Using the Caltrans Performance Measurement System (PeMS) for TCR’s

Jane Berner and Tim Hart
Caltrans HQ, Division of Traffic Operations

jane_berner@dot.ca.gov, (916) 654-2843
timothy_hart@dot.ca.gov, (916) 651-5324

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Outline for Today’s Presentation

► General overview of PeMS and how it works
► How to log into PeMS
► How to navigate and find data in PeMS
► How to find specific performance measures for TCRs
► Tips for analyzing data and getting help
What is PeMS?

➤ A website that *anyone* can access:  [http://pems.dot.ca.gov](http://pems.dot.ca.gov)

➤ A centralized traffic data warehouse
   - Near real-time and historical data
   - Including data collected through automated detection
     ➤ Over 37,000 detectors deployed on urban freeways throughout California

➤ A data visualization and analysis tool

➤ A system that enables system monitoring and evaluation
Where does PeMS fit into Caltrans’ Mobility Pyramid?

- PeMS lies at the base of the mobility pyramid under “System Monitoring and Evaluation”
  - PeMS allows planners, engineers, and policy makers to track system performance across most urban freeways and other facilities
  - Causes of problems can be identified for further investigation
  - Data are presented historically and in real time
A detector is a device that:

- Measures the number of vehicles (flow or volume) and how long they remain over the detector (occupancy) on a facility for each lane; sometimes it measures speed directly.

- Reports data on a cycle to the controller (typically every 30 seconds).

- Forms the basis of PeMS.

- Comes in many types of devices:
  - Inductive loops, magnetometers, radar.
How is data sent to PeMS?

- Detection on the road measures flow, occupancy, and sometimes speed

- Vehicle Detector Station = VDS or “Station”
  - Set of detectors
  - Covering all lanes
  - In one direction of travel
  - Monitoring one type of facility (e.g., on-ramp, off-ramp, mainline, HOV)
Data in PeMS

- More than data from our automated, real-time detectors

- Traffic Census station data
  - Non-real-time volume data and AADTs from all over the state

- Weigh-in-Motion (WIM) and vehicle classification data
  - Approximately 100 locations

- Caltrans Photolog

- Electronic Toll Collection (ETC) tag data
  - Provides travel times in the San Francisco Bay Area

- Incident data
  - Real-time and archived CHP data, and archived accident data from TASAS (for Caltrans users only)

- Lane Closure System
  - Real-time and archived lane closure information

**Items in blue are available in all districts**
Types of TCR Data in PeMS

- Annual Average Daily Traffic (AADT)
- Vehicle Miles Traveled (VMT)
- Daily Vehicle Hours of Delay (DVHD)
- Bottleneck Locations
- Peak Hour/Peak Period Data
- Managed Lanes (HOV) Data
- Travel Time Reliability
- Level of Service (LOS)
# How can data be analyzed in PeMS?

<table>
<thead>
<tr>
<th>Object in PeMS</th>
<th>Description</th>
<th>How to find?</th>
<th>Example</th>
<th>Example Report</th>
</tr>
</thead>
<tbody>
<tr>
<td>Station</td>
<td>Individual sensor point</td>
<td>Know the ID, search on map, know the location</td>
<td>VDS 317842</td>
<td>Flow versus time</td>
</tr>
<tr>
<td>Freeway Segment</td>
<td>Arbitrary section of a freeway</td>
<td>Know the freeway and the postmile range</td>
<td>I-80 from PM 75 to PM 85</td>
<td>Delay versus time of day</td>
</tr>
<tr>
<td>Route</td>
<td>Predefined freeway segment</td>
<td>Know the name of the route</td>
<td>“D03 Davis-Sacramento”</td>
<td>Travel time versus time</td>
</tr>
<tr>
<td>Corridor</td>
<td>Route with extra features</td>
<td>Know the corridor name</td>
<td>“22A: Placer I-80”</td>
<td>Animations</td>
</tr>
<tr>
<td>Managed Facility</td>
<td>Route on a freeway with HOV/HOT facilities</td>
<td>Know the facility name</td>
<td>“D03 US50”</td>
<td>HOV demand versus ML demand</td>
</tr>
</tbody>
</table>
Accessing PeMS on the Internet

Login with your username and password

If you don't have an account, you can apply for one. It is usually instantaneous.
Clicking on the PeMS logo always takes you back to this homepage.

Return to your homepage (specify under your account settings by clicking on your username).

Jump to Maps – Real-Time for current conditions, Performance for data visualization, and Inventory to find detector locations.

Dashboards for high-level information; click “more” links for additional details.
More Homepage Navigational Tips

- Report tabs
- Report Finder – a short cut for finding traffic data
- System-wide help. General topics not specific to a single page (e.g., Calculations)
- Jump to a District Dashboard, or to county, city or freeway-specific pages
- Important announcements
How do I get to the data I want?

➤ Three Main Paths
  – The Inventory Map
  – By navigating through the Facilities & Devices > Freeways list from the statewide, district, or county pages
    ➤ Primary way that we will cover
  – The Report Finder (a shortcut)
Map-Based Navigation
Best for point analysis, but great for understanding where detection is located

Click on the Inventory Map link
Map-based Navigation

- **Inventory Map** displays devices (mainly VDS and Census Stations) over a geographic area.
- You can turn on and off the various types of devices.
- Click on an icon to view details and links to data.

[Image of the PeMS 12.2 interface with various elements labeled: Inventory Map, Zoom in to district, Turn on Mainline detector stations (VDS), Click on title to jump to the VDS’ configuration page.]
Station Configuration Page

- Shows what we know about a station

- Contains:
  - Map
  - Description
  - Configuration change history
  - TSN information for this location

All the reports about this object in PeMS. The Performance tab takes you to data for this VDS.

Reference information stays fixed
Map-based Navigation

- Traffic Census sensor locations can also be viewed in PeMS

Choose Truck Weights to see WIM stations

Turn on Traffic Census Stations
List-based Navigation

► We’re back on the PeMS Homepage

► Useful when you want to analyze a freeway segment, instead of a single location (one VDS). Most TCR performance measure can be obtained using this navigation method.

► We can first jump to a district using the Quick Links

Select D7 LA/Ventura
List-based Navigation

- Note that we are now on the D7 homepage.
- Scroll over “Facilities & Devices” on the toolbar at the top of the page. Click on “Freeways.”

Select: Facilities & Devices > Freeways

Indicates D7 Homepage
Select a Freeway-Direction to analyze. We will choose the Northbound direction of I-5.

Click on the #VDSs (209) for I-5 North.
List-based Navigation

- This is the homepage for this freeway-direction (I-5 N) in District 7.
- You can see a list of all of the VDS on this facility.

The Performance pull down menu is your entry-point to data.

You can view detection present at different points in time.
Finding Data

- Data for the freeway is found under the Performance tab.
- To look at performance measures for TCR’s outlined in the new TCR Guidelines including VMT and Delay, let's start with Performance > Aggregates > Time Series.
Finding Data for TCR’s

Select days to limit search
Enter Absolute postmiles

Use pull down menu to choose performance measure
Absolute Post Miles

- PeMS uses Absolute Postmiles
- Click on View Crossings to bring up list of postmiles
- This example is US-50 in D03 from Sunrise Blvd. to Folsom Blvd.
After making selections click on “Draw Plot” to view data graphically or “View Table” to view tabular data.
Finding AADT Data

- To find AADT within a TCR segment, go to Performance > Planning Analysis > Spatial AADT

- Can limit AADT search to defined TCR segment. Use Abs postmiles.

- The Volumes Book is a good resource for AADTs. A reason to use PeMS is to evaluate more recent data.
Finding AADT Data

Select the starting month and year (e.g., Jan 2011 gives you the AADT for Jan – Dec 2011)

Can select Mainline or HOV data under station type

Select from multiple AADT values within segment

Click View opposite direction of travel to analyze opposite direction
AADT Data

Note that PeMS calculates AADT for each freeway-direction separately, and also separates the mainline AADT from HOV AADT.

About This Report is a resource for more information about the report calculations. Clicking on it will bring up a pop-up window. Here we can read about the different AADT calculations.
Finding Bottlenecks

Select Performance > Bottlenecks > Top Bottlenecks

To find bottlenecks in TCR segment, enter Abs postmiles

Sort by # Days Active

Note that bottlenecks can form in both the mainline (ML) and in the HOV (HV) lane. There may be nearby bottlenecks that should be combined into one.
Tips for Analyzing Bottlenecks

➢ Traffic Operations prepares the Mobility Performance Report (MPR – formerly HICOMP) and we evaluate bottlenecks
  – Over a calendar year (e.g., Jan 1, 2012 to Dec 31, 2012)
  – Look for bottlenecks active on at least 50 days (or 20% of all weekdays) in the year
  – Average duration of at least 15 minutes
  – Average vehicle hours of delay of at least 100
  – Goal: find the recurrent bottlenecks resulting in significant congestion
Photolog Interface

From PeMs homepage click Photolog link

Click and drag car to desired study location

Expand/Collapse video

District drop down menu

Expand/Collapse roadway details
PeMS Best Practices

- Be mindful of Detector Health (Percent Observed)
- Shown in plots and tables, and in Excel downloads
- PeMS imputes, or estimates, data for whatever percentage is not observed

<table>
<thead>
<tr>
<th>Month</th>
<th>VMT</th>
<th># Lane Points</th>
<th>% Observed</th>
</tr>
</thead>
<tbody>
<tr>
<td>02/01/2012</td>
<td>327,839,641.43</td>
<td>8,199,360</td>
<td>69.0</td>
</tr>
<tr>
<td>03/01/2012</td>
<td>667,115,614.82</td>
<td>16,895,823</td>
<td>66.0</td>
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<tr>
<td>04/01/2012</td>
<td>653,191,926.05</td>
<td>16,372,600</td>
<td>67.0</td>
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<tr>
<td>05/01/2012</td>
<td>692,725,579.62</td>
<td>17,142,878</td>
<td>68.0</td>
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<tr>
<td>06/01/2012</td>
<td>689,017,774.83</td>
<td>16,666,560</td>
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</tr>
<tr>
<td>07/01/2012</td>
<td>718,030,364.80</td>
<td>17,293,193</td>
<td>62.0</td>
</tr>
<tr>
<td>08/01/2012</td>
<td>731,667,663.92</td>
<td>17,667,660</td>
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</tr>
<tr>
<td>09/01/2012</td>
<td>678,595,405.85</td>
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<td>62.0</td>
</tr>
<tr>
<td>10/01/2012</td>
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<td>12/01/2012</td>
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<td>01/01/2013</td>
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<tr>
<td>02/01/2013</td>
<td>314,671,550.38</td>
<td>8,299,830</td>
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</tr>
<tr>
<td>Total</td>
<td>8,154,168,177.32</td>
<td>206,596,394.00</td>
<td>65.0</td>
</tr>
</tbody>
</table>
PeMS Best Practices

- Save the data you are using to Excel. This way, you can refer back to it and have a record of where you got the data
  - View the Report Description tab for the URL of the report, in case you can’t find your way back.
PeMS Best Practices

- Recheck your postmile ranges when you switch to the opposite direction of freeway – sometimes they get reset.

- Email Technical Support with questions, or email Jane or Tim directly.

- We are here to help!
Going Forward

➤ Check out our instructions for using PeMS for TCR’s
  – More details than presented here

➤ As the TCR process evolves, we will do our best to update these instructions so that they reflect agreed-upon methodologies and best practices

➤ Let us know if you would like to request in-person training
In Summary…

- PeMS is a dynamic system that allows for convenient retrieval of performance measurement data
- PeMS has a rich variety of features and reports on traffic data
- PeMS has a large archive of data, especially on urban freeways
- PeMS is one more tool for you to use in system planning

Thank you!