PeMS 14.0 – Release Notes

Summary of Changes

1) The *Top Bottlenecks* Report supports multiple speed threshold options for the delay values presented.
2) Algorithm changes including:
    a. More accurate speed estimation
    b. More accurate aggregation over lanes and over time
    c. More accurate Long Term Trends calculations
3) All historical PeMS measurements were reprocessed using the new algorithms enumerated in step 2 above.
4) Added support for Conventional Highway Vehicle Detector Stations (VDSs) and updated the computation of aggregate spatial performance measures to reflect the arterial nature of the roadway on conventional highways.
5) When running most Performance reports, a small widget has been added to indicate any incidents or lane closures that took place within the spatial and temporal boundaries of the report.
6) There is a new *Export to PDF* function
7) The PeMS Search engine has been improved
8) Support for Tag Readers and new Tag Reader reports are available
9) There are additional data sets available in the Data Clearinghouse

Details

1. The *Top Bottlenecks* Report now supports multiple speed threshold options for the delay values presented
    - The Performance > Bottlenecks > *Top Bottlenecks* report displays the Total Delay or Average Delay (in vehicle-hours) associated with each bottleneck. With this PeMS update, the user now can select the desired speed-threshold value from the set of (35, 40, 45, 50, 55, or 60 mph) that is used to calculate the hours of delay. In PeMS versions before 14.0, the delay calculation used a fixed speed threshold value of 60 mph.

2. Algorithm changes including:
    a. More accurate speed estimation

        G-factor estimates are now more robust because:
        - The new logic better handles certain situations like:
            - More long vehicles during the daytime
            - Low volume during the early morning hours (the previous algorithm would occasionally incorrectly indicate low speeds in the middle of the night)
        - The computational complexity is significantly reduced as hourly data drives the calculation instead of the previously used five-minute data.

- More accurate estimates for speed are generated immediately when a station starts to report measurements. Previously when a new station was activated, a generic g-factor was used to estimate speed until a station-specific value was created in the bootstrap process. The generic g-factor sometimes produced erroneous speeds/delays. Now a station-specific g-factor is calculated immediately.

b. More accurate aggregation over lanes and over time

PeMS now uses flow-weighted harmonic mean speed instead of arithmetic mean speed when aggregating over lanes and over time. For example, when calculating the speed for a segment, a lane's speed is weighted by its flow. So a lane with a higher flow contributes more to the segment speed than a lane with a smaller flow.

Effect of this change is that now:

- Individual lane Vehicle Hours Traveled (VHT) now sum to the station VHT.
- Station's Q (= VHT / VMT) now equals station speed.
- Station's hourly VHT is now equal to the sum of the temporally included 5-minute VHTs.
- Station daily VHT is now equal to the sum of the temporally included hourly VHTs.

c. More accurate Long Term Trends calculations

When calculating delay over monthly intervals, PeMS now sums the individual daily delays. Previously, the average speed and flow over the monthly interval drove the calculation.

The effect of this change is that delays are almost always a bit larger than those calculated using the old algorithm. This is a result of the flow being stable over days in most cases; hence Jensen's Inequality applies. That is, Avg(1/speed) > 1/Avg(speed)

3. All historical PeMS measurements were reprocessed using the new algorithms enumerated in step 2 above

Reprocessing historical measurements using the updated algorithms has created a more accurate historical record of traffic activity on California freeways. A few observations about the results:

- Correcting the anomalies enumerated in #2 above gives high confidence in the VHT calculations.
- Changes in the Vehicle Miles Traveled (VMT) values are at least partially due to the correction of a small aggregation anomaly that is experienced during real-time operation, but not experienced in historical reprocessing. The root cause of the discrepancy is that, in real-time mode, measurement collection can be delayed beyond when an aggregation operation starts for a time interval. For

example, during the five minute aggregation from 00:00:00 to 00:05:00, imagine that the measurements from 00:04:55 are not received until 00:05:30 and the aggregation begins at 00:05:15. So, the 5-minute aggregation will not include the 00:04:55 data in the aggregation calculation. Fortunately, this anomaly does not appear with historical reprocessing. Thus, more accurate values for VMT estimates are produced.

4. Added Support for Conventional Highway VDSs

   Uses of measurements from detectors installed on conventional highways now reflect the arterial nature of those roadways. The fundamental change is that the assumption for freeways – that free-flow speed is exhibited during low levels of occupancy – is not true for arterials as signals constrain vehicular speed. Thus, the two areas of change are:
   - Estimating the speed at these stations is different from Freeways in that a "fixed reasonable" g-factor is used, instead of a calculated g-factor. This yields estimated speeds that are more accurate than those produced by earlier versions of PeMS for this type of station.
   - Collected measurements are not included in rollups for spatial measures. It's important to note that this change reduces Delay and VMT values when compared to those produced by the previous releases of PeMS because the conventional highway stations are no longer included in the calculations.

   The stations designated as residing on Conventional Highways can be displayed by opening the Inventory Map and checking the box to display the icons for *Conventional Highways - Mainline*. With the release of PeMS 14.0, District 3 has 18 Conventional Highway Stations, District 5 has 6, District 10 has 116, and District 11 has 7.

5. When running most Performance reports, a small widget has been added to indicate any incidents or lane closures that took place within the spatial and temporal boundaries of the report.

   The objective of this update is to provide immediate insight into the cause(s) of congestion displayed in the performance reports. If any roadway incidents or lane closures took place on the section of roadway(s) and within the time constraints of the report, the small widget contains the number of occurrence(s). There are four components to the widget:
   - The Yield sign and the number to the right of it, indicate the number of CHP Incidents.
   - The Cone and the number to the right of it, indicate the number of Lane Closures.
   - The Circle enclosing a bar and the number to the right of it, indicate the number of TASAS accidents (Caltrans users only).
   - The Notepad and the number to the right of it, indicate the number of Administrative Notes that meet the space and time constraints of the report. Administrative Notes are a new feature in which users with administrative rights can add information about data (e.g., the data feed in District X was not operational from 3/1/2014 to 3/2/2014).

6. Exporting to PDF is now supported in most PeMS reports.

An *Export to PDF* button has been added to most reports to produce a PDF-formatted document containing the chart and the underlying tabular data that is currently being displayed. Note that the report appears in a new tab within the user's browser, assuming that the browser is configured to enable this operation. If the user wishes to save the PDF content, please use the browser's *Save to File* function. The procedure is different for each browser type. Here are a few examples describing how to do this:

- Internet Explorer 8, running on Windows 7:
    - Select the floppy-disk icon that is on the left of the browser tool bar that appears at the bottom center of the screen
    - The Save a Copy dialog appears, specify the filename and click *Save*
- Internet Explorer 9, running on Windows 7:
    - Select the Tool widget, it looks like a gear, in the top right of the browser
    - Select *File* and then *Save as*
    - The Windows Save dialog appears, specify the filename and click *Save*
- Google Chrome , running on Windows 7:
    - Select the floppy-disk icon that is in the lower right of the browser tab
    - The Save As dialog appears, specify the filename and click *Save*
- Mozilla Firefox, running on Windows 7:
    - Select the download icon in the upper right of the browser
    - Choose to Open in Adobe Acrobat, and then save the file using Adobe Acrobat

7. A new search engine has been embedded into PeMS to facilitate locating the large number of objects within the system. The text box for entering the search string can be found in the top right of the PeMS application. To use this function, simply enter the search string into the text box and click on the Search button found immediately to the right of the text box. The search function is designed to work in four modes:
    - Geospatial Search – To find items based on their location or placement in other areas/objects, use the terms 'in' or 'on' as appropriate.
        - Stations on 880
        - Controllers in district 4
        - Everything on 80
    - Keyword Search – To find things based on their description such as field element names, route names, etc., simply enter a few keywords in the search box. Use double quotes to search for phrases.
        - "Bay Bridge"
        - Ashby
        - 80-E
        - I80-E
        - CMIA D7
        - Mainline stations 101
    - ID Search – To search for specific field element(s) (LDS, VDS, etc.) by ID, simply enter the numeric ID.
        - 314157

- Lat-Long Search – To find things around a specific latitude-longitude, simply enter the latitude and longitude in decimal degrees.
    - 33.8832, -118.0275

8. Support for Tag Readers added to PeMS

Tag readers can now be added to PeMS and the collected data displayed in three ways:

- The number of reads completed by a reader over time
- The travel time between two tag readers over time
- A travel time matrix showing the travel times between readers, containing a maximum of eight readers, over time.

Adding a tag reader requires System Administration privileges. If you have this right, follow the steps below to add a tag reader:

a. Verify that the make and model of the tag reader you wish to install is supported by PeMS.
b. Log into PeMS and select the *System Administration* link located under the Tools menu.
c. The System Administration Dashboard appears, select the *Tag Reader Management* link found in the User Content Section.
d. The Configuration screen appears. Select the *Add New Reader* button.
e. A Reader Info form appears, enter appropriate text into each of the text boxes and click the Save button located in the lower right corner of the form.
f. The newly configured reader will appear on the map and will be placed at the appropriate latitude/longitude.
g. Contact PeMS support if the tag reads are not being collected within 10 minutes. Some readers require a manual step where an API key is entered in the database. Note that matching tag reads for a vehicle may require up to 10 minutes after the trip is complete.

The Tag Reader report can be found within the PeMS menu bar under Performance > Tag Readers > Map. The report contains the three report types mentioned above. Selection is accomplished by radio buttons at the top left of the report. Selection of the tag reader to report against is accomplished by selecting the labels found on the map. The report types operate as follows:

- **Tag Count** – displays the number of tag counts per 5-minute interval over the time range selected. Note that only one tag reader may be selected at a time and selecting another removes the previous reader from the report, leaving only the newly selected one.
- **Travel Time** – displays the travel time between two readers over the time interval selected. Note that exactly two tag readers must be selected for this report to operate. Selecting a third causes the first selected tag reader to be replaced by the third one.
- **Travel Time Matrix** – displays the average travel time and the number of observed trips between pairs of tag readers. Two to eight tag readers may be selected for this report. Each interior cell of the matrix contains the average trip time between the two

stations and, in parenthesis, the number of trips observed in the requested time interval.

9. Additional Data Sets Available in the Data Clearinghouse

Additional data sets are now prepared for download using the Data Clearinghouse User Interface that can be found under the Tools menu on the left column of PeMS immediately after a successful login. The additional data sets are:

- CHP Incidents Day
- CHP Incidents Month
- Census Trucks Hour
- Census Trucks Day
- Census Volume Day Daily
- Census Volume Day Monthly
- Census V-Class Hour
- Census V-Class Day
- Census Station Definitions
- FasTrak 5-minute
- FasTrak Hour
- FasTrak Day
- FasTrak Location Sets
- Re-ID Raw
- Re-ID 5-minute
- Re-ID Hour
- Re-ID Station Definitions

Open the Data Clearinghouse User Interface for a detailed list of data available in each data set. Note that the data sets are separated into one-month increments.