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The Regional Integrated Transportation Information System (RITIS) is an automated data fusion and dissemination system that provides an enhanced, multi-faceted view of the transportation network. Participating agencies are able to view essential transportation information through innovative visualizations and use it to improve their project planning, traffic operations, and emergency preparedness. RITIS also uses regional standardized data to provide information to third parties, the media, and other traveler information resources, such as web sites, paging systems, and 511. There are three main components in RITIS: (1) real-time data feeds, (2) real-time situational awareness tools, and (3) archived data analysis tools.

Real-Time Data Feeds: RITIS data feeds deliver direct access to real-time incident, event, detector, probe, weather, transit, and other data sources (e.g., ITS device status). These data feeds are designed to facilitate the reintegration of RITIS data into legacy and third-party systems, and for third-party application developers who need access to real-time information for dynamic mobility applications. The data feeds offer implementation flexibility in both data format and retrieval method. The RITIS platform allows each agency to determine which data elements it wishes to include in the data feed, and which to keep secure from other agencies or the public.

Real-Time Situational Awareness Tools: The RITIS website allows users to view all of the real-time RITIS data in a browser. The website provides users with a dynamic set of visualizations and tools that present efficient situational awareness. Authorized users can interact with live events, incidents, weather, sensors, radio scanners, response vehicles, and other data sources and devices in maps, lists, and other graphics. Other capabilities include a rich set of filters, access contact information, and the ability to set up alerts.

Archived Data Analysis Tools: All data within RITIS is archived indefinitely, meaning that no data is ever deemed “too old” to be removed from user access. RITIS has a number of tools allowing users to query, analyze, and derive performance measures from this archive. Many of these tools are highly interactive and dynamic. They have been developed with the user in mind, and possess a high degree of freedom to explore the data with minimal training needed. Data within the archive can also be downloaded and/or exported so that users can perform their own independent analysis. These tools allow users to identify accident hotspots, analyze queue lengths and traffic congestion/bottlenecks at specific areas, perform after-action reviews, and evaluate the effectiveness of transportation operations strategies.

RITIS is used by over 4,200 decision makers, researchers, planners, operations specialists, the military, and homeland security officials in every state to:

- Significantly reduce agency costs while dramatically speeding up the ability of agency staff to respond to the media and decision makers;
- Reduce transportation research costs by as much as 50%;
- Enable coordinated regional responses and improved interagency cooperation among hundreds of agencies;
- Deliver transparent decision making through data-driven approaches to prioritizing and justifying projects; and
- Facilitate better communication with decision makers and the public.

If you are interested in using RITIS within your agency or have questions or feedback for any of the information below, please contact Michael L. Pack at PackML@umd.edu, or at 301.405.0722.

The following provides a high-level pictorial overview of the RITIS tools and their functionality and applications.
RITIS Suite of Tools

RITIS enables real-time operations, coordination between agencies, planning and performance measures, analytics, and visualization through several embedded tools:

- Probe Analytics
- History Explorer
- TreeVersity
- TIMELINE
- Virtual Weigh Station
- Incidents Clustering Explorer

Integrated • Easy to Use • Powerful • Dramatically Increases Productivity • Cost-Effective
RITIS consolidates, standardizes, and fuses disparate data sources and systems into a platform for use by a wide range of users and application:
Why Choose RITIS?

• Tens of millions of dollars have already been invested in RITIS by public safety agencies, DOTs, Homeland Security, and the Military.

• RITIS does not have complex software licensing fees or restrictions on agency usage.

• RITIS developers have focused on usability and visualization to ensure the best possible user experience for operations, planners, and researchers alike.

• We process, archive, and fuse more data (including sheer quantity, depth, and breadth) from more agencies than ANY other transportation system in the world, public or private.

• We can act as a broker for agency data transmission to third parties, relieving the agency of the need to worry about responding to data inquiries.

• Because our system is not hosted on a DOT network, it can dramatically reduce the bandwidth needed to share data with the public and with other agencies.
Why Choose RITIS? (Cont’d.)

- RITIS enables cross-agency, cross-border collaboration. No other system in the U.S. covers as many states and systems.

- We understand the complexities of dealing with multiple states, MPOs, local officials, etc. when it comes to MOUs, legal agreements, and consensus-building.

- We understand (and are bridging the gaps between) the operations, planning, and research communities and how they relate to decision making, public interaction, and the media.

- New features are constantly being developed, and are deployed no less than once every quarter (but usually once per month).

- As government employees, all CATT Lab staff are public servants. We pride ourselves on the quality of our work, and remain open and unbiased towards other providers and services. We work well with vendors, and typically remain contractually open and non-exclusive when bidding on work. As a non-profit, we can only charge for our actual expended hours and equipment.
The Three Primary Components of the RITIS Process

- Real-Time Data Fusion
- Real-Time Redistribution of Fused Data
- Archiving & Analytics of Data

The ultimate goal of this process is to provide users with concise, actionable information that speaks to senior leadership, legislators, and the general public for (1) comprehensive conditions analysis; (2) clear communication; (3) effective decision making; and (4) cost-effective project programming and evaluation.
RITIS Data Feeds

RITIS Data Feeds – Trusted Feeds for Public Agencies

RITIS Filter

RITIS Filter Web Service is the most complex and robust data dissemination interface in RITIS. Most clients will find this to be the best option. It is a polling web service that allows consumers to receive data in several different formats (XML, JSON, and GeoRSS). Data can be consumed in either the standard format or the custom-built RITIS format. The RITIS format provides additional information that is not available in these standards, but is provided by the source agencies. The most significant difference between this service and the other services RITIS provides is a robust set of filtering capabilities that allow consumers to filter data not just by source agencies, but also by specific fields (such as geospatial filters, time filters, event type filters, lane closure number and percentages, etc). This service also provides data from a wider array of agency sources. A user may subscribe to event data, but can only request the information that changed since the last request.

Benefits

- Several data format options
- Rich set of filtering capabilities allowing consumers to obtain highly specifics sets of data
- Largest set of data sources
- All of the information is secured using SSL and IP address filtering
RITIS Data Feeds – Trusted Feeds for Public Agencies

JMS Filter

This feed utilizes real-time publish/subscribe model using a Java Messaging Service broker. This method allows update messages in XML format to be pushed asynchronously to the subscribers as RITIS receives them. Upon the initial connection, the subscriber receives a full inventory of devices or events, followed by asynchronous incremental updates.

**Benefits**
- Provides data in as close to real-time as possible, since each message is generated and sent as soon as data arrives in RITIS.
- Updates are incremental.

XML Filter

XML Feed is an SSL-secured web page that provides a list of XML GZIP files with a snapshot of current data. The data consumers poll the page at a set interval to pull the latest snapshot in the XML format. The files are updated no more than once a minute, and should not be downloaded more often than that.

**Benefits**
- Simple to implement, since a consumer can connect at their own time interval and pull the snapshot data.
Trusted Feeds for Public Agencies include:

- RITIS Filter
- JMS Feed
- XML Feed

Trusted Feeds for Third-Party Developers and the Public:

- TrafficView API & Developer Resource Page
Gaining Access – RITIS Website Login Screen

RITIS is for military, public safety, and transportation agency/research use only:
www.ritis.org

To gain access, users and/or agencies must register for an account through a simple online form:
Examples of the Suite of Tools for:

- Real-Time Visualizations
- User Preferences & Customization
- Evacuation Support
- Communication
- Website Administration
- Personal Alerts
- Collaborative Decision Making
- Work Zone Dashboard
**Transportation System Status for Operations**

Once logged in, the user has access to the RITIS Incident list, Traffic Map, and an ever-growing suite of operations, planning, research, and collaboration tools.

<table>
<thead>
<tr>
<th>Incident List</th>
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</thead>
<tbody>
<tr>
<td><strong>RITIS Real-Time Visualizations</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Source</th>
<th>Location</th>
<th>Type</th>
<th>Updated</th>
<th>Start Time</th>
<th>Lane Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>MDOT.CHART</td>
<td>MD 144 EAST/WEST AT MARIETTAVILLE RD</td>
<td>Road Maintenance</td>
<td>less than a min ago</td>
<td>2 hrs 5 mins ago</td>
<td>West South, East North</td>
</tr>
<tr>
<td>MDOT.CHART</td>
<td>I-97 SOUTH AT NEW CUT RD</td>
<td>Road Maintenance</td>
<td>less than a min ago</td>
<td>6/30/15 4:40AM</td>
<td>South North</td>
</tr>
<tr>
<td>MDOT.CHART</td>
<td>MD 542 NORTH AT LOCK HAVEN SERVICE RD</td>
<td>Road Maintenance</td>
<td>less than a min ago</td>
<td>1 hr 23 mins ago</td>
<td>South North</td>
</tr>
<tr>
<td>MDOT.CHART</td>
<td>MD 546 SOUTH AT WILLS AVE</td>
<td>Road Maintenance</td>
<td>less than a min ago</td>
<td>3 hrs 49 mins ago</td>
<td>South North</td>
</tr>
<tr>
<td>MDOT.CHART</td>
<td>1-19 SOUTH PRIOR TO EXIT I895 RD 179 ELDON NEWNHAM RD MB 106-109</td>
<td>Road Maintenance</td>
<td>less than a min ago</td>
<td>1 hr 3 mins ago</td>
<td>South North</td>
</tr>
<tr>
<td>MDOT.CHART</td>
<td>MD 25 SOUTH BETWEEN SHAWAN RD AND PROCTOR RD</td>
<td>Road Maintenance</td>
<td>less than a min ago</td>
<td>2 hrs 27 mins ago</td>
<td>South North</td>
</tr>
<tr>
<td>MDOT.CHART</td>
<td>US 5 SOUTH FROM 9 JEFFERSON ST TO MD 28</td>
<td>Road Maintenance</td>
<td>less than a min ago</td>
<td>3 hrs 7 mins ago</td>
<td>South North</td>
</tr>
<tr>
<td>MDOT.CHART</td>
<td>1-495 EAST PRIOR TO EXIT I-895 MD 650 EAST NEW HAMPSHIRE AVE</td>
<td>Stranded Vehicle</td>
<td>less than a min ago</td>
<td>less than a min ago</td>
<td>--</td>
</tr>
<tr>
<td>MDOT.CHART</td>
<td>US 219 SOUTH AT MD 23</td>
<td>Road Maintenance</td>
<td>less than a min ago</td>
<td>1 hr 16 mins ago</td>
<td>South North</td>
</tr>
<tr>
<td>MDOT.CHART</td>
<td>1-95 SOUTH EAST TUNNEL, MM 0.8 - 0.9 END</td>
<td>Road Maintenance</td>
<td>less than a min ago</td>
<td>11/16/15 2:45AM</td>
<td>South North</td>
</tr>
<tr>
<td>MDOT.CHART</td>
<td>MD 85 SOUTH AT I-270</td>
<td>Alert</td>
<td>less than a min ago</td>
<td>Wed 11/25 1:30AM</td>
<td>--</td>
</tr>
<tr>
<td>MDOT.CHART</td>
<td>US 40 WEST AT COTTIENAL, LA</td>
<td>Road Maintenance</td>
<td>less than a min ago</td>
<td>1 hr 42 mins ago</td>
<td>West East</td>
</tr>
<tr>
<td>MDOT.CHART</td>
<td>US 40 EAST AT LOUIS LA</td>
<td>Road Maintenance</td>
<td>less than a min ago</td>
<td>3 hrs 38 mins ago</td>
<td>West East</td>
</tr>
<tr>
<td>MDOT.CHART</td>
<td>US 28 NORTH AT EXIT 26A MD 179 BLOCK (SB)</td>
<td>Road Maintenance</td>
<td>less than a min ago</td>
<td>9/13/13 9:34AM</td>
<td>South North</td>
</tr>
<tr>
<td>MDOT.CHART</td>
<td>1-95 OUTER LOOP EXIT 21 STOYSONG RD</td>
<td>Road Maintenance</td>
<td>less than a min ago</td>
<td>1 min ago</td>
<td>South North</td>
</tr>
<tr>
<td>MDOT.CHART</td>
<td>1-70 EAST FROM MD 17 TO CO 237</td>
<td>Road Maintenance</td>
<td>less than a min ago</td>
<td>3 hrs 6 mins ago</td>
<td>South North</td>
</tr>
<tr>
<td>MDOT.CHART</td>
<td>1-95 SOUTH EXIT 99 MD 139 LEWIS RD (SB) MD 87-87.3 (LONG TERM AND CONTINUOUS)</td>
<td>Road Maintenance</td>
<td>less than a min ago</td>
<td>8/24/15 11:13AM</td>
<td>South North</td>
</tr>
<tr>
<td>MDOT.CHART</td>
<td>MD 270 WEST AT MD 10</td>
<td>Road Maintenance</td>
<td>less than a min ago</td>
<td>1 hr 24 mins ago</td>
<td>--</td>
</tr>
</tbody>
</table>
Once logged in, the user has access to the RITIS Incident list, Traffic Map, and an ever-growing suite of operations, planning, research, and collaboration tools.

### RITIS Real-Time Visualizations

#### Transportation System Status for Operations (Cont’d.)

These buttons allow users to open an incident on the map, open a chatroom associated with the incident, and open the incident timeline.
Traffic Map and Display Modes

The real-time map has many interactive layers, search functionality, filters, and navigation features.
Map Layer Customization

Through the map’s User Preferences, users can customize their default region of interest:

Map Settings

Layer functionality includes:
- Ordering
- Opacity
- ITS devices
  - Inactive devices can be hidden
  - Devices with “expired” data can be removed
- Search and zoom functionality in some layers (e.g., transit and points of interest)

Options for Evacuation Routes
Opacity: 100%

Map Layer List

Hide Layer List
- Incidents and Events
- Dynamic Message Signs
- Traffic Detectors
- Traffic Cameras
- Road Weather
- Radio Scanners
- FITM Plans
- Evacuation Support
- Public Transit
- Montgomery County
- CAD
- Fleets
- Philadelphia Papal
- Points of Interest
- Metro Routes
- Probe Speed Data
- Weather Radar
- Weather Alerts
Interactive Incident Layer

When clicked, incident and event icons display additional details about the incident.
Filtering Customization

Each user has complete control over which data is displayed and/or hidden—thus making it easier to customize for specific operations scenarios and minimize information overload.

By setting Incident Filters, users can choose to show or hide incidents based on their type, the number of lanes they close and a number of other qualifiers.
Interactive timelines quickly reveal how the incident is being managed while showing the relationships between responder notifications and arrival times, lane closures, traffic queues, clearance times, communication logs, CCTV, and dynamic message signs.
Incident Timelines (Cont’d.)

- Nearby CCTV feeds
- Active DMS with historic and real-time message postings
Dynamic Message Signs

Active and inactive, portable or fixed dynamic message signs can be visualized. Even the status of beacons and other related device information can be displayed.
National Radio Scanners

Listen to multiple police, fire, rescue, air traffic control, etc. simultaneously across the entire country.
Real-Time Weather Alerts

National Weather Service weather alerts are mapped with detailed reports available on demand.
RITIS Real-Time Visualizations

Real-Time Weather Radar

RITIS provides many options for displaying both real-time and predicted weather.

Real-Time Weather Radar
Real-Time Ground Weather

The plus icons (=addition symbol) indicate multiple RWIS stations in a given area. The data can be viewed in “Standard” or “Advanced” formats.

- **Standard** format provides a quick, easy-to-read overview of typical weather-related info, including road surface status.
- **Advanced** format provides much more robust data and key performance indicators to help make crucial weather-related decisions.
Weather Forecasts

Using a time slider bar, users can move forward and backward in time to view predicted conditions anywhere in the country for various types of weather forecasts.
RITIS Real-Time Visualizations

**Speed and Volume Sensor Data**

Interactive sensor station data from HERE, SpeedInfo, and sensor deployments from individual DOTs can be displayed. Details can be viewed in pop-up windows that help to identify trends.
**Probe Data support for HERE, INRIX, TomTom, LPR, Bluetooth, etc.**

Probe-based speed and travel time data can be drawn in various forms: Speed, Comparative Speed, Congestion, and Average Congestion.

<table>
<thead>
<tr>
<th>Confidence Score:</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low:</td>
<td>The data is based primarily on historical data</td>
</tr>
<tr>
<td>Moderate:</td>
<td>The data is based on real-time data across multiple segments and/or based on a combination of expected and real-time data</td>
</tr>
<tr>
<td>High:</td>
<td>The data is based on real-time data for that specific segment</td>
</tr>
<tr>
<td>Ranges from low (worst) to high (best)</td>
<td></td>
</tr>
</tbody>
</table>

**Selection Box**

- **All Sections:** The following style applies to all sections
- **Brown:** No data is has been recently reported for this section of road
- **Speed:** Current speed of the segment in MPH
  - **Green:** Speed is above 50MPH
  - **Yellow:** Speed is between 25MPH and 50MPH
  - **Red:** Speed is between 15MPH and 25MPH
  - **Dark Red:** Speed is below 15MPH
- **Comparative Speed:** Current speed of the segment compared to the average speed recorded for that hour of the day and day of week:
  - **Green:** Current speed is greater than 75% of the average speed
  - **Yellow:** Current speed between 55% and 75% of the average speed
  - **Red:** Current speed between 25% and 55% of the average speed
  - **Dark Red:** Current speed is less than 25% of the average speed
- **Congestion:** Current speed of the segment compared to the calculated speed of traffic on that road when there is no congestion (reference speed)
  - **Green:** Current speed greater than 75% of the reference speed
  - **Yellow:** Current speed between 55% and 75% of reference speed
  - **Red:** Current speed between 25% and 55% of reference speed
  - **Dark Red:** Current speed is less than 25% of the reference speed
- **Average Congestion:** The average speed compared to the calculated speed of traffic on that road when there is no congestion (reference speed)
  - **Green:** Average speed is greater than 75% of the reference speed
  - **Yellow:** Average speed between 55% and 75% of the reference speed
  - **Red:** Average speed between 25% and 55% of the reference speed
  - **Dark Red:** Average speed is less than 25% of the reference speed

---

**RITIS Real-Time Visualizations**

**Probe Speed Layer Help**

If the Probe Speed layer is active, double clicking on the map will display the speed data popup instead of re-centering the map.

**Options for INRIX Speed Data**

- **View:** Speed, Comparative Speed, Congestion, Average Congestion
- **Source:** Congestion
- **Opacity:** 100%

**Probe Speed Data Sub-Layers**

- **Probe Speed Data**
- **Weather Radar**
- **Weather Alerts**

**VDOT Detector (VDOT_DS)**

South on TSS 0095 N 16712 - 1020 S Off Ramp

- **Ref. Speed:** 55 mph
- **Avg. Speed:** 11 mph
- **Volume:** 16 veh/min
- **Lane(s):** 1

Click and Drag to Zoom. Double-Click to Reset.

<table>
<thead>
<tr>
<th>Reference Speed</th>
<th>Volume</th>
<th>Speed</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 veh/min</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.5 veh</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---
Virtual Weigh Stations

Virtual Weigh Station data are visible within RITIS. They are used primarily by law enforcement, and are available in both the desktop and mobile versions. For each vehicle that passes, axle weights, axle spacing, speeds, and other measurements are taken, along with photos of the vehicle. License plate recognition will be deployed soon to help identify repeat offenders.
Live CCTV

Users can view camera locations on the map. Clicking on an individual camera icon will play that camera's live video feed.
CCTV Media Wall

Users can create their own Personal Media Wall with anywhere from 1 to 100+ simultaneous live-streaming videos.
Customizing & Saving Media Walls

Through the Traffic Camera page, users can save favorite video streams and customize their video wall layout.
DOT and Public Safety Fleet Management

The Fleets layer can be used to track and monitor agency vehicle fleets. Live videos directly from patrol vehicles can be streamed, and the status of in-vehicle equipment can be viewed (e.g., plow status, treatment spreading rates, etc).
Real-Time Fleet Data in Action

During major events, fleet tracking can show how many responders are on-scene, and what their exact positions are. In the RITIS screenshot below, orange circles are actual first responders and DOT service patrol vehicles at or near the scene of an incident.
Rail Transit

Rail lines, stations, AVL, and arrival data are displayed on the map.
Bus routes, stops, and vehicle data are displayed on the map.

**Bus #555**

**Wilson Blvd @ N Veitch Street**

- **Next Stop:** 900 Second Street, 10 min
- **Route:** 41 Columbia Pike-Ballston-Court House
- **Direction:** Inbound to Friendship Heights
- **Speed:** 30 mph
- **Heading:** Northbound
- **Passenger Count:** 25/50
- **Driver Name:** Driver 1
  - In service 3 hours
Evacuation Support Layers

The Evacuation support layer is currently integrated for six regions, including:

- Delaware
- District of Columbia
- Maryland
- Pennsylvania
- Virginia
- West Virginia
Staging Areas
Clicking on a staging area shows how many parking spaces are available at that location, paved conditions, and the address, and provides aerial photography of the location with access points overlaid.
Hospitals and Beds

Clicking on hospital icons provides contact information for the hospital, as well as the number of available beds.
Traffic Control Points

Clicking on a traffic control point brings up a diagram depicting how that intersection should be managed during the course of an active evacuation. Details include turning restriction, signal timing plan changes, the number of cones or other traffic control devices needed, signage, and recommended personnel locations.
Evacuation Filtering

Evacuation layers can be filtered based on the event type, scenario, and location. Blue lines with slight red outlines represent scenario-specific evacuation routes.
Points of Interest

If the user is looking for a specific location like a school or a business, they can use the Point of Interest search option. The user can define a radius of miles within which to search in order to narrow down the search results.
Points of Interest

Search results are displayed directly on the map and in a list. Details can include names, addresses, and phone numbers.
Chatroom & File Sharing

Users can chat with any other user currently logged into RITIS, including users on agency-run chat services. Users are sorted by agency. Chats can be between two users, or they can be specific to an event, with an unlimited number of users sharing and collaborating. Images, documents, and other files can be associated with events and shared between users.
Address Books

Detailed address books can be sorted by location or agency, are searchable, and will show contact information, operating hours, and other details about a specific agency or individual employee.
Active Incident Management

This screenshot shows an active incident being managed within RITIS. Note the wide array of information available, including operator notes, a live chat room dedicated to the incident, real-time CCTV feeds, and pictures taken at the scene and uploaded to the site.
User Administration

- Users can change their own passwords while logged in.
- If passwords are forgotten, they can be automatically reset by the user.
- User self-registration is simple and quick. For vetted agencies, individual user account approval is automatic, instantaneous, and secure.
Administration – Data access controls

All data sources and tools can be restricted per user or per agency. Archived data can also be restricted by date range.
Custom Personal Alerting

Customize Alerts to be sent to your:
- Cell phone
- Email

Alerts can be based off of:
- Speeds (falling above or below some threshold for some amount of time)
  - Time of Day & Day of Week
  - Single or multiple corridors
- Events and Incidents
  - Event types
  - Percent of lanes closed
  - Time of Day and Day of Week
  - Single or multiple corridors

Speed Thresholds

Step 3: Tell us under what conditions you’d like to receive a speed alert.

Alert me when the speed on any segment of the selected road has...

- fallen below \( \frac{100}{\%} \) percent of the free flow speed
- \( \frac{65}{\text{MPH}} \) MPH

...for at least 15 minutes.

Alert me 15 minutes after all segments along the selected roads no longer match the criteria selected above.
**Personal Event Alerts**

Users can define routes for which they want to be notified. Alert criteria include time-of-day and day-of-week, event type, lane status, and location. Alerts can be emailed or sent via text message to your cell phone.
Personal Traffic Alerts

With personal traffic alerts, users can define routes for which they will receive notification when speeds fall below their predefined speed thresholds. Alert criteria include full or partial road selections, time of day, and day of week. Alerts can be emailed or sent via text message to your cell phone.
• Originally developed for the NCR and now available to other RITIS users
• Simple RITIS-based webinar function that allows for:
  − Faster call management (eliminates the need for roll-call)
  − Multiple-presenter functionality
  − Interactive mapping – data layer control, share documents, draw on the screen
  − Shared view of an event or incident
  − Meeting note-taking
  − Open and transparent decision making (e.g., real-time polling)
  − Participants receive a PDF meeting summary at the conclusion of the call
• Works on all internet browsers.
  − No plugins required
  − Supports up to 300 participants per session
Collaborating During Significant Events (Hurricanes or Other…)

- **RITIS Meeting Platform**
  - Anytime/anywhere
  - PC or mobile device, such as iPad (participants only)

- **It’s situational awareness**
  - Weather (radar, alerts, road surface condition)
  - Events/incidents (construction, crashes, etc)
  - Probe speed data/DMS messages

- **It’s collaborative decision making**
  - Leverage multiple layers of data
  - Share documents
  - Discuss ideas and recommendations
  - Conduct attendee polling

- **It’s multifaceted**
  - Multi-agency/multi-user
  - Plan, respond to, follow up
  - Extreme weather, special events, incident management

- **It’s fast and easy**
  - Simple meeting set-up, agenda creation
  - One-click hyperlinks to send to attendees
  - Intuitive and user-friendly
  - Instant follow-up email with an automatically generated meeting log (MOR)

Cover photos source: http://www.I95coalition.org
Collaborative Decision Making

Collaborative Decision Making Tools – Meeting in Progress

Clear, comprehensive, and organized layout of tools and information makes collaborating simple and easy.
Collaborative Decision Making

Collaborative Decision Making Tools – Meeting in Progress (Cont’d.)

Pre-weather event meeting showing impending weather and incidents.
Collaborative Decision Making

Collaborative Decision Making Tools – Meeting in Progress (Cont’d.)

Running a Poll
The host of a meeting has the ability to run polls and get input from the meeting participants. Poll results are displayed in the top right panel.
Collaborative Decision Making Tools – Meeting in Progress (Cont’d.)

Sharing Documents or Images (and annotating them)

The host of the meeting or a designated presenter can share images and documents during the meeting. This person can add and remove annotations on the files they are sharing. In the image below, RITIS Meeting is used during a water main break to identify closures, rerouting, and other items. The meeting host used the drawing tool to walk participants through the event.
Collaborative Decision Making

Collaborative Decision Making Tools – Meeting Log

A meeting log is generated after every meeting. This log keeps track of all the information shared in the meeting, who attended, who voted, which documents were shared, recommendations, meeting minutes, and what actions need to be taken. It is sent out to all the participants automatically at the conclusion of the meeting.

MATOC Weather Call: January 26 Event
1/25/15 2:00 PM
Host: Taran Hutchinson
District of Columbia

This is the RITIS Meeting for MATOC Severe Weather Coordination Working Group to discuss the anticipated winter weather event forecasted to impact the region Sunday night into Monday (1/26) morning.

Recommandation:
Recommend MWCOG Snow Call for 3AM Monday (1/26)

We will have a follow up MATOC Weather Call at 2PM Monday (1/26) to discuss how the event is progressing and impacts to PM rush as well as impacts for Tuesday AM rush.

Number of Attending: 9

Forecast:
Current Advisory
NATIONAL WEATHER SERVICE BALTIMORE MD/WASHINGTON DC
1040 AM EST SUN JAN 25 2015

WINTER WEATHER ADVISORY REMAINS IN EFFECT FROM 2 AM TO 6 PM EST MONDAY....

* PRECIPITATION TYPE...SNOW...POSSIBLY HEAVY AT TIMES.

* ACCUMULATIONS...1 TO 2 INCHES.

* TIMING...SNOW WILL BEGIN LATE TONIGHT AND CONTINUE THROUGH LATE MONDAY AFTERNOON. THE HEAVIEST SNOWFALL WILL OCCUR BETWEEN EARLY MONDAY MORNING AND MONDAY AFTERNOON.

* TEMPERATURES...IN THE LOWER 30S.

* WINDS...NORTHEAST 10 TO 15 MPH

* IMPACTS...ROADS WILL BE SNOW COVERED AND SLIPPERY WITH VISIBILITIES BEING REDUCED TO NEAR ONE-HALF MILE AT TIMES. THE COMBINATION OF SNOW COVERED ROADS AND LOW VISIBILITY WILL MAKE TRAVELING DANGEROUS.

* OUTLOOK...SNOW WILL CONTINUE MONDAY NIGHT INTO TUESDAY...WITH ADDITIONAL ACCUMULATION POSSIBLE.

PRECAUTIONARY/PREPAREDNESS ACTIONS...

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A WINTER WEATHER ADVISORY FOR SNOW MEANS THAT PERIODS OF SNOW WILL CAUSE PRIMARILY TRAVEL DIFFICULTIES. BE PREPARED FOR SNOW COVERED ROADS AND LIMITED VISIBILITIES...AND USE CAUTION WHILE DRIVING.

Polls:

**Poll #1**
- Sunday afternoon (late): 0
- Sunday evening: 1
- Monday morning (early): 4
- Monday morning (late): 0

8 of 8 Attendance Voted

---

**TABLE 1: Transportation system status levels**

<table>
<thead>
<tr>
<th>Road Condition</th>
<th>Description</th>
<th>Suggested terminology and implications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Road Condition 5: IMPASSABLE/ DANGEROUS/ TREACHEROUS</td>
<td>Some roads could be temporarily impassable. This may be the result of severe weather (low visibility, etc.) or road conditions (frost heave, snow drifts, ice, etc.).</td>
<td>Impassable: impassable, “impassable” (non-technical term) when you need to be by tomorrow. Drive with caution.</td>
</tr>
<tr>
<td>Road Condition 4: ICY/SNOW COVERED</td>
<td>The pavement surface is covered with packed snow or ice. There may be loose snow on top of the ice or packed surface. Transit, trains, buses, and vehicles may be restricted, or travel is not recommended.</td>
<td>“perilous,” “impassable,” “major delays” (technical term) where you need to be by tomorrow. Avoid or prepare travel for next hour. Icy or snow covered over an hour, avoid travel during or after event.</td>
</tr>
<tr>
<td>Road Condition 3: SNOW AND/OR SLUSH COVERED</td>
<td>The pavement surface has continuous stretches of packed snow or snow and slush. Travel conditions may vary.</td>
<td>“major delays,” “impassable” may be expected. Avoid or prepare travel for next hour. Icy or snow covered over an hour, avoid travel during or after event.</td>
</tr>
<tr>
<td>Road Condition 2: SNOW / SLUSH COVERED W/ WHEEL TRACKS EXPOSED</td>
<td>Accumulations of loose snow or slush up to 2 inches are found on the pavement surface. Regular transit services with some minor exceptions and controls for buses and minor snow.</td>
<td>“near impassable” travel. Avoid unnecessary travel. Please contact your route for further details.</td>
</tr>
<tr>
<td>Road Condition 1: CLEAR WET/DRY</td>
<td>Clear and dry pavement surface is the general condition. There are occasional spots having minor or low accumulations resulting in drifting, shallow snow, squalls, minor snow, etc. Transit operations per schools.</td>
<td>“near impassable,” avoid unnecessary travel. Please contact your route for further details.</td>
</tr>
</tbody>
</table>
The **Work Zone Performance Monitoring (WZPM)** tool was developed to facilitate compliance with the Final Rule on Work Zone Safety and Mobility.

**WZPM** targets three different user groups:

- Project engineers and managers – Real-time performance and alert capabilities
- Public affairs officials – Real-time and historical performance information when responding to customer inquiries
- Planners and decision makers – Review of past performance and information on work zone costs associated with user delays
Work Zone Dashboard Interface – UDC, Queues, and Nearby Accidents

**CURRENT WORK ZONES IN MARYLAND**

- **Anne Arundel** (5): 575 incidents, 0.1 queue length, $2,280,361 delay cost.
- **Baltimore** (3): 478 incidents, 0 queue length, $1,467,547 delay cost.
- **Calvert** (1): 7 incidents, 0 queue length, $228,265 delay cost.
- **Caroline** (1): 0 incidents, 0 queue length, $0 delay cost.
- **Harford** (1): 6 incidents, 0 queue length, $6,244,393 delay cost.
- **Howard** (1): 0 incidents, 0 queue length, $20,300 delay cost.
- **Kent** (2): 0 incidents, 0 queue length, $0 delay cost.
- **Queen Annes** (1): 1 incident, 0 queue length, $8,412,152 delay cost.
- **Saint Marys** (1): 0 incidents, 0.1 queue length, $1,671,645 delay cost.
- **Worcester** (4): 27 incidents, 0 queue length, $8,115,508 delay cost.

**TOP CRITICAL WORK ZONES**

- **Severity/Event**
  - Major (7)
    - MD 4 NORTH BETWEEN MD 335 AND PATUXENT BLVD
    - I-895 NORTH PAST 295 ENTRANCE (MM 3.6-4.7) LONG TERM SHOULDER CL.
    - MD 50 WEST PRIOR TO MD 611
    - US 40 EAST AT RIDGE RD
    - MD 313 NORTH PAST HIGH BRIDGE RD
    - US 113 NORTH BETWEEN US 13 AND MD 12
    - MD 2 NORTH BETWEEN MD 648 AND WHITE RD

**USER DELAY COST BY CORRIDOR AND DAY OF WEEK**

<table>
<thead>
<tr>
<th>Day</th>
<th>I-95</th>
<th>I-695</th>
<th>I-95</th>
<th>US-50</th>
<th>I-70</th>
<th>Daily Totals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tue 12/30</td>
<td>$161.1K</td>
<td>$318.9K</td>
<td>$2.2M</td>
<td>$185.7K</td>
<td>$31.1K</td>
<td>$2.9M</td>
</tr>
<tr>
<td>Wed 12/31</td>
<td>$106.2K</td>
<td>$82.9K</td>
<td>$1.7M</td>
<td>$59.6K</td>
<td>$45.5K</td>
<td>$2.0M</td>
</tr>
<tr>
<td>Thu 1/01</td>
<td>$15.8K</td>
<td>$19.7K</td>
<td>$2.2K</td>
<td>$59.7K</td>
<td>$43.2K</td>
<td>$161.1K</td>
</tr>
<tr>
<td>Fri 1/02</td>
<td>$45.5K</td>
<td>$26.8K</td>
<td>$62.1K</td>
<td>$62.3K</td>
<td>$22.8K</td>
<td>$219.4K</td>
</tr>
<tr>
<td>Sat 1/03</td>
<td>$107.8K</td>
<td>$65.1K</td>
<td>$662.6K</td>
<td>$95.3K</td>
<td>$50.1K</td>
<td>$980.9K</td>
</tr>
<tr>
<td>Sun 1/04</td>
<td>$70.5K</td>
<td>$41.5K</td>
<td>$337.2K</td>
<td>$67.2K</td>
<td>$57.8K</td>
<td>$774.1K</td>
</tr>
<tr>
<td>Mon 1/05</td>
<td>$56.8K</td>
<td>$453.3K</td>
<td>$2.2M</td>
<td>$494.1K</td>
<td>$46.1K</td>
<td>$3.2M</td>
</tr>
<tr>
<td>Tue 1/06</td>
<td>$813.9K</td>
<td>$1.3M</td>
<td>$4.1M</td>
<td>$517.3K</td>
<td>$462.7K</td>
<td>$7.2M</td>
</tr>
<tr>
<td>Corridor Totals</td>
<td>$1.4M</td>
<td>$2.3M</td>
<td>$11.5M</td>
<td>$1.6M</td>
<td>$759.2K</td>
<td>Grand Total: $17,575M</td>
</tr>
</tbody>
</table>
Individual Work Zone Analysis – Camera & Graph Options
Work Zone Alerting

Customizing Work Zone Alerts

Customized Work Zone Alerts can be sent via:
- Text message
- Email

Work Zone Alerts can be based off of:
- Nearby incidents
- Bottleneck/Queue Severity
- Speeds surpassing a threshold

Work Zone Alerts can be scheduled:
- By time of day
- By day of week
RITIS as an Input Tool for Incident Management

- RITIS has the capability to be an “input” tool for agencies who want to get involved in operations and incident management.

- This functionality is currently being tested by two agencies in the National Capital Region. It is scheduled to be released to additional agencies in late 2015.

- If your agency is interested in this feature, please contact us at PackML@umd.edu.
RITIS Analytics Tools

Probe Analytics • Detectors • Road Weather • Virtual Weigh Station • CHART Reporting

Exploring and Visualizing Crashes • Hierarchical Data Explorers

Transit Data (In Development)
Overview

Probe analytics allow agencies to support operations, undertake planning activities, perform analysis and research activities, and develop performance measurement reports with lightning speed. The probe analytics tools make use of third-party probe data fused with other agency transportation data in a true “big data” analytics platform.
Algorithms are Open and Transparent

The algorithms used in the Probe Data Analytics Suite are open and transparent. Our algorithms and displays were developed by a mix of academics, professional computer scientists, statisticians, graphic artists, and state and MPO transportation engineers. All of the algorithms used to calculate performance metrics are published online in our FAQs so that agencies can review them, reproduce them, better understand their meaning, and provide input and feedback for continuous improvement.

User delay calculations are performed hourly at the TMC level, then aggregated across the requested geographic region for each day in the analysis period.

Calculating User Delay Cost with AADT Counts

When calculating Average Daily Traffic counts (ADT) from Annual Average Daily Traffic (AADT) counts, daily factors must be applied.

<table>
<thead>
<tr>
<th>Day of Week</th>
<th>Adjustment Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monday to Thursday</td>
<td>+5%</td>
</tr>
<tr>
<td>Friday</td>
<td>+10%</td>
</tr>
<tr>
<td>Saturday</td>
<td>-10%</td>
</tr>
<tr>
<td>Sunday</td>
<td>-20%</td>
</tr>
</tbody>
</table>

Some TMC segments may span across two or more defined volume link locations, and vice versa (as shown in Figure 1). In order to obtain a single AADT measurement for TMCs that fall under this case, the AADT of the overlapped detector locations must be weighted by the distance of the portion of the TMC that falls into the range of each link location.

![Image of TMC and overlapping detector locations](image-url)

Some TMC segments may span across two or more defined volume link locations, and vice versa (as shown in Figure 1). In order to obtain a single AADT measurement for TMCs that fall under this case, the AADT of the overlapped detector locations must be weighted by the distance of the portion of the TMC that falls into the range of each link location.

In order to be able to calculate many of the delay analysis measures, hourly profiles must be found for each TMC to give an hourly volume. In order to find these, the following calculations must be performed (assuming the necessary data is provided):

1. Define the functional class of the TMC — the functional class (Freeway or Non-Freeway) is defined based on TMC information. If the road class is Interstate, the functional class is Freeway. Any other road class is Non-Freeway.
2. Day type — weekday or weekend, the day of week determines which hourly profile to use. Note that all hourly weekend delay calculations rely solely on the two unique weekend profiles, regardless of congestion level or directionality (see Exhibit A-5).
3. Congestion level — can be one of Low, Moderate, or Severe. Congestion level is found for each TMC segment through multiple steps:
   - Calculate an average peak period speed using speed data from 6am - 10am and 3pm - 7pm. The days to select this data from depend on the desired outcome of the report. If looking at a whole year and you only want to see annual values, each TMC will need to have the average speed calculated for all weekdays (giving one result). If looking at a weekend and you want to see values for every day of the week, the average speed would be calculated per weekday (giving 5 results), therefore five hourly profiles for each day of week.
   - Calculate a peak period speed reduction factor that will determine the congestion level. This is done by dividing the average peak period speed by the free-flow speed.

   speed reduction factor (SRF) = \[(\text{average peak period speed} - \text{freeway speed}) ÷ 100\]

   For Freeways:
   - SRF is greater than or equal to 90 (low congestion)
   - SRF is between 75 and 90 (moderate congestion)
   - SRF is below 75 (severe congestion)

   For Non-Freeways:
   - SRF is greater than or equal to 80 (low congestion)
   - SRF is between 65 and 80 (moderate congestion)
   - SRF is below 65 (severe congestion)

4. Determine the directionality of the TMC — Directionality defines which peak period (AM or PM) this TMC segment is congested worse during. This is found by calculating both peak period speeds (AM being 5am - 10am and PM being 3pm - 7pm). The lowest speed of the two determines the directionality. If the difference between the two speeds is less than or equal to 0, the directionality is considered Even. The same day selection rules for average peak period speed apply here.

Assign the hourly profile to the TMC — See the hourly volume distribution charts for percentages of the ADT for the day. For single days, the ADT for that day must be multiplied for each of the hourly factors in the profile.
Probe Data Analytics Features

- Travel time and reliability analysis
- Real-time and historic dashboards
- Vehicle- and person-hours of delay
- User delay costs
- Animated historic maps
- Shareable reports for press releases
- Collaborative analytics
- Regional and state-wide bottleneck ranking
- Congestion trend analysis
- Performance summary tables
- Graphics and data exports
- Raw and aggregated data downloads
- Interactive and engaging
Common Uses of Probe Data Analytics

- Develop system performance reports
- Identify problems
- Prioritize projects
- Perform after-action incident review
- Conduct “before and after” studies
- Make informed, real-time operations decisions
- Travel time and reliability analysis
- Work zone monitoring
- Develop and publish press releases for public and media consumption
- Measure the economic and environmental impacts of passenger and commercial vehicle user delay

### Combined passenger and commercial delay costs (in thousands of dollars)

| Time     | 10 AM | 11 AM | 12 PM | 1 PM  | 2 PM  | 3 PM  | 4 PM  | 5 PM  | 6 PM  | 7 PM  | 8 PM  | 9 PM  | 10 PM | 11 PM | Daily Totals |
|----------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-----------|
| 1/14/19 | $0.2k | $0.2k | $0.2k | $0.2k | $0.2k | $11.9k| $16.2k| $2.7k | $0.2k | $0.2k | $0.1k | $1.4k | $7.7k | $10k     |
| 1/15/19 | $0.2k | $0.2k | $0.2k | $0.2k | $0.2k | $12.9k| $17.6k| $2.7k | $0.2k | $0.2k | $0.1k | $1k  | $6.6k | $10k     |
| 1/16/19 | $0.2k | $0.2k | $0.3k | $0.3k | $0.3k | $12.2k| $14.6k| $0.9k | $0.1k | $0.1k | $0.1k | $14.9k| $21.4k| $10k     |
| 1/17/19 | $0k   | $0k   | $0k   | $0k   | $0k   | $10.2k| $14.6k| $2.1k | $0k   | $0k   | $0k   | $10k  | $10k  | $10k     |
| 1/18/19 | $0k   | $0k   | $0k   | $0k   | $0k   | $0k   | $0k   | $0k   | $0k   | $0k   | $0k   | $6.6k | $10k  | $10k     |
| 1/19/19 | $0k   | $0k   | $0k   | $0k   | $0k   | $0k   | $0k   | $0k   | $0k   | $0k   | $0k   | $10k  | $10k  | $10k     |
| 1/20/19 | $0k   | $0k   | $0k   | $0k   | $0k   | $0k   | $0k   | $0k   | $0k   | $0k   | $0k   | $10k  | $10k  | $10k     |
| Hourly Totals | $0.2k | $0.2k | $0.2k | $0.2k | $0.2k | $11.4k| $10.4k| $0.8k | $0.1k | $0.1k | $0.1k | $1.4k | $7.7k | $10k     | $33k |

**Delay cost:**
- Total: $25,751.51
- Per user: $9.22

**Hours of delay:**
- Total: 5,176.45 hours
- Per user: 0.35 hours

**Data validity:** 99.85%

Click the table cell to see links to congestion maps.
Geographic Search Parameters & Filters

- Individual Road(s)/Corridor(s)
- Region(s)
  - State(s)
  - County(s)
  - Zip code(s)
- List of TMC segments
- Full or partial corridors by:
  - Mile-marker
  - Intersection
  - TMC
- Save TMC sets from previous searches

Add and compare multiple regions, roads or TMC sets
**Time Based Queries**

Select time by:

- Day or days
- Month or months
- Year or years
- Date range
- Filter by day of week
- Filter by time of day
- Average date ranges
- Leave dates separate
Available Granularity

- 1 minute (raw data)
- 5 minutes
- 10 minutes
- 15 minutes
- 1 hour
- Day of week (and filtered by specific time ranges)
Customizable Dashboards

The “Dashboard” application was launched in the first quarter of 2015 and includes:

- Customizable widgets
- Custom geographic setting
- Multi-state
- State
- County
- Multi-county
- Corridor
- Multi-corridor
- Multiple date/comparison parameters
- Resizable and interactive
Customizable Dashboards – Building Your Dashboard

Users will be able to generate their own customized dashboards, share their dashboards with others, and create multiple layouts for each dashboard.
Customizable Dashboards – Adding and Customizing Widgets

Various widgets are available for analyzing speeds, travel times, reliability, and accident data. Each widget allows users to see current conditions compared to one or more historic values.
Each widget can be laid out in a single-page view that can be recalled by the user quickly and easily.
Customizable Dashboards – Roadway Performance/Top Bottlenecks Widgets

The top widget shows current speed and travel times compared to a two-year historic average for that time of day and day of week.

The bottom widget shows current bottleneck and queue statistics for the region of interest. For both widgets, the user can define their own set of corridors, counties, or other regions to include.
Customizable Dashboards – Incident/Planning Time Index Widgets

These widgets show accident stats (pie charts) and planning time index stats for the current time compared to historic times (years and months).
Customizable Dashboards – Region/Multi-corridor Widgets

Any number of congestion and reliability measures can be displayed, including planning time index, buffer time index, travel time index, etc. Users can choose to generate these measures for a single corridor, a group of corridors, a single county, multiple counties, a single state, or multiple states. Each widget is interactive.
Customizable Dashboards - Interactive Bottleneck Ranking Widget

This widget shows the top x bottlenecks in a region. The table depicts how the ranking of each bottleneck location has changed over the past 12 months (top). The user can highlight the top x bottlenecks to see how their rank changes over time (middle). They can also mouse over a single bottleneck ranking number to highlight its movement within the list over time (bottom).
Probe Data Analytics – Regional History

Choose any point in time to view historical accident stats, weather radar, queues, travel times, bottlenecks, and other conditions.

- Ranked Bottleneck List
- Links to Timelines and Other Visualizations
- Bottleneck Queue Stats and Travel Time Index
Raw Data Downloads

Users can select any combination of road segments (an entire region, set of corridors, zip codes, etc), and any date range and time of day. Raw or aggregated data can be downloaded, along with quality indicators and other measurements.
Congestion Scans

Congestion and other measures can be visualized in both directions of travel along a corridor. Accident and event data can be overlaid on the Congestion Scan to help determine causality.
Congestion Scans (Cont’d.)

The Congestion Scan tool allows for detailed zooming, cropping, and custom display configurations for each of its graphs.
Probe Data Analytics

**Congestion Scans (Cont’d.)**

Users can display multiple date ranges for each scan. This is useful for “before and after” studies on the impacts of construction projects.
Probe Data Analytics

**Congestion Scan Exports**

Export all Congestion Scan data to a preformatted Excel file.
Trend Maps (sometimes called animated maps) can be used for:
- Comparing multiple travel days, weeks, or other time periods.
- Providing the public with information on expected travel conditions for holidays.
- Showing the impacts of events.
- After-incident analysis.
- Collaborative analysis.
Trend Maps (Cont’d.)

Up to seven maps can be drawn and animated simultaneously with the Trend map tool.

Trend Maps are interactive!

Trend Maps are interactive!
Trend Maps (Cont’d.)

Trend maps can be can be shared as links, movies, animated GIFs, and interactive embeds on agency webpages.

Trend Maps are interactive!
Performance Charts

Line charts let users see average travel times, speeds, reliability measures, etc; colored bands depict the variability in the data over time. The dark blue band below represents the 25th/75th percentile, while the lighter blue bands represent the 5th/95th percentile.
Performance Charts – Metrics/Display Modes

Performance Charts has a number of different Metrics and Display Modes available.
Performance Charts – Display Modes

Box-and-whisker plots show average values, along with 25th/75th percentile and 5th/95th percentile bands to give a sense of variability in travel times, reliability, and other metrics.
Performance Charts – Display Modes (Cont’d.)

Bar, scatter, line, and box-and-whisker plots are all options.

All charts can be exported as images or Excel files.
The Performance Charts tool also has lockable tool tips.
Bottleneck Ranking – Results Summary Page

Useful for identifying problem locations, the bottleneck ranking tools allow a user to “rank” the most congested locations in a corridor, a county, a state, or a larger region. The results (shown on the next few slides) provide details on how severe each bottleneck was in terms of queue length, average duration, and number of occurrences during a given date range. Event information has been overlaid to give a much more robust picture of conditions. All results summaries can be exported.

Each bottleneck location includes a column for “All Events/Incidents” indicating the total number of occurrences for the selected date range.

Maps provide a display of bottleneck conditions with the bottleneck rank and total number of incidents shown in the blue box.

The line diagram shows detail over the course of each day for the months of August and September, for both bottlenecks and events.

Hovering over a specific bottleneck or incident will give more detailed information. Clicking on a chart element will generate a Congestion Scan (bottleneck) or Event Timeline (events).
Bottleneck Ranking – Mapped multiple ranked bottlenecks with event information

Each row in the table from the previous page includes a checkbox that controls whether the bottleneck shown in that row will be plotted on the map.

Checkboxes on the map panel allow the user to disable “highlighting” for the selected bottleneck and toggle the ranking numbers next to each map icon. The total number of events is shown in the diamonds. Zooming in reveals more event details. Clicking on a plus icon (area of multiple events) opens a detail box for that location.
Bottleneck Ranking – Event Timelines & Congestion Scans

Additional details generated by clicking on an event icon (resulting in an Event Timeline) or clicking on a bottleneck (resulting in a Congestion Scan).
**Incident Icons Legend**

- **Red** — Severe events and incidents
  - Emergency Roadwork
  - Injury
  - Medical Emergency

- **Orange** — Roadwork

- **Yellow** — All other events and incidents
  - Animal struck
  - Closure
  - Collision
  - Congestion
  - Debris
  - Delays
  - Disabled Vehicle
  - Drawbridge Opening
  - Fallen Rocks
  - Fallen Tree
  - Fire
  - Flood
  - Fog
  - Hazmat
  - Incident
  - Other
  - Overgrown Foliage
  - Police Activity
  - Signal System
  - Special Event
  - Sports Event
  - Tornado
  - Vehicle Fire
  - Water Main Work
  - Wind

Temporal spirals can be shown in color or grayscale, and have the same features as the line chart in terms of hovering over and clicking on bottlenecks or events to get more details.

For ease of illustration, the 29 possible incident and event types have been grouped into three categories.

The Bottleneck Location Table provides additional details (start time/clear time) and can be exported to Excel.
The Michigan Analytics Suite includes a Speed Threshold Breakdown tool with which users can choose a stretch of road to view speeds that occur above or below a particular threshold, using time-of-day and day-of-week criteria for one or more specific date range(s).
User Delay Cost Analysis

Tool allows user to:

• Define one or more corridors for analysis
• Customize delay parameters:
  - Deviation from historical average
  - Fall below a certain percentage of free-flow
  - Fall below an absolute speed
• Edit commercial and passenger vehicle average hourly time value
User Delay Cost Analysis (Cont’d.)

Here is an example of UDC estimates for both passenger and commercial vehicles. The table is interactive: mousing over any cell brings up additional details about that hour of day and day of week. The user can switch what is displayed in the table from “Combined UDC” to “Delay Per Person,” “Delay Per Vehicle,” “Person Hours of Delay,” “Volumes,” “Data Availability,” etc. Tables can be exported to Excel.

<table>
<thead>
<tr>
<th>Vehicle Type</th>
<th>Display</th>
<th>All</th>
<th>Total Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total Cost</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Delay cost:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total: $63,510.40</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Per vehicle: $0.38</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Per person: $0.32</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Hours of delay:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Person-hours: 2014h 13m 12s</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vehicle-hours: 1606h 11m 7s</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Per vehicle: 36s</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Volume:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total: 168,319 vph</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Passenger: 126,239 vph</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Commercial: 42,080 vph</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Data validity: 100%</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Click the table cell to see links to congestion scans.

Want to know how the user delay cost is calculated? Read more in our documentation.

Notes:
- The values in the "Total cost" display mode are rounded to the nearest hundredth and displayed in thousands when values larger than $1K exist.
- The range of values for the colored backgrounds of each cell are based on the date of the selected display mode.
- Delay metrics are displayed for every hour of every day within the selected time range.
- The totals for every hour are shown in the bottom rows while the totals for every day are shown in the rightmost column.
- The grand total for the entire time period is shown as the actual value and displayed at the bottom right corner.
- Volumes shown for each hour are summed across all road segments.

Legend:

- **Lowest** (lightest color)
- **Highest** (darkest color)
- **Weekends** (mid-color)
- **Weekdays**
- **Highest**
- **Lowest**
- **No data**

Export to Excel
Performance Measures Tables

Users can generate tables with all performance measures during morning and evening rush hours (or any other time of day), for use in reports or modeling and simulation inputs.
Online Video Tutorial

All tutorial videos are bookmarked by subject area and/or tool.
NPMRDS Data is Available

- Where appropriate, NPMRDS data has been integrated into all of the previously mentioned tools.
- NPMRDS data produces meaningful results when looking at a month and/or an entire year’s worth of aggregated performance measure data.
- The Probe Data Analytics tools show where gaps exist in the NPMRDS when viewing individual days and/or weeks worth of data.
Multiple PowerPoint® and Word® templates have been developed to help agencies quickly produce:
- Project Justification Reports
- Before and After Study Fliers

The following slides showcase two sample brochure templates that are available.

Agencies can cut/paste graphics from the Probe Data Analytics Suite and drop them directly into these templates (along with their own description).

I-95 Corridor Coalition Members, in partnership with the CATT Lab, have aided in the development of these templates.
Probe Data Analytics

Reporting Templates for Before and After Studies (Cont’d.)

Project Assessment Summary
July 16, 2012

I-80/Squirrelwood Road
Highway Operational Improvement
Interchange #56, MP 56.78 – 57.47
West Paterson, Passaic County

Start Date: June 8, 2007
Completion Date: March 3, 2008
Construction Cost: $1,282,204

Project Background
In March, 1999, the I-80/Squirrelwood Road interchange was entered into the NUDOT’s Pipeline Process via a Problem Statement generated by Township officials.

According to the Problem Statement, inadequate capacity at the unsignalized intersection of the I-80 off ramp of I-80 with Squirrelwood Road causes traffic to back-up on the ramp and into the I-80 mainline, creating safety and operational problems. There is also a secondary capacity constraint at the intersection of Squirrelwood Road and Glavere Avenue that may contribute to this problem.

In June, 1992, a Needs Assessment report was prepared by the Bureau of Transportation and Camoir Analysis. This report described the existing conditions, general characteristics of the surrounding region, traffic analyses and proposed improvement concepts. Subsequently, a Tier II Screening Report was completed in February, 2005, that presented accident history, revised traffic analyses and proposed traffic control and geometric improvements.

Geographic Context
Route I-80 is a vital east-west interstate facility in northern New Jersey. It provides a continuous route between the Delaware Water Gap (at the PA border) and the George Washington Bridge (at the NY border) and is essential in serving the bedroom communities of northwest NJ and New York City, goods movement (local, regional and national) and recreational areas, such as the Pocono Mountains and Delaware Water Gap National Recreation Area.

Squirrelwood Road is classified as a urban minor arterial (County Route 936) and is accessed from I-80 at interchange 56. This road serves the densely populated municipalities of Paterson and West Paterson in Passaic County.

Project Detail
The project will eliminate the bottleneck occurring at the intersection of Squirrelwood Road and the I-80 off ramp, that causes traffic to queue back down the ramp and deceleration lane and into the I-80 through lanes, by:

- Signalizing the intersection of the I-80 off ramp and Squirrelwood Road (to reduce left turn delays and queues)
- Widening the ramp to 2 lanes (for extra storage capacity and to remove the conflict of left turning vehicles blocking right turning vehicles)
- Extending the deceleration lane leading to the I-80 off ramp (for extra storage capacity)
- There are no right-of-way issues with widening the ramp or extending the deceleration lane on I-80.

Highway Capacity Software Intersection Analysis

<table>
<thead>
<tr>
<th>Location</th>
<th>Volume</th>
<th>Level of Service</th>
<th>Avg. Queue (ft.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Approach</td>
<td>Movement</td>
<td>AM Signal</td>
<td>No Signal</td>
</tr>
<tr>
<td>Squirrelwood Road</td>
<td>Eastbound Through</td>
<td>250</td>
<td>A</td>
</tr>
<tr>
<td></td>
<td>Westbound Through</td>
<td>1020</td>
<td>A</td>
</tr>
<tr>
<td>Route I-80 Exit 56</td>
<td>Ramp</td>
<td>Northbound Left</td>
<td>570</td>
</tr>
<tr>
<td>Northbound Left</td>
<td>Right</td>
<td>340</td>
<td>F</td>
</tr>
<tr>
<td>Southbound Left</td>
<td>Right</td>
<td>600</td>
<td>F</td>
</tr>
</tbody>
</table>

HCM analysis indicates a substantial LOS and Aug. Queue improvement on the ramp approach of the intersection with only a slight LOS degradation on the Squirrelwood Rd. approaches.

* This queue represents the cumulative storage on the ramp. Observed queue extends as far as 1,490’ on the I-80 Rds. mainline. ** LOS under signalized conditions is not provided for channelized left turn. Results would be similar to unsignalized analysis.
During the PM Peak Hour (5:00 PM), there has been a 13% increase in speed along the section of NB I-80 approaching the Squirrelwood Road interchange (blue highlight) since the implementation (and shut-down period) of the project. The AM Peak Hour showed a 4% increase in speed.

There has been a substantial improvement in speeds that fall below 45 MPH (a threshold indicating the beginning of congested conditions). In the ‘Before’ condition, PM Peak Hour (5:00 PM), 34% of readings were < 45 MPH. In the “After”, the percentage of readings dropped to 16%, an overall decrease of 53%.

Using a VPP congestion scan, comparisons between the before & after condition show improvement in congestion intensity and duration in the 5 PM WB direction of I-80, prior to the Squirrelwood Rd interchange.

The project was further evaluated for changes in Delay Cost (total, per vehicle and per person) and Hours of Delay (person-hours, vehicle-hours and per vehicle) using the VPP Suite User Delay Cost Analysis module.

Comparisons of changes in Travel, Buffer and Planning Times show favorable reductions in the After condition that can be attributed to the improved flow in the WB lanes of I-80 prior to the Squirrelwood Rd off-ramp.

Comparisons of changes in User Delay Cost show substantial reductions in cost and hours of delay in the After condition, across all categories.
I-280 (from MP 14.7 to 15.9) Harrison Town, Hudson County -- VPP Suite® Bottleneck & Congestion Scan Analysis

Using the Vehicle Probe Project (VPP) Suite, information was gathered on bottleneck conditions and associated travel times, queue lengths and congested speeds for this section of I-280.

**Analysis**: VPP Bottleneck & Congestion Scan analysis for this segment of WB I-280 can be summarized as follows:

- **Travel Time Indices** show TTIs of 2-5 for most of the AM peak period, and 2-4 for the PM peak period, indicating that travel within this section is taking 2 to 5 times longer than under free-flow conditions during these periods.
- **Queue Lengths** generally range between 1.0 and 1.2 miles during the same AM & PM peak periods.
- **Congestion Scan results** show severely slow speeds (indicated by the circled dark red areas) between 5th Street and Cleveland Ave., from approximately 8:00-8:20 AM, and 6:15-7:00 PM. Excessively slow speeds (indicated by the red areas) occur between 5th Street and NJ Route 21, from approximately 7:45-8:30 AM and 5:30-7:00 PM.
- A 5-day average congestion scan (June 20th – June 24th, 2011) showed slightly better speed conditions during the WB peak periods. There are no apparent excessive to severe congestion problems in the EB direction.

*The Vehicle Probe Project (VPP) Suite is being developed by the University of Maryland for the HS Corridor Coalition.*

*Technical Analysis Unit, Bureau of Systems Planning.*
Different styles of Maps and Charts are shown on the next few pages.
Accident and Event Analytics – Event Heat Map
Accident and Event Analytics – Event Cluster Diagram
Accident and Event Analytics – Event Icon Map

Event icon maps are filterable by event type and other characteristics.
Incident and Event Analytics

Simple bar charts depict how many accidents occur on each corridor over a given date range.
Events aggregated by time of day.
Other graphing options include things like incident duration by type of incident, incident detection source, number of incidents managed by each operations center, etc.

Accidents by Ops Center (and other options)
The web-based “ICE” tool provides advanced analytics for incident data. This includes multivariate statistical analysis and many interactive visualizations. One- and two-dimensional histograms, parallel coordinate plots, and other interactive graphics make this incident analytics tool a favorite among researchers.
The CLARUS History Explorer allows users to view the effect of various road weather issues (e.g., precipitation rates, visibility, wind speed, etc) on speeds, volumes, and accident rates.
Detector Explorer

The following pages showcase the visualizations and query capabilities of the RITIS Detector Explorer. This tool allows users to download raw or aggregated detector data. It also allows the user to graph data (speeds, volumes, occupancy, etc), analyze detector health, and develop reliability, travel time, and other metrics. All tools are interactive and allow the user to save and export graphs and background data.
The Detector Explorer application allows users to select one or more detectors from a hierarchical list or map.
Detector Explorer – Graphing & Quality Tools

The interactive tools also allow users to analyze the profiles of detectors, roadways, and quality.
Detector Explorer – User-Defined Graphs

With Detector Tools users can graph any pair of variables and date ranges.
Detector Explorer – Congestion & Reliability Metrics

Road profiles can zoom into a section of roadway, and, based on the selected date range, display an analysis of travel times, congestion, reliability, and more.
Detector Explorer – Road Profile Charts

The results of a query to analyze speeds, travel times, and reliability along a corridor.
Speed/Volume Sensor Data Analytics

**Detector Explorer – Health of Sensors**

View a hierarchy of sensor health by agency, road, and direction of travel.
Virtual Weigh Station Analytics

Users can monitor, analyze, and print violations directly from within RITIS. Officers are also provided with analytics tools to help identify dates and times of day at which the most significant violations are likely to occur. Reports can be generated, emailed, and printed.
The analytics tools help:

- Search for times at which violations are most likely to occur.
- Search for repeat offenders.
- License Plate Recognition will help to identify and track repeat offenders.
Detailed Violation Report

• Clicking on an hour from the prior slide opens up a list of violators for that hour.

• Clicking directly on an individual vehicle within this image will print out a field violation notice.
Virtual Weigh Station Analytics (Cont’d.)

The Virtual Weigh Station Analytics tool provides many other violation report types and graphing options.
Hierarchical Data Explorer

The following pages contain screenshots from the TreeVersity2 application, which allows users to explore changes to hierarchical (tree structure) data sets. The tool can be used to explore the changes in traffic bottlenecks over time, and is being integrated for use with certain RITIS data sets.

There are two YouTube videos that explain this advanced analytics tool in greater detail. Visit the TreeVersity page on the CATT Lab website (www.cattlab.umd.edu) to view them.

(Note: This tool is in a beta stage, and has not been released to a wide audience yet. Slated deployment is mid to late 2015.)
Hierarchical Data Analytics

Changes in the severity of bottlenecks over time by nation→state→county can be explored.
Hierarchical Data Analytics (Cont’d.)

Here the user has zoomed in to see which county in North Carolina seems to be experiencing an abnormal amount of congestion for this particular month.
The CATT Lab is working with the MTA, WMATA, and Blacksburg Transit agencies to develop a suite of transit analytics for measuring:

- On-time performance
- Reliability
- Maintenance issues that affect performance
- Ridership and fare collection
- Operations HR data and performance
- Etc.

The following page is a screenshot of an early version of one such web-based interactive tool, which is expected to be deployed to RITIS in the future for transit agencies.
In this web-based tool, a user can explore the on-time performance and ridership for various routes and stops. Clicking on calendar dates, stops, and routes changes other graphs and reports to help the user identify trends and issues.
Custom Reporting for Agency and Third-Party ATMS Data

Customized reporting tools can be integrated into RITIS for use by individual agencies with specialized reporting needs.

The following screenshots show a case study in which the Maryland State Highway Administration’s ATMS data was integrated into a specialized operations log reporting tool. The reports take into account the detailed nature of the operations logs from their ATMS platform.
Filtering by agency-specific attributes

<table>
<thead>
<tr>
<th>Type</th>
<th>Location</th>
<th>County</th>
<th>Start date</th>
<th>Current Lanes Closed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Planned roadway closure</td>
<td>I-955 SOUTH PRIOR TO EXIT 4 MD 255 BALTIMORE PARKWAY (LONG-TERM &amp; CONTINUOUS)</td>
<td>Baltimore</td>
<td>Aug 9, 2013 12:19:17 PM</td>
<td>South North</td>
</tr>
<tr>
<td>Planned roadway closure</td>
<td>I-955 NORTH PAST 255 ENTRANCE (MM 36.4-4.7) LONG TERM SHOULDER CLOSURE</td>
<td>Baltimore</td>
<td>Sep 19, 2013 8:30:35 AM</td>
<td>South North</td>
</tr>
<tr>
<td>Planned roadway closure</td>
<td>I-955 OUTER LOOP 90571424</td>
<td>Baltimore</td>
<td>May 7, 2014 5:05:14 AM</td>
<td>Inner loop Outer loop</td>
</tr>
</tbody>
</table>
Scheduling automatic report delivery

All reports can be “scheduled” to run at specific intervals. During major snow events or catastrophes, it is not uncommon to have them run every 30 minutes. The resulting reports are automatically emailed to various user groups, which include ops managers, state and local emergency management officials, and the Governor.
Operator performance statistics

CHART wanted access to detailed reports on the response and clearance times for each operations center and field responder. The reports can be filtered to show on-duty and off-duty response times by operator, ops center, responder type, and vehicle type. Additional charts and graphs can be generated on demand.
Analysis of Detailed Police Accident Reports

For agencies that provide detailed accident reports from state and local police departments, the “EVC” application can be used to generate detailed reports and perform other safety data analyses. The user interface allows analysts to run queries on specific intersections, corridors, or other regions (where a “region” can be a city, county, or entire state).
The Detailed Query Builder within EVC makes it extremely quick and easy for users to generate complex queries based on location, date range, crash type, damage received, causality, lighting conditions, vehicle type, age, gender, type of injury received, and drug/alcohol involvement.
Analyzing and Visualizing Crashes

**Analysis of Detailed Police Accident Reports – Detailed Report Generation**

Accident maps, cluster diagrams, and stock summary reports can be generated and printed from the results of any query.
Exploring and Visualizing Crashes

Analysis of Detailed Police Accident Reports – Hot Spot Diagrams

Accident “hot spot diagrams” help to easily identify the most dangerous intersection or stretch of road along any corridor.
Intersection Crash Diagrams
What Our Customers are Saying:

“Analysis that used to take an entire year to accomplish with one or two full-time employees now takes only 10 minutes, and I don’t need an entire IT staff to support it.”
~MPO Senior Transportation Analyst

“The VPP Suite represents a quantum leap in capabilities for problem identification, problem confirmation, and communicating with the public.”
~DOT Planner

“The amount of funding we have to ask for from our DOT program manager has decreased as a result of access to these tools. They are saving money, and we are more nimble.”
~DOT Consultant
What Our Customers are Saying (Cont’d.):

“We are making better-informed decisions about which ops centers to keep open, where to deploy patrols, and what type of economic impact we are having on the traveling public. We’ve never had this type of insight into operations before.”

~DOT Operations Manager

“Someone finally understands how to display operations data in a way that makes sense and doesn’t make me rely on 10 different systems on 5 different computer terminals. And it’s fast! I’m simply blown away!”

~Center Operations Engineer

“This is amazing! We can tell some really compelling stories to the public about our impact, and it’s so easy!”

~Private Sector Public Information Officer and Media Relations for a DOT
Resources (and costs) shared among all agencies.

- When one agency invests in a new feature or new hardware, all agencies benefit. RITIS is akin to a pooled fund project.

All algorithms are open and transparent.

- Want to know how we calculate BTI, TTI, bottlenecks, and UDC? All of our formulas are open to the public, and your members helped us define, review, and approve them.

We can do more as a team than as individual agencies.

- There is great value to “seeing” across our jurisdictional boundaries.
- Working together as dozens of states and MPOs means we can ultimately accomplish more by pooling our resources and our knowledge to ensure success.

Agencies influence and prioritize features.

- Your analysts, statisticians, managers, and operations specialists drive our development goals.
Data Agnostic

- RITIS works with all agency data, plus third-party data from ATMS vendors, ITS device manufacturers, and data providers like HERE, INRIX, and TomTom. You can even change providers and keep your historic data.

Engaged in and Committed to MAP-21

- RITIS Developers, management, and user group members are tuned in to MAP-21 rulemaking efforts, and have provided significant guidance to FHWA

- The team has been preparing and performing work in the background to ensure the Suite meets your MAP-21 target-setting goals.

Unparalleled Team Support

- RITIS is developed and supported by a dedicated interdisciplinary team of graphic artists, UX specialists, transportation faculty, IT staff, professional engineers, software developers, and you, making RITIS a powerful national asset.
To find out more about RITIS, please contact:

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