Georgia Department of Transportation

Automated Traffic Signal Performance Measures

Installation Manual

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ATSPM ....Automated Traffic Signal Performance Measures

GDOT ....Georgia Department of Transportation

MOE... Measures of Effectiveness

UDOT ....Utah Department of Transportation

Introduction

This is the first of three documents that comprise the full Georgia Department of Transportation (GDOT) Automated Traffic Signal Performance Measures (ATSPM) documentation package. Together, the three documents detail the installation and use of the Automated Traffic Signal Performance Measures website, including site navigation, reporting components, and report interpretation. This document provides detailed instructions on how to configure and install the ATSPM.

1. Prerequisites

1.1. Server Requirements

These installation procedures assume that the environment is prepared to the following specifications.

- Windows Server 2008 or newer installed
- .NET 4.5.2 Framework installed. Earlier or later versions of .NET Framework are not supported.
  - o In Server 2012, this is installed using **Add Features** under **Server Manager**.
    - ▪ When adding the .NET framework, ensure that **HTTP Activation** and **TCP Port Sharing** are also installed.
  - o In Server 2008, .NET 4.5.2 is a separate download and install.
    - ▪ Make sure WCF Activation and HTTP Activation are enabled. These are available in **Server Manager**, **Features** > **Add Features** as features for .NET Framework 3.5.1.
- IIS 7 or later installed, along with ASP.NET 4.0 or later
  - o In Windows Server, IIS is installed using Add Roles (Server 2008 or later).
  - o When adding the IIS role:
    - ▪ Ensure ASP.NET 4.0 or later is included. In Server 2008 or later, this is found under **Web Server (IIS)** > **Web Server** > **Application Development** when adding IIS.
  - o For Server 2008: When the Web Server (IIS) role is added, make sure all the IIS **Management Tools** below it are also installed.
- Firewall exceptions for connections to the controllers
- SQL Server or SQL Server Express 2012 or later installed along with Management Studio.
  - o When installing SQL Server & Management Studio:
    - ▪ Install a **Default Instance**.
    - ▪ Use NT AUTHORITY/NETWORK SERVICE for SQL Server Database Engine.
    - ▪ For Account Provisioning, select **Windows Authentication Mode**. Select a Windows account to serve as a SQL Server Administrator.
  - o Set up a common account to access the database:
    - ▪ Log in via SQL Server Management Studio. Use your Windows authentication and your account.

- Go to **Security** > **Logins** and create a new "SQL Server" login for the database. Name it "atspm," or similar, and assign a password. Under **Server Roles**, select **dbcreator** along with **public**. Use defaults for all other settings of the new Login.
- Right click the server, select **Properties** > **Security**. Ensure that "SQL Server and Windows Authentication mode" is selected.
- If Watchdog features are desired, installation requires access to an SMTP (email) server. It will accept email from the automated traffic signal performance measures (ATSPM) server. The SMTP server can reside on the same machine that hosts the ATSPM website.
- Microsoft Visual Studio 2013 or later is recommended.

1.2.   Other Requirements

- Your organization must have a Microsoft Bing Maps key. For information on obtaining one, please visit: https://www.bingmapsportal.com/

2.   New Install Procedure

Following these steps will install the Utah Department of Transportation (UDOT) ATSPM software on a server with no previous SPM installation. Typically, all components are installed in the same server, but individual components may be housed in different locations on the network. There must be one folder on the server or network that is shared to both the website and the location of the web services. This folder path is used to store chart images, and is specified during the website installation process in section 2.1.

2.1.   Create the Website using IIS

The website installation is the first step needed to install SPM. Once installed, a website tool will set up the database.

1. Create a folder for the website files. To do this, copy the ATSPMWebPage folder from the "\ATSPM Executables" folder in the installation media, into C:\inetpub\wwwroot.
2. Set up a shared folder to host website images:
    a. Create folder "SPMImages" at the C:\ root, or other desired location.
    b. Right click the folder and select **Properties** > **Security**.
    c. Click **Edit** then **Add**.
    d. On the **Select Users or Groups** dialog, enter object names **IUSR** and **IIS_IUSRS**. These will source from machine name of the server.
    e. Change the **location** to the top network domain. Then enter object name "Everyone." Click **OK**.
    f. These users should now have the default read permissions on the "SPMImages" folder.
3. Add ATSPM as a new application in IIS (Figure 1):
    a. Open IIS. Expand {Computer name} > Sites > Default Web Site. The ATSPMWebPage folder should be listed.

b. Right click **Default Web Site** and select **Add Application**. Give the application a descriptive **Alias**.

c. Set the **Physical Path** to the website folder created within wwwroot.

d. Set the Application pool to ASP.NET v4.0, or to an equivalent app pool with CLR version 4.0 or later and Integrated Pipeline mode.

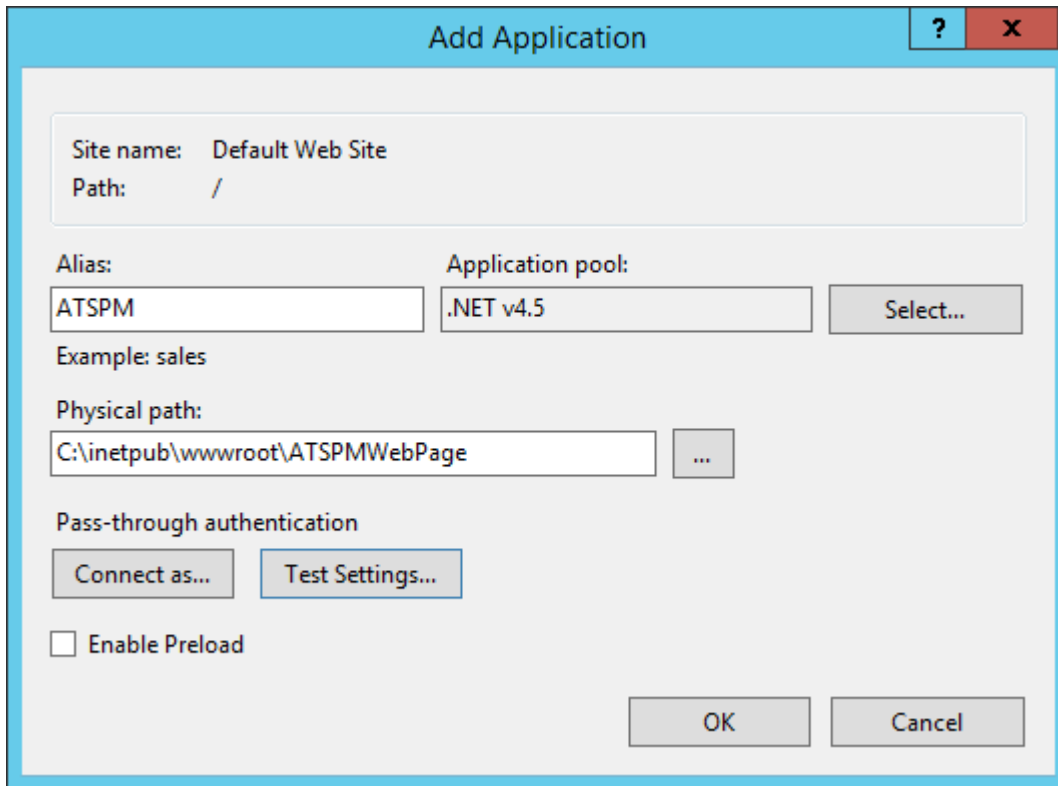**Figure 1: Configure ATSPM Application in IIS**

4. Add IUSR and IIS_IUSRS roles to the website physical path folder (Figure 2):

a. Right click the folder and select **Properties** > **Security**.

b. Click **Edit** then **Add**.

c. On the **Select Users or Groups** dialog, enter object names **IUSR** and **IIS_IUSRS**. These will source from the name of the machine.
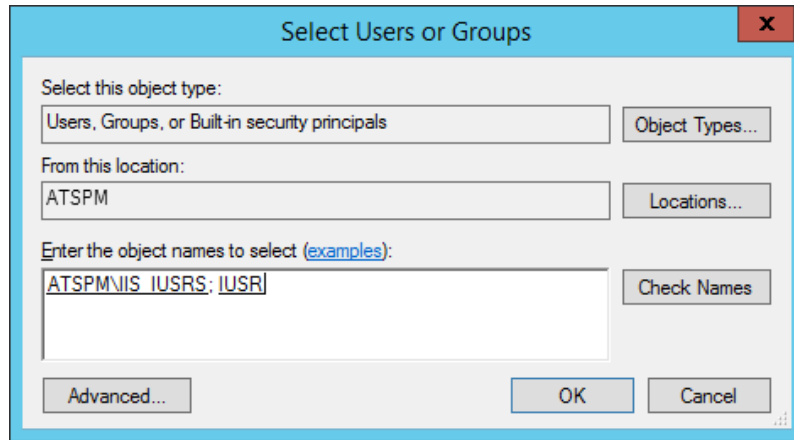
d. Grant each the default read permissions.

Figure 2: Folder permissions

5. Create the ATSPMImages application in IIS, underneath Default Web Site. Point the physical path to the shared images location created several steps above. Use the same Application Pool as the ATSPM application.
6. Edit the **web.config** file in the website physical path folder:
    a. Set the database connection string:
        i. Go to the <connectionStrings> block in web.config and edit the **SPM** connection string.
        ii. Change **data source** to the machine the SQL is running on (localhost, if same machine).
        iii. Set **initial catalog** to MOE. This is the name of the database that will be created.
        iv. Set **User ID** and **Password** to the values created when the SQL Server was configured.

        Here is an example:

        ```
        <add name="SPM" connectionString="data
        source=localhost;initial catalog=MOE;Persist Security
        Info=True;User
        ID=atspm;Password=password;MultipleActiveResultSets=True;Ap
        p=EntityFramework" providerName="System.Data.SqlClient" />
        ```

    b. Set the ImageLocation key to the absolute path of ATSPMImages. In this example, C:\ATSPMImages\. Be sure to include the trailing backslash.
    c. Set the **LinkPivotImageLocation** key to the same value as **ImageLocation**.
    d. Set **SPMImageLocation** to the external URL of images, linked to the image folder from the last two steps. Be sure to include the trailing forward slash. The external URL is recommended; for example: http://mysite.com/ATSPMImages/

2.2. Launch Website and Populate Database

1. Browse to the website. It should now be accessible from:

http://{domain}/{alias}

Where {domain} is your public web domain, and {alias} is the name chosen above for the ATSPM application in IIS.

2. Click **Register** and create a user account. Verify you can log in and out with this login.
3. Launching the website should automatically set up the MOE database (the "initial catalog" from the connection string).
4. Go to SQL Server Management Studio, log into the server, and check that the MOE database has been created.
5. Expand **Tables** within the MOE database, see Figure 3. Verify that several dozen tables have been created. Right-click the **ControllerTypes** table and select the top 1000 rows. Verify that signal controllers have been populated.
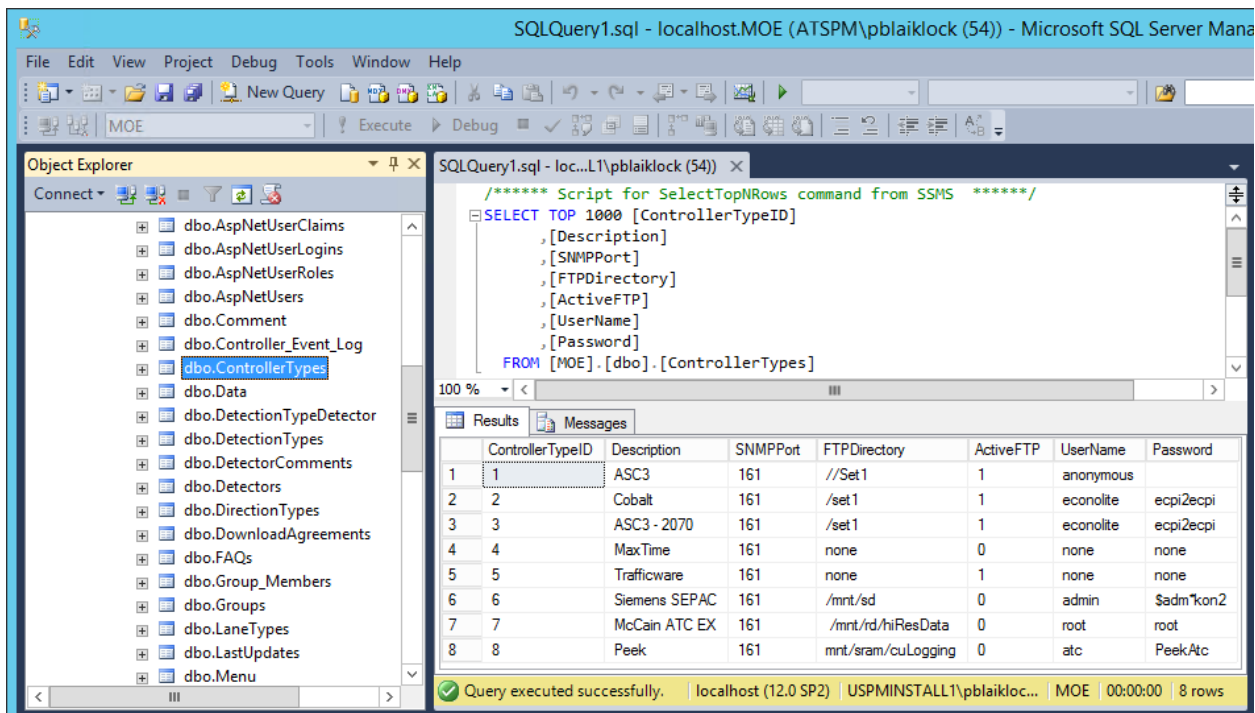
Figure 3: Checking tables in SQL Server Management Studio

2.3.   Set up Regions

All signals within ATSPM are divided among geographical regions. These can be districts within a department of transportation or any other administrative division. By default, the ATSPM database is populated with five regions (four numbered, one other). It will be necessary to reconfigure these for the correct local jurisdictions by directly editing them using SQL Server Management Studio. To do so:

1. Log in to the server using SQL Server Management Studio; expand the MOE database and the **Region** table (Figure 4).
2. Right-click and select **Edit Top 200 Rows**.
3. Change the **ID** numbers and **Descriptions** (names) to reflect local jurisdictions.
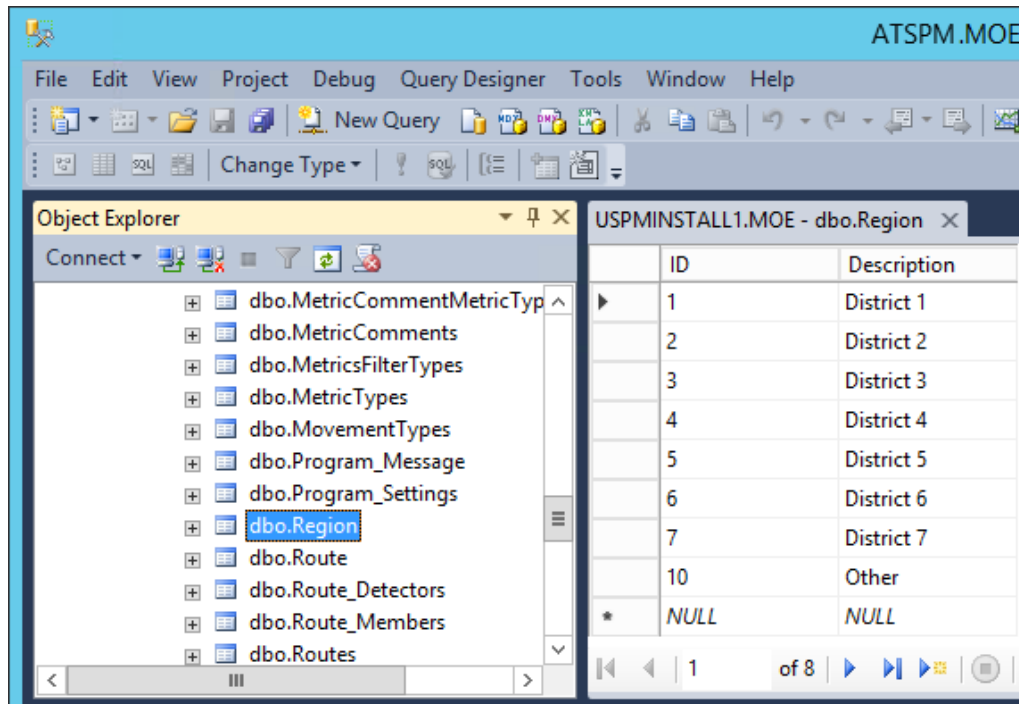
Figure 4: Set up regions in SQL Server Management Studio

2.4. Set up User Accounts

1. Click **Register** on the ATSPM website menu. Create a new account for yourself and any other individuals who will use ATSPM. Verify that the user account(s) can successfully log in to the website.
2. It will be necessary to create administrative accounts. To do so, log in using the default administrative account, which is:
   - Username: defaultadmin@spm.gov
   - Password: L3tM3in!
3. Once logged in, change the password of the default administrative account. Click your email address in the top right corner of the screen, and then **Change your password.**
4. Go to **Admin** > **Security** > **Roles**. Click **Add Role To User**.
5. Assign the administrative role to any desired user.

2.5.   Configure Signals, Approaches, and Routes

1. Log in using an administrative account (created in the previous section).
2. From the top menu, navigate to **Admin** > **Signal Configuration**.
3. Click **Create New Signal**. Enter a unique ID number for the signal. This will create the signal ID within the system database.
4. In the next page, enter the **Primary Name**, **Secondary Name**, **IP Address**, **Latitude**, **Longitude**, **Region**, and **Controller Type** for the signal. Also, choose a **Region** for the signal (these should match those configured earlier).
5. Click **New Phase/Direction** and add at least one approach for the signal, including detector(s).
6. For each approach, click **Detectors** and add any detector hardware.
7. Click **Save** to confirm.
8. Enter any applicable **Comments** for the signal, and check any applicable metrics that apply to the comment. Click **Create** to save the comments and supported metrics.
9. Configure additional signals by repeating the steps above.
10. Create routes (necessary to use the Purdue Link Pivot):
    a. Navigate to **Admin** > **Route Configuration**.
    b. Click **Create New** to begin entering routes utilizing the signal approaches previously created.

2.6.   Configure the "Generate Add Data Script" Component

The **Generate Add Data Script** application is a key website component. It must be scheduled to scan the database periodically, and output the AddData.js file. This javascript file contains geolocated information of each signal in the system, and is used by the map feature in SPM to place signal pins.

To set up this feature, perform the following steps:

1. Navigate to the "\ATSPM Executables\GenerateAddDataScript" folder in the installation media. Copy this folder to a suitable location (for example, the C:\ root).
2. Edit the GenerateAddDataScript.exe.config file in the destination folder.
    a. Find the <connectionStrings> section. Change the "SPM" connection string to the same one used during website setup (see section 2.1 above).
3. Find the <appSettings> block. Change the location of the "Path1" key to the installed location of the website. For example, C:\inetpub\wwwroot\ATSPMWebPage\Scripts\AddData.js. Use **Windows Task Scheduler** to launch the application on a periodic basis:
    a. Open Windows Task Scheduler and select **Create Task**.
    b. On the **General** tab, give the task a suitable name. Run the task as the **SYSTEM** user. The task should be configured to run whether the user is logged in or not. On the **Triggers** tab, create a trigger to begin the task "On a schedule" to start at the current time. Then under **Advanced settings**, repeat it every 15 minutes indefinitely. See Figure 5.
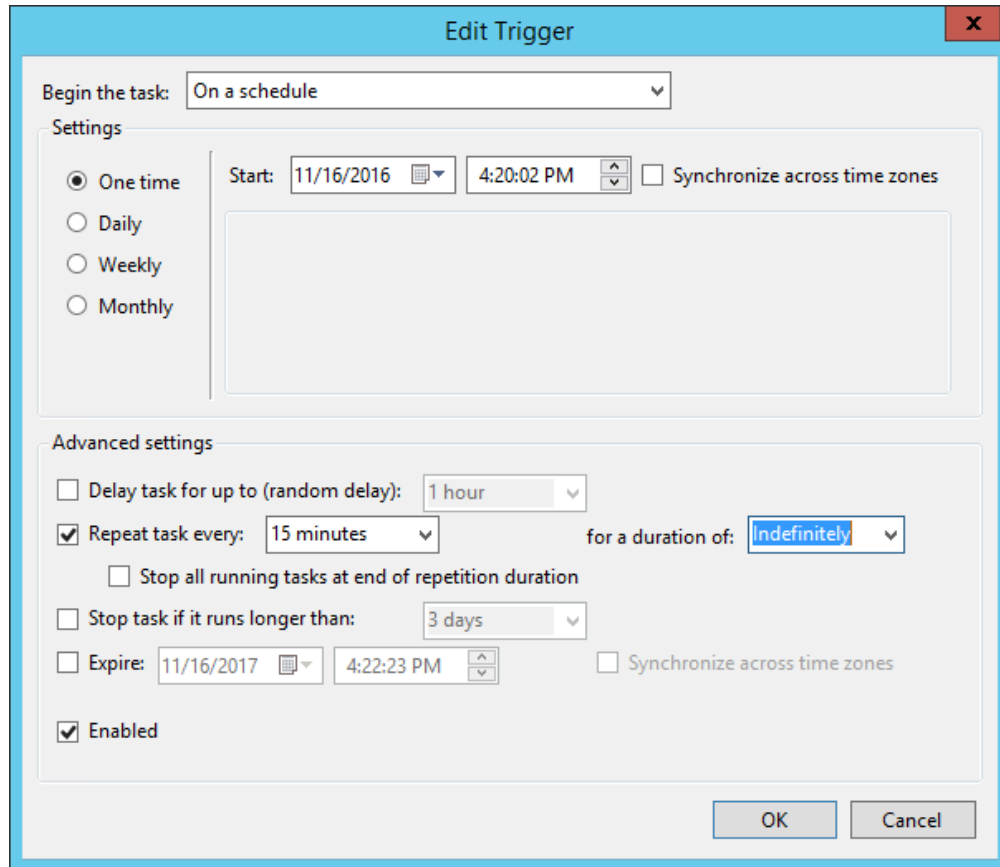
Figure 5: Task trigger setup

c. On the **Actions** tab, direct the task to run the GenerateAddDataScript executable.
d. On the **Settings** tab, check the option to run the task as soon as possible if a scheduled start is missed.
e. Click **OK**. The task should now be listed in the Task Scheduler pane. You may test the task at any time by clicking the **Run** command.
f. Check that the AddData.js file is updating periodically as expected.
g. If ATSPM is running on several different servers, you may copy and insert additional numbered Path keys (Path2, Path3, etc.) to update all servers with a single instance of the executable.
4. By default, the map will center over Utah. You may change this for the local area. To do so:
    a. Open **Map.js** in a text editor. This file is in the same Scripts folder as AddData.js.
    b. Within the GetMap() function:
        i. Change the **credentials** to your organization's Bing maps key.
        ii. Find the line starting with "**center**:". Change the latitude and longitude in Microsoft.Maps.Location() to correspond to the desired location.
    c. Within the GetMapWithCenter() function:
        i. Change the **credentials** to your organization's Bing maps key.

2.7. Create Web Services

It is necessary to install web services utilized by the SPM website. These are the Metric Generator and Link Pivot Service. Follow these steps:

1. Copy the \ATSPM Executables\WCFWebServices folder in the installation media, to C:\inetpub\wwwroot.
2. Add IUSR and IIS_IUSRS roles to this new folder:
   a. Right click the MOEWcfService folder and select **Properties** > **Security**.
   b. Click **Edit** then **Add**.
   c. On the **Select Users or Groups** dialog, enter object names **IUSR** and **IIS_IUSRS**. These will source from the name of the machine.
   d. Grant each default read permissions.
3. Install the services:
   a. In the WCFWebServices folder which was copied, open Web.config in a text editor:
      i. Locate the **ImageLocation** key. Change the file path to the shared SPMImages folder created earlier in this document. Be sure to include the trailing backslash.
      ii. Locate the **ImageWebLocation** key. Change it to the equivalent URL of images, linked to the shared image folder. Be sure to include trailing forward slash. The external URL is recommended; for example: http://mysite.com/SPMImages/
   b. Create the **MOEWcfService** application in IIS, underneath Default Web Site. Point the physical path to the WCFWebServices folder created within wwwroot. Use the same Application Pool as the SPM application.
   c. Browse to the Web.config corresponding to the main ATSPM website (in this case, C:\inetpub\wwwroot\ATSPMWebPage\web.config). Edit the file to correspond to the two new services:
      i. Browse to the end of the file and locate the <client> block.
      ii. Change the endpoint address for link pivot service to the equivalent URL. The external hostname is recommended; for example: http://mysite.com/MOEWcfService/MOEWcfServiceLibrary.LinkPivotService.svc
      iii. Change the endpoint address for the metric generator service to the equivalent URL. The external hostname is recommended; for example: http://mysite.com/MOEWcfService/MOEWcfServiceLibrary.MetricGenerator.svc
   d. Test the services by generating charts (**Charts** > **Default Charts**) and the Purdue Link Pivot (**Charts** > **Purdue Link Pivot**).

2.8. Install the "Import Controller Logs" Component(s)

This section describes installation of the components that retrieve logs from signal controllers. Table 1 specifies which component to install for each controller type. You only need to install components for the signal controller types that will provide data to the ATSPM system.

Table 1: Controller and Component logs to install

Signal Controller Type	Required Component to Retrieve Logs
MaxTime	GetMaxTimeRecords
All other types	FTPFromAllControllers

2.8.1.   Install the "FTPFromAllControllers" component

1. Locate the \ATSPM Executables\FTP\AllFTPControllers folder in the installation media. Copy this folder to a suitable location (for example, the C:\ root).
2. Navigate to the destination folder and open FTPfromallcontrollers.exe.config in a text editor:
    a. Change the **HostDir** to the local path in which you would like downloaded logs to be placed. Include the backslash at the end of the path. (A new folder on the C:\root is recommended, such as C:\DownloadedLogs\).
    b. Change the **SPM** connection string key to point to the database. Use the same string configured for previous components.
    c. Before starting the application for the first time, set the **DeleteFilesAfterFTP** key to false. This key controls whether files are removed from the signal controller after being downloaded. This setting can be changed later (set to true) once this component and the overall system are working correctly.
3. In SQL Server Management Studio, log in to the server and review the contents of the **ControllerTypes** table. If necessary, edit the contents (username, password) to match the controllers in the field.
4. Create a scheduled task to run the executable with recurrence every 15 minutes for an indefinite duration. You may follow the scheduling instructions detailed previously for Generate Add Data Script.
5. Verify that logs are being retrieved from controllers via ftp and being added to the **HostDir** folder. The system automatically creates numbered subdirectories corresponding to the signal IDs configured in the database.

2.8.2.   Install the "GetMaxTimeRecords" Component

1. Locate the \ATSPM Executables\FTP\MaxTime folder in the installation media. Copy this folder to a suitable location (for example, the C:\ root).
2. Navigate to the destination folder and open GetMaxTimeRecords.exe.config in a text editor:
    a. Change the **SPM** key to point to the database. Use the same string configured for previous components.
3. Create a scheduled task to run the executable with recurrence every 15 minutes for an indefinite duration. You may follow the scheduling instructions detailed previously for Generate Add Data Script.
4. Verify that the tool is working correctly:
    a. Check the **Controller_Event_Log** table in SQL Server Management Studio to ensure signal events have been incorporated.

2.9.   Install the "Decode and Import" Component(s)

Table 2 specifies which log decoder to install for each controller type. You only need to install components for the signal controller types that will provide data to the ATSPM system.

Table 2: Decode and Import components to install

Signal Controller Type	Required Log Decoder
ASC3	DecodeAndImportASC3Logs
MaxTime	(No component necessary. The "GetMaxTimeRecords" component installed previously handles database import.)
Peek	DecodePeekLogs
Siemens	DecodeSiemensLogs
Trafficware	DecodeTrafficwareLogs

2.9.1.   Install the "DecodeAndImportASC3Logs" Component

1. Locate the \ATSPM Executables\Decoders\ASC3 folder in the installation media. Copy this folder to a suitable location (for example, the C:\ root).
2. Navigate to the destination folder and open NEWDecodeandImportASC3Logs.exe.config in a text editor:
   a. Change the **ASC3LogsPath** to the local path that contains the downloaded logs. Be sure to include the closing backslash. (In this case, path is C:\DownloadedLogs\).
   b. Change the **CSVOutPath** key to a local folder where decoded logs (CSV files) will reside. Be sure to include the closing backslash. (for example, C:\DecodedASC3Logs\).
   c. Change the **SPMConnectionString** key to point to the database. Use the same string configured for previous components.
   d. Before starting the application for the first time, set the **DeleteFile** key to false. This key controls whether downloaded controller logs are deleted after being decoded. This setting can be changed later (set to true) once this component and the overall system are working correctly.
3. Create a scheduled task to run the executable with recurrence every 15 minutes for an indefinite duration. You may follow the scheduling instructions detailed previously for Generate Add Data Script.
4. Verify that the tool is working correctly:
   a. Check the **CSVOutPAth** location for decoded files (note: this CSV output has to be enabled in the code, then the program recompiled in Visual Studio).

b. Also, check the **Controller_Event_Log** table in SQL Server Management Studio to ensure signal events have been incorporated.

2.9.2.   Install the "DecodePeekLogs" Component

Retrieval and ingestion of information from Peek controllers is configured on a case-by-case basis. Consult a Peek representative for configuration of ATSPM deployments for use with Peek hardware.

2.9.3.   Install the "DecodeSiemensLogs" Component

1. Locate the \ATSPM Executables\Decoders\Siemens folder in the installation media. Copy this folder to a suitable location (for example, the C:\ root).
2. Navigate to the destination folder and open DecodeSiemensLogs.exe.config in a text editor:
    a. Change the **DecoderPath** key to the full path of the SiemensDecoder.exe file. (The path must include SiemensDecoder.exe). To obtain this executable, contact Siemens.
    b. Change the **LogPath** key to the local path that contains the downloaded logs. Be sure to include the closing backslash. (In this case, path is C:\DownloadedLogs\).
    c. Change the **CSVOutPAth** key to a local folder where decoded logs (CSV files) will reside. Be sure to include the closing backslash (for example, C:\DecodedSiemensLogs\).
    d. Change the **SPMConnectionString** key to point to the database. Use the same string configured for previous components.
    e. Before starting the application for the first time, set the **DeleteFile** key to false. This key controls whether downloaded controller logs are deleted after being decoded. This setting can be changed later (set to true) once this component and the overall system are working correctly.
3. Create a scheduled task to run the executable with recurrence every 15 minutes for an indefinite duration. You may follow the scheduling instructions detailed previously for Generate Add Data Script.
4. Verify that the tool is working correctly:
    a. Check the **CSVOutPAth** location for decoded files.
    b. Also, check the **Controller_Event_Log** table in SQL Server Management Studio to ensure signal events have been incorporated.

2.9.4.   Install the "DecodeTrafficwareLogs" Component

1. Locate the \ATSPM Executables\Decoders\TrafficWare folder in the installation media. Copy this folder to a suitable location (for example, the C:\ root).
2. Navigate to the destination folder and open DecodeTrafficwareLogs.exe.config in a text editor:
    a. Change the **DecoderPath** key to the full path of the SiemensDecoder.exe file (The path must include SiemensDecoder.exe). To obtain this executable, contact TrafficWare.
    b. Change the **TWLogsPath** key to the local path that contains the downloaded logs. Be sure to include the closing backslash (In this case, path is C:\DownloadedLogs\).
    c. Change the **CSVOutPAth** key to a local folder where decoded logs (CSV files) will reside. Be sure to include the closing backslash (for example, C:\DecodedTrafficWareLogs\).
    d. Change the **SPM** connection string key to point to the database. Use the same string configured for previous components.

      e.   Before starting the application for the first time, set the **DeleteFile** key to false. This key controls whether downloaded controller logs are deleted after being decoded. This setting can be changed later (set to true) once this component and the overall system are working correctly.

3. Create a scheduled task to run the executable with recurrence every 15 minutes for an indefinite duration. You may follow the scheduling instructions detailed previously for Generate Add Data Script.
4. Verify that the tool is working correctly:
   a. Check the **CSVOutPAth** location for decoded files.
   b. Also, check the **Controller_Event_Log** table in SQL Server Management Studio to ensure signal events have been incorporated.

2.10. Install the "Speed Listener" Component

Note: The Speed Listener only works with Wavetronix SmartSensor™ Advance, and only when the device is configured to deliver speed data. The Approach Speed Measure is the only the only metric which uses this data. Hardware setup steps specific to ATSPM are required; please see Appendix A in this document for additional information.

1. Locate \ATSPM Executables\WavetronicsSpeedListener in the installation media. Copy this folder to a location where you want to store the Speed Listener Service Components (for example, the C:\ root).
2. Open a command prompt and use the "installUtil.exe" program to install the Speed Listener executable as a service. The location of the installUtil.exe can be different depending on your operating system version. The command, however, will look something like this:
   c:\windows\microsoft.net\framework\v4.0.30319\installutil.exe
   C:\WavetronicsSpeedListener\WavetronicsSpeedListener.exe
3. Navigate to the destination folder and open WavetronicsSpeedListener.exe.config in a text editor. Change the **SPM** connection string key to point to the database. Use the same string configured for previous components.
4. Using the Services Control Panel, set the SpeedListener service to start automatically. Press the **Start** button to start the service.

2.11. Install the ATSPM Watchdog Component

The ATSPM Watchdog component must be installed and configured if email notification of system-wide events is desired. This component requires that an SMTP server be available for sending ATSPM emails; SMTP can be installed on the same machine that hosts the ATSPM website.

1. Locate the \ATSPM Executables\SPMWatchDog folder in the installation media. Copy this folder to a suitable location (for example, the C:\ root).
2. Navigate into the destination folder and open SPMWatchDogNew.exe.config in a text editor:
   a. Change the **SPM** connection string key to point to the database. Use the same string configured for previous components.

      b.   Change the **EmailServer** key to the proper SMTP server. If the SMTP server is hosted on the same machine running watchdog, use the machine's network name.

      c.   The **ToAddress** field is optional. This address will always receive a copy of the watchdog email, in addition to the applicable addresses in the database.

3. Before running the Watchdog for the first time, ensure that the desired users are configured to receive emails. Currently this is managed by connecting directly to the database. To do so:

      a.   Open SQL Server Management Studio and log in to the server.

      b.   Find the **AspNetUsers** table in the MOE database. Right click it and edit the top 200 rows.

      c.   Set the **ReceiveAlerts** flag to 1 for the user(s) who will receive emails.

4. If desired, you may execute the program at this time. If it is working correctly, it will immediately send an email to the users(s) signed up for alerts.

5. Create a scheduled task to run the executable with recurrence every 24 hours for an indefinite duration. Watchdog by default scans between 1:00 and 5:00AM, and between 5:00 and 6:00PM the previous day. Hence, 7:00AM is highly recommended for scheduling WatchDog to have a complete set of data. You may follow the scheduling instructions detailed previously for Generate Add Data Script.

2.12.   Configure Menus

The final step of installation is to customize menus. To do so, go to **Admin** > **Menu Configuration**.

The **Menu Configuration** screen lists all menu items available in this installed instance, including nested items. To create a new menu item, click **Create New**. To edit an existing menu item, click **Edit**. To delete an existing item, click **Delete**. To view details of an existing item click **Details**.

Using these commands, it is possible to edit and view parameters of each menu item. These parameters are:

- **MenuId:** A unique, numeric ID (starting at 1) identifying the menu item. This number has no relation to the ordering or hierarchy of the item.
- **MenuName:** The displayed name of the menu item
- **ParentId**: For nested menu items, this is the MenuId of the parent command. For top-level menu commands, the ParentId is 0.
- **DisplayOrder**: A number designating the order the menu item appears in its hierarchy level. The number increases from left to right for top-level menu items, and from top to bottom for nested items.
- **Controller**: The name of the controller in the ATSPM website the command uses. The available controllers are detailed in Table 4 below.
- **Action:** The action invoked within the controller to complete the menu command. The available actions, sorted by parent controller, are detailed in Table 3 below.
- **Application:** The main ATSPM web application as named in IIS; for example, SignalPerformanceMetrics. This will be the same for all menu items in the system.

Note that web hyperlinks on the **Links** menu must be manually added in the database. These can only be added to the bottom of the Links menu. The rest of the Links menu and submenus are configured as described above.

To configure web hyperlinks on the Links menu:

- Open SQL Server Management Studio, log in to the server, and navigate to the **ExternalLinks** table in MOE.
- Right-click the table and select **Edit Top 200 Rows**.
- Add, modify, or remove URLs as needed; see Figure 6 below.
    - **ExternalLinkID** is automatically populated when a new URL is added.
    - **Name** is the name of the link as it will appear on the menu.
    - **Url** is the complete web address, starting with http://.
    - **DisplayOrder** controls the ordering of the links at the bottom of the Links menu.

Table 3: Controller and action pairs for menu configuration

| Controller	Action	Function
#	#	Spawn another menu level within the current level
Account	RoleIndex	Account role configuration
ActionLogs	Create	Log Action Taken
ActionLogs	Usage	Chart usage report
Approach Routes	Index	Route configuration screen
DefaultCharts	Index	The main signal performance measures (excluding Purdue Link Pivot)
FAQs	Display	Frequently asked questions list
Home	About	ATSPM "About", or welcome, page
Images	(a filename)	Display the file (PDF, image, etc) in web browser
Link Pivot	Analysis	Purdue Link Pivot
Signals	Index	Signal configuration screen
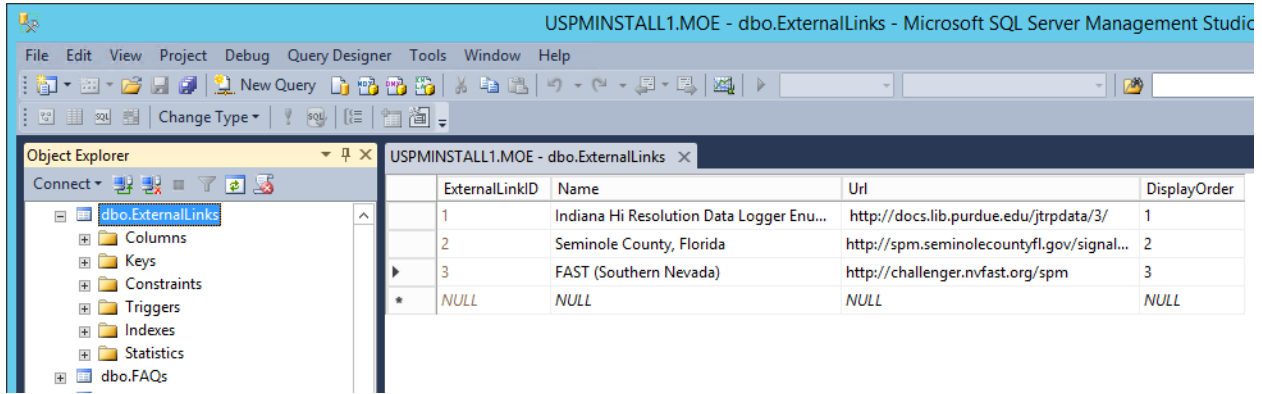
Figure 6: Customize web addresses for the Links menu

Appendix A.   Wavetronix SmartSensor Advance Configuration

In order to use a Wavetronix SmartSensor Advance with the ATSPM Speed Listener, it is necessary to configure the hardware to communicate with the system. There are two components of relevance to ATSPM, a Serial to Ethernet converter and the SmartSensor Device itself. UDOT has used the DIGI PortServer TS 4 serial to Ethernet converter (aka "Digi") in order to retrieve speed data from the Wavetronix SmartSensor Advance; however, other serial to Ethernet converters may work as well.

This appendix only covers configuration specifically related to ATSPM connection using Digi PortServers. For further information on SmartSensor configuration, please contact Wavetronix.

A.1.   Serial to Ethernet Converter Configuration

Configure each port pushing speed data on the Digi as follows:

Set the Port Profile to either TCP or **UDP Sockets** (Select **Change Profile** to make a change). TCP sockets are preferred as they are more secure, more reliable and are native to the Wavetronix Advance and Matrix SmartSensors (as they are written around TCP internet protocols).

TCP:

1. Under the TCP Server Port Security Settings, check the box **Only allow network access from the following devices or networks**. In the **IP Address:** box, type in the IP address of the server to receive the data. Under the Advanced Serial Settings **Terminal Type**: box , type in "vt100", enable **Verbose connection status message** and enable **Enable RTS Toggle** with 0 ms for both Pre-delay and Post-delay.
2. Click the **Apply** button.

UDP:

1. Under the UDP Client enter the following settings: In the **Send data to:** box, type the name of the SPM server in **Description**, its IP address in **Send To,** "10088" in **UDP Port**, then click the **Add** button. Both this IP address and port must be publicly accessible.
2. Check the **Send data when the following string is found** checkbox, and select the **Custom string** radio button. In the text box underneath **Custom string**, type "\r\r".
3. Clear the **Send data after the following number of idle milliseconds** checkbox.
4. Click the **Apply** button.

Figure 7: Wavetronix Serial to Ethernet setup

A.2.　SmartSensor Advance Configuration

1. Ensure that the sensor is updated to Advance 3.2.0 software version.
2. Connect to the Sensor, open the Sensor Settings UI and open the Communication Tab. At the bottom of this tab ensure that Remove Multi-Drop Prefix is set to OFF. Click **OK**.
3. Open Channel-Alerts-Zones UI, Open Setup Output Communication.
4. In the Select trigger speed options area, use the dropdown next to **Port** to select the proper port to monitor for speed. This is usually the port that is not already selected in the top portion of this interface. For example, Figure 8 shows "Port 2" selected in the "Select port to transmit output:" field, so speed trigger port will be "1").
5. Also in the Select trigger speed options area, use the dropdown next to Channel to select "2". Complete the textbox next to Tag with the Signal ID of the intersection, and the detector channel number of this detector. (Example - Signal ID is "8403". The detector channel is "8". The tag must be a six-digit number, so the number in the Tag box must be "840308").
6. Click **OK**, Click the **Save** icon (the button that looks like a briefcase with a lightning bolt on it). When the save operation is complete, click **Close** and follow prompts to disconnect.
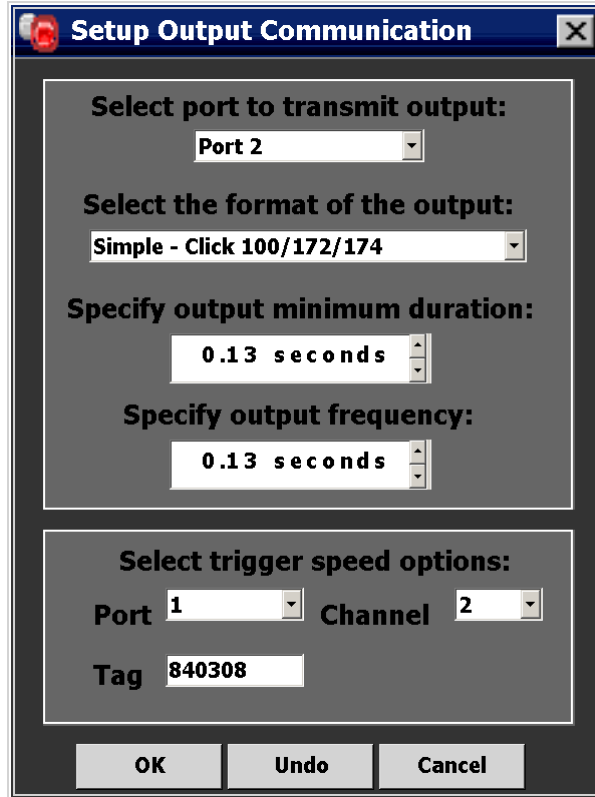
Figure 8: Wavetronix SmartSensor Advance Setup

Appendix B.   How to add a new measure

ATSPM has a modular architecture allowing the user to add new charts (measures) to the system. The directions below require Microsoft Visual Studio 2013 or later, and assume basic software development skills.

1. Open the MOE database in SQL Server Management Studio. Add an entry into the MetricTypes table with the name of your new chart.
2. Launch Visual Studio on the development machine and open the Signal Performance Metrics solution.
3. Create a class in MOE.Common -> Business -> WCFServiceLibrary that inherits from the MetricOptions class.
4. Add the [DataContract] attribute to this new class.
5. Mark any property required to build your class with the [DataMember] attribute so that it can be serialized and sent to the WCF service.
6. Create your business logic objects. Make sure that any new tables are created through Entity Framework. All new tables should have corresponding repositories found in MOE.Common -> Models -> Repositories.
    a. If new tables are created a new Entity Framework migration will need to be created. Please see https://msdn.microsoft.com/en-us/library/jj554735(v=vs.113).aspx for more information.
7. From the CreateMetric method in the MetricOptions class you created in step 3, call base.CreateMetric(), then load your business objects. This function should return a string array with the location of the images through IIS.
8. In the MOEWcfServiceLibrary project, open the IMetricGenerator class and add the following for your new MetricOptions class:
    ```
    [ServiceKnownType(typeof(MOE.Common.Business.WCFServiceLibrary.YourNewM
    etricOptions))]
    ```
9. In the SPM project, add a new partial view that takes your new MetricOptions class as the model.
10. In the SPM project DefaultChartsController class, add a line in the MetricOptions(int id) method that returns your new partial view.
11. In the SPM project DefaultChartsController class, add a method that accepts your new MetricOptions class as an argument. This class should open a new client to the metric generator service, pass your metric options to it and get back a string array of image locations. It should then return the MetricResults partial view with your populated string array as the model.
12. Modify Index.cshtml file found at SPM -> Views -> DefaultCharts. Add a line in the scripts section that uses Razor to build the url to the DefaultChartsController. This will ensure the url is correct wherever it is installed.
13. Modify the GetMetric.js script found at SPM -> Scripts. Add a function that collects the options the user has selected from the web page and passes them to the DefaultChartsController method you created in step 11. Use the GetCommonValues() to add the base MetricOptions properties to the collection. Use the GetMetric() function to make the call to the DefaultChartsController.
14. Modify the GetMetric.js script found in SPM -> Scripts. Change the $('#CreateMetric').click() function to call the function you created in the previous step.