Bottleneck Ranking Tool
New Algorithm & Features

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Bottleneck Ranking Tool – the need for change

Why the change?

› The prior algorithm, though innovative at the time, has a number of deficiencies related to
  › Duplicate counting
  › Issues with merging
  › Processing (expensive/resource hog)

› You helped us vet our new algorithms
Bottlenecks are tough!

- Bottlenecks are **dynamic** - they grow, shrink, and can merge with neighboring bottlenecks over their lifetimes

- Identifying the Bottleneck "**source**" (head) location is critical to identifying problem areas

- The new algorithm **tracks the movements of “congestion events”**
  - some of which are truly bottlenecks,
  - some of which are just heavy congestion,

- The new algorithm better **estimates the head of the bottleneck**
  which is key to defining appropriate mitigation measures
What’s different:

> More accurate & flexible bottleneck identification & ranking through:

  - A new algorithm
  - New terminology
  - New visualizations
Anatomy of a Bottleneck

New Terminology:

> **Occurrence** - congestion, whose head is at a given point on the road at a single point in time.

> **Element** - congestion, whose head is at a given point on the road, that can change in length over time.

> **Blob** - a collection of spatially and temporally adjacent congestion elements.
Some Bottleneck Stories

- Growing & shrinking
- Moving back
- Merging
- Two separate
Blob growing and shrinking

Congestion occurs because of merging at Location A.
Additional traffic caused by the morning rush builds up. Congestion starts backing up at this point.
Blob growing and shrinking

Congestion continues to grow.
Blob growing and shrinking

The morning rush is subsiding, lessening congestion.
Blob growing and shrinking

Rush hour ends and traffic normalizes.
Blob growing and shrinking

Rush hour ends and traffic normalizes.
This is what the Blob looked like.
An incident occurs at **Location A** incurring a lane closure that causes congestion to build.
The lane is still closed so congestion continues to build.
The incident is cleared and all lanes opened. Traffic starts flowing normally at Location A. Residual congestion remains just upstream and continues to build.
Residual congestion lessens as traffic begins to normalize.
All traffic is flowing normally.
This is what the Blob looked like.
A work zone at Location A causes congestion due to a lane closure.
The work zone at Location A continues to cause congestion. As rush hour begins, Location B also begins to experience congestion due to constrained merging conditions.
Congestion from **Location A** continues to build upstream, merging with congestion from **Location B**.

**Blob and Element Graph**

The Blob at location A grows and merges with the blob at location B, forming a single Element consisting of six TMC segments.
The work zone at Location A is removed and traffic begins to dissipate. Meanwhile congestion at Location B persists.
Rush hour comes to an end and traffic returns to normal at Location B. There is still some residual congestion.
Rush hour comes to an end and traffic dissipates at Location B. There is still some residual congestion.

Blobs merging
This is what the resultant Blob looked like:
A disabled vehicle blocking a lane at **Location B** causes backup. A vehicle fire in the westbound lanes causes rubbernecking at **Location A**.
The disabled vehicle is removed from the roadway, clearing traffic at Location B. Rubbernecking congestion continues to back up.
The vehicle fire is cleared in the Westbound lanes. There is no longer anything to see so congestion clears in the Eastbound lanes.
Increased traffic due to rush hour causes congestion to build at Location A.
Congestion continues to build up at Location A.
The rush hour ends and traffic clears.
This is what the three Blobs looked like.
Changes & New Features
The table now ranks Bottleneck head location in terms of frequency (how often) and impact (how bad) those locations are as Element heads.

1. Changed “Location” heading to “Bottleneck head location”
2. “Total duration” column replaces the “Occurrence” column
3. A “Display options” button has been added
Changes to the Bottleneck Map

For the Map:

- Your “check-marked” selection in the Bottleneck ranking table will be shown blue on the map, and noted at the bottom.

- Other selections will be shown in orange after clicking the “Highlight on selected location” checkbox.

- A “Display options” button has been added that enhances the usability of the map.
Displaying elements:

1. Extending out from the head are all the elements that started at that location.

2. The elements are layered, and extend back to the maximum distance for that instance (Element #2).

- Each instance adds another layer that makes the road segment more opaque closer to the head:

   - More congested occurrences
   - Less congested occurrences

Hover over an element to see detail about that location.
Displaying elements:

1. The time spiral will show elements that had the selected location as their head.

2. Hovering over an individual element will show information about that element, as well as the associated blob.

3. A **Display options** button has been added:

<table>
<thead>
<tr>
<th>Display options</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Show:</strong></td>
</tr>
<tr>
<td>○ Day</td>
</tr>
<tr>
<td>○ Week</td>
</tr>
<tr>
<td>□ Events/Incidents:</td>
</tr>
<tr>
<td>○ During selected time range</td>
</tr>
<tr>
<td>○ Only during bottleneck conditions</td>
</tr>
</tbody>
</table>

The center represents March 1, 2015 and the outer edge represents March 31, 2015.
Displaying elements:

1. The Timeline will show elements that had the selected location as their head.

2. Hovering over an individual element will show information about that element, as well as the associated blob.

3. A Display options button has been added:

   - Show:
     - Events/Incidents:
       - During selected time range
       - Only during bottleneck conditions
New! Elements Graph – Single Day

Click on the date to bring up a calendar for quick selection

Use the arrow buttons to move the date forward or back

www.I95Coalition.org

April 21, 2016
New! Elements Graph - Overview

1. Location selected from the Ranking Table
2. TMC segment indicators
3. Each colored part in the graph represents an element (temporal/spatially)
4. Number of days congested
   Darker the color = more congested days
New! Elements Graph - Features

Hover over graph to see a tooltip with element detail

Hover over the top bar graph, Average Miles, to see average miles congested for that time

Hover over the right bar graph, Hours Total, to see total hours congested
New! Elements Table

Click on the Elements Table dropdown for the selected head location.

The list shows all the instances that location was an element.

Sort the table using this dropdown.

<table>
<thead>
<tr>
<th>Start time</th>
<th>End time</th>
<th>Duration</th>
<th>Max length (miles)</th>
<th>Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sun 3/1/15 12:46 PM</td>
<td>Sun 3/1/15 12:47 PM</td>
<td>1 m</td>
<td>1.64</td>
<td>1.64</td>
</tr>
<tr>
<td>Sun 3/1/15 02:45 PM</td>
<td>Sun 3/1/15 02:47 PM</td>
<td>3 m</td>
<td>3.24</td>
<td>6.48</td>
</tr>
<tr>
<td>Sun 3/1/15 02:47 PM</td>
<td>Sun 3/1/15 02:49 PM</td>
<td>3 m</td>
<td>3.60</td>
<td>7.21</td>
</tr>
<tr>
<td>Sun 3/1/15 02:50 PM</td>
<td>Sun 3/1/15 02:53 PM</td>
<td>3 m</td>
<td>2.46</td>
<td>7.40</td>
</tr>
<tr>
<td>Mon 3/2/15 06:26 AM</td>
<td>Mon 3/2/15 06:28 AM</td>
<td>2 m</td>
<td>1.02</td>
<td>2.04</td>
</tr>
<tr>
<td>Mon 3/2/15 06:28 AM</td>
<td>Mon 3/2/15 10:04 AM</td>
<td>3 h 36 m</td>
<td>4.16</td>
<td>521.66</td>
</tr>
<tr>
<td>Mon 3/2/15 10:58 AM</td>
<td>Mon 3/2/15 11:07 AM</td>
<td>9 m</td>
<td>4.84</td>
<td>43.56</td>
</tr>
<tr>
<td>Tue 3/3/15 06:33 AM</td>
<td>Tue 3/3/15 07:03 AM</td>
<td>30 m</td>
<td>5.41</td>
<td>144.88</td>
</tr>
<tr>
<td>Tue 3/3/15 07:03 AM</td>
<td>Tue 3/3/15 07:04 AM</td>
<td>1 m</td>
<td>5.78</td>
<td>5.78</td>
</tr>
<tr>
<td>Tue 3/3/15 07:04 AM</td>
<td>Tue 3/3/15 07:05 AM</td>
<td>1 m</td>
<td>5.41</td>
<td>5.41</td>
</tr>
<tr>
<td>Tue 3/3/15 07:05 AM</td>
<td>Tue 3/3/15 07:15 AM</td>
<td>10 m</td>
<td>5.78</td>
<td>57.83</td>
</tr>
<tr>
<td>Tue 3/3/15 07:15 AM</td>
<td>Tue 3/3/15 07:27 AM</td>
<td>12 m</td>
<td>5.41</td>
<td>65.01</td>
</tr>
<tr>
<td>Tue 3/3/15 07:27 AM</td>
<td>Tue 3/3/15 07:33 AM</td>
<td>6 m</td>
<td>5.78</td>
<td>649.68</td>
</tr>
</tbody>
</table>
New! Blob Table

Click on the Blobs Table dropdown for the selected head location.

The list shows all the blobs the selected head location was part of.

Sort the table using this dropdown.

Blob icon
Element icon

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<table>
<thead>
<tr>
<th>Location</th>
<th>Start time</th>
<th>End time</th>
<th>Duration</th>
<th>Max length (miles)</th>
<th>Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>MD-193/UN...</td>
<td>Sun 3/15 12:41 PM</td>
<td>Sun 3/15 12:49 PM</td>
<td>8 m</td>
<td>2.22</td>
<td>6.90</td>
</tr>
<tr>
<td>MD-97/GE...</td>
<td>Sun 3/15 12:46 PM</td>
<td>Sun 3/15 12:47 PM</td>
<td>1 m</td>
<td>1.64</td>
<td>1.64</td>
</tr>
<tr>
<td>US-29/COL...</td>
<td>Sun 3/15 12:47 PM</td>
<td>Sun 3/15 12:49 PM</td>
<td>2 m</td>
<td>0.25</td>
<td>0.51</td>
</tr>
<tr>
<td>MD-193/UN...</td>
<td>Sun 3/15 02:42 PM</td>
<td>Sun 3/15 03:10 PM</td>
<td>28 m</td>
<td>5.21</td>
<td>74.55</td>
</tr>
<tr>
<td>MD-97/GE...</td>
<td>Sun 3/15 02:45 PM</td>
<td>Sun 3/15 02:47 PM</td>
<td>3 m</td>
<td>3.24</td>
<td>6.48</td>
</tr>
<tr>
<td>MD-97/GE...</td>
<td>Sun 3/15 02:47 PM</td>
<td>Sun 3/15 02:49 PM</td>
<td>3 m</td>
<td>3.60</td>
<td>7.21</td>
</tr>
<tr>
<td>MD-185/CO...</td>
<td>Sun 3/15 02:49 PM</td>
<td>Sun 3/15 02:50 PM</td>
<td>1 m</td>
<td>5.21</td>
<td>5.21</td>
</tr>
<tr>
<td>MD-97/GE...</td>
<td>Sun 3/15 02:50 PM</td>
<td>Sun 3/15 02:53 PM</td>
<td>3 m</td>
<td>2.46</td>
<td>7.40</td>
</tr>
<tr>
<td>MD-185/CO...</td>
<td>Sun 3/15 02:53 PM</td>
<td>Sun 3/15 02:58 PM</td>
<td>5 m</td>
<td>3.05</td>
<td>16.36</td>
</tr>
<tr>
<td>MD-185/CO...</td>
<td>Sun 3/15 02:58 PM</td>
<td>Sun 3/15 03:05 PM</td>
<td>7 m</td>
<td>3.59</td>
<td>20.40</td>
</tr>
<tr>
<td>MD-185/CO...</td>
<td>Sun 3/15 03:05 PM</td>
<td>Sun 3/15 03:10 PM</td>
<td>5 m</td>
<td>1.60</td>
<td>8.03</td>
</tr>
<tr>
<td>MD-97/GE...</td>
<td>Mon 3/2 06:26 AM</td>
<td>Mon 3/2 11:55 AM</td>
<td>5 h 29 m</td>
<td>6.44</td>
<td>1078.69</td>
</tr>
<tr>
<td>MD-97/GE...</td>
<td>Mon 3/2 05:23 PM</td>
<td>Mon 3/2 06:05 PM</td>
<td>42 m</td>
<td>3.87</td>
<td>50.04</td>
</tr>
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<td>5 m</td>
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<td>10.56</td>
</tr>
</tbody>
</table>
Thanks!

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