Our review was conducted in accordance with attestation standards established by the American Institute of Certified Public Accountants. A review is substantially less in scope than an examination, the objective of which is the expression of an opinion on management's assertion. Accordingly, we do not express such an opinion.

[*Additional paragraph(s) may be added to emphasize certain matters relating to the attest engagement or the assertion.*]

Based on our review, nothing came to our attention that caused us to believe that management's assertion referred to above is not fairly stated, in all material respects, based on [*identify the criteria—for example, the ABC criteria referred to in the investment management agreement between XYZ Company and DEF Investment Managers, Ltd., dated November 15, 20X1*].

This report is intended solely for the information and use of XYZ Company and [*identify other specified parties—for example, DEF Investment Managers, Ltd.*] and is not intended to be and should not be used by anyone other than these specified parties.

[*Signature*]

[*Date*]

[Paragraph renumbered by the issuance of SSAE No. 11, January 2002.]

Coalfire
IT Governance, Risk & Compliance

Acyclica White Paper:
RoadTrend does not Capture PII

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Date
December 18, 2015

Acyclica

Table of Contents

Intro

Acyclica is the leading provider of high resolution, real-time traffic congestion information. They are the fastest growing ITS company providing congestion management solutions. Its suite of traffic analytics software and sensor devices are currently being used by over 50 agencies both domestic and international to help to monitor and improve traffic congestion. Acyclica works with cities, municipalities and Departments of Transportation to aggregate and analyze data to bridge gaps in traditional traffic data services. Acyclica also provides data to organizations and businesses in need of relevant travel information services ranging from origin and destination information to travel-times.

Based on the data Acyclica captures, their customers/client then have information that can be provided to travelers and traffic engineers, such as a calculated average speed for different monitored roadway segments, duration of traffic/turn signals, and average progress time along different monitored roadway segments, representative of travel and stop time and delays. This then allows traffic engineers to correct traffic signal length, set sensors and traffic lights to be shorter/longer, and provide information to travelers about traffic signals or other pertinent information around delays.

Applications of Acyclica technology include: Signal Timing & Coordination, Traffic network optimization, Street parking congestion analysis, Congestion mapping, Route planning, Workzone congestion enforcement, Variable message signs, Incident Detection, Emergency responder routing and Route Utilization.

Acyclica technology anonymously collects media access control (MAC) address information and send the data to the cloud using WiFi technology through the use of their RoadTrend Sensor. This sensor is a proprietary Linux-based device that is discreetly installed inside of traffic control cabinets for their clients/customers. The devices are Ethernet connected and have a WiFi adapter capturing the MAC addresses of all devices within its range. Based upon the design and configuration, Acyclica believes that they are able to be exponentially more accurate, capturing several hundred times more data than normal mobile apps or traffic pattern analyzers.

> **Commented [D1]:** Wifi is not used for communication. All communication is over wired networks with data transmission either over encrypted cellular networks or a hard line.

Using WiFi detection of MAC addresses, Acyclica is able to identify and differentiate vehicle movement as it approaches, stops and leaves an intersection. From the aggregated data, Acyclica is able to extract and provide actionable information to their clients/customers to make informed choices on the traffic service enhancements and resolution of traveler challenges.

Summary/Intended Message

Acyclica technology anonymously collects media access control (MAC) address information and send the data to the cloud using WiFi technology through the use of their RoadTrend Sensor. Using WiFi detection of MAC addresses, Acyclica is able to identify and differentiate vehicle movement as it approaches, stops and leaves an intersection.

MAC address is a media access control address which uniquely identifies a device connected to a network. MAC addresses are usually assigned by a manufacturer and the information is hard-coded to the device and stored in its hardware. MAC addresses are independent of device ownership such that there is no immediate connection

to the device owner/user. A MAC address thus does not represent any personally identifiable information (PII). If device ownership changes, the device MAC address remains unchanged. Within the product and services provided by Acyclica, the applicable device is a mobile device. The only way to connect a MAC address to the mobile device owner/user is to work with a mobile carrier to associate the MAC address to an active mobile phone number listed on mobile customer's account. In this case, the PII resides with the mobile carrier who maintains the details of a mobile customer's account.

Even though this information is not PII, since it not inherently tied to an individual mobile device owner/user, Acyclica still does protect the data using encryption technology embedded within proprietary code that secures the non-PII MAC address at the device prior to transmission to the Acyclica's backend infrastructure for analysis. Other methods of securing the non PII data include specific design and configuration of the backend infrastructure components, as well as industry standard security practices for access controls and logging/monitoring and alerting.

Acyclica's clients/customers are agencies both domestic and international, including cities, municipalities and Departments of Transportation. Depending upon the contracted service(s), these clients/customers may have access to the aggregated data through a web portal.   Since no PII is captured, there is no PII shared with Acyclica's clients/customers through this portal. However, Acyclica still does protect the data using encryption technology for data encryption across the internet providing an encrypted web portal using a third party encryption certificate.

Question/Concern
What information does Acyclica collect? Is this information PII?
Mobile device MAC address data is collected by Acyclica for their analytics, however there is no PII captured that could identify an individual mobile device owner/user, such as name or mobile device number. The captured MAC address cannot be tied to an individual mobile device owner/user unless done so by the mobile carrier, which is outside of the purview of Acyclica.

Mobile device MAC address data collected by Acyclica and provided to their customers/clients is very minimal, and includes only a hashed value of the MAC address (never a full, unhashed version), in addition to timestamp, strength (of signal) and serial number (of sensor device). This information is provided to the customer/client by way of an access controlled web portal, which can also permit an export to csv. And API is also made available for customers/clients to integrate the data into digital signage for real-time communication to travelers in determined areas.

Why is it important to protect the non-PII data that is collected?
While not PII, if data from a mobile carrier were to be made available, by means either accidental or nefarious, a third party may be able to correlate the data and use the analysis to track the movements and activities of the mobile device owner/user. In these cases, the movements and activities of the mobile device owner/user could reveal addresses of personal residence or workplace, as well as those dates and times when the mobile device

owner/user was regularly present or absent at either location. The likelihood of this occurrence can vary and there are many other variables that contribute to the overall level of risk.

How does Acyclica secure the collected non-PII data?

Regardless of risk likelihood and level, Acyclica employs industry-standard measures to secure the data itself as it is captured at the device, retained in the backend infrastructure components and made available to the customer/client, as well as during data transmission from the device to the backend infrastructure components and the presentation of the data in a web portal. Acyclica ensures also that there are configuration standards and industry-accepted hardening criteria incorporated into the design and implementation of their sensor devices and backend infrastructure components, as well security practices that enforce strong access controls, configuration management procedures and methods of being aware of the state of the systems at all times.

Specifically, the following security measures are in place to secure the non-PII MAC address:

1. Limited data capture of MAC address
   - The intended design of the sensor devices limits the collection of MAC address data based upon the signal strength that is broadcasted to the WiFi antenna within the designated traffic cabinets range (500-700 feet). This means that there is a focused effort to only capture data within the predetermined range which will provide the most relevant data.

2. Encryption technology at device prior to transmission
   - Acyclica has created proprietary code that incorporates encryption technology using industry standard algorithm and cipher strengths, as well as inclusion of the use of a cryptographic hash function with a generated salt value. A cryptographic hash function is a way to easily validate that a string of data corresponds to a specific hash value. If the original data string is unknown, but the stored hash value is known, by design, the cryptographic hash function makes it challenging to recreate the original data string. Utilization of hash function is intended to assure the integrity of data in transmission. In cryptography, a salt is random piece of data that is used, in addition to a string of data, in the creation of a hash value through use of a hash function.
   - The primary function of salts is to prevent retro calculation of the hashed value if the hash function is known. Use of a salt precludes the effectiveness of using a list of possible pre-computed values since the salt is randomly generated. With Acyclica's proprietary technology solutions, the salt rotates every 24 hours on the actual sensor device. The salt value is determined by timestamp which enables the hash to be dynamic. This encryption methodology is in sync with industry standard protocols. Additionally, there is proprietary code that is running on the sensor device that performs the encryption function. The proprietary nature of the code strengthens to nature of the encryption methodology. The methodology of transmission to the cloud is a direct post to the back end systems, versus an HTTPS transmission or broadcast over open, public networks which is considered less secure.

3. Secure transmission to Acyclica's backend environment –
   - Acyclica avoids the use of HTTPS transmission or broadcast of data over open, public networks.

4. Encryption technology in the backend environment –
   - [More information is needed here if it is to be included]

5. Database schema design and repository in AWS environment –
   - Information such as address, name, race and gender is not captured, only MAC address. All other data capture corresponds to needed data which would be publically available and which is relevant specifically for traffic analysis.

6. Secure presentation to customers/clients in an encrypted (HTTPS) web portal –
   - The web portal (https://cr.acyclica.com) uses industry-accepted encryption by way of a third-party certificate.

7. Secure configuration and hardening of device –
   - Acyclica uses of a pared down proprietary Linux installation with a specific embedded processor, chosen for processing optimization. Minimal storage is available on this device to enable only intended functionality and to also limit data retained. Additionally, there are specific access controls set to ensure restricted logical access to the device.

8. Secure configuration and hardening of backend infrastructure –
   - [Unsure of how much technical information is appropriate here if it is to be included]

9. Industry standard security practices –
   - Acyclica employs logical access controls to ensure minimally assigned access and privileges, based upon a need-to-know. Vulnerability of systems are managed with patch procedures and change management processes, and logs are captured and monitored for maximum security awareness of the state of the devices and systems

10. Security language built into the contractual agreement with customers/clients –
    - Acyclica has built specific security language into their contracts to clearly delineate the responsibilities between Acyclica and the customer/client for security of data and associated regulatory requirements.

Validation

In order to validate the design and operational effectiveness of Acyclica's security program which protects the non PII MAC address data that it collects for analysis, Coalfire reviewed Acyclica's proprietary encryption code, as well as their documented processes. Additionally, configuration settings were validated with demonstrations and real-time observations with administrate personnel. Coalfire also investigated data repositories to look for any PII, as well as validate that the non PII that is captured is appropriately secured when made available to the customer/client.

Results

Based upon the results of the evaluation efforts, Coalfire was able to confirm the operation effectiveness of Acyclica's device and systems design such that there is no PII retained in any data repository, nor is the non PII MAC address ever presented to customer/clients in an unencrypted, unhashed format. Design effectiveness was confirmed with review, observation and interviews of configuration and code implementation with administrative personnel. Documented processes were also validated as effectively designed and operational as

demonstrated by supporting evidence assessed during review of data repositories and device and system configurations.

Conclusion

Acyclica sensor device technology anonymously collects media access control (MAC) addresses data from mobile devices through the use of a WifF connection on their RoadTrend Sensor. The sensor detects the MAC address on mobile devices within a specific broadcast range of signal strength. With this proprietary device, Acyclica is able to be more accurate, capturing significantly more data than traditional mobile apps or traffic pattern analyzers.

Since MAC addresses are hard-coded to a mobile device, they are independent of device ownership such that if device ownership changes, the MAC address on that device remains unchanged. This solution design thus precludes any direct connection to the device owner and cannot indicate any personally identifiable information (PII). The only way to connect a MAC address to a mobile device owner/user is to work with the associated mobile carrier to associate the MAC address to an active mobile phone number listed on mobile customer's account. In this case, the PII resides with the mobile carrier who maintains the details of a mobile customer's account.

This methodology of data collection for vehicle movement is a more secure alternative to the traditional capture of license plate information. Capture of this information can reliably identify the identity of the driver based upon associated vehicle registration information. As a result, license plate data should be considered PII. While this information may not be immediately available to the general public, whomever has access to the data has the ability to retroactively connect the license plate dirctly to the registered owner of the vehicle.

Even though MAC address data is not PII, if account data from a mobile carrier were to be made available, by means either accidental or nefarious, a third party may be able to correlate the data and use the analysis to track the movements and activities of the mobile device owner/user. In these cases, the movements and activities of the mobile device owner/user could reveal addresses of personal residence or workplace, as well as those dates and times when the mobile device owner/user was regularly present or absent at either location. The likelihood of this occurrence can vary and there are other variables that outside Acyclica that would contribute to the overall level of risk.

Regardless of risk likelihood and level, Acyclica takes active steps to employ industry-standard security measures to protect the non-PII MAC address data itself as it is captured at the device and retained in the backend infrastructure components using a proprietary encryption and hashing methodology. Acyclica also secures both their front end sensor devices, as well as their back end supporting infrastructure components with specific design parameters. Also, the presentation of the data to the customer/client is intentionally pared back to preclude the availability of unhashed, unencrypted MAC address data; instead only the encrypted and hasted data is made available and only through a secure web portal. Finally, Acyclica has incorporated industry standard security practices that enforce strong access controls, configuration management procedures and methods of being aware of the state of the systems at all times.

This comprehensive approach to securing non PII MAC address data was evaluated by Coalfire through review of code and documented processes, as well as validation of configuration settings and investigation retained data. Through this evaluation, Coalfire was able to confidently conclude that PII data is not captured, nor retained and the intended security measures implemented to secure the non PII MAC address data were in place and operating as intended.

Acyclica Go

User Guide

v3.5

Last modified November 22, 2017

Contents

Section 1

Overview

Figure 1.1 - Go Interface

1.1   **Interface**

Go's interface (Figure 1.1) is made up of the following components:

- *Top Nav*
  - Displayed along the top of the interface, this includes the Date Picker tools and dropdowns to view Analytics, Configuration Options, User Information, and Help
- *Map*
  - Displays Locations, Segments, Routes, and a visual representation of traffic data
- *Alerts*

- ○ Located in the lower left corner, this panel will be green when there are no active alerts. When there are active alerts, it will be pink, and will contain the number of active alerts

  - ▪ *Locations*

    - ○ Indicated by markers on the map, a Location is the set of hardware that exist at a single physical location. A Location can hold one or more sensors from Acyclica and other manufacturers
    - ○ There are 5 states:
      - ∗ Online (Green) - all equipment at a location is uploading data
      - ∗ Selected (Blue) - used when a location is selected
      - ∗ Offline (Gray) - no recent data uploaded from any hardware at a location
      - ∗ Some Hardware Offline (Split Green and Gray) - some hardware at a location has recently uploaded data, and some has not uploaded data recently
      - ∗ Alert (Red) - alert is in progress at a location

  - ▪ *Information Panel*

    - ○ Displayed when an item has been selected. This includes sensors, routes, and segments. It will show information about the item, analytics that can be run, and associated sensors or routes

1.2 Registration

To create an account for Acyclica Go:

1. Open https://go.acyclica.com in your web browser
2. Select **Create Your Account**, as seen at the bottom of Figure 1.2
3. Complete the registration form
4. Please note the password requirements:

   - ▪ Password must be eight (8) characters or longer
   - ▪ Password cannot be your username
   - ▪ Password cannot be in the list of 1000 most common passwords

5. Select **Sign Up**
6. Open the verification email sent to your address
7. Select the account verification link in the email

In order to see sensors, routes, and other information in Go, you must be part of a client group. You will already be part of a client group if you received an invitation to join and signed up with the email address that invitation was sent to. If you didn't receive an invitation, your client group administrator will need you to add you to the group. Please contact support@acyclica.com if you don't know who your client group admin is.

Figure 1.2 - Go Login
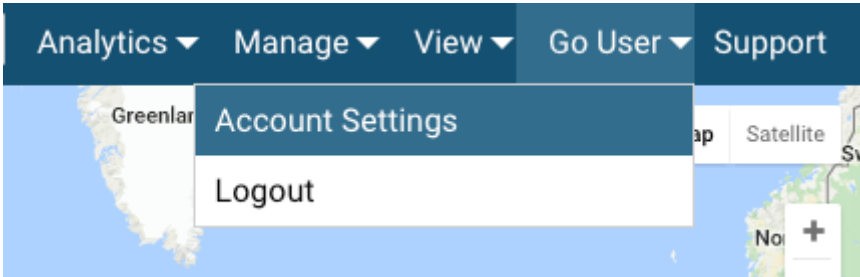
Figure 1.3 - Access Account Settings.

1.3   User Types

There are four types of users in Go:

- *Standard Users*

  - Can access all analytics and modules available to the client group, but cannot make any configuration changes

- *Configuration Admins*

  - All the same permissions as a Standard User, and also have the ability to configure hardware, create routes, create alerts, and so forth

- *User Admins*

  - Can add or remove users from their client groups, and set admin levels.

- *Client Group Owners*

  - Have complete access to all permissions available. Client Group Ownership privileges can only be added or removed by Acyclica Support

If you don't know who your client group admin is and need additional access, contact support@acyclica.com .

Chapter 2

User Management

2.1   Introduction

User Administrators can use the My Groups section of Settings to view lists of users, manage the users within their groups, and set the access privileges that those users have.
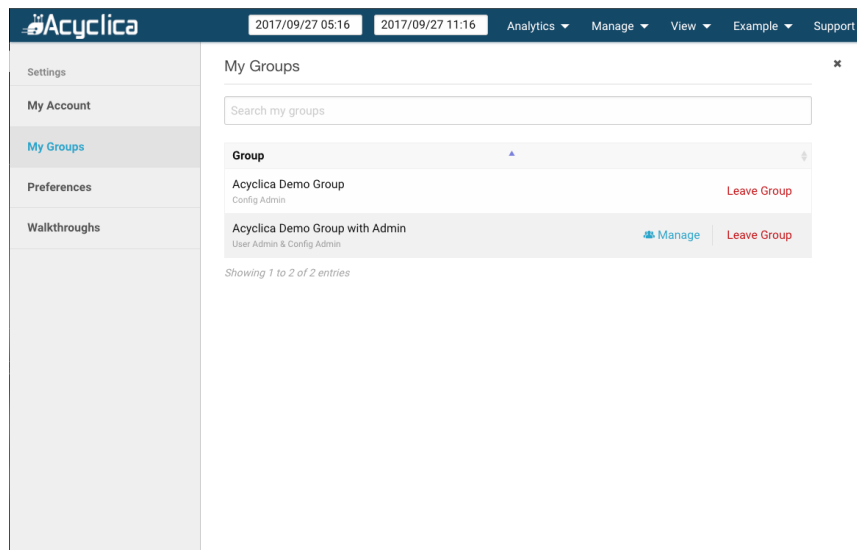
Figure 2.1 - List of client groups for the example user.

As seen in Figure 2.1, the Settings section for *My Groups* will list all of the client groups the user can access. There are four levels of user access to a client group, which are as follows:

- **Group Owners** can manage group memberships, permissions, setup sensors, and create routes, O/D Groups, and alerts; their permissions *cannot* be changed by user admins or other owners

- **User Admins** can manage group membership including adding or removing users and setting permissions

- **Config Admins** can setup sensors and create routes, O/D groups, and alerts

- **Standard Users** have access to run and view analytics in the software

Group Owners and User Admins have the ability to modify users' access to the client group, and can raise or lower a user's permissions within the client group.

2.2   Managing the Client Group
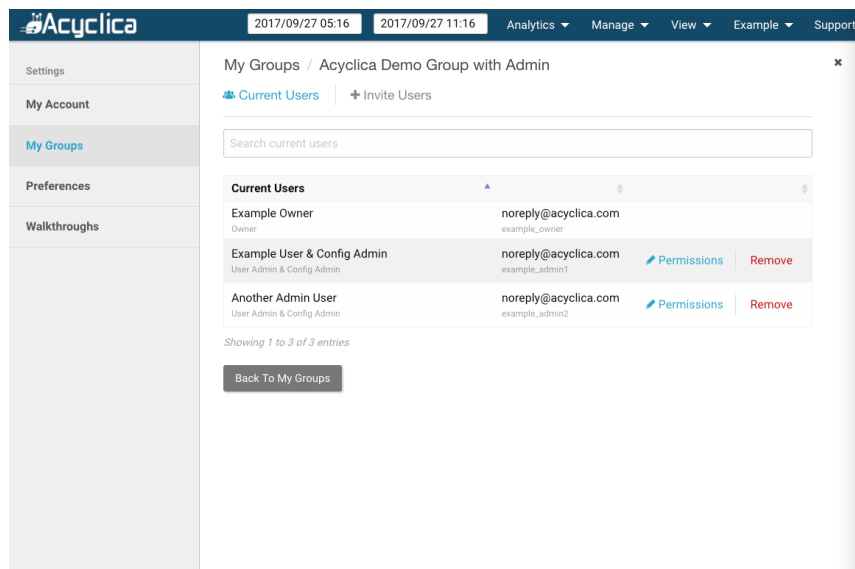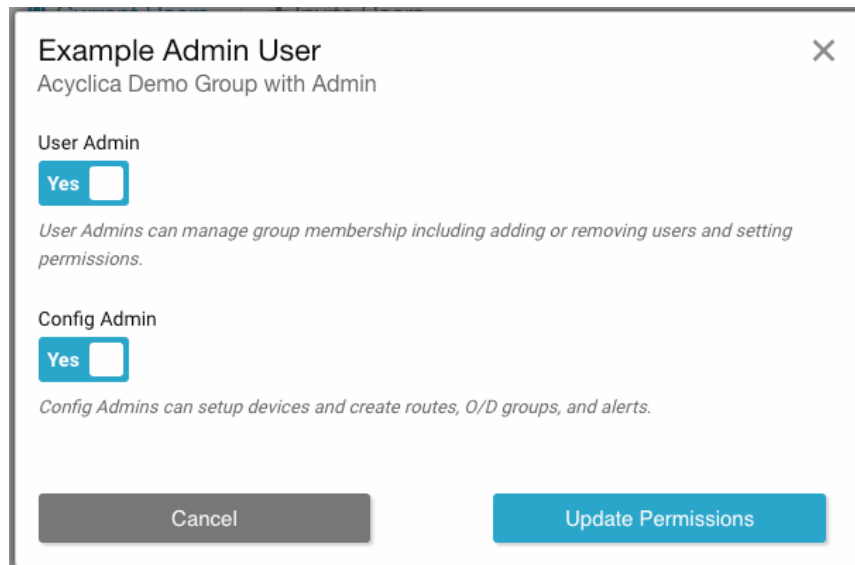
Figure 2.2 - List of users in an example client group.

Selecting **Manage** on the *My Groups* tab of the settings view will allow a user with User Admin or Group Owner to see a list of all non-owner users in the selected client group, as seen in Figure 2.2. From here, individual user permissions may be modified. Selecting **Invite Users** at the top will allow a user to invite additional users to the client group, as well as allowing the user to set those invited users' permission levels.

2.2.1   User Permissions

Figure 2.3 - Modifying user permissions.

An individual user's permissions are defined by what level of user access that user has to the client group, and is determined on a per-client group basis. For example, a user may be a User Admin in one group, but a standard user in another. This would allow the user to manage the other users in the first client group, but only allow that user to run and view analytics in their second client group.

2.2.2   Adding New Users
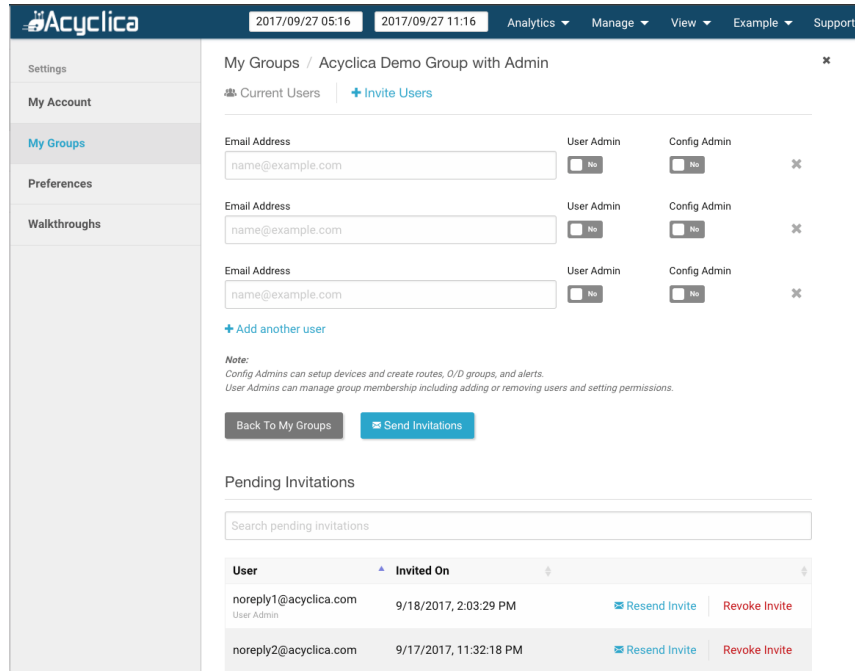
Figure 2.4 - Invite new users and manage user invitations.

The different levels of access that may be configured by a client group's Group Owner and User Admin level users are shown in Figure 2.3. Group Owners can only be set by Acyclica Support, please contact Support at support@acyclica.com . Figure 2.4 shows the **Invite Users** view, from which Group Owners and User Admins can manage new user invitations to their client groups.

Users are invited to a client group by entering their email address into the field, selecting their permission levels (any combination of User Admin, Config Admin, or neither), and selecting *Send Invitations*. Once the invitation is sent, the invited user will receive an email from noreply@acyclica.com prompting them to create an account, which will be automatically added to the group they are invited to join.

Section 3

Configuration
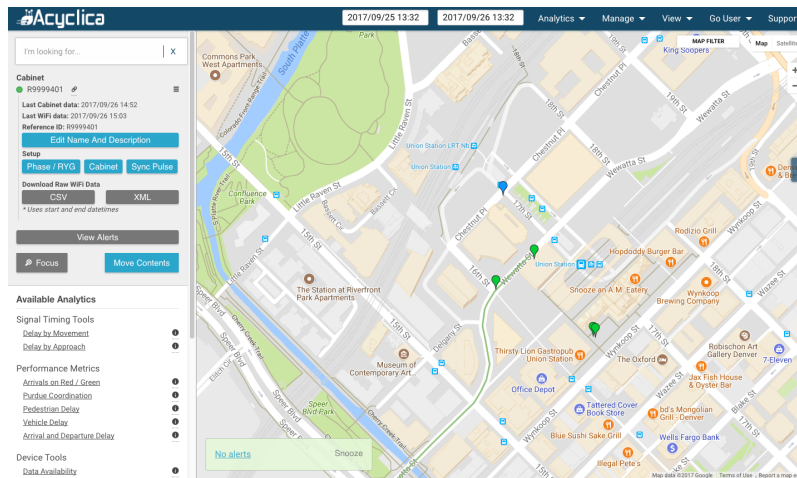
Figure 3.1 - Sensor configuration is accessed through the Information Panel.

3.1   Sensor
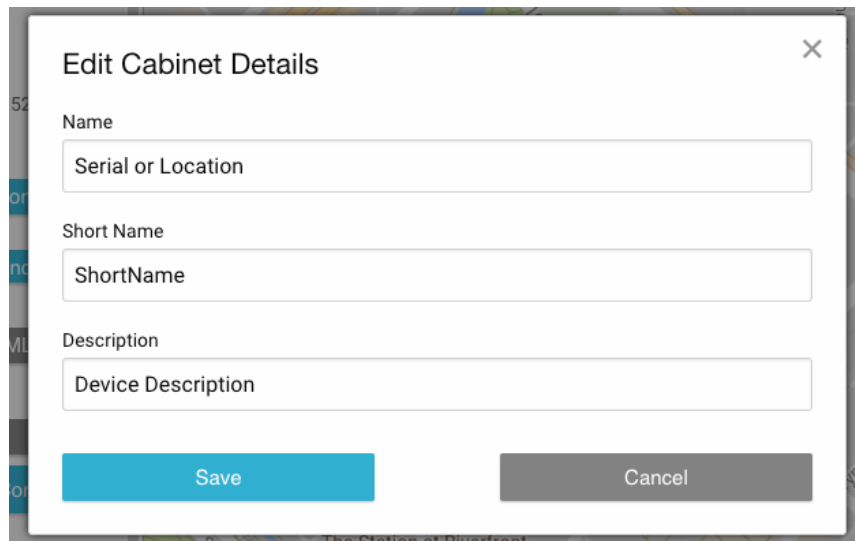
Sensor names, locations, and descriptions can be set in Go. This can be done before installation if the intended locations for all sensors are known, or can be done after installation in the field.

3.1.1   Name & Description

1. Select a location using the *Search Field* or by selecting the sensor on the map

    a) Note: if a name has not yet been given to the sensor, you can use the sensor's serial number in the search field.

2. Open the *hamburger menu* (three horizontal lines), next to the sensor to be edited

3. Select *Edit Name and Description*

4. Update as necessary

5. Select *Save*

Notes:

- The name is used across Go as a name for your sensor

- The short name is used for display in Locations where long sensor names may not fit

- The description field is useful as a general sensor notes area

- It is best to use a consistent naming convention for sensors. This makes it easier to use the search field to find sensors. If the name *Broadway* is used for some sensors and *Brdwy* is used for others, it can be more difficult to find those sensors with the search function. It is also a good idea to consistently name intersections, for example always using east-west before north-south.

Figure 3.2 - Set the sensor's Name, Short Name, and Description.

3.1.2   Sensor Location

There are three methods for setting a sensor location:
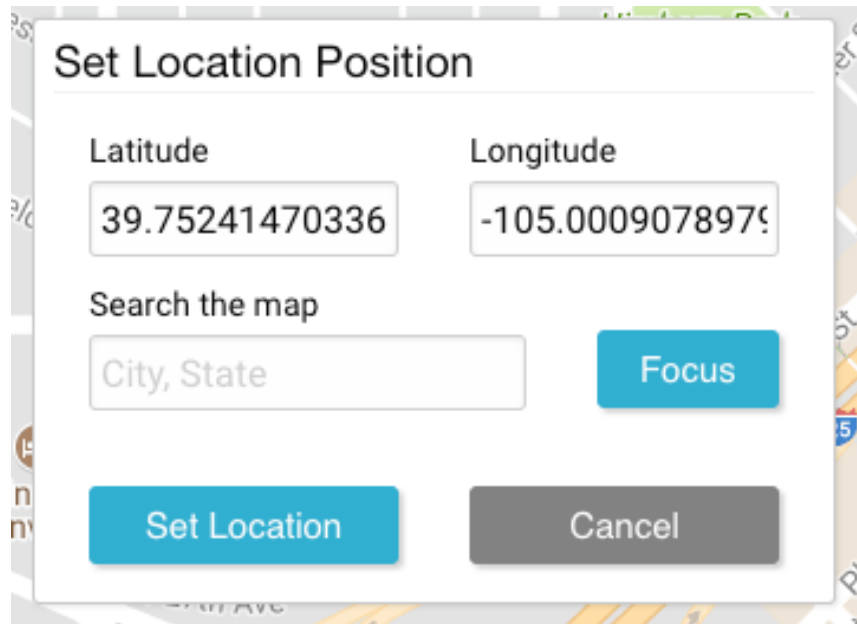
- Entering Latitude and Longitude coordinates

- Selecting a location on the Map

- Via GPS positioning (Data Aggregators only)

To set a sensor location:

1. Select a sensor location using the search field or by locating it on the map

2. Select *Move Contents*

3. Set the location by one of the following methods:

    a) Enter Latitude and Longitude in the appropriate fields
    b) Select the desired location on the map

4. Select *Set Location*

5. If the sensor is part of one or more routes and it is being moved away from its currently location to a new one, it is recommended that you remove those routes to prevent data processing problems in the future. If it is a small tweak moving the sensor to a different spot at the same intersection this isn't necessary. A dialog will prompt you to do this:

    a) To delete routes, select *Delete Routes*
    b) To keep the routes, select *Keep Routes*

Notes:

- If a sensor is moved to a new location, the underlying connections that drive data processing will need to be updated by Acyclica. We will receive a notification that this needs to be done, and will complete the changes within one business day. If you need to include the sensor in routes sooner than that, please contact support and the changes will be performed as soon as possible

- Data Aggregators will be placed on the map automatically if there is a GPS signal and they have never been manually located in Go

Figure 3.3 - Set the sensor's location.

3.2   Routes

3.2.1   Creating a Route

A route only represents traffic flow in one direction. To analyze traffic going both northbound and southbound, two different routes need to be created. Routes must include all sensors along the route. The Route Creation Tool now enforces this and will not allow you to select a sensor that is not adjacent to the last selected sensor. To create a route:

1. Hover over *Manage* in the Top Navigation Bar and select *Add Route*.

2. Select the sensors in the order that the route will be travelled. As sensors are selected, adjacent sensors will become available for your route (Figures 3.4, 3.5, and 3.6)

3. Once all of the sensors for the route have been added, select *Save* (Figure 3.7)

4. Set the route name

5. Select *Save*

Note: if you are attempting to create a route, and a sensor that you want to select is grayed out, the sensor connection definitions will need to be updated. To make this request, hover over the sensor you would like to use, and select the *Report* button.
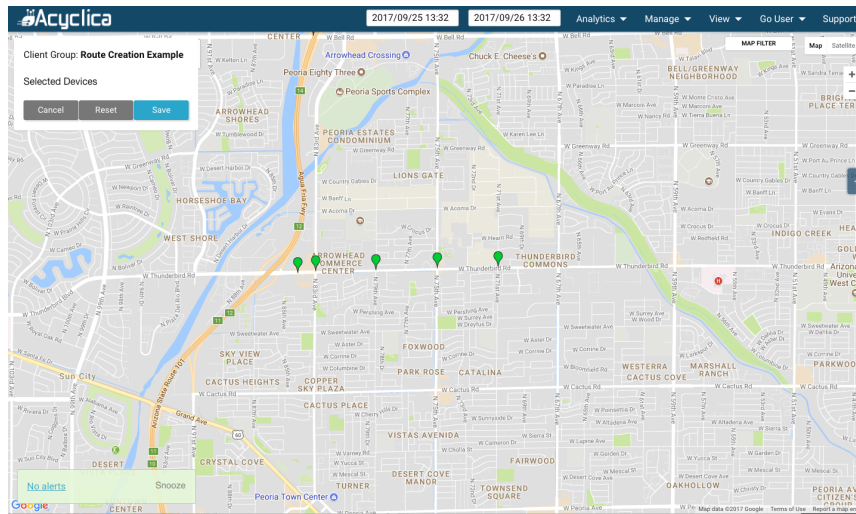
Figure 3.4 - All available sensors to start the route
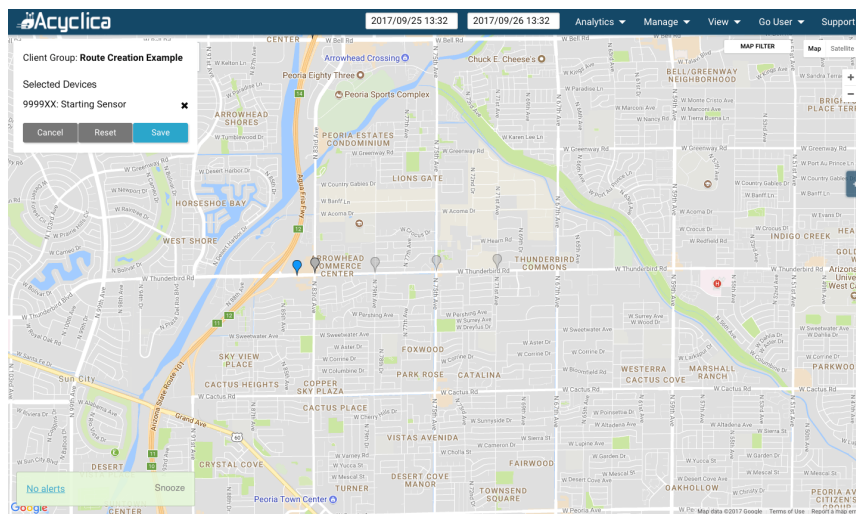
Figure 3.5 - First sensor selected, non-adjacent sensors are greyed out

3.2.2 Travel Time Alerts

Travel time alerts can be set on any created route. A travel time alert will send an email to your user when certain thresholds are exceeded. If the alert is set with a threshold of 120, triggers of 3 and time bins of 15, then this alert will trigger if there are is an average travel time of 120 seconds in three consecutive 15 minute spans. To create an alert, your user must have at least Config Admin permissions. These alerts can be created as follows:
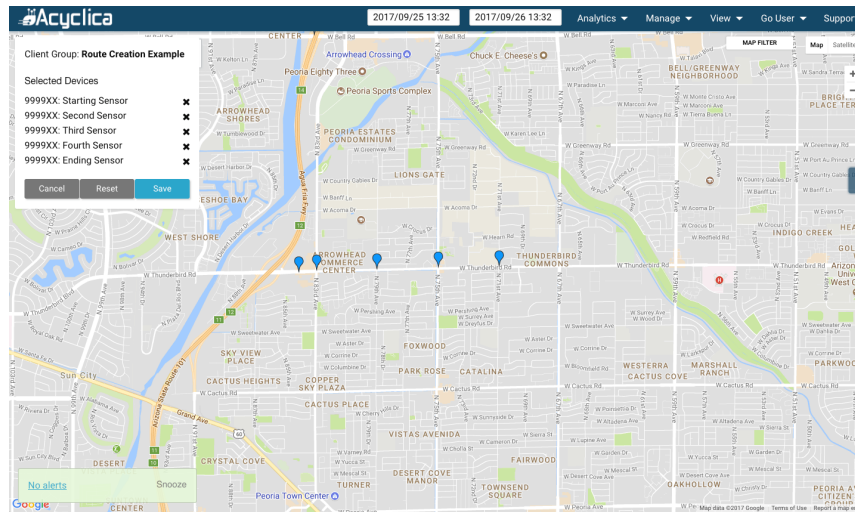
Figure 3.6 - Select all sensors in the order they appear in the route. As you do, adjacent sensors will be selectable
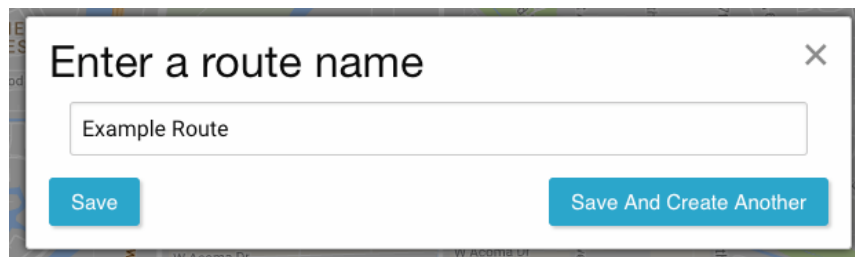
Figure 3.7 - Once the route is fully selected, click Save

1. Select the route.

2. In the sidebar, select *Manage Travel Time Alerts*.

3. Select the days of the week for the alert.

4. Select the hours of the day for the alert.

5. Enter a travel time threshold in seconds. Travel times over this threshold will bin together to potentially trigger the alert. (Defaults to 120 seconds)

6. Enter a number of times a travel time must be over the threshold before it triggers the alert. (Defaults to 3)

7. Enter the time frame for a travel time alert to be binned. (Defaults to 15 minutes)

8. Select *Save* to save this travel time alert.

3.3   Origin-Destination (OD) Groups

1. Hover over *Manage* in the *Top Navigation Bar* and select *Add OD Group*

2. Select the sensors that will be part of the group. This can be done in any order.

3. Select *Save*.

4. In the dialog box that appears, name your OD Group and select *Save*.

Note: The *Reset* button will clear all sensors from the selected sensor list, while the *Cancel* button will exit the OD Group tools without saving any changes.

3.4   Volume Speed and Occupancy

Volume Speed and Occupancy (VSO) sensors are available from Sensys and FLIR; in addition to providing those three metrics, they can also be combined with Travel Time and other route-based data for more advanced analytics.
Initial setup of a VSO sensor must be done by a member of the support team at Acyclica. If you wish to add any VSO sensors to your client group, please contact support@acyclica.com to do so. Please have the serial of the sensor or sensors you wish to associate with the VSO sensor(s).

Once a VSO sensor has been added to your client group, a configuration admin will be able to set the location and other configuration parameters.

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

2. In the resulting list, locate the sensor name starting with the sensor type that represents your VSO sensor (eg. a FLIR camera associated with sensor 999000 would be listed as "FLIR – 999000:").

3. Open the *Hamburger Menu* (three horizontal lines), next to the sensor to be edited.

   ▪ To modify the name, short name, and/or description of the VSO sensor, select *Edit Name and Description*

   ▪ To modify the location of the sensor, select *Move Contents* and follow the procedure for moving a sensor, as listed in part 3 of Section 3.1.2

4. To associate a VSO sensor with an existing sensor, select *Move Contents* and then locate the map marker for the sensor sensor you want to connect, then select *Save*.

Section 4

Analytics

4.1   Algorithms

Acyclica uses five different algorithms to calculate travel time. These provide insight into different aspects of traffic conditions in order to develop a complete picture of roadway conditions. Figure 4.1: is an illustration of the five algorithms and the detection points that are used to calculate them. Travel time is calculated on a per-segment basis, and are summed to provide route travel time. By default, the Strength, Maximum and Minimum travel times will be displayed. Display of these can be toggled temporarily when running analytics, and defaults can be changed in Settings > Preferences.

- **Strength** – measures travel time from stop bar (Point B) to stop bar (Point B) between intersections. This is the best single representation of what a driver might expect to see when traveling a route

- **Minimum (Min)** – calculates travel time from the last detection (point C) at the first intersection, to the first detection (Point A) at the second intersection. This excludes delay at the intersections, and provides a representation of free flow travel time

- **Maximum (Max)** – calculate travel time from the first detection (Point A) at the first intersection to the last detection at the second intersection (Point C). By including all potential delay, this shows the maximum length of time it could take to traverse the route

- **First** – travel time is calculated from the first detection (Point A) at the first intersection to the first detection (Point A) at the second intersection. This includes delay from the first intersection while excluding it from the second. Looking at data this way will have the greatest effect when looking at routes that are made up of smaller numbers of sensors.

- **Last** – travel time is calculated from the last detection (Point C) at the first intersection to the last detection (Point C) at the second intersection. This excludes delay from the first intersection and excludes it from the second. Looking at data this way will have the greatest effect when looking at routes that are made up of smaller numbers of sensors.
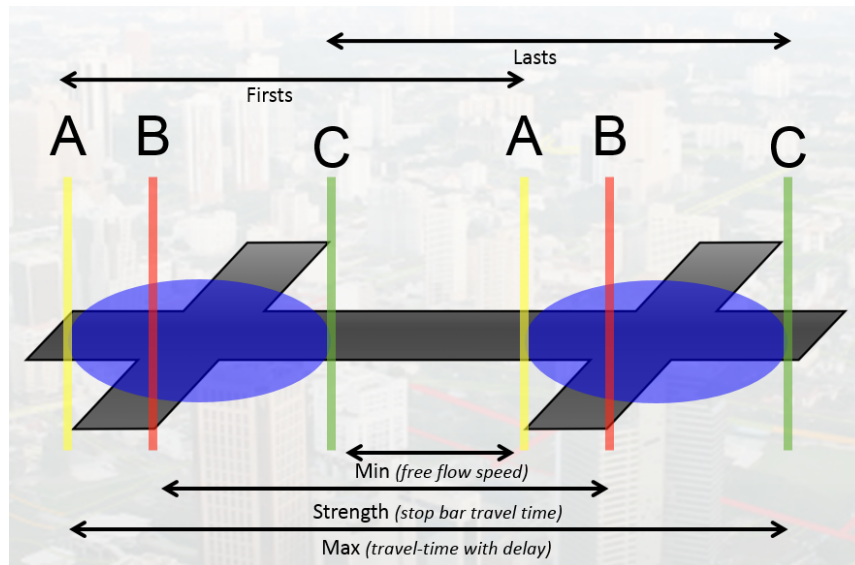
Figure 4.1 - The Five Travel Time Algorithms. Traffic flows from left to right

4.2   Running Analytics

All analytics are run using the same basic information.

- **Time Interval** – use the date/time picker to set the interval over which the analytic will be run. Some analytics have maximum intervals over which they can be run (e.g. 3 hours, 7 days, etc.). The maximum intervals are listed with each of the analytics in the descriptions that follow. Maximum intervals are based on the amount of data that needs to be loaded and the time that it can take to download and display the data. On slower connections it may be necessary to use shorter intervals in order to ensure that they can be displayed properly.

- **Data Source** – the Route, Sensor, or VSO Location for which the analytic will be run. These can be selected using Map Markers and the Information Panel, or the Search Field.

- **Analytic** – after the Time Interval and Data Source have been selected, the Analytic can be run from the Information Panel or the menu in Top Nav. Different Analytics will require different Data Sources. For example, Route-Based Analytics require a Route as the Data Source. If the correct Data Source has not been selected prior to running an Analytic, the system will prompt the selection of one. Analytics are organized by Data Source in the descriptions below.

4.3   Analytics Modules

Please note, Performance Metrics and Signal Timing Tools are optional added-cost modules and may not be available if they weren't included with the original purchase. If you have questions about whether these should be available.

4.4   Route Tools

4.4.1   Travel Time by Segment
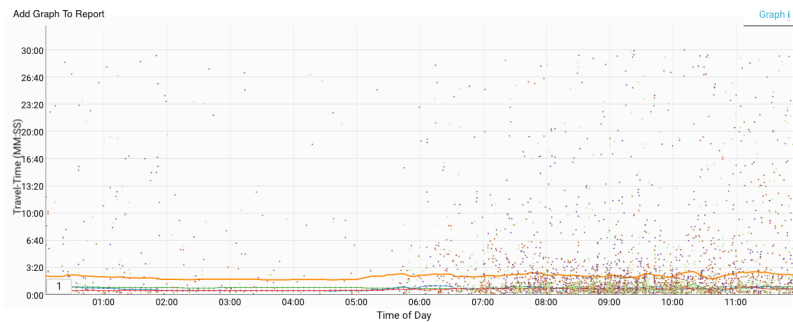
Figure 4.2 - Travel Time by Segment

Shows travel time for each Segment within a route, and for the Route as a whole. Travel times for segments make it easier to see whether congestion on a single segment, multiple segments, or entire route is responsible for elevated travel time. For intervals longer than 24 hours, hovering over the chart will display travel times for each of the segments and the route on the right side of the page. If the selected period of time is less than 24 hours, individual matches will be displayed as points on the graph, as shown in Figure 4.2, and hovering over the chart will show travel times for individual matches. This analytic has a maximum time frame of 4 months or 124 days.

4.4.2   Travel Time
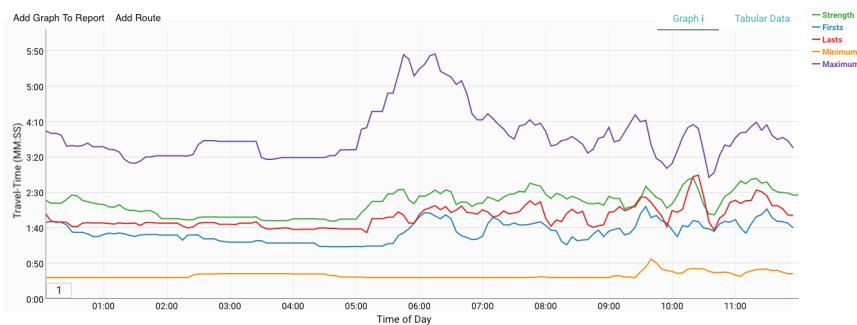
Figure 4.3 - Travel Time

Displays travel time for a route. The five travel time algorithms provide insight into different aspects of travel time, including - typical travel time (strength), free flow without delay (min), and all potential

delay (max), as shown in Figure 4.3. Hovering over the chart will show the travel time based on each of the selected algorithms. This analytic has a maximum time frame of 4 months or 124 days.

4.4.3   Speed
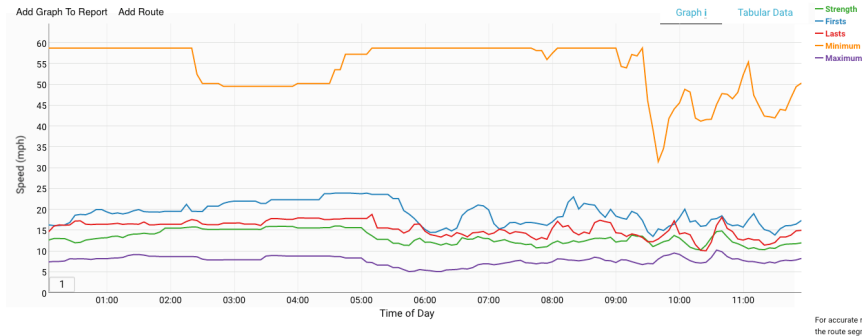
Figure 4.4 - Speed

Calculates speed along a route using route length and the five travel time algorithms. Because speed is calculated using travel time and route length, it will provide average speed along the route and not instantaneous speed. In order for speeds to be calculated accurately, it is necessary for all segments within the route to have overlays. as shown in Figure 4.4. Hovering over the chart will show the time the cursor is over, and the average speed for the route at that time. This analytic has a maximum time frame of 4 months or 124 days.

4.5   Signal Timing Tools

4.5.1   Route

4.5.1.1   Intersection Route Delay

Displays the average length of time that WiFi devices spent at each intersection along a route, as shown in Figure 4.5. This can be helpful seeing the relative delay at intersections that make up a route, making it easier to see which ones are performing worst overall. Hovering over each of the columns will display the name of the intersection (sensor) and its delay on the right side of the page. This analytic has a maximum time frame of 4 months or 124 days.

4.5.1.2   Progression Diagram

Plots speed as a function of distance and travel time for each segment along a route. The X axis displays time in minutes and seconds, and the Y axis displays distance in miles (or KM if selected in User Preferences). Steeper slopes indicate higher speeds. The Progression Diagram provides a visual display of how segments within a route are performing relative to each other. Segments where the slope flattens are performing worse than those around them, making it easy to see where performance is
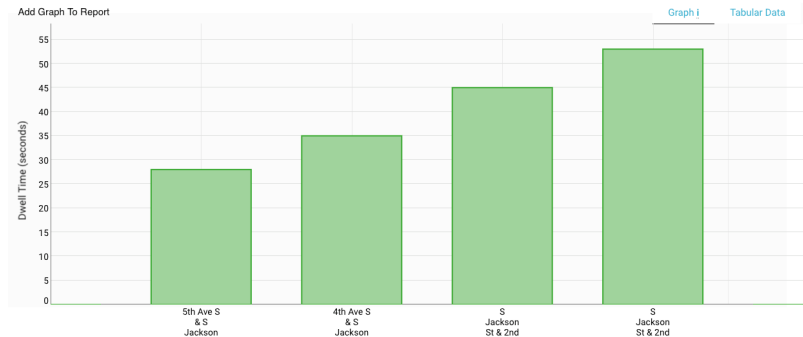
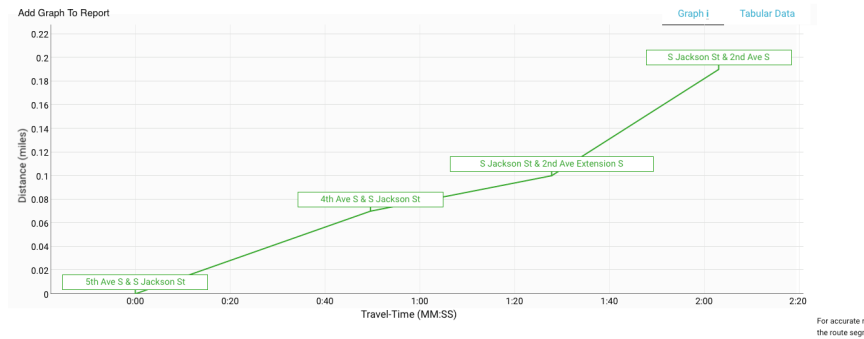*Figure 4.5 - Intersection Route Delay*

Figure 4.6 - Progression Diagram

not what it should be, as shown in Figure 4.6. Hovering over the chart will display information about distance and travel time. This analytic has a maximum time frame of 4 months or 124 days.

4.5.1.3   Speed by Segment

Similar to Travel Time by Segment, this analytic displays the average speed of vehicles traveling each of the segments of a route as well as average speeds for the route as a whole, as shown in Figure 4.7. Seeing speed for each of the segments makes it easier to see which may be responsible for performance problems. This analytic has a maximum time frame of 4 months or 124 days.

4.5.1.4   Timing Plan Analysis

Displays travel time for user-defined intervals for each day of a week, for a single week. as shown in Figure 4.8. To look at a single interval during two different weeks, use the Comparison option within Timing Plan Analysis. This analytic has a maximum time frame of one week or seven days.
When running Timing Plan Analysis, the *Name* and *Client Group* fields need only be completed if the
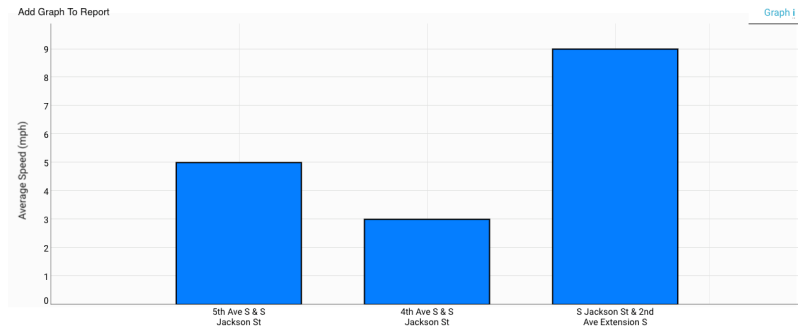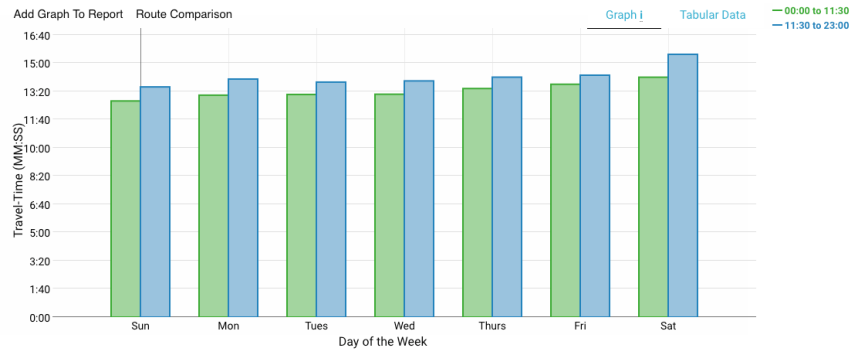
Figure 4.7 - Speed by Segment

Figure 4.8 - Timing Plan Analysis

plan is to be saved. Otherwise, the Timing Plan to be analyzed may be entered in the Start and End Time, adding more rows as necessary with the plus (**+**) button. Once this plan has been constructed, select **Run** (or **Save & Run**, to save a custom plan) and wait for the analytic to load. If a timing plan has been previously created, it can be found under the **Saved** section, from where it may be selected and run.

4.5.1.5 Travel Time by Day of Week

Provides a representation of typical travel conditions for each day of the week. Travel Times for each instance of each day of the week during the selected interval are averaged together in the intervals selected in Data Resolution. For example, if 5 minutes is selected for the data resolution, the data from every five minute interval in every Tuesday during the selected are averaged to create a typical Tuesday, and so forth. Figure 4.9. This analytic has a maximum time frame of 4 months or 124 days. Selecting longer intervals will decrease the influence of anomalous travel conditions on individual days. Hovering over the chart will show the time of day, and travel time in minutes and seconds for each day of the week.
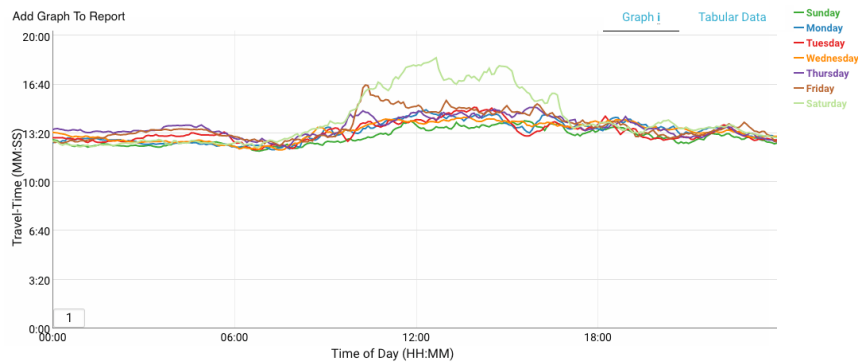
Figure 4.9 - Travel Time by Day of Week

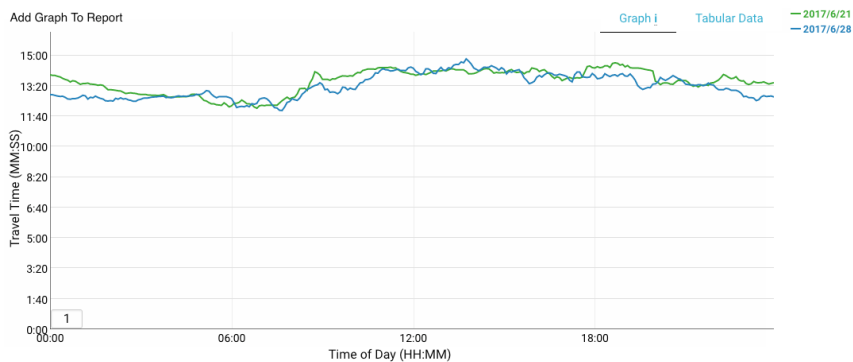### 4.5.1.6   Week Over Week Travel Times

Figure 4.10 - Week Over Week Travel Times

This provides a different type of comparative analysis for days of week. Instead of showing what a typical day of the week looks like, it will show travel time for every instance of a specific day of the week within a selected time frame. For the chosen day of the week, travel times for every week within the selected interval of time will be displayed. Each is given a separate line within the graph to provide easy comparisons, as shown in Figure 4.10. Some places where this type of comparison may be useful are when there is an event that you'd like to compare to more typical travel conditions, or before and after comparison when making timing changes. Hovering over the chart will show the time of day, date and travel time in minutes and seconds. This analytic has a maximum time frame of 4 months or 124 days.

4.5.1.7   Timing Run

Provides data similar to what can be provided by a float car study. Each timing run is a single WiFi sensor that was seen at every sensor along a route. Devices that miss one or more sensors aren't
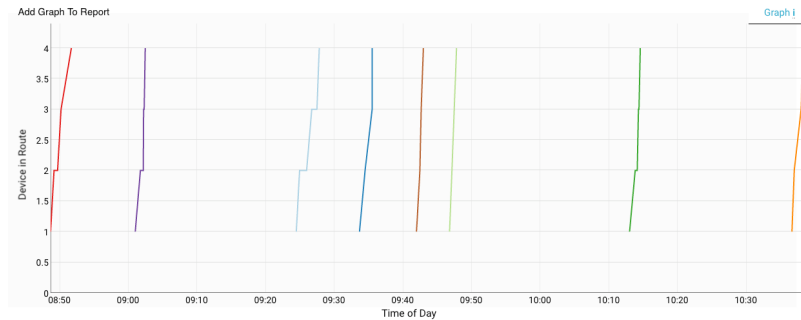
Figure 4.11 - Timing Run

included, as shown in Figure 4.11. Each timing run displayed includes the length of time taken to travel between sensors as well as delay incurred at intersections along the route. Hovering over the chart will show the number of the timing run, and the number of the sensor at which the data was collected. Because individual devices must be seen at every sensor along a route, this analytic works best on higher volume routes with lower numbers of sensors. Longer routes with lower volume will have smaller numbers of vehicles to display. This analytic has a maximum time frame of 1 day.

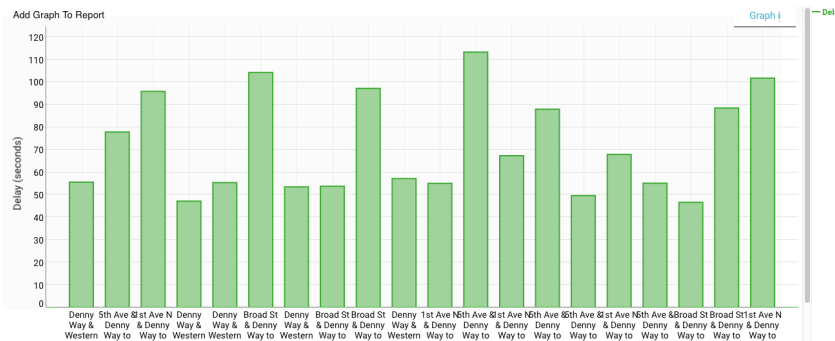### 4.5.2   Device

4.5.2.1   Delay by Movement

Figure 4.12 - Delay by Movement

On a per-approach basis, the average time WiFi sensors are seen at an intersection, as shown in Figure 4.12. The labels for movements can be thought of as origin and destination pairs, with the selected intersection as a mid-point. For each movement, the column label will include the name of the origin sensor that a device was seen at prior to going through the selected intersection, and the destination

24

sensor that the device passed through after going through the selected intersection. Hovering over a column shows delay in seconds. This analytic has a maximum time frame of 1 month or 30 days.
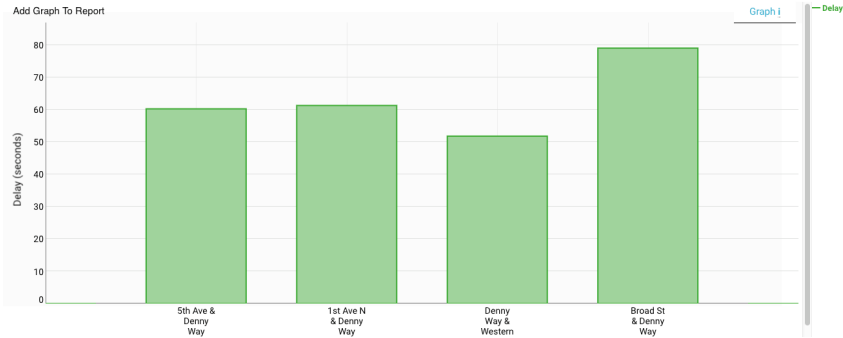
4.5.2.2   Delay by Approach

Figure 4.13 - Delay by Approach

On a per-approach basis, the average time WiFi sensors are seen at an intersection, as shown in Figure 4.13. The labels for approaches are the name of the last sensor that a device was seen at before going through the selected intersection. Hovering over the columns will show delay in seconds to the right of the chart. This analytic has a maximum time frame of 1 month or 30 days.

4.6   Performance Metrics
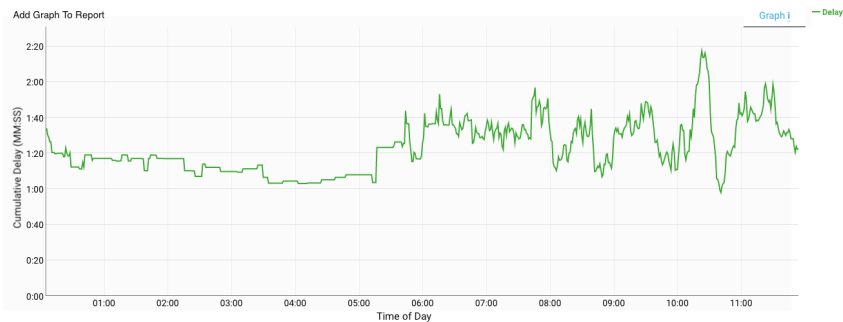
4.6.1   Route

4.6.1.1   Cumulative Route Delay

Figure 4.14 - Cumulative Route Delay

The cumulative delay that individual vehicles traveling a route encounter. The delay incurred at each intersection is summed to find a total, as shown in Figure 4.14. Hovering over the chart will show the date and time of day, and delay in minutes and seconds. This analytic has a maximum time frame of 4 months or 124 days.
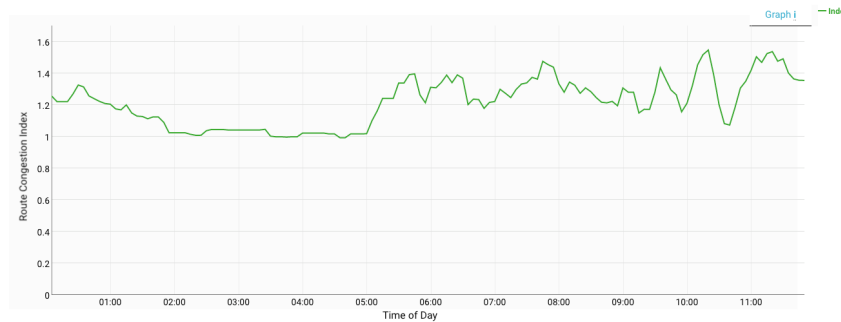
4.6.1.2   Congestion Index

Figure 4.15 - Congestion Index

Shows travel-time as a multiplier of the estimated free-flow travel-time 1.0 represents free-flow conditions and higher numbers such as 1.25 indicate more congestion, as shown in Figure 4.15. This analytic has a maximum time frame of 4 months or 124 days.

4.6.1.3   Congestion Overlay

Shows whether current conditions are better or worse than average. The current fifteen minute interval is compared to average travel times from the previous two weeks during the same interval of time on the same day of the week.Hovering over the chart will show the date and time, and the multiplier of that time's travel times compared to the historical data. 1.2 would mean that current travel times are 120 percent of the historical data. This analytic has a maximum time frame of 4 months or 124 days.

4.6.1.4   Vehicle Hours Traveled

Uses volume data from count stations and travel time data to calculate the total number of vehicle hours traveled on a route during the selected interval of time. Calculated by multiplying counts by the average travel time, as shown in Figure 4.16. Hovering over the chart displays the number of vehicle hours traveled in five minute increments on the right side of the page. This analytic has a maximum time frame of 4 months or 124 days.

4.6.1.5   Vehicle Miles Traveled

Uses count data and route distance to calculate the total number of vehicle miles that were traveled along the selected route during the chosen period of time. Vehicle Miles Traveled are found by multi-
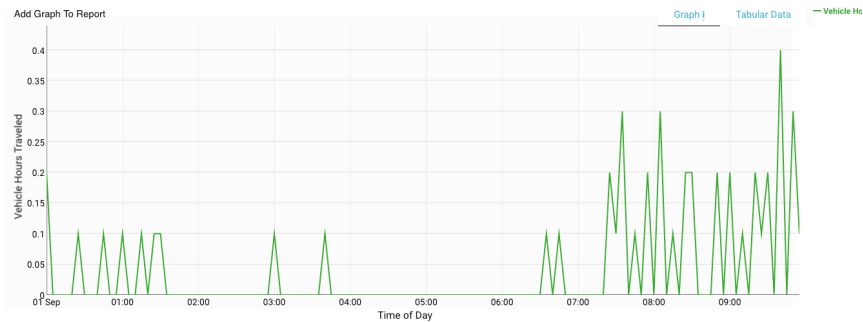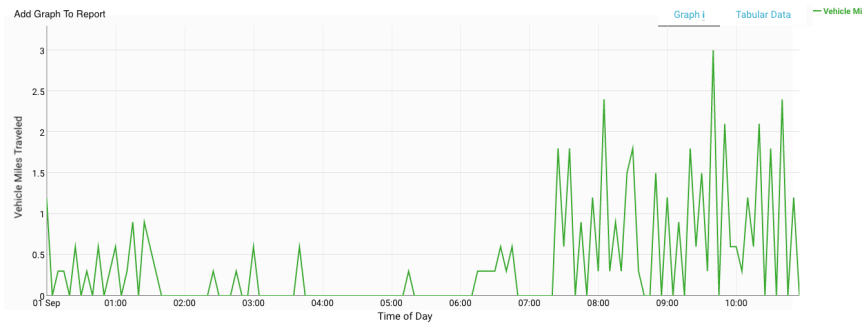
Figure 4.16 - Vehicle Hours Traveled

Figure 4.17 - Vehicle Miles Traveled

plying counts by route length, as shown in Figure 4.17. Hovering over the chart displays the number of vehicle miles (or kilometers, depending on settings) traveled on the right side of the chart. This analytic has a maximum time frame of 4 months or 124 days.

4.6.1.6   VMT vs VHT

Provides a scatter plot based on Vehicle Miles Traveled and Vehicle Hours Traveled, as shown in Figure 4.18. This analytic has a maximum time frame of 4 months or 124 days.

4.6.1.7   Idle Emissions

Uses vehicle counts and travel times to calculate emissions attributable to idling. EPA estimates for idle emissions are multiplied by the difference between current conditions and free flow on a per-vehicle basis to find emissions. This analytic has a maximum time frame of 1 month or 31 days.
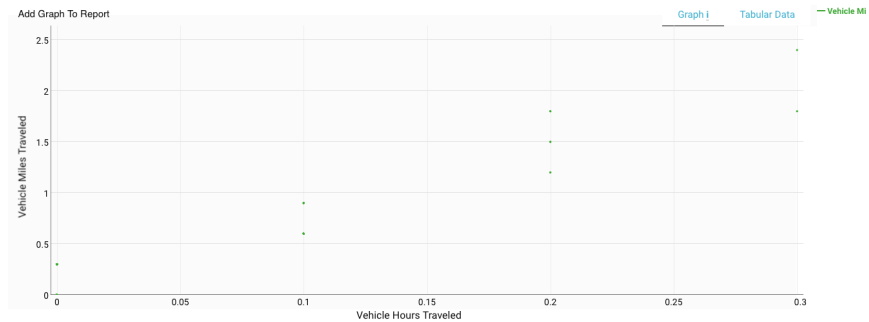
Figure 4.18 - VMT vs VHT
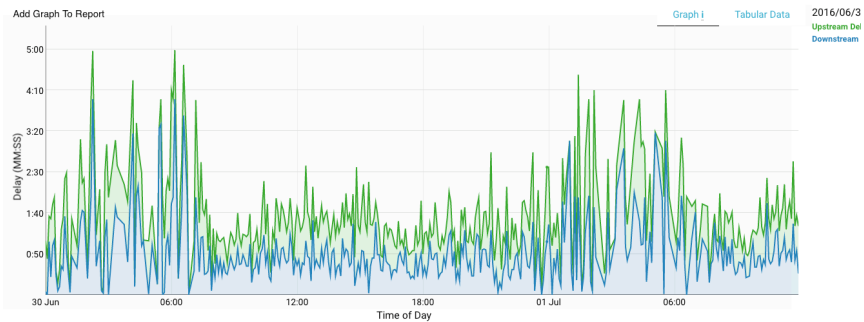
4.6.1.8   Vehicle Delay Hours

Figure 4.19 - Vehicle Delay Hours

Hours of vehicle travel times that are attributable to delay. It is found by multiplying delay by vehicle counts.

4.6.1.9   Congestion Emissions

Multiplies travel time due to congestion with emissions averages to find emissions due to congestion. Emissions averages used in calculations are sourced from the EPA. This analytic has a maximum time frame of 1 month or 31 days.

4.6.2   Cabinet

4.6.2.1   Arrivals on Red / Green

Shows a breakdown of when cars arrive at the intersection. Arrivals during green will contribute to that percentage. Arrivals on yellow and red will count toward red. This analytic requires that Activation Detectors and RYG Channels be selected for each phase for which the analytic will be run. This analytic has a maximum time frame of 1 week or 7 days.

4.6.3   Cabinet

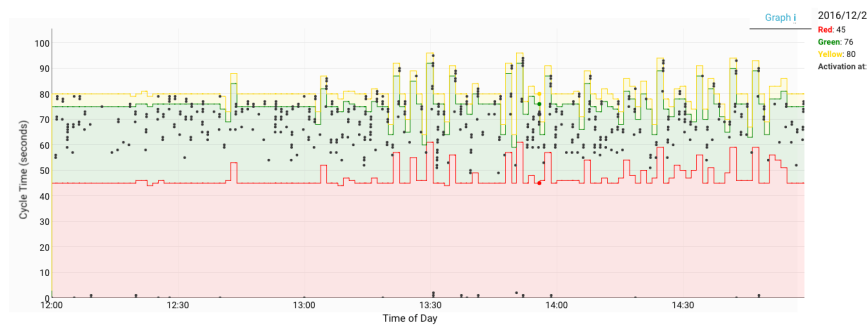### 4.6.3.1   Purdue Coordination Diagram

Figure 4.20 - Purdue Coordination Diagram

Shows where activations occur during the phase cycle to provide a visual representation of when platoons of cars are arriving, as shown in Figure 4.20. Ideally, platoons should arrive on green toward the beginning of phase. Platoons arriving later or in other parts of the phase cycle indicate that intersection timing could be adjusted to provide better performance. The phase can be selected on the right side. This analytic requires that Activation Detectors and RYG Channels be selected for each phase for which the analytic will be run. This analytic has a maximum time frame of 1 week or 7 days.

4.6.4   Cabinet

4.6.4.1   Pedestrian Delay

Calculates the length of time from Ped button activation to service, showing how long pedestrians wait until they are given a walk sign. The dropdown on the left side of the chart can be used to select the phase for which data will be displayed. Hovering over the chart will show the date and time, and Pedestrian Delay in seconds. This analytic has a maximum time frame of 1 week or 7 days.

4.6.5   Cabinet

4.6.5.1   Vehicle Delay

Calculates the length of time from detector activation until green phase. Times are provided for average vehicle delay and for total vehicle delay. Hovering over the chart will display the date and time interval, and the Average Vehicle Delay and Total Vehicle delay in HH:MM:SS format. The phase can be selected using the dropdown to the left of the chart. This analytic has a maximum time frame of 1 week or 7 days.

4.6.6   Device

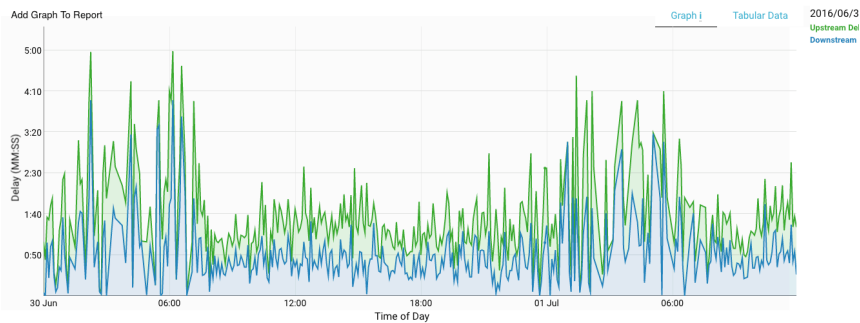#### 4.6.6.1   Arrival and Departure Delay

Figure 4.21 - Arrival and Departure Delay

Illustrates whether delay is incurred when approaching an intersection, or after passing through, as shown in Figure 4.21. Hovering over the chart will show the date and time, and the delay in minutes and seconds that occurred before (Upstream) or after (Downstream) vehicles have passed through the intersection. This analytic has a maximum time frame of 1 month or 31 days.

4.7   Device Tools

4.7.1   Data Availability

Each square represents a single calendar day. The color of the square indicates the volume of data collected by the selected sensor on that day. Darker blue indicates a larger volume of data collected by the sensor. Hovering over each square provides the number of records collected, as shown in Figure 4.22. This analytic has a maximum time frame of 12 months or 365 days.

4.7.2   Records per Hour

Displays two things - the number of unique WiFi devices seen by a sensor, and the total number of probe requests seen from all WiFi devices, as shown in Figure 4.23. Hovering over the chart will dis-
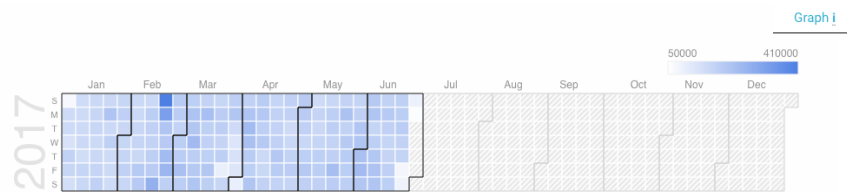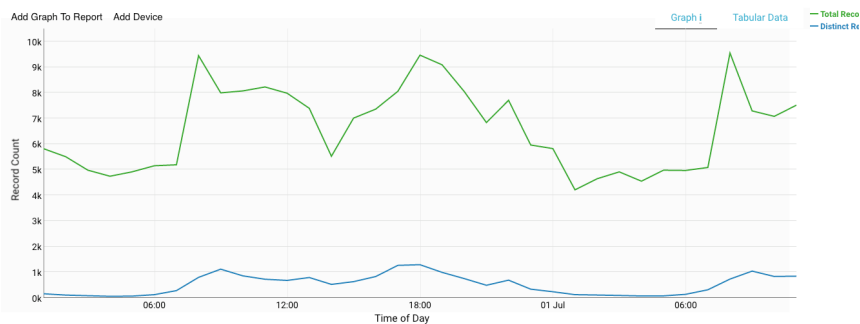
Figure 4.22 - Data Availability

Figure 4.23 - Records per Hour

play the date and time interval, as well as the number of distinct records, and the total number of records. This analytic is useful when looking at a sensor to determine when it has been online and offline, such as when there have been issues with network connectivity. It can also be used to ensure that adequate data is being collected to calculate travel time. This analytic has a maximum time frame of 12 months or 365 days.

4.7.3   Distinct Records per Day

The number of unique WiFi devices seen at a sensor per day. Each WiFi device is counted only once, as shown in Figure 4.24. Hovering over the bars will display the date and the number of unique WiFi devices seen that day. This analytic has a maximum time frame of 12 months or 365 days.

4.7.4   Delay

The average time WiFi sensors spend around an intersection. Average time is displayed as a line. The length of time each sensor was seen is also plotted as a point, as shown in Figure 4.25. Hovering over the chart will show the delay for individual WiFi devices, and the overall average delay at that time. This analytic has a maximum time frame of 1 month or 31 days.
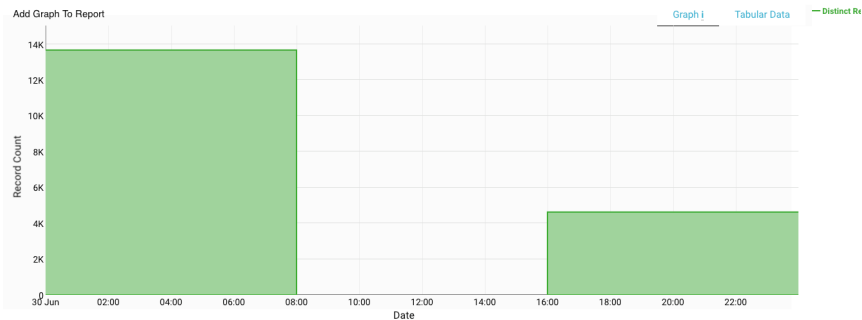
Figure 4.24 - Distinct Records per Day
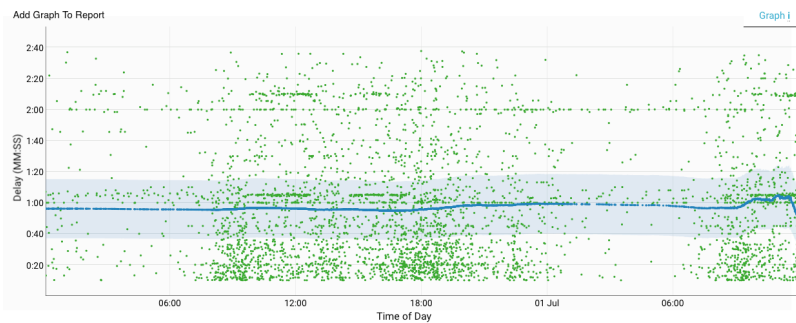
Figure 4.25 - Delay

4.8   VSO Analytics

4.8.1   Data Availability

A visual representation of the volume of data collected by VSO sensors. Darker blue indicates that a larger number of records were recorded, as shown in Figure 4.26. Hovering over the chart shows the volume collected. This analytic has a maximum time frame of 1 year or 365 days.

4.8.2   Time of Day Distribution

The distribution of overall traffic volume collected during the following parts of the day: Early AM (before 7:00 am), AM Peak (7:00-9:00 am), Midday (9:00 am - 4:00 pm), PM Peak (4:00-6:00 pm), and Evening (after 6:00 pm), as shown in Figure 4.27. This analytic has a maximum time frame of 4 months or 120 days.

32
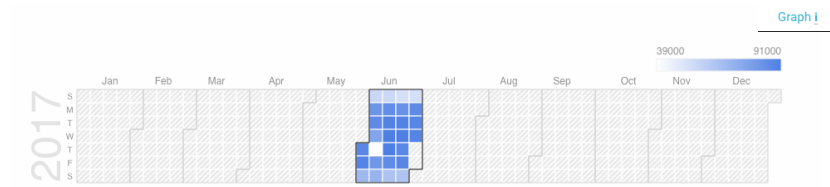
Figure 4.26 - Data Availability
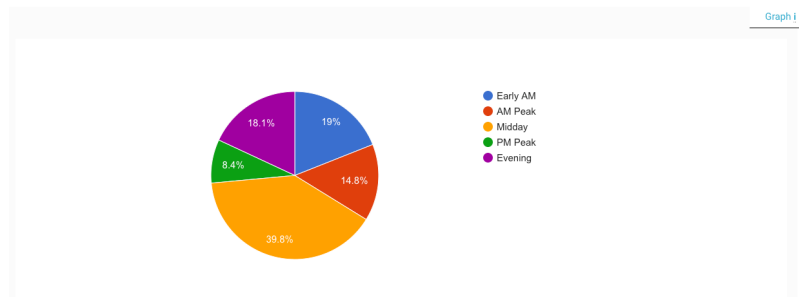
Figure 4.27 - Time of Day Distribution

4.8.3   Volume

Number of vehicles counted per minute, per detector, over the selected time period, as shown in Figure 4.28. Options are available to look at counts overall, by individual count station, or by count zones. Hovering over the chart will show the date and time, and volume. If more than one count station, or zone is displayed, these will be labeled in the display on the right side. This analytic has a maximum time frame of 4 months or 120 days.

4.8.4   Speed

Average speed of vehicles on a per detector basis, updated every minute, as shown in Figure 4.29. These are instantaneous speeds as measured by the detector and not average speeds along segments or routes. Options are available to look at speed overall, by individual count station, or by count zones. Hovering over the chart will show the date and time, and speed. If more than one count station, or zone is displayed, these will be labeled in the display on the right side. This analytic has a maximum time frame of 4 months or 120 days.
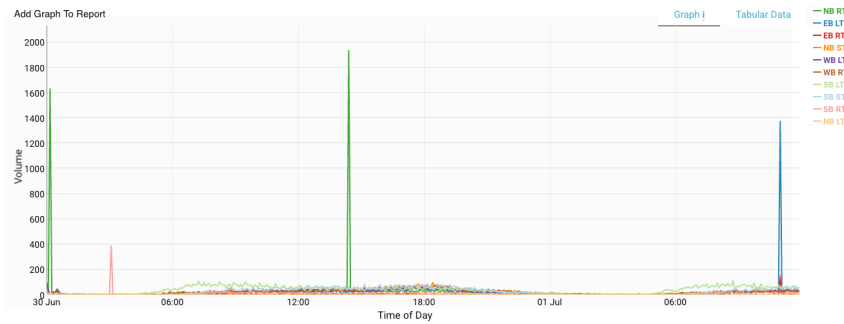
Figure 4.28 - Volume
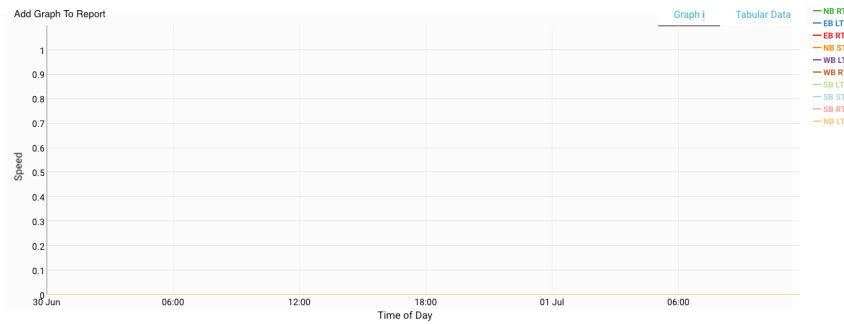
Figure 4.29 - Speed

4.8.5   Occupancy

Percent of time that the detection zone of a detector is occupied by a vehicle, as shown in Figure 4.30. Options are available to look at occupancy overall, by individual count station, or by count zones. Hovering over the chart will show the date and time, and occupancy. If more than one count station, or zone is displayed, these will be labeled in the display on the right side. This analytic has a maximum time frame of 4 months or 120 days.
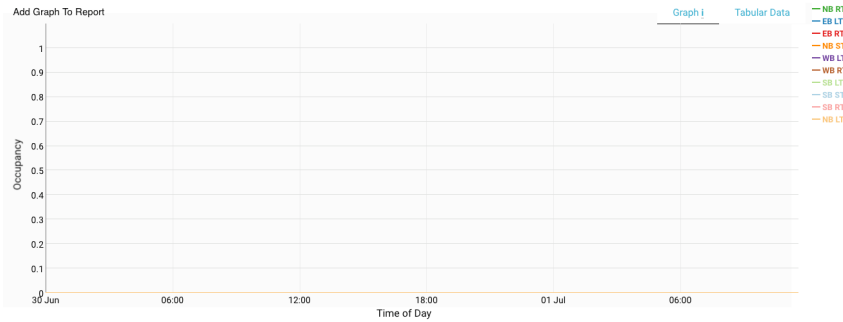
Figure 4.30 - Occupancy

4.9   Origin / Destination

4.9.1   OD Groups
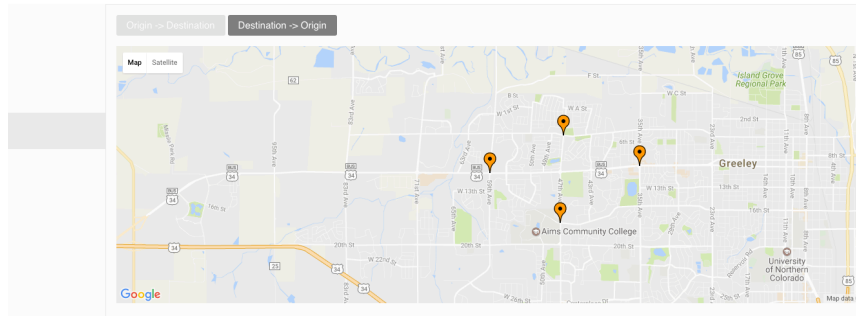
Figure 4.31 - OD Groups
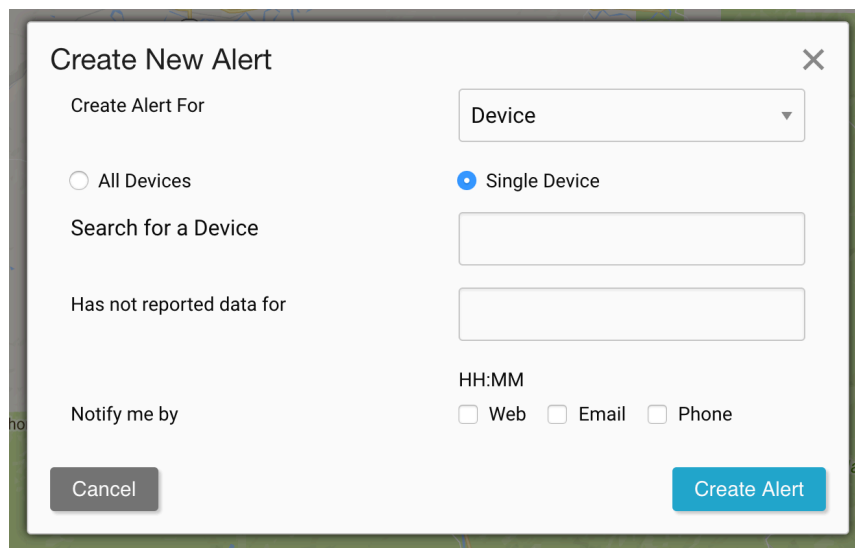
A flexible Origin-Destination Trip Table. The system calculates traversals between the sensors included in the O-D group. Any sensor can be set as an origin or destination. Trips can be displayed as percentages or as counts of traversals. Travel time for each of the segments is also calculated. The Map view is an interactive display where sensors can be selected and percentages of trips originating at, or going to other sensors are displayed, as shown in Figure 4.31. This analytic has a maximum time frame of 1 month or 31 days.

Appendix A

Alerts

A.1　Access Alerts

A.1.1　To access the Alerts Creation Tool:

1. Login to Go.

2. Hover over **Manage** and select **Create Alert**.

Figure A.1 - The Alerts Creation Tool modal.

A.2   Alert Creation

A.2.1   To create an Alert for a Device:

1. Select **Device** in the Alert Creation Tool.

2. Choose whether you want to create an Alert for a single Device or for all Devices in a Client Group.

   a) If *Single Device* is selected, search for the Device's serial.
   b) If *All Devices* is selected, the Alert will be assigned to all Devices in the selected Client Group.

3. Enter the threshold at which the alert will be triggered formatted as *HH:MM*.

   a) The minimum threshold for an Alert is 10 minutes.
   b) The maximum threshold for an Alert is 24 hours.
   c) In areas with known connectivity issues, a longer interval may be preferred to avoid false positives.
   d) Where it is important to have uninterrupted travel times, such as where information is being displayed on variable message signs, a shorter interval may be preferred.

4. Select the notification methods for the alert. If the alert is triggered, all selected methods will be used to contact you.

A.2.2   To create and Alert for a Traffic Cabinet:

1. Select **Cabinet** in the Alert Creation Tool.

2. Choose whether you want to create an Alert for a single Traffic Cabinet or for all Traffic Cabinets in a Client Group.

   a) If *Single Cabinet* is selected, search for the Cabinet's serial.
   b) If *All Cabinets* is selected, the Alert will be assigned to all Traffic Cabinets in the selected Client Group.

3. User the drop down, select the type of Cabinet Alert you wish to create.

4. Select the notification methods for the alert. If the alert is triggered, all selected methods will be used to contact you.

A.2.3   Alert Methods

- **Web** — A web alert will appear in the Alerts Notification area, in the bottom left of the web interface.

- **Email** — An Alert will be sent to the email address linked to your account.

- **Phone** — An SMS containing the Alert will be sent to the phone number set in your *Account Settings* page. At this time, if you do not have a phone number set, this option will not alert you.

A.3   Alert Management

A.3.1   To access the Alert Management Window:

1. Login to Go.

2. Hover over **Manage** and select **All Alerts**.

3. The Alerts Management Window will open.

A.3.2   To Manage Alert Subscriptions:

1. Find the Alert or Alerts to which you wish subscribe. The search field can be used to quickly find an Alert by type or Device/Traffic Cabinet serial number.

2. Select the type of Alert you wish to receive using the check boxes.

3. Select **Save** to update your Alert preferences.

Note: At this time, when you **Delete** an Alert, it retains the Alert setup, but unsubscribes you, and any other user using that Alert, from the selected Alert.

Appendix B

API

B.1 About

All available API methods are HTTP GETs.

Please contact support@acyclica.com to get your API key and to learn more about the limits on our API.

Successful calls will correctly include HTTP Status Code 200, while failures will include appropriate 4XX and 5XX Codes.
The default endpoint host is https://go.acyclica.com.

B.2 Sensor

B.2.1 Sensor Inventory

B.2.1.1 About

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

- Sensor Serial

- Sensor Name (Long form, as set in Acyclica Go)

- Sensor Description (As set in Acyclica Go)

- Latitude

- Longitude

- LastReport (the last time the sensor reported data)

B.2.1.2   Endpoint

```
/datastream/device/inventory/xml/[API_KEY]
```

B.2.1.3   Parameters

- **[API_KEY]**
  - A generated user access token used to authenticate a user against the Acyclica Go plat-form. Contact support@acyclica.com to receive your API key.

B.2.1.4   Example Output

XML

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

B.2.2   Sensor Data

B.2.2.1   About

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

B.2.2.2   Endpoint

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

B.2.2.3   Parameters

- **[FORMAT]**
  The format of the data you are querying, either "xml" or "csv"

- **[API_KEY]**
  - A generated user access token used to authenticate a user against the Acyclica Go soft-ware. Contact support@acyclica.com to receive your API KEY.

- **[DEVICE_ID]**
  - The 4–7 digit number that represents an individual diffrf sensor, cabinet, or other sensor.
- **[START_TIME]**
  - The beginning time in the range you are searching. Time values must be in epoch format, in **milliseconds**. March 15, 2017 00:00 would be represented by 1489536000000.
- **[END_TIME]**
  - The end time in the range you are searching. Time values must be in epoch format, in **milliseconds**. March 15, 2017 03:00 would be represented by 1489546800000.

B.2.2.4   Example Output

XML

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

CSV

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

B.2.3   Sensor Record Count

B.2.3.1   About

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

B.2.3.2   Endpoint

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

B.2.3.3   Parameters

- **[API_KEY]**
    - A generated user access token used to authenticate a user against the Acyclica Go software. Contact support@acyclica.com to receive your API KEY.

- **[DEVICE_ID]**
    - The 4–7 digit number that represents an individual diffrf sensor, cabinet, or other sensor.

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

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

B.2.3.4   Example Output

JSON

```
{
    "serial": [
        "[SERIAL]"
    ],
    "count": 72810,
```

```
    "start_time": "2017-03-15 00:00:00 ",
    "end_time": "2017-03-15 10:00:00 "
}
```

B.2.4   Sensor Delay Matches

B.2.4.1   About

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

B.2.4.2   Endpoint

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

B.2.4.3   Parameters

- **[API_KEY]**

    ○ A generated user access token used to authenticate a user against the Acyclica Go software. Contact support@acyclica.com to receive your API KEY.

- **[DEVICE_ID]**

    ○ The 4–7 digit number that represents an individual diffrf sensor, cabinet, or other sensor.

- **[START_TIME]**

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

- **[END_TIME]**

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

B.2.4.4   Example Output

XML

```xml
<device id="">
    <name>Sensor Name</name>
    <description/>
    <delaydata>
        <data>
            <hash>
                Hashed MAC Address
```

```
            </hash>
            <first_time>1467266416.05</first_time>
            <strength_time>1467266416.05</strength_time>
            <last_time>1467266416.05</last_time>
            <timespan>0.0</timespan>
            <strongest>-63</strongest>
        </data>
        ...
    </delaydata>
</device>
```

B.3   Cabinet

B.3.1   Cabinet Inventory Listing

B.3.1.1   About

This call enumerates all of the cabinet locations available to your user, along with mapped RYG channels, if they are configured.

B.3.1.2   Endpoint

`/datastream/cabinet/meta/json/[API_KEY]`

B.3.1.3   Parameters

- **[API_KEY]**
  - A generated user access token used to authenticate a user against the Acyclica Go software. Contact support@acyclica.com to receive your API KEY.

B.3.1.4   Example Output

JSON

```
[
    {
        "longitude": -104.999303833,
        "id": CABINET_ID1,
        "configured_channels": [
            {
                "phase": 1,
                "name": "NB LT",
                "movement": 1,
```

```json
                "approach": 1
            },
            {
                "phase": 3,
                "name": "NB RT",
                "movement": 1,
                "approach": 1
            },
            {
                "phase": 2,
                "name": "NB Thru",
                "movement": 1,
                "approach": 1
            },
            ...
        ],
        "latitude": 39.7512958333,
        "name": "Cabinet Name",
        "phases": [
            {
                "phase": 1,
                "name": "NB LT",
                "movement": 1,
                "approach": 1
            },
            {
                "phase": 3,
                "name": "NB RT",
                "movement": 1,
                "approach": 1
            },
            {
                "phase": 2,
                "name": "NB Thru",
                "movement": 1,
                "approach": 1
            },
            ...
        ]
    },
    {
        "longitude": -104.999303833,
        "id": CABINET_ID2,
        "configured_channels": [],
        "latitude": 39.7512958333,
```

```json
        "name": "Cabinet Name 2",
        "phases": []
    },
    ...
]
```

B.3.2 Cabinet RYG Data

B.3.2.1 About

This will output the raw Red-Yellow-Green state data during the range of time requested, for the cabinet requested.

B.3.2.2 Endpoint

`/datastream/da/ryg/raw/[FORMAT]/[API_KEY]/[DEVICE_ID]/[START_TIME]/[END_TIME]`

B.3.2.3 Parameters

B.3.2.4 Example Output

JSON

```json
[
    [
        1499644812000,
        6,
        3,
        1,
        1,
        2,
        1,
        1,
        1,
        3,
        1,
        1,
        1,
        0,
        1,
        3,
        1,
        0,
        0,
        0,
```

```
        0,
        0,
        0,
        0,
        0
    ],
    ...
]
```

XML

```
<data_aggregator_ryg_data>
    <data_aggregator_ryg_point>
        <timestamp>1499644812000</timestamp>
        <channel_1>6</channel_1>
        <channel_2>3</channel_2>
        <channel_3>1</channel_3>
        <channel_4>1</channel_4>
        <channel_5>2</channel_5>
        <channel_6>1</channel_6>
        <channel_7>1</channel_7>
        <channel_8>1</channel_8>
        <channel_9>3</channel_9>
        <channel_10>1</channel_10>
        <channel_11>1</channel_11>
        <channel_12>1</channel_12>
        <channel_13>0</channel_13>
        <channel_14>1</channel_14>
        <channel_15>3</channel_15>
        <channel_16>1</channel_16>
        <channel_17>0</channel_17>
        <channel_18>0</channel_18>
        <channel_19>0</channel_19>
        <channel_20>0</channel_20>
        <channel_21>0</channel_21>
        <channel_22>0</channel_22>
        <channel_23>0</channel_23>
        <channel_24>0</channel_24>
    </data_aggregator_ryg_point>
    ...
</data_aggregator_ryg_data>
```

CSV

```
Timestamp,Channel 1,Channel 2,Channel 3,Channel 4,Channel 5,Channel 6,Channel 7,Channel 8,Channel 9
1499644812000,6,3,1,1,2,1,1,1,3,1,1,1,0,1,3,1,0,0,0,0,0,0,0,0
1499644813000,6,3,1,1,2,1,1,1,3,1,1,1,0,1,0,1,0,0,0,0,0,0,0,0
...
```

B.3.3   Cabinet RYG Phase Data

B.3.3.1   About

This outputs all of the phase data for the time frame requested for the sensor requested if phase information has been previously configured on this sensor.

B.3.3.2   Endpoint

`/datastream/da/ryg/phase/[FORMAT]/[API_KEY]/[DEVICE_ID]/[START_TIME]/[END_TIME]`

B.3.3.3   Parameters

- **[FORMAT]**

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

- **[API_KEY]**

    ○ A generated user access token used to authenticate a user against the Acyclica Go software. Contact support@acyclica.com to receive your API KEY.

- **[DEVICE_ID]**

    ○ The sensor ID as noted in the enumeration query.

- **[START_TIME]**

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

- **[END_TIME]**

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

B.3.3.4   Example Output

JSON

```
[
    {
        "ryg_data": [
            {
                "ryg_id": 1,
                "phase": 2,
                "channel": 1
            },
            {
                "ryg_id": 3,
                "phase": 3,
                "channel": 2
            },
            {
                "ryg_id": 3,
                "channel": 3
            },
            {
                "ryg_id": 1,
                "phase": 5,
                "channel": 4
            },
            {
                "ryg_id": 1,
                "phase": 6,
                "channel": 5
            },
            {
                "ryg_id": 3,
                "phase": 7,
                "channel": 6
            },
            {
                "ryg_id": 3,
                "phase": 9,
                "channel": 7
            },
            {
                "ryg_id": 1,
                "phase": 4,
                "channel": 8
            },
            {
                "ryg_id": 3,
```

```
            "channel": 9
        },
        {
            "ryg_id": 1,
            "phase": 8,
            "channel": 10
        },
        {
            "ryg_id": 3,
            "channel": 11
        },
        {
            "ryg_id": 1,
            "channel": 12
        },
        {
            "ryg_id": 1,
            "channel": 13
        },
        {
            "ryg_id": 1,
            "channel": 14
        },
        {
            "ryg_id": 1,
            "channel": 15
        },
        {
            "ryg_id": 1,
            "channel": 16
        },
        {
            "ryg_id": 0,
            "channel": 17
        },
        {
            "ryg_id": 0,
            "channel": 18
        },
        {
            "ryg_id": 0,
            "channel": 19
        },
        {
            "ryg_id": 0,
```

```
                    "channel": 20
            },
            {
                    "ryg_id": 0,
                    "channel": 21
            },
            {
                    "ryg_id": 0,
                    "channel": 22
            },
            {
                    "ryg_id": 0,
                    "channel": 23
            },
            {
                    "ryg_id": 0,
                    "channel": 24
            }
        ],
        "timestamp": 1483552800000
    },
    ...
]
```

XML

```
<data_aggregator_ryg_data>
    <data_aggregator_ryg_point>
        <timestamp>1483552800000</timestamp>
        <channel_1
            <ryg_id>1</ryg_id>
            <phase>2</phase>
        </channel_1>
        <channel_2>
            <ryg_id>3</ryg_id>
            <phase>3</phase>
        </channel_2>
        <channel_3>
            <ryg_id>3</ryg_id>
        </channel_3>
        <channel_4>
            <ryg_id>1</ryg_id>
            <phase>5</phase>
        </channel_4>
        <channel_5>
            <ryg_id>1</ryg_id>
```

```xml
        <phase>6</phase>
    </channel_5>
    <channel_6>
        <ryg_id>3</ryg_id>
        <phase>7</phase>
    </channel_6>
    <channel_7>
        <ryg_id>3</ryg_id>
        <phase>9</phase>
    </channel_7>
    <channel_8>
        <ryg_id>1</ryg_id>
        <phase>4</phase>
    </channel_8>
    <channel_9>
        <ryg_id>3</ryg_id>
    </channel_9>
    <channel_10>
        <ryg_id>1</ryg_id>
        <phase>8</phase>
    </channel_10>
    <channel_11>
        <ryg_id>3</ryg_id>
    </channel_11>
    <channel_12>
        <ryg_id>1</ryg_id>
    </channel_12>
    <channel_13>
        <ryg_id>1</ryg_id>
    </channel_13>
    <channel_14>
        <ryg_id>1</ryg_id>
    </channel_14>
    <channel_15>
        <ryg_id>1</ryg_id>
    </channel_15>
    <channel_16>
        <ryg_id>1</ryg_id>
    </channel_16>
    <channel_17>
        <ryg_id>0</ryg_id>
    </channel_17>
    <channel_18>
        <ryg_id>0</ryg_id>
    </channel_18>
    <channel_19>
```

```
            <ryg_id>0</ryg_id>
        </channel_19>
        <channel_20>
            <ryg_id>0</ryg_id>
        </channel_20>
        <channel_21>
            <ryg_id>0</ryg_id>
        </channel_21>
        <channel_22>
            <ryg_id>0</ryg_id>
        </channel_22>
        <channel_23>
            <ryg_id>0</ryg_id>
        </channel_23>
        <channel_24>
            <ryg_id>0</ryg_id>
        </channel_24>
    </data_aggregator_ryg_point>
    ...
</data_aggregator_ryg_data>
```

B.4   Data Aggregator 300

B.4.1   Data Aggregator Sensor Listing

B.4.1.1   About

This enumerates the DA-300 units you have access to view, along with any mapped RYG channels, if they are configured.

B.4.1.2   Endpoint

`/datastream/da/meta/[FORMAT]/[API_KEY]`

B.4.1.3   Parameters

- **[FORMAT]**

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

- **[API_KEY]**

  - A generated user access token used to authenticate a user against the Acyclica Go software. Contact support@acyclica.com to receive your API KEY.

B.4.1.4   Example Output

XML

```xml
<data_aggregators>
    <data_aggregator>
        <id>[ID]</id>
        <reference_id>[DA_Serial]</reference_id>
        <cabinet_id>[ID]</cabinet_id>
        <ryg_map></ryg_map>
    </data_aggregator>
    <data_aggregator>
        <id>[ID]</id>
        <reference_id>[DA_Serial]</reference_id>
        <cabinet_id>[ID]</cabinet_id>
        <ryg_map>
            <ryg_channel>
                <channel>2</channel>
                <phase>3</phase>
            </ryg_channel>
            <ryg_channel>
                <channel>3</channel>
                <phase>3</phase>
            </ryg_channel>
            <ryg_channel>
                <channel>6</channel>
                <phase>5</phase>
            </ryg_channel>
            <ryg_channel>
                <channel>7</channel>
                <phase>5</phase>
            </ryg_channel>
            <ryg_channel>
                <channel>5</channel>
                <phase>4</phase>
            </ryg_channel>
            <ryg_channel>
                <channel>8</channel>
                <phase>4</phase>
            </ryg_channel>
        </ryg_map>
    </data_aggregator>
    ...
</data_aggregators>
```

JSON

```
[
    {
        "cabinet_id": 1,
        "data_aggregator_reference_id": "[DA_Serial]",
        "data_aggregator_id": 1,
        "ryg_map": []
    },
    {
        "cabinet_id": 2,
        "data_aggregator_reference_id": "[DA_Serial]",
        "data_aggregator_id": 2,
        "ryg_map": [
            {
                "channel": 2,
                "phase": 3
            },
            {
                "channel": 3,
                "phase": 3
            },
            {
                "channel": 6,
                "phase": 5
            },
            {
                "channel": 7,
                "phase": 5
            },
            {
                "channel": 5,
                "phase": 4
            },
            {
                "channel": 8,
                "phase": 4
            }
        ]
    },
    {
        ...
    }
]
```

B.5   OD Groups

B.5.1   Origin-Destination Group Listing

B.5.1.1   About

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

B.5.1.2   Endpoint

`/datastream/odgroup/inventory/xml/[API_KEY]`

B.5.1.3   Parameters

- **[API_KEY]**
  - A generated user access token used to authenticate a user against the Acyclica Go software. Contact support@acyclica.com to receive your API KEY.

B.5.1.4   Example Output

XML

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

B.6   Route

B.6.1   Route Listing

B.6.1.1   About

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

B.6.1.2   Endpoint

```
/datastream/route/inventory/xml/[API_KEY]
```

B.6.1.3   Parameters

- **[API_KEY]**
  - A generated user access token used to authenticate a user against the Acyclica Go software. Contact support@acyclica.com to receive your API KEY.

B.6.1.4   Example Output

XML

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

```
        </AcyclicaSegments>
    </AcyclicaRoute>
    ...
</AcyclicaRouteInventory>
```

B.6.2   Route Data

B.6.2.1   About

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

1. Strength

2. First

3. Last

4. Minimum

5. Last

B.6.2.2   Endpoint

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

B.6.2.3   Parameters

- **[FORMAT]**

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

- **[API_KEY]**

  ○ A generated user access token used to authenticate a user against the Acyclica Go software. Contact support@acyclica.com to receive your API KEY.

- **[ROUTE_ID]**

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

- **[START_TIME]**

  ○ The beginning time in the range you are searching. Time values must be in epoch format, in **seconds**. March 15, 2017 00:00 would be represented by `148953600`.

- **[END_TIME]**

  ○ The end time in the range you are searching. Time values must be in epoch format, in **seconds**. March 15, 2017 03:00 would be represented by `148954680`.

B.6.2.4   Example Output

XML

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

CSV

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

B.6.3   Route Information -- Most Recent Data

B.6.3.1   About

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

B.6.3.2   Endpoint

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

B.6.3.3   Parameters

- **[API_KEY]**

  - A generated user access token used to authenticate a user against the Acyclica Go software. Contact support@acyclica.com to receive your API KEY.

- **[ROUTE_ID]**

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

B.6.3.4   Example Output

XML

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

B.7   VSO Sensors

B.7.1   VSO Listing

B.7.1.1   About

This enumerates the VSO sensors available to your user account.

B.7.1.2   Endpoint

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

B.7.1.3   Parameters

- **[FORMAT]**
  - The format of the data you are querying, either "json" or "xml"

- **[API_KEY]**
  - A generated user access token used to authenticate a user against the Acyclica Go software. Contact support@acyclica.com to receive your API KEY.

B.7.1.4   Example Output

JSON

```
[
    {
        "description": "VSO Sensor Description",
        "name": "VSO Sensor Name",
        "zones": [
            {
                "zone_id": ZONEID,
                "reference_id": "REFERENCE ID"
            },
            {
                ...
            }
        ],
        "id": VSOID,
        "lastdata": 1489611839000,
        "count_stations": [
            {
                "route_id": 4314,
                "name": "alpha",
                "zones": [
```

```
                1,
                2,
                3
            ],
            "cs_id": 3
        }
    ],
    "location_id": LOCATIONID,
    "client_groups": [
        6
    ],
    "dev_type": "Sensor Type",
    "short_name": "",
    "serial": "SERIAL"
},
{
    ...
}
]
```

XML

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

B.7.2 VSO Count Station Data

B.7.2.1 About

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

B.7.2.2 Endpoint

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

B.7.2.3 Parameters

- **[FORMAT]**

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

- **[API_KEY]**

  o A generated user access token used to authenticate a user against the Acyclica Go software. Contact support@acyclica.com to receive your API KEY.

- **[DEVICE_ID]**

  o The sensor ID as noted in the ennumeration query.

- **[PERIOD]**

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

- **[START_TIME]**

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

- **[END_TIME]**

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

B.7.2.4 Example Output

JSON

```
[
    {
        "speed": 0,
        "timestamp": 1483552700000,
        "occupancy": 0,
```

```json
        "count_station_id": [VSO_ID],
        "volume": 0
    },
    {
        "speed": 0.0,
        "timestamp": 1483552700000,
        "occupancy": 0.0,
        "count_station_id": [VSO_ID],
        "volume": 16
    },
    ...
]
```

XML

```xml
<vso_sensor>
    <vso_count_station_data time="1483552700000">
        <count_station_id>[VSO_ID]</count_station_id>
        <volume>0</volume>
        <speed>0</speed>
        <occupancy>0</occupancy>
    </vso_count_station_data>
    <vso_count_station_data time="1483552700000">
        <count_station_id>[VSO_ID]</count_station_id>
        <volume>16</volume>
        <speed>0.0</speed>
        <occupancy>0.0</occupancy>
    </vso_count_station_data>
    ...
</vso_sensor>
```

B.7.3   VSO Zone Data

B.7.3.1   About

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

B.7.3.2   Endpoint

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

B.7.3.3   Parameters

- **[FORMAT]**
    - The format of the data you are querying, either "json", "xml", or "csv"

- **[API_KEY]**
    - A generated user access token used to authenticate a user against the Acyclica Go software. Contact support@acyclica.com to receive your API KEY.

- **[DEVICE_ID]**
    - The sensor ID as noted in the ennumeration query.

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

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

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

B.7.3.4   Example Output

JSON

```
[
    {
        "speed": 0,
        "timestamp": 1489536000000,
        "zone_id": [ZONE_ID],
        "volume": 0,
        "occupancy": 0
    },
    {
        "speed": 0,
        "timestamp": 1489536000000,
        "zone_id": [ZONE_ID],
        "volume": 0,
        "occupancy": 0
    },
    ...
]
```

B.8   Segments

B.8.1   Segment Match Data

B.8.1.1   About

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

1. Strength

2. First

3. Last

4. Minimum

5. Maximum

B.8.1.2   Endpoint

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

B.8.1.3   Parameters

- **[FORMAT]**

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

- **[API_KEY]**

    ○ A generated user access token used to authenticate a user against the Acyclica Go software. Contact support@acyclica.com to receive your API KEY.

- **[DEVICE_ID1]**

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

- **[DEVICE_ID2]**

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

- **[START_TIME]**

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

- **[END_TIME]**

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

B.8.1.4   Example Output

XML

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

B.8.2   Segment Match Algorithm Data

B.8.2.1   About

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

B.8.2.2   Endpoint

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

B.8.2.3   Parameters

- **[API_KEY]**

  - A generated user access token used to authenticate a user against the Acyclica Go soft-ware. Contact support@acyclica.com to receive your API KEY.

- **[DEVICE_ID1]**

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

- **[DEVICE_ID2]**

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

- **[START_TIME]**

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

- **[END_TIME]**

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

B.8.2.4   Example Output

XML

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

```
    </matchdata>
```

B.8.3   Segment Match Filtered Algorithm Data

B.8.3.1   About

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

B.8.3.2   Endpoint

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

B.8.3.3   Parameters

- **[API_KEY]**

    - A generated user access token used to authenticate a user against the Acyclica Go software. Contact support@acyclica.com to receive your API KEY.

- **[DEVICE_ID1]**

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

- **[DEVICE_ID2]**

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

- **[START_TIME]**

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

- **[END_TIME]**

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

B.8.3.4   Example Output

CSV

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

```
1489104017.628,2ac18e62c91b35003af5eda83fef94526d842df478e8bc8c51857686f0a5a020,10.0,4
1489104017.628,2ac18e62c91b35003af5eda83fef94526d842df478e8bc8c51857686f0a5a020,150.457,5
...
```

FLORENCE BOULEVARD TRAFFIC ANALYSIS

Congestion and Route Analysis using Acyclica Technology

Abstract

The following report is a detailed analysis of route utilization and congestion on westbound Florence Boulevard between Camino Mercado and Marshall Road. This assessment specifically examines traffic originating near the offramp of Interstate 10 and traveling west through Casa Grande

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Acyclica

Overview

The following report is an analysis of traffic on West-bound Florence Boulevard during the one-week period from the 16th of September 2017 through the 22nd of September 2017. The analysis captures typical traffic patterns on Florence Boulevard and identifies potential bottlenecks which result in elevated travel-times for those who travel the duration of the roadway from Interstate 10 through the city of Casa Grande.

Technology

The technology used for the following analyses includes the Acyclica RoadTrend sensors and Go software analytics platform. The RoadTrend sensors capture roughly 40% of all roadway traffic and aggregates the information to better understand how people are using the roadway. These sensors are installed in traffic cabinets where they can accurately monitor travel-times and intersection delay by movement and by approach. The data from the RoadTrend sensors is transmitted to the cloud-based Go software platform which analyzes the data and produced the analyses included in this report.

Privacy

The RoadTrend sensors anonymously capture Wifi MAC addresses from roadway users using Acyclica's patented technology. These MAC addresses are hashed, or irreversibly anonymized, using best-in-class anonymization techniques which protect the privacy of roadway users by making it impossible to identify them based on the information captured. The anonymization procedures of been verified assessed by independent third-party consultants and a copy of that report is available by request.

Destination Analysis

The following analysis shows the utilization of Florence Boulevard for all traffic originating at Camino Mercado. For this analysis, the origin was constrained at the intersection of Florence Boulevard and Camino Mercado while the destination was left unbounded. The map below is colored based on the number of segment traversals captured by the Acyclica RoadTrend sensors at each intersection. The purpose of the destination analysis is to examine how traffic originating from I-10 travel down Florence Boulevard.
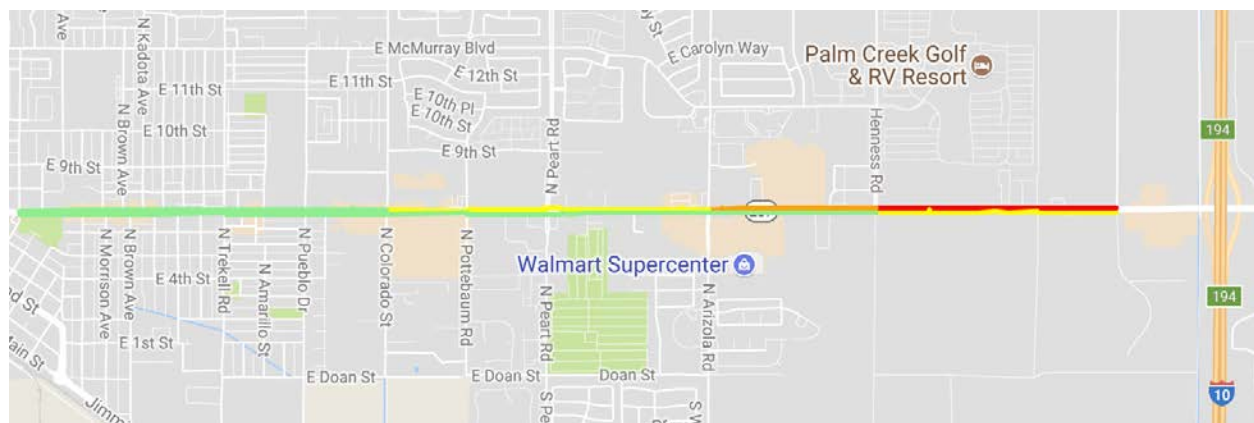

Figure 1. This roadway utilization map shows how many people travel each segment of road based on originating at Florence & Camino Mercado, just off of I-10. The map segments are colored based on the number of vehicles traversing those segments.

Since no RoadTrend sensors are currently installed either north or south of Florence Boulevard, we do not know the ultimate destination of the drivers but the following route analysis can show how far along the defined route vehicles traveled.

Table 1 below shows a list of all the segments which were traveled as part of routes which originated at Florence Blvd and Camino Mercado. As one would expect, the most frequently traveled segments are those near the origin of the route. Since there are no RoadTrend sensors north, south or east of this location, all traffic that is tracked travels west. The initial segment captured 21,380 matches while the following segments captured 13,725 and 12,661 respectively, suggesting that many vehicles turn either north or south at Henness Road.

Start	End	Segment Count	Distance	Travel-Time
273227 - Florence Blvd. & Camino Mercado	273110 - Florence Blvd & Henness Rd	21380	1.2 mi	1:01 (mm:ss)
273110 - Florence Blvd & Henness Rd	273113 - Florence Blvd. & Banner Med. Ctr.	13725	0.5 mi	0:38 (mm:ss)
273113 - Florence Blvd. & Banner Med. Ctr.	273653 - Florence Blvd & Arizola Rd	12661	0.33 mi	0:34 (mm:ss)
273651 - Florence Blvd. & Peart Rd.	273652 - Florence Blvd. & Pottebaum Rd.	8391	0.39 mi	0:45 (mm:ss)
273653 - Florence Blvd & Arizola Rd	273651 - Florence Blvd. & Peart Rd.	8325	0.82 mi	1:04 (mm:ss)
273110 - Florence Blvd & Henness Rd	273227 - Florence Blvd. & Camino Mercado	7813	1.2 mi	1:02 (mm:ss)
273652 - Florence Blvd. & Pottebaum Rd.	273138 - Florence Blvd. & Colorado St.	6632	0.41 mi	0:46 (mm:ss)
273653 - Florence Blvd & Arizola Rd	273113 - Florence Blvd. & Banner Med. Ctr.	3765	0.33 mi	0:30 (mm:ss)
273652 - Florence Blvd. & Pottebaum Rd.	273651 - Florence Blvd. & Peart Rd.	3410	0.4 mi	0:46 (mm:ss)
273138 - Florence Blvd. & Colorado St.	273673 - Trekell Rd & Florence Blvd	3311	0.81 mi	1:12 (mm:ss)
273113 - Florence Blvd. & Banner Med. Ctr.	273110 - Florence Blvd & Henness Rd	2937	0.5 mi	0:32 (mm:ss)
273138 - Florence Blvd. & Colorado St.	273652 - Florence Blvd. & Pottebaum Rd.	2687	0.4 mi	0:45 (mm:ss)
273673 - Trekell Rd & Florence Blvd	273111 - Florence Blvd. & Cameron St.	2211	0.7 mi	0:49 (mm:ss)
273111 - Florence Blvd. & Cameron St.	273226 - Florence Blvd. and Marshall St.	1615	0.31 mi	0:28 (mm:ss)
273651 - Florence Blvd. & Peart Rd.	273653 - Florence Blvd & Arizola Rd	1503	0.8 mi	1:01 (mm:ss)
273226 - Florence Blvd. and Marshall St.	273111 - Florence Blvd. & Cameron St.	872	0.31 mi	0:28 (mm:ss)
273111 - Florence Blvd. & Cameron St.	273673 - Trekell Rd & Florence Blvd	844	0.71 mi	0:51 (mm:ss)
273673 - Trekell Rd & Florence Blvd	273138 - Florence Blvd. & Colorado St.	744	0.83 mi	1:15 (mm:ss)

Table 1 shows the number of matches on each segment of roadway for traffic that originated at Florence Blvd and Camino Mercado. The coloring in the table corresponds to the coloring of the map segments in the map above.

Route Analyses

Below, Figure 2 shows a summary of the five most frequently traveled which originated at Camino Mercado and Florence Boulevard. In total, 15,132 distinct trips were analyzed starting at Camino Mercado and an assumption can be made that most of this traffic is originating from I-10.
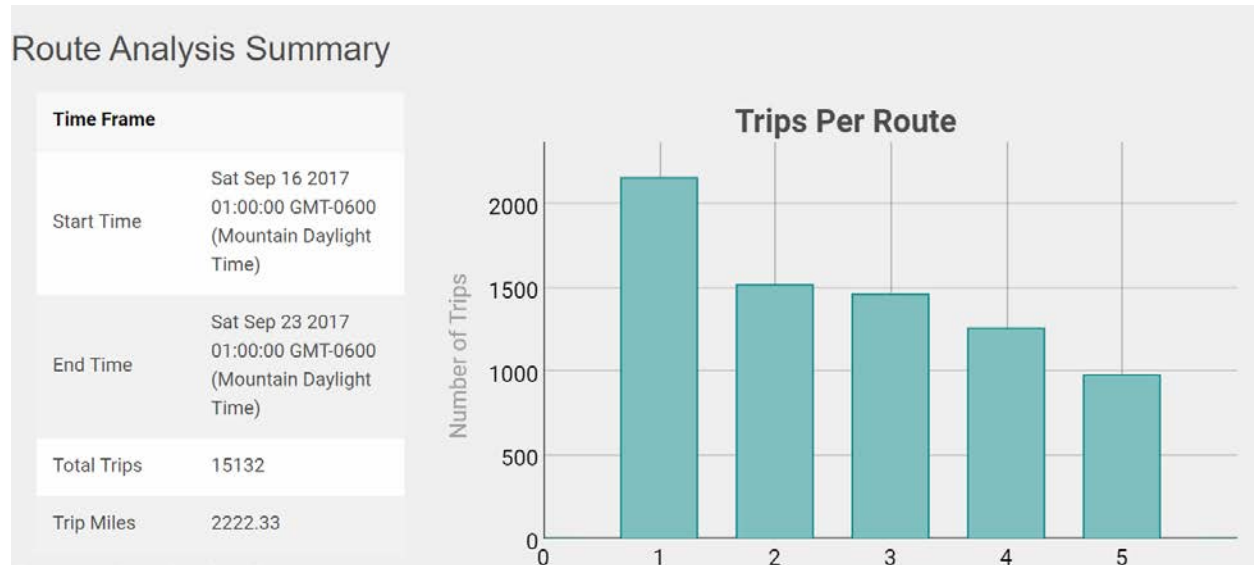

Figure 2 shows the frequency of travel for the 5 most traveled routes originating at Camino Mercado and traveling west bound.

Figure 3 through Figure 7 show the details of the five most traveled routes originating at Camino Mercado.
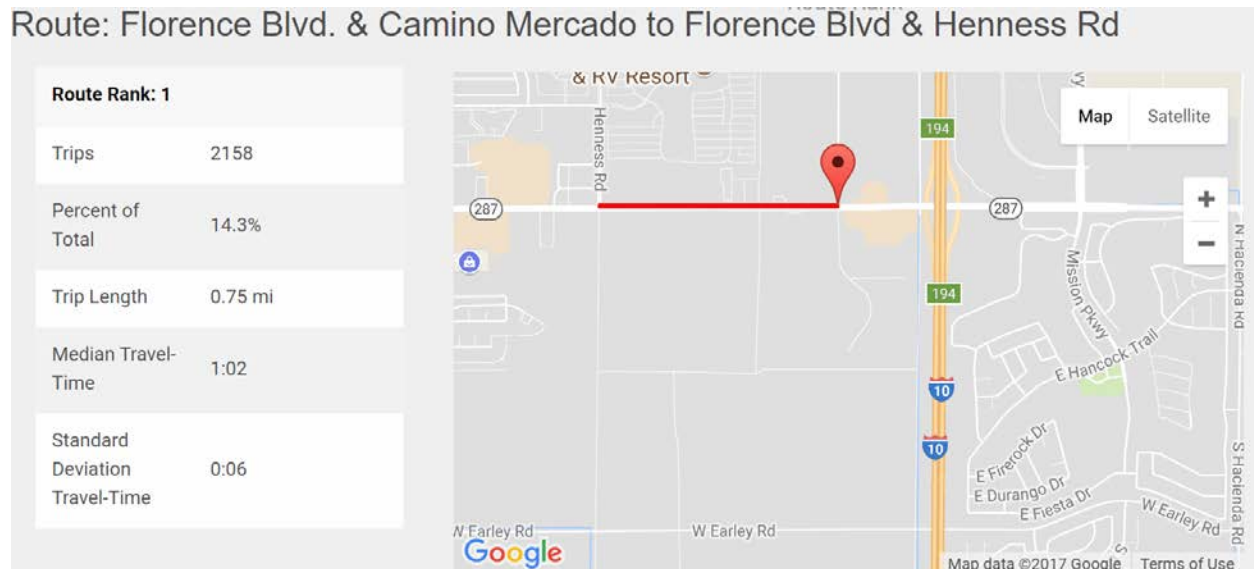
Figure 3 shows that 2,158 trips were observed for people who traveled from Camino Mercado to Henness Rd., but no further, on Florence Boulevard.

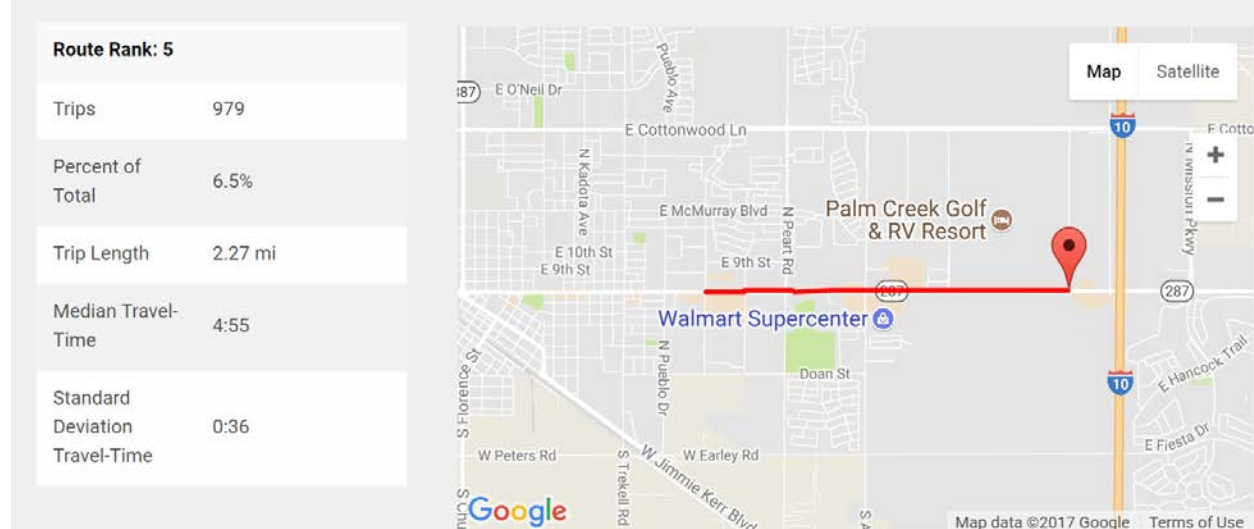## Route: Florence Blvd. & Camino Mercado to Florence Blvd & Arizola Rd

Route Rank: 2	
Trips	1518
Percent of Total	10.0%
Trip Length	1.26 mi
Median Travel-Time	2:16
Standard Deviation Travel-Time	0:12
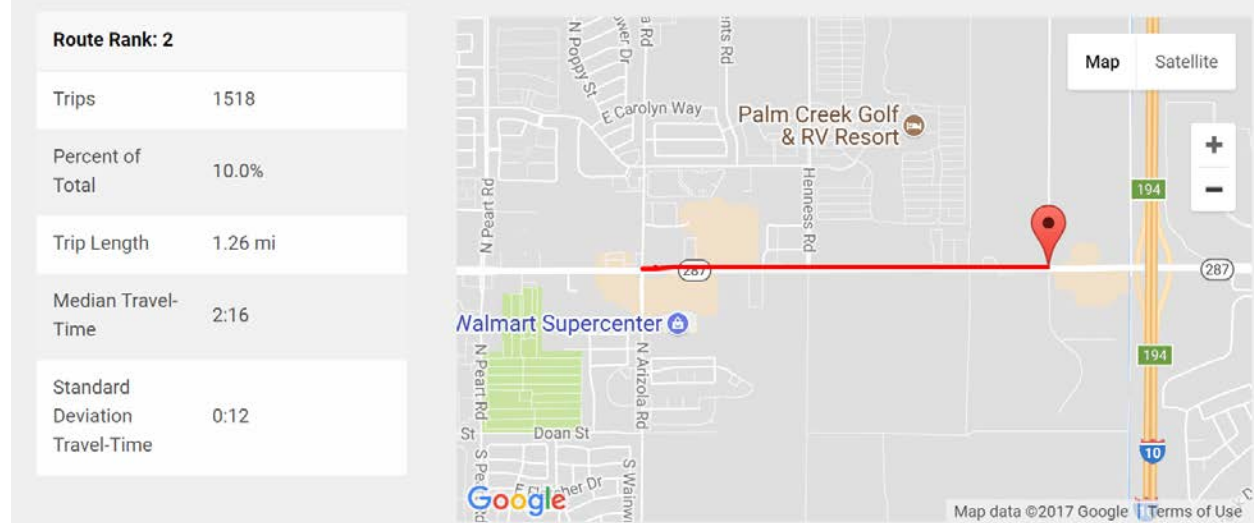
Figure 4 shows that 1,518 trips were observed for people who traveled from Camino Mercado to Arizola Rd., but no further, on Florence Boulevard.

Route: Florence Blvd. & Camino Mercado to Florence Blvd. & Banner Med. Ctr.

Route Rank: 3	
Trips	1463
Percent of Total	9.7%
Trip Length	1.05 mi
Median Travel-Time	1:40
Standard Deviation Travel-Time	0:07
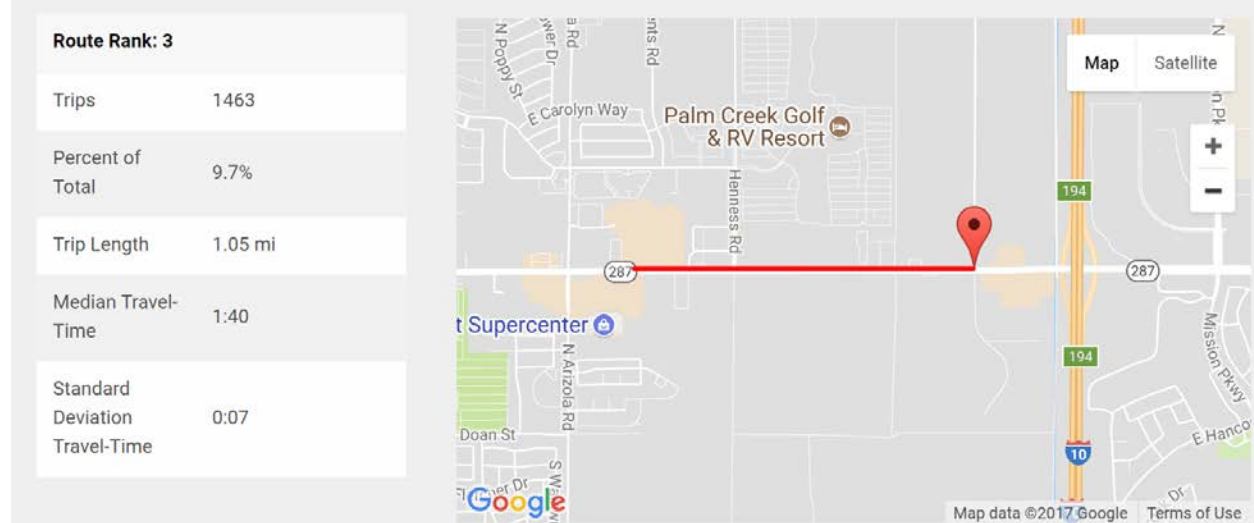
Figure 5 shows that 1,463 trips were observed for people who traveled from Camino Mercado to Banner Medical Center, but no further, on Florence Boulevard.

Route: Florence Blvd. & Camino Mercado to Florence Blvd. & Peart Rd.

Route Rank: 4	
Trips	1260
Percent of Total	8.3%
Trip Length	1.77 mi
Median Travel-Time	3:22
Standard Deviation Travel-Time	0:18
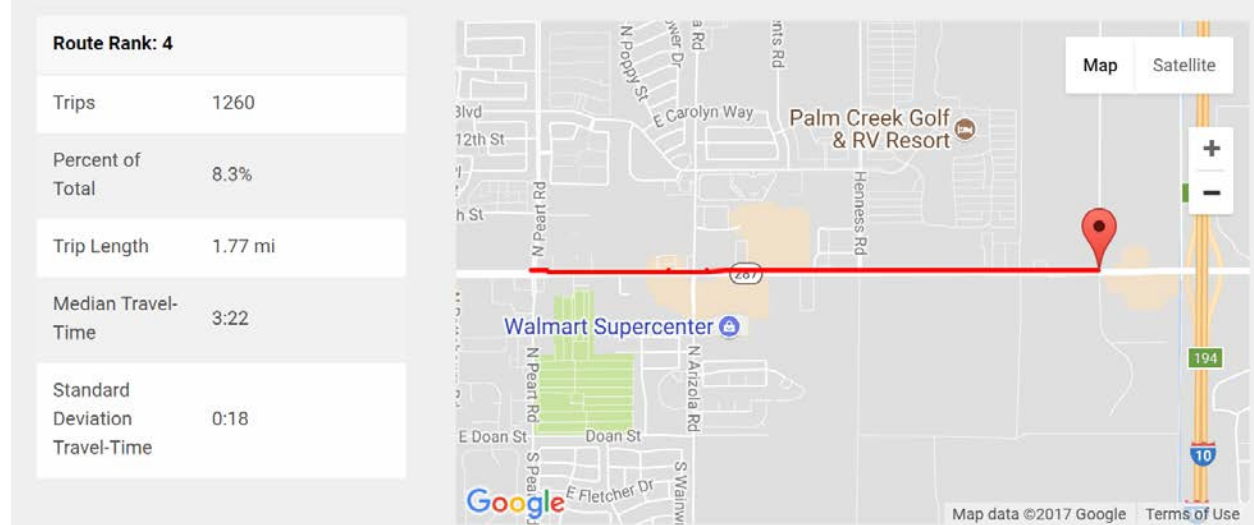
Figure 6 shows that 1,260 trips were observed for people who traveled from Camino Mercado to Peart Rd., but no further, on Florence Boulevard.

Route: Florence Blvd. & Camino Mercado to Florence Blvd. & Colorado St.

Route Rank: 5	
Trips	979
Percent of Total	6.5%
Trip Length	2.27 mi
Median Travel-Time	4:55
Standard Deviation Travel-Time	0:36

Figure 7 shows that 979 trips were observed for people who traveled from Camino Mercado to Colorado St., but no further, on Florence Boulevard.

Analysis of Travel Times

In addition to examining the utilization of Florence Boulevard from Interstate 10, an analysis of the entire route in the westbound direction was performed. Figure 8 shows the travel-time of traffic on Westbound Florence Boulevard in green compared to the travel-time of Eastbound Florence Boulevard depicted in blue. As one might expect, the high volume of traffic originating from Interstate 10 likely causes elevated travel-time.

Figure 8 shows the travel time of Florence Boulevard for westbound traffic (green) compared with eastbound traffic (blue)

Segment Analysis

In order to assess which segments, if any, contribute to the high spikes in travel-time, a travel-time by segment analysis was performed as shown in Figure 9. The top line (orange) shows the aggregate travel-time for the entire westbound route on Florence Boulevard from Camino Mercado to Marshall St. Each one of the constituent components are broken down individually which provides interesting insights. Upon careful examination, it is clear that the purple line, representing the segment from Peart Road to Pottebaum Road disproportionately contributes to the spiking travel-time, particularly during the afternoon peak period.
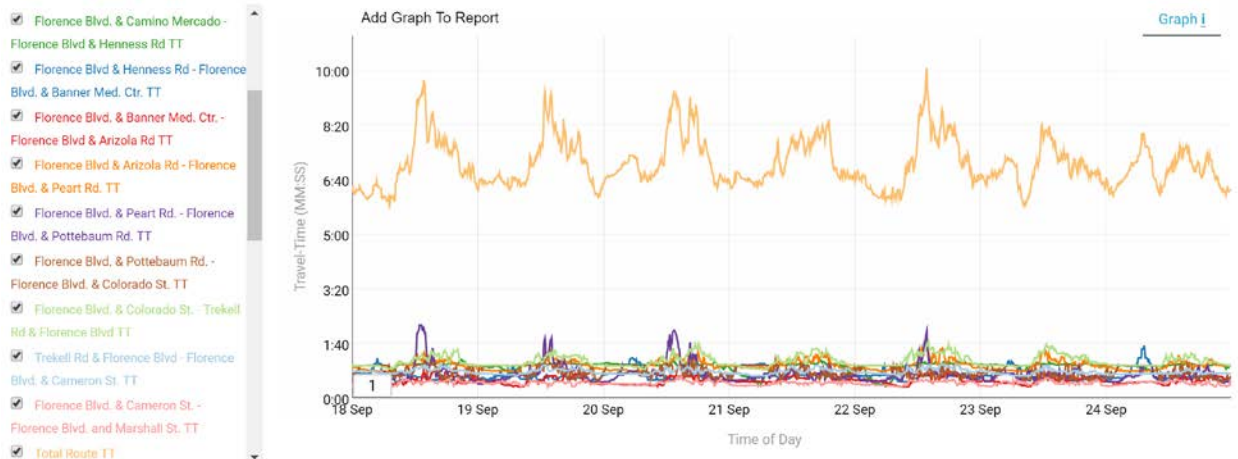
Figure 9 shows travel-time by segment. The top orange line depicts the aggregate travel time for the route which is made up of the contituent components below.

Identifying the key segment which causes the travel-time to jump for the overall route is critical for developing a congestion mitigation strategy. In order to better characterize the congestion, a delay analysis is needed.

Intersection Delay Analysis

Intersection delay is calculated by analyzing the amount of time that vehicles are within the detectable range of the RoadTrend sensor. Intersection delay, or dwell time, can be further broken down in several different ways due to the unique nature of Acyclica's WiFi technology:

- Total delay: time from the first detection at an intersection until the last detection at an intersection
- Upstream delay: time from the first detection at an intersection until the time of the peak signal strength
- Downstream delay: time of the detection of the peak signal strength to the time of the last detection
- Delay by approach: intersection delay associated with an individual approach to an intersection (i.e. westbound approach delay)
- Delay by movement: intersection delay associated with a movement (i.e. eastbound, left-turn delay)

Due to the placement of sensors, it is not possible to identify delay except for westbound and eastbound approaches. To examine side-street delay and associate the northbound or southbound approaches or delays associated with movement, additional RoadTrend sensors should be placed north and/or south of the desired intersections. Below, Figure 10 shows the total intersection delay at each intersection along the route. The results of the intersection delay analysis corroborate the travel-time by segment analysis showing that the intersection delay at Florence Boulevard and Pottebaum Road is significantly higher than other intersections.
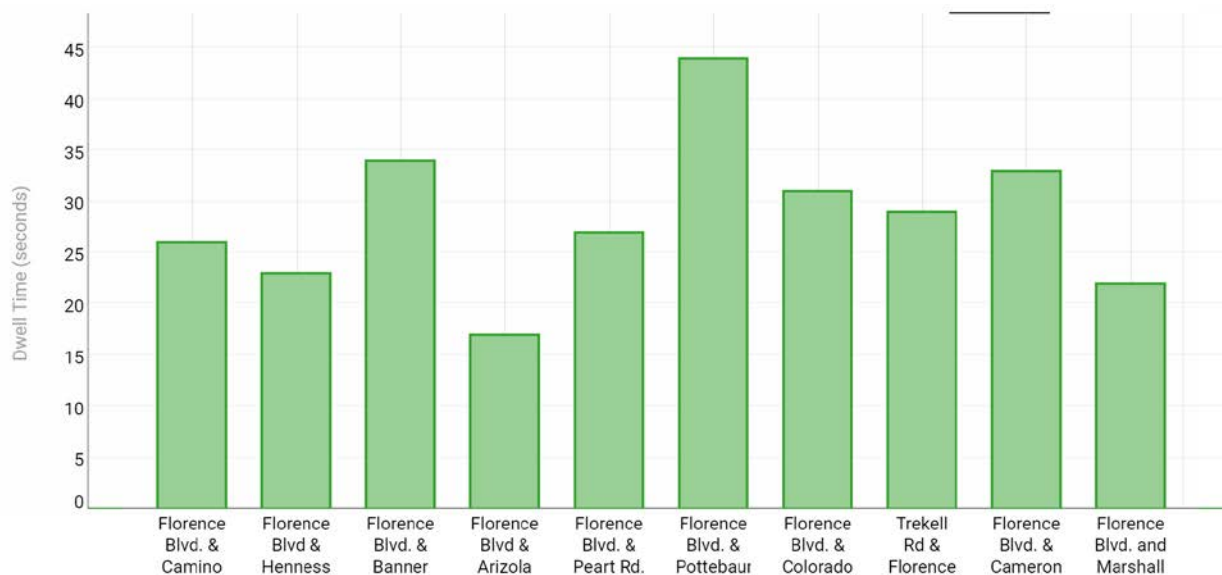
Figure 10 shows the route delay report which shows the intersection dwell time at all intersections along the route.

An intersection delay heatmap such as the one shown Figure 11 is colored based on the relative delay of all intersections along Florence Bouldevard.

Figure 11 delay heatmap where increased intersection delay is depicted by deeper reds whereas intersections with comparatively low delay are colored green.

Acyclica's analysis tools allows us to examine the delay at Florence Boulevard and Pottebaum Rd. in more detail by examining the approach delay as we see in Figure 12. The figure clearly shows that the traffic approaching from Peart Road has an average delay of nearly two minutes during one of the travel-time peaks on the 22nd of September.
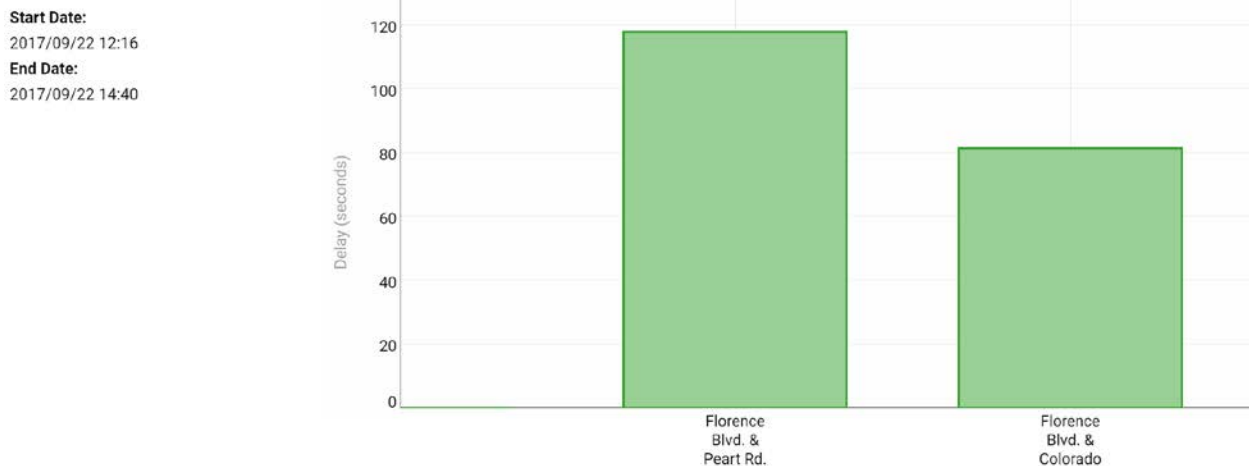

Start Date:
2017/09/22 12:16
End Date:
2017/09/22 14:40

Figure 12 shows intersection delay by approach at Florence Boulevard and Pottebaum Rd.

Conclusions

In order to measure congestion and develop mitigation strategies, the city of Casa Grande has installed a number of Acyclica RoadTrend sensors along Florence Boulevard. These sensors allow both real-time and historical analysis of traffic conditions. This report provides a detailed synopsis and analysis of traffic traveling westbound on Florence Boulevard with specific detail of troips originating near the I-10 off ramps. A route utilization analysis was performed to determine that most traffic travels from I-10 with a destination between Henness and Arizola Roads.

Furthermore, a detailed congestion analysis shows that the segment of roadway between Peart and Pottebaum roads overwhelmingly contributes to elevated route travel times during peak period. In further assessing the congestion conditions, it appears likely that the primary cause of this delay is related to dwell time at the intersection of Pottebaum road on the westbound approach from Peart road.

Traffic Success:
Greeley, Colorado

Acyclica

Table of Contents

Summary

To address increasing congestion and a rapidly growing population, Greeley optimized its traffic signals through an adaptive system and Acyclica's powerful analytics. Using advanced tools like Travel Times, Progression Diagrams, Weekly Analysis, Day of Week Analysis, and Delay By Phase, Greeley was able to feed their adaptive system with the most accurate information. As a result, travel times were reduced 10-20%, and Greeley is now well-prepared for future growth.

Population Growth, Increasing Congestion

Since the year 2000 Greeley's population has grown over 30%, from approximately 75,000 to more than 100,000 people[1]. The city's burgeoning population began to put a strain on the city's infrastructure, threatening increased congestion and delay. To combat this problem, engineers were presented with two options—expand roadways using costly construction methods, or use technology to optimize their existing systems. Greeley chose to do the latter, installing an adaptive signal system along one of their most burdened corridors.

After the purchase of this new adaptive technology, Greeley needed to do two things. First, they needed to provide the adaptive system with the most accurate information possible so that it would be able to respond to traffic effectively. Second, they needed to validate the purchase of this technology by comparing baseline statistics for the corridor to new data showing the benefits of the system.

[1]U.S. Census Bureau, Population Division, Annual Estimates of the Resident Population, May 2016

Big Data, Actionable Information

In order to establish baseline travel times for the corridor, Greeley could have chosen to use a floating car study. These studies have been the gold standard for obtaining travel time data for decades. However, as discussed in a recent US Department of Transportation report, floating car studies are often ineffective at determining the efficacy of adaptive systems because their exorbitant cost usually leads to insignificant sample rates[2]. Instead of using this inefficient method, Greeley chose to use data and analytics provided by Acyclica to improve and validate their adaptive system. Acyclica devices cost a fraction of the price of a single floating car study, and yet provide an incomparably greater amount of information. They collect up to 250,000 records per hour at a sampling rate of 30-55%. This results in traffic information at over 95% accuracy, collected every hour of the day. These incredible capture rates are accomplished through Acyclica's patented passive data collection technology that monitors passing cellular devices. This anonymous information is encrypted, analyzed, and fed into the Acyclica *Go* online interface. After installation, Greeley then used several tools in *Go* to analyze information to improve their corridor.

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[2] US DOT Federal Highway Administration. Measures of Effectiveness and Validation Guidance for Adaptive Signal Control Technologies. March 6, 2014. Accessed July 05, 2016. http://www.ops.fhwa.dot.gov/publications/fhwahop13031/chap8.htm.

Travel time measurement is the most commonly used analysis source for traffic studies[3]. While floating car studies often have an insignificant sample size, Acyclica's methods provide a wealth of information at each intersection. Acyclica's advanced detectors can monitor when a car enters the wifi detection zone, how long it lingers there, and when it leaves. When paired with information from other detectors on a corridor, algorithms are used to determine travel times on the route. This information can then be viewed in *Go*, Acyclica's online software. Travel times can be viewed by route, segment, in a graph or spreadsheet, and more. Greeley used travel times to provide their adaptive system with accurate information so it could respond accordingly. Then they used new travel time data to validate the technology, showing that average times were reduced by 10-20%.
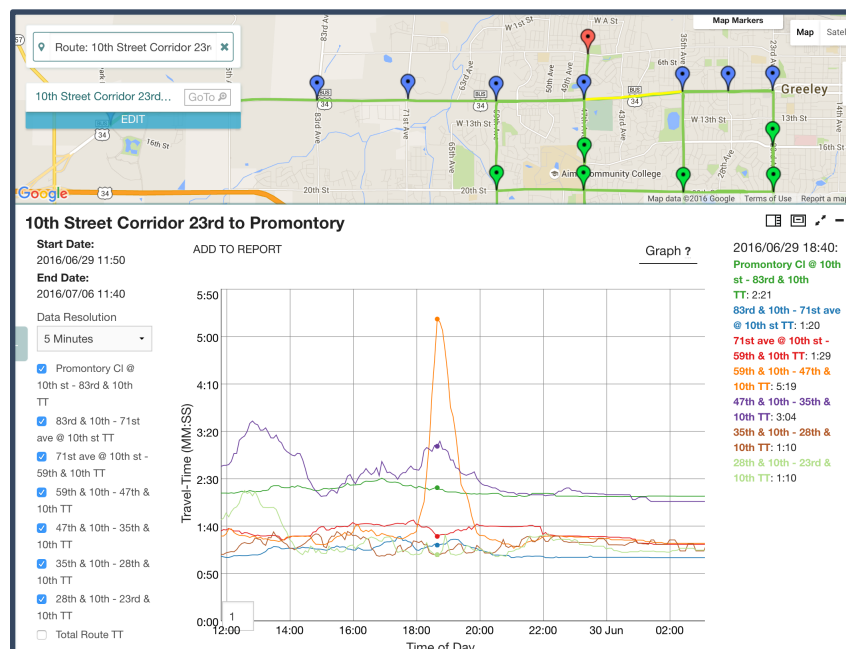

Figure 1: Travel Times Graph

[3] US DOT Federal Highway Administration. Measures of Effectiveness and Validation Guidance for Adaptive Signal Control Technologies. March 6, 2014. Accessed July 05, 2016. http://www.ops.fhwa.dot.gov/publications/fhwahop13031/chap8.htm.

Progression Diagram

Another way to view travel information is in a progression diagram. This tool is powerful because it displays distance and travel time, thus showing a vehicle's speed along the route. The average speed for each segment is displayed visually so that it can easily be compared to others. This allows the user to see where delay is being experienced on a route. In Greeley's case, the route below shows a fairly smooth progression through the corridor, with none of the segments being significantly steeper than the others. If one of the sections was flat, Greeley would know that this area of the road was more congested, and could focus their efforts there.
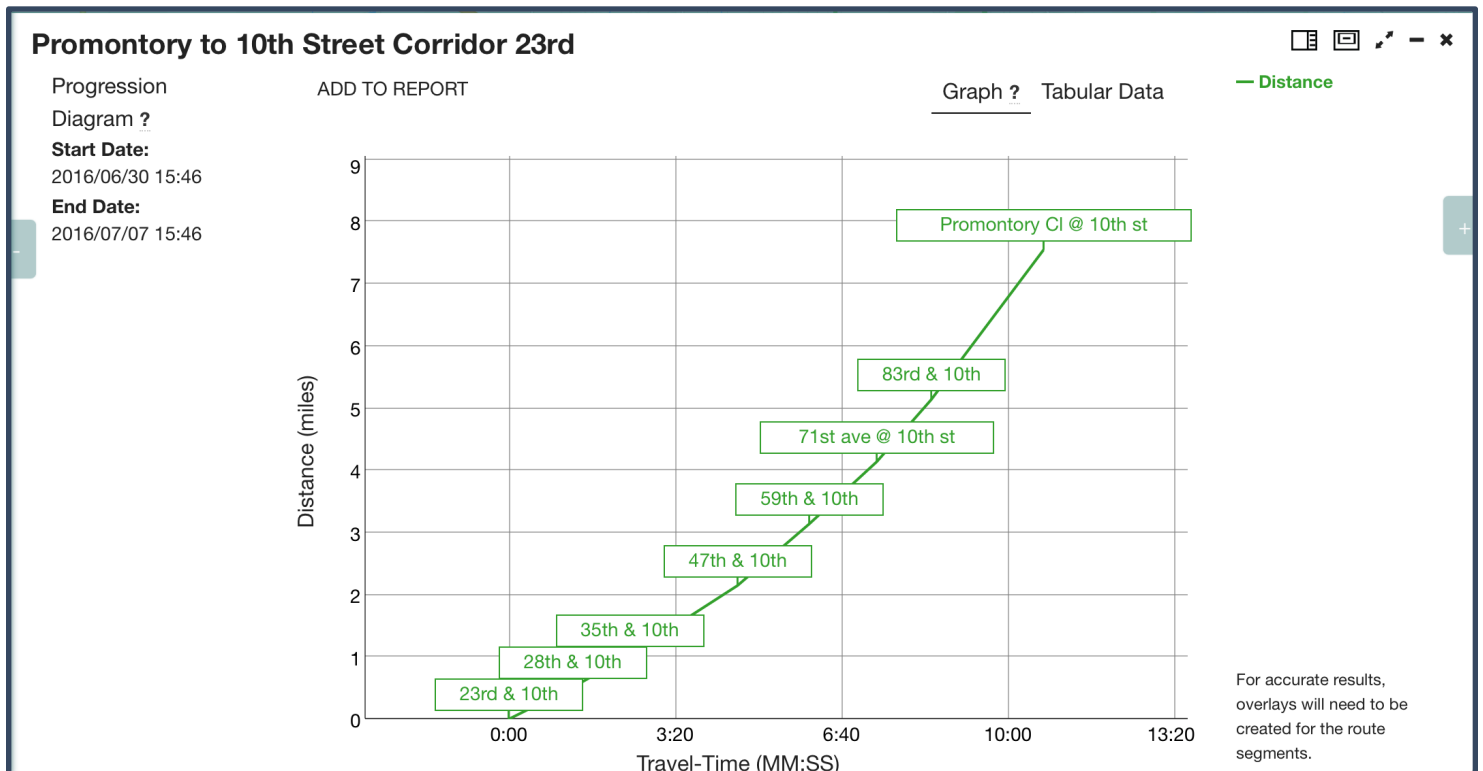

Figure 2: Progression Diagram

The Weekly Analysis tool gives the user the ability to compare average travel times for a specific day by week over an extended period of time. The graph below shows the travel times for Wednesdays in June through early July, 2016. Greeley saw a significant increase in travel times on Wednesday evening on the week of June 29th from an average of about 12 minutes to almost 16 minutes. The problem was corrected the next week as Wednesday travel times returned to normal. Further investigation utilizing the progression diagram tool could allow the city to pin point where the delay originated.
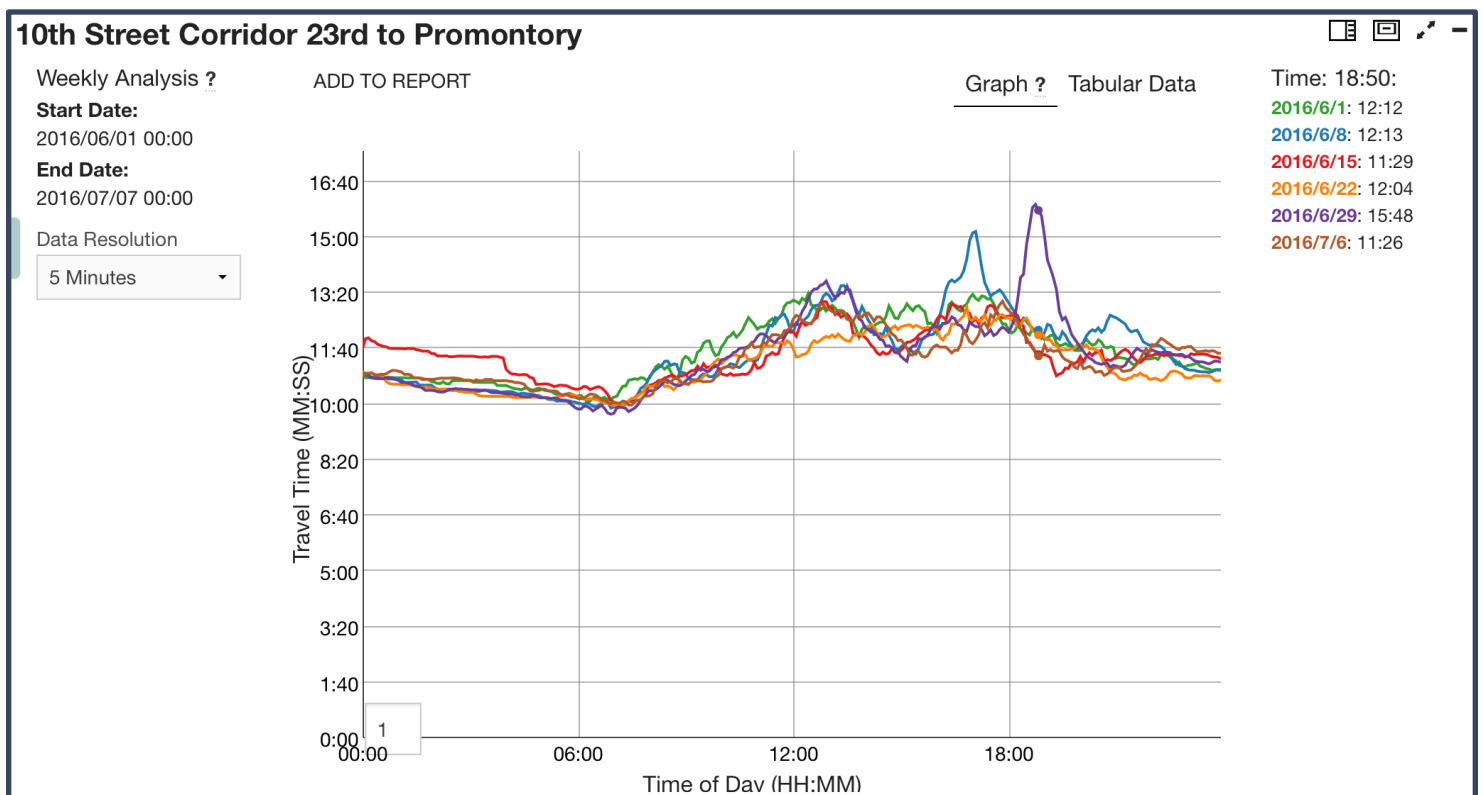

Figure 3: Weekly Analysis Graph

Day of Week Analysis

The Day of the Week Analysis allows the user to see the average travel times for each day in a week. For Greeley, this tool is a powerful way to further analyze the information discovered in the previous Weekly Analysis graph. The question to examine is whether the Wednesday spike observed is indicative of a larger problem that affected the more days in the week, or if it was an isolated incident. Examining the Day of Week Analysis graph below reveals that it was an anomaly that didn't affect surrounding days, and was quickly corrected.
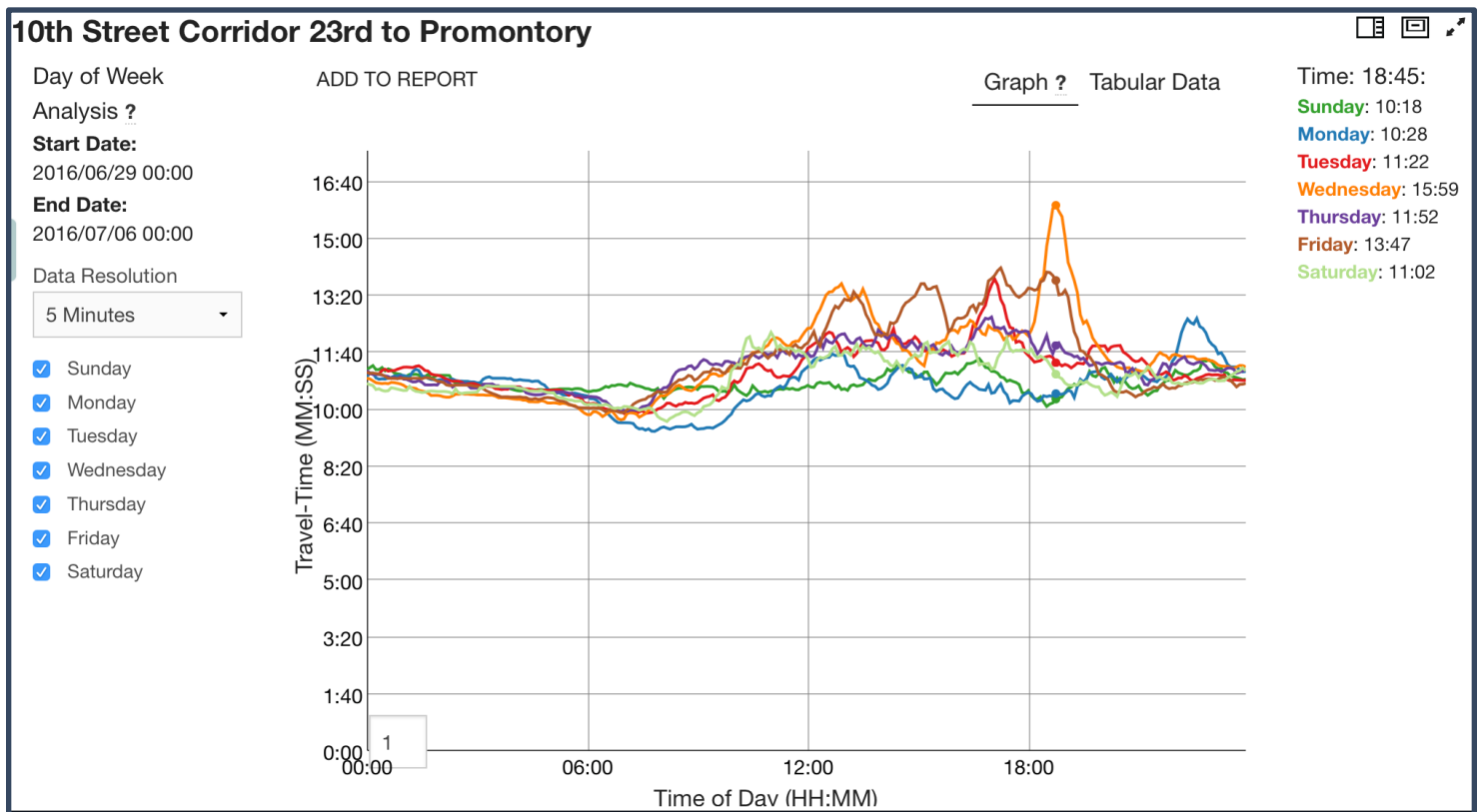
10th Street Corridor 23rd to Promontory

Day of Week Analysis ?

Start Date:
2016/06/29 00:00
End Date:
2016/07/06 00:00

Data Resolution

5 Minutes

☑ Sunday
☑ Monday
☑ Tuesday
☑ Wednesday
☑ Thursday
☑ Friday
☑ Saturday

ADD TO REPORT

Graph **?**   Tabular Data

Time: 18:45:
Sunday: 10:18
Monday: 10:28
Tuesday: 11:22
Wednesday: 15:59
Thursday: 11:52
Friday: 13:47
Saturday: 11:02

(Y-axis: Travel-Time (MM:SS) — 0:00, 1:40, 3:20, 5:00, 6:40, 8:20, 10:00, 11:40, 13:20, 15:00, 16:40)

(X-axis: Time of Day (HH:MM) — 00:00, 06:00, 12:00, 18:00)

Figure 4: Day of Week Analysis Graph

Another useful tool is Delay By Phase, which allows Greeley to see how much delay a vehicle experiences at a given intersection depending on which direction the car is coming from and which way it is going. For example, in the graph below the highest delay time is a left turn coming from the south. This is not unusual, as left turns often present the most delay. However, the second-highest delay is for cars coming from the same direction, but making a right turn. Right turns usually have a comparatively low dwell time, so Greeley may want to look into why this particular intersection is experiencing so much right-turn delay.
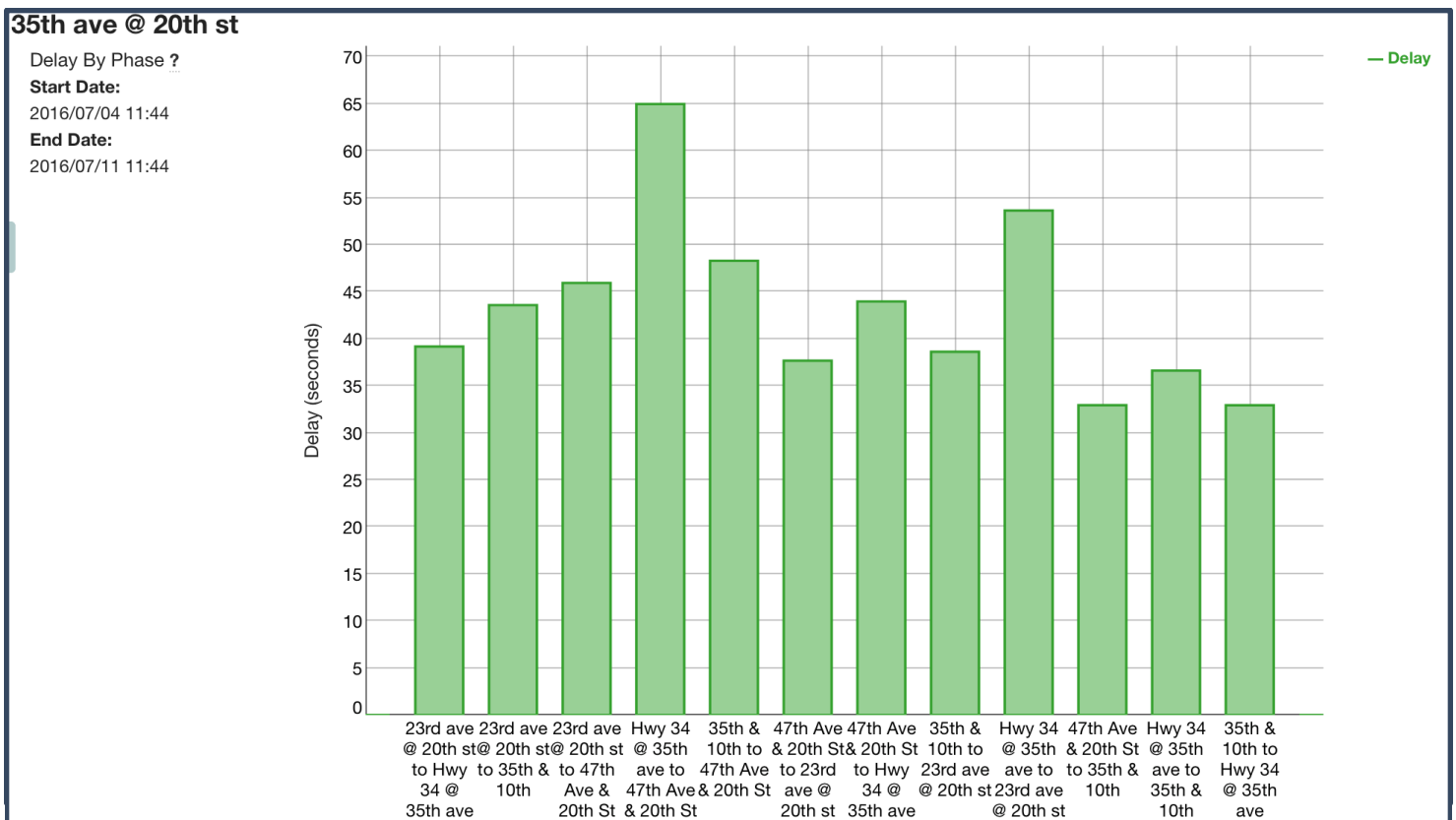

Figure 5: Delay By Phase Graph

Conclusion: Traffic Success

Greeley was able to accomplish their dual goals of feeding the adaptive system with the best information, and demonstrating the effectiveness of the new technology.

Acyclica's advanced travel time measurements were used to feed the adaptive system with the most up-to-date traffic data. This allowed the system to optimize signals to respond to the city's increasing congestion and reduce travel times. To prove the benefit of the adaptive system, Greeley used Acyclica's other tools like Progression Diagrams, Weekly Analysis, Day of Week Analysis, and Delay By Phase. Using these analytics, Greeley was able to show a 10-20% decrease in travel times along the route. All this was accomplished for the cost of a single floating car study.

Today, Greeley uses their system to monitor changes and prepare for the effects of further population growth. Acyclica's sensors collect information from Greeley's corridors 24 hours a day, 365 days a year. Armed with the best data, Greeley is ready to face the challenges of the future.