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

Driven by Questions & Feedback from Users

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

Bottleneck Ranking Tool – the changes

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.

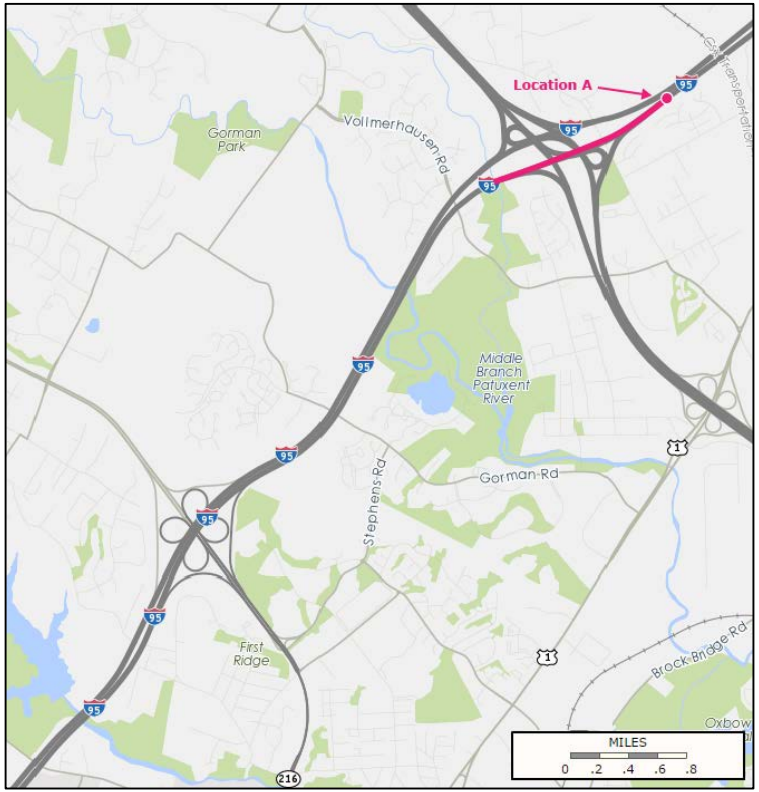
- **Blob** - a collection of spatially and temporally adjacent congestion elements.

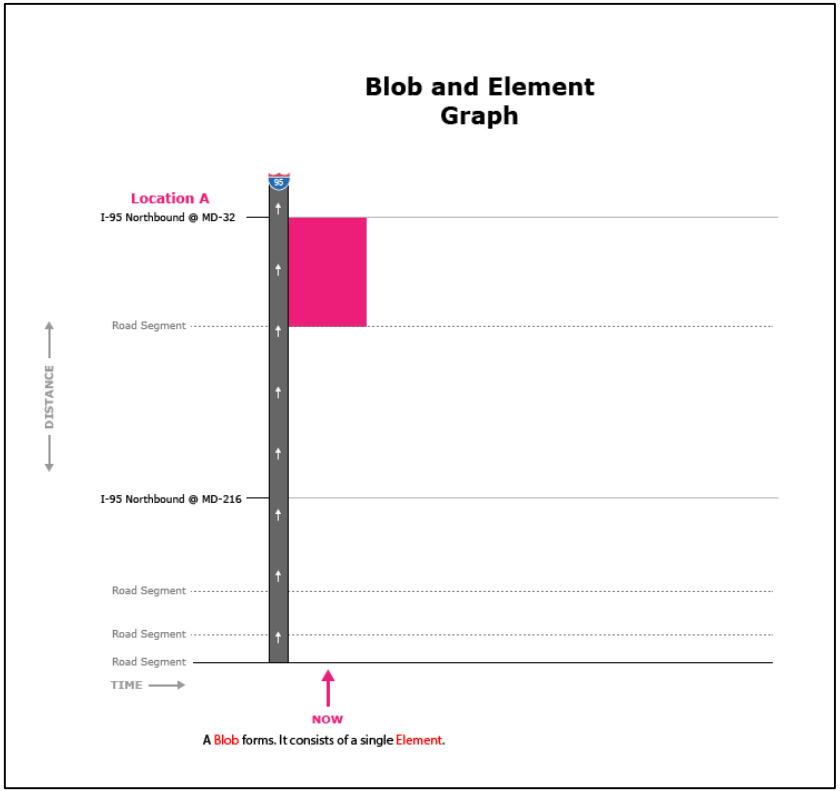
Some Bottleneck Stories

- Growing & shrinking
- Moving back
- Merging
- Two separate

Blob growing and shrinking

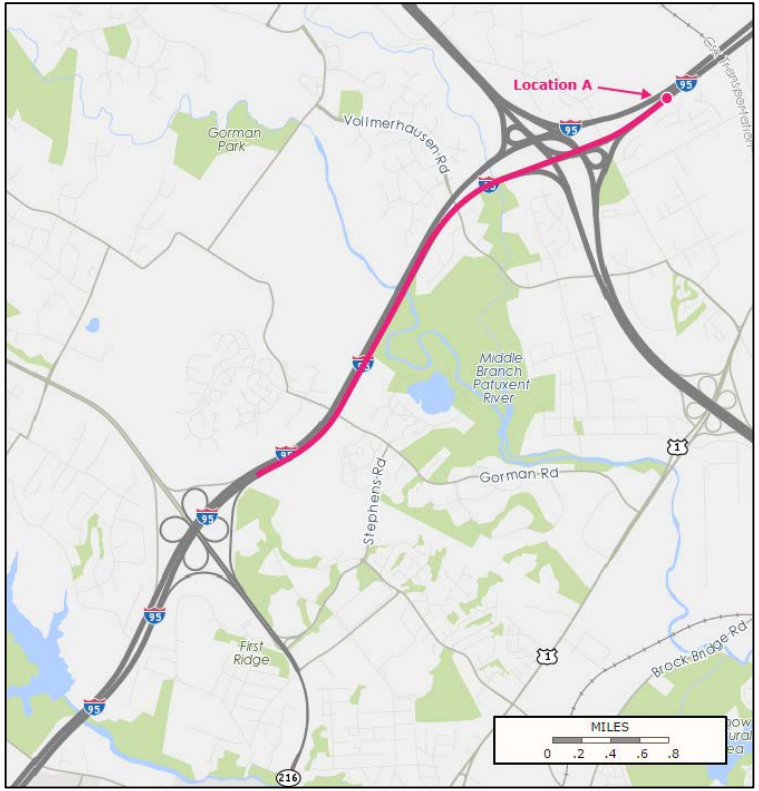
Congestion occurs because of merging at Location A.

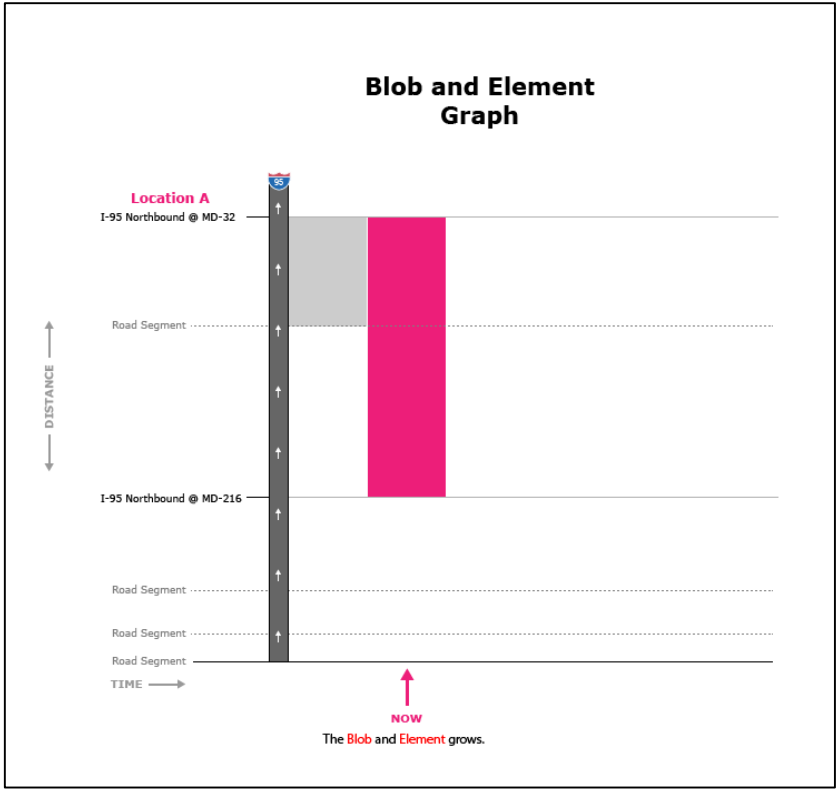




Blob growing and shrinking

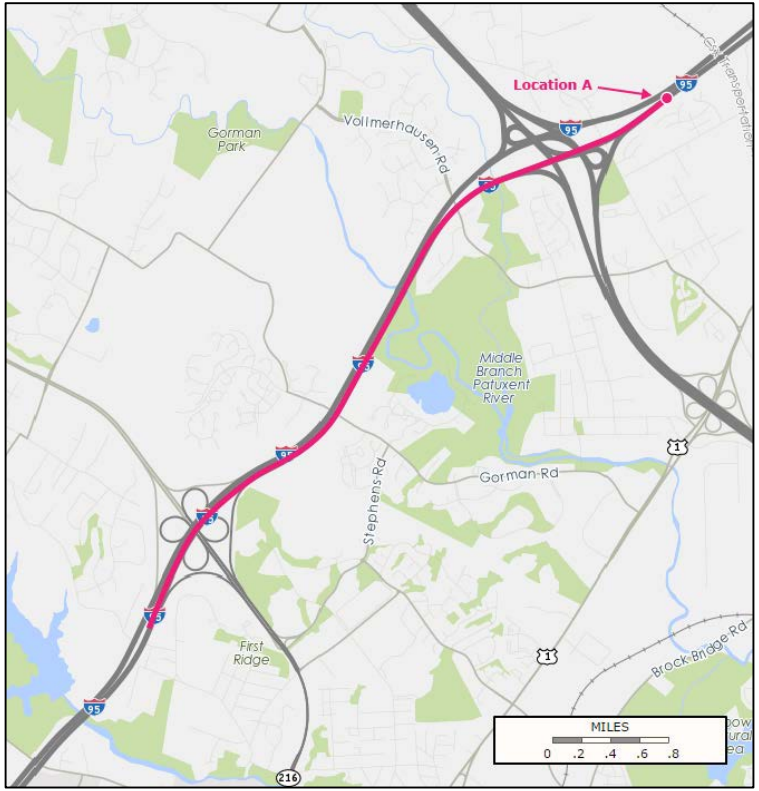
Additional traffic caused by the morning rush builds up. Congestion starts backing up at this point.

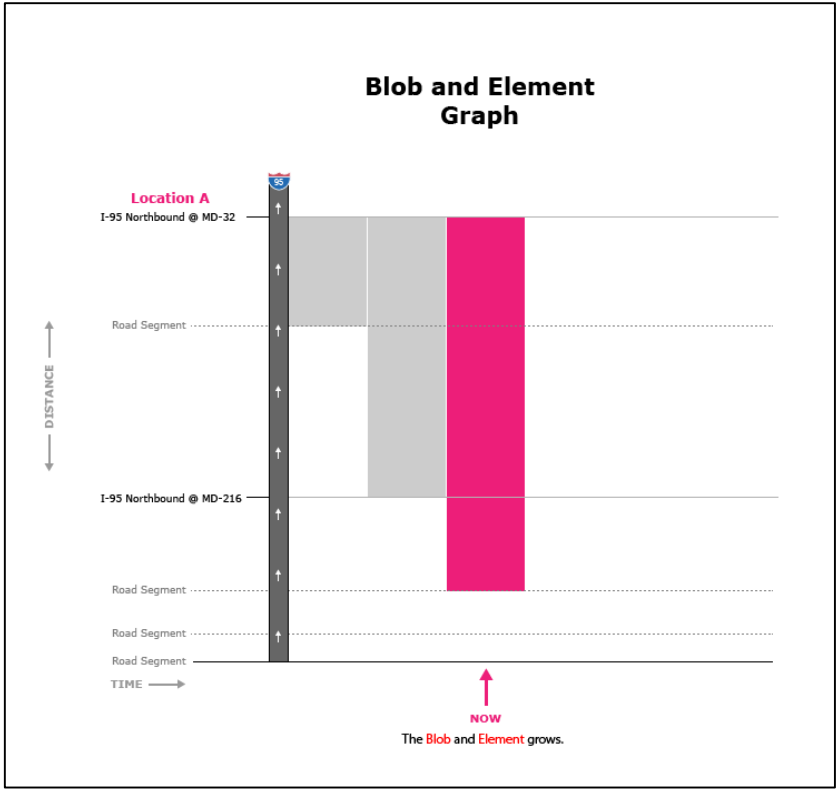




Blob growing and shrinking

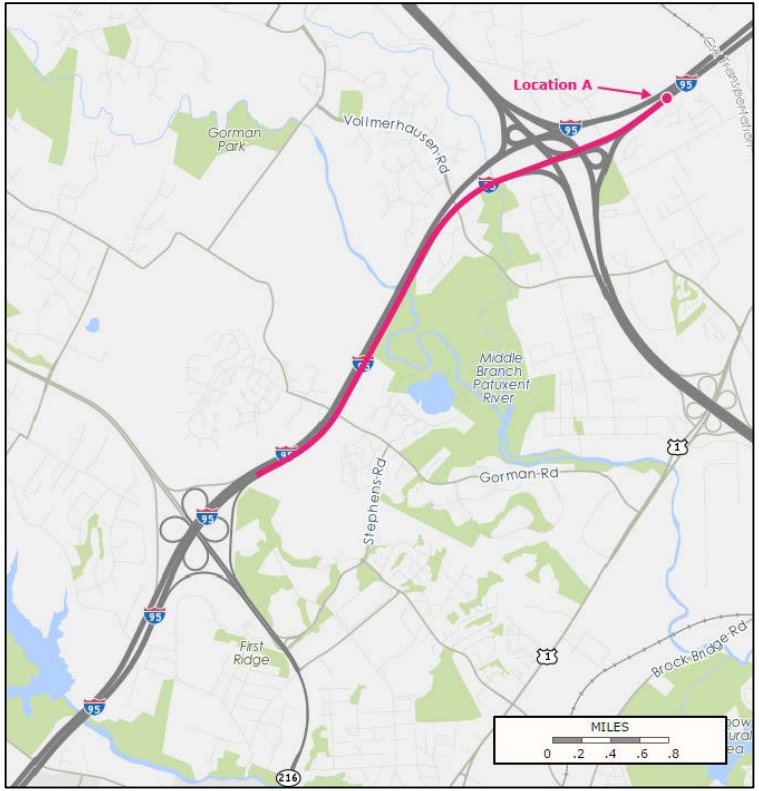
Congestion continues to grow.

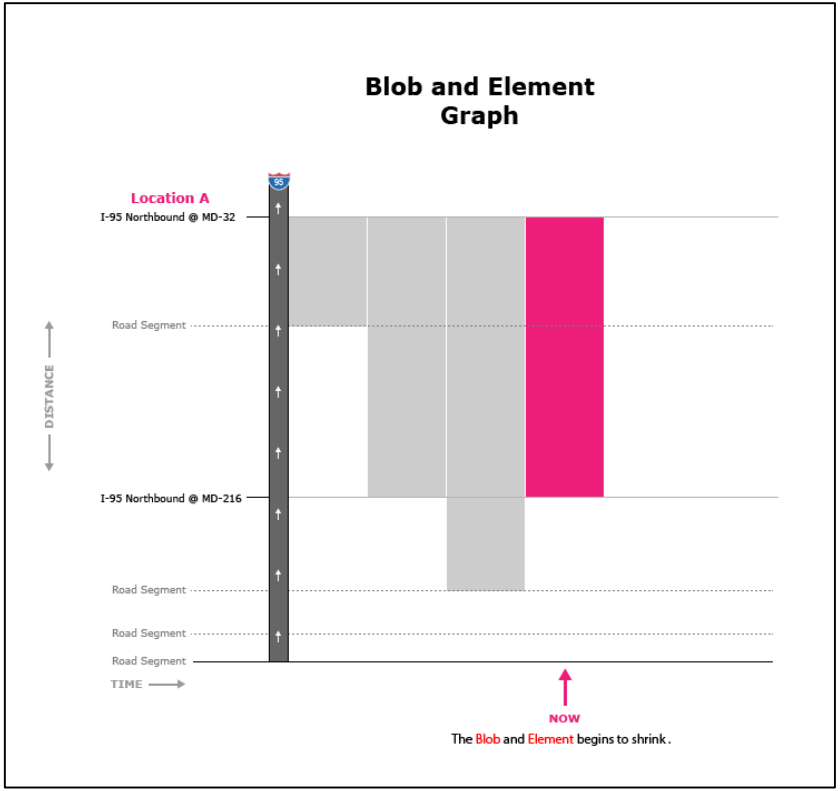




Blob growing and shrinking

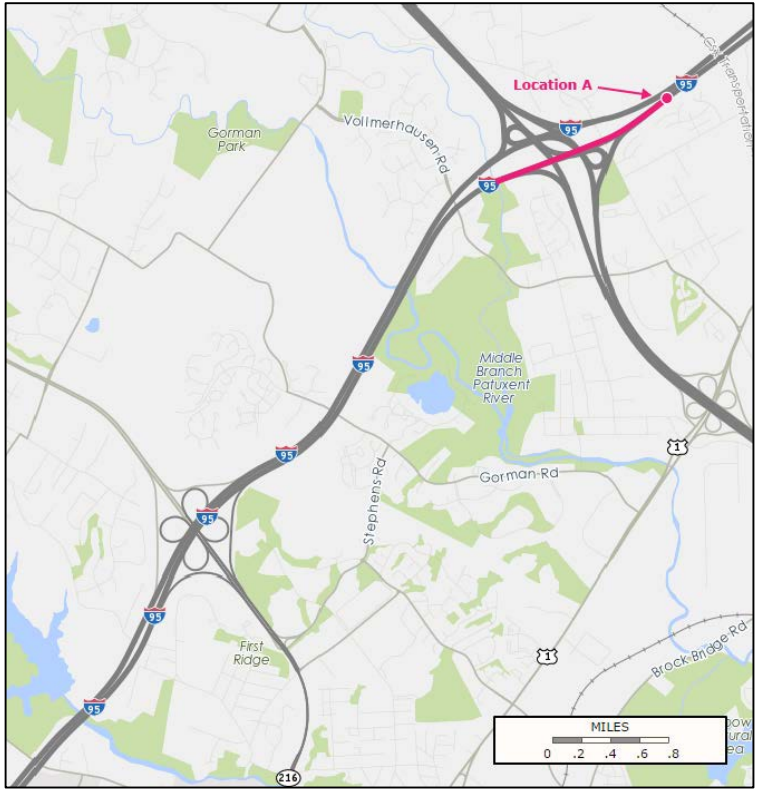
The morning rush is subsiding, lessening congestion.

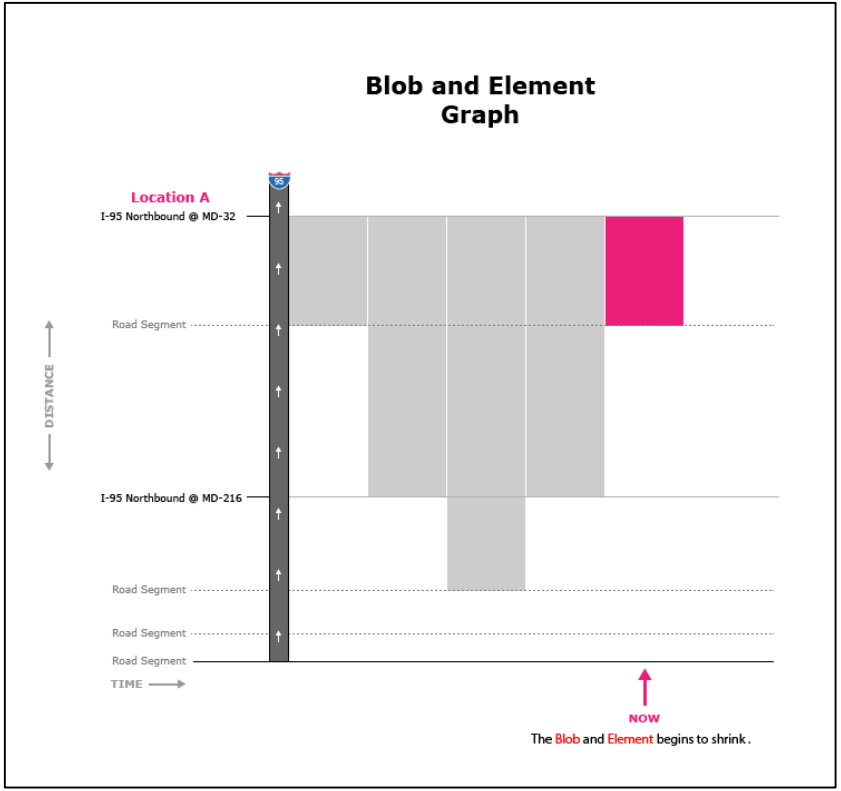




Blob growing and shrinking

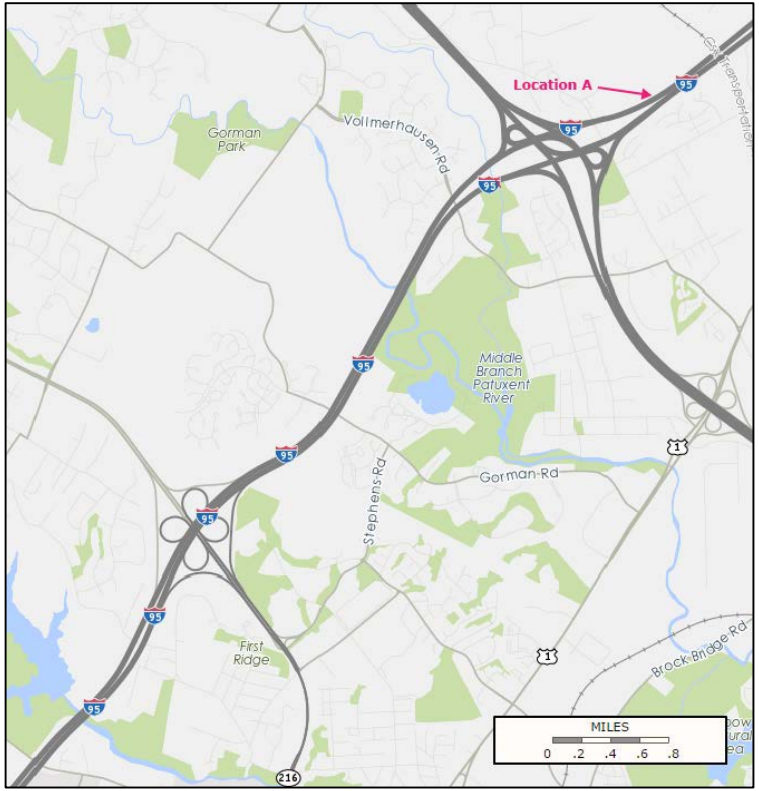
Rush hour ends and traffic normalizes.

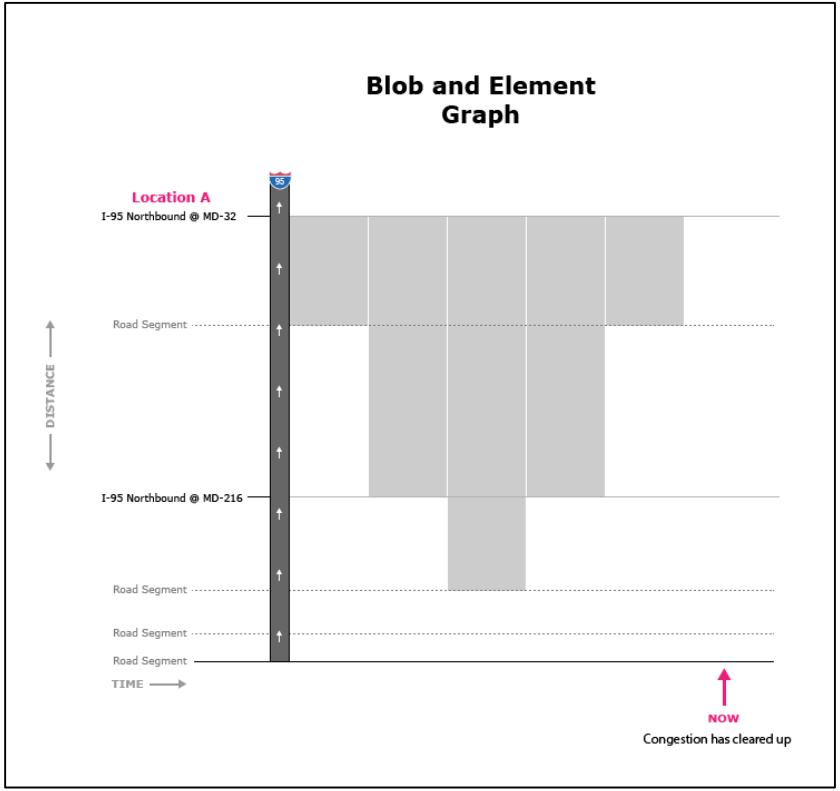




Blob growing and shrinking

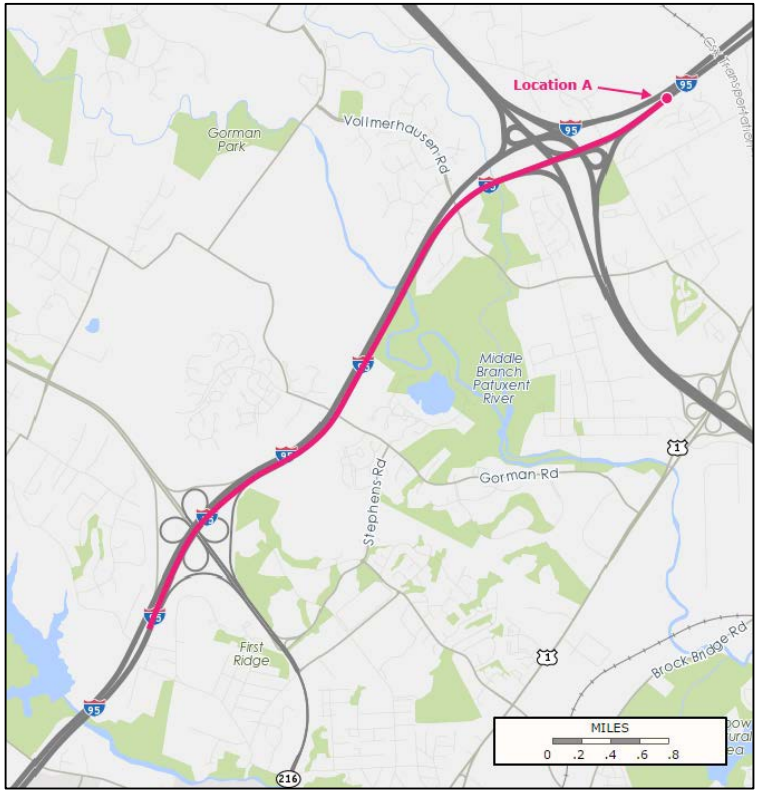
Rush hour ends and traffic normalizes.

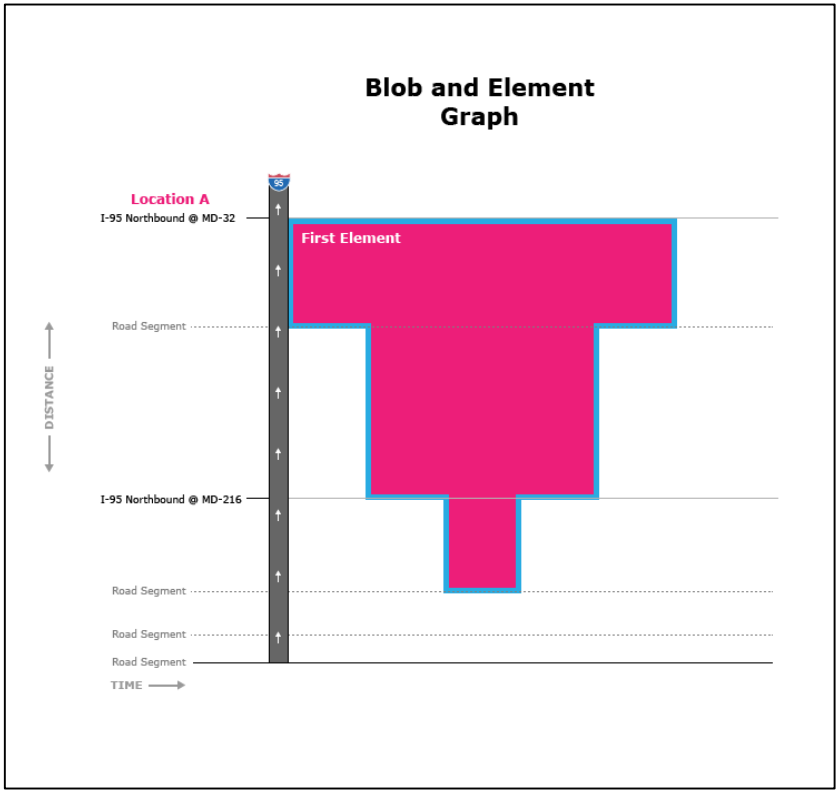




Blob growing and shrinking

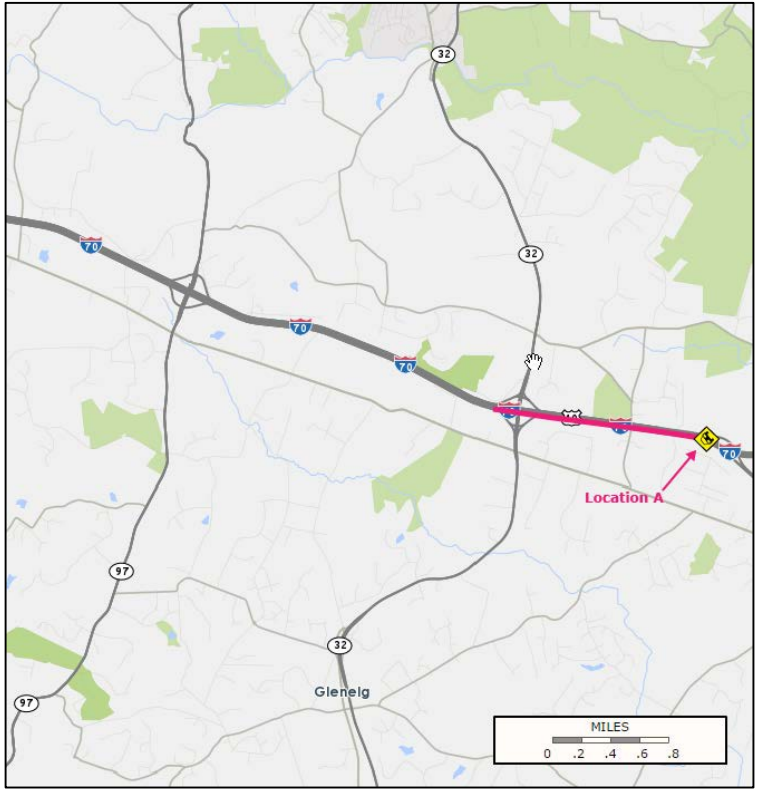
This is what the Blob looked like.

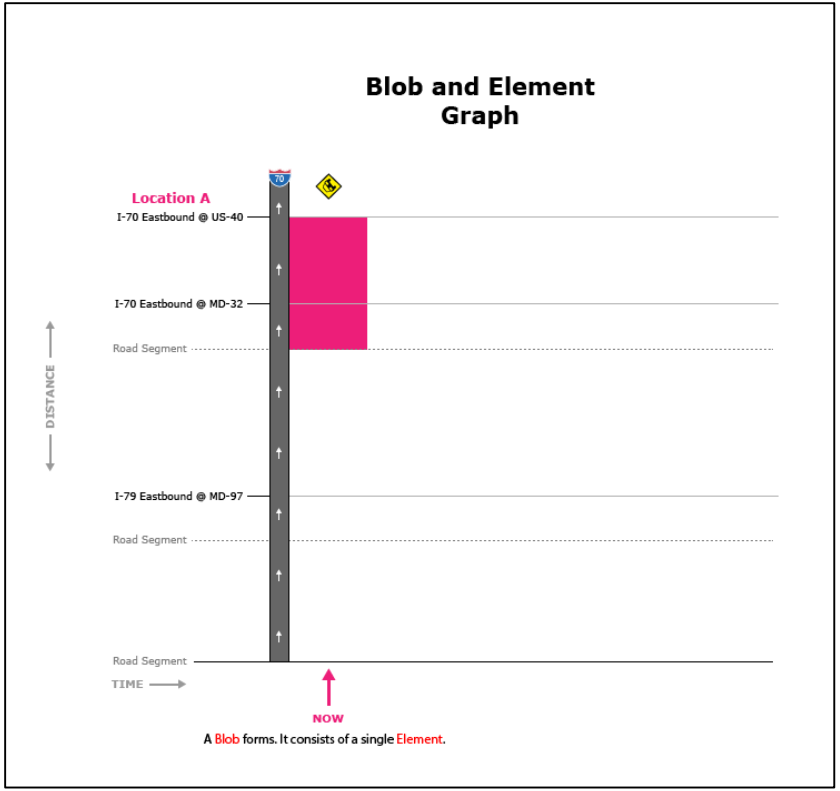




Blob moving back

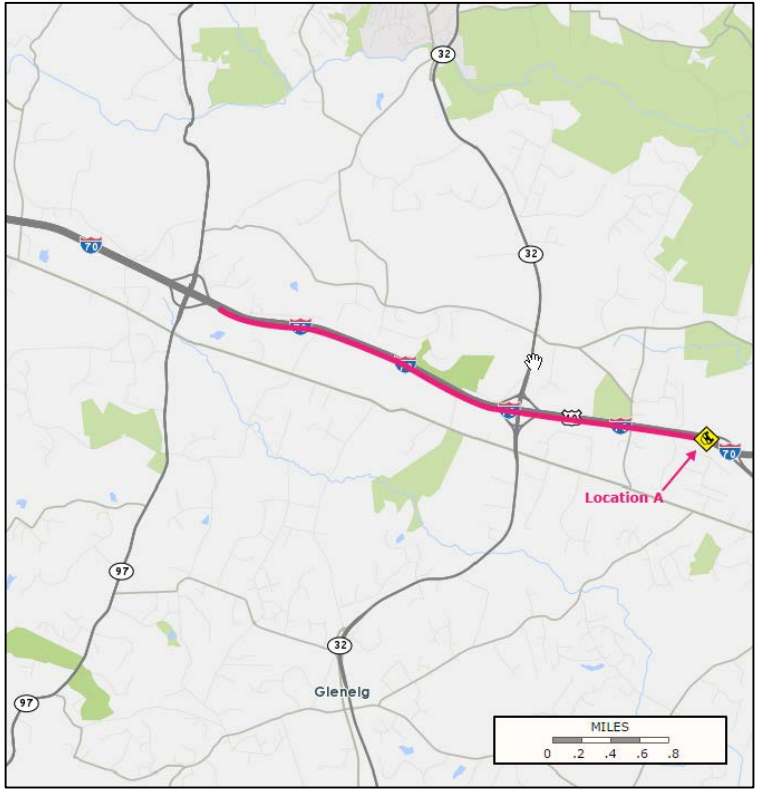
An incident occurs at Location A incurring a lane closure that causes congestion to build.

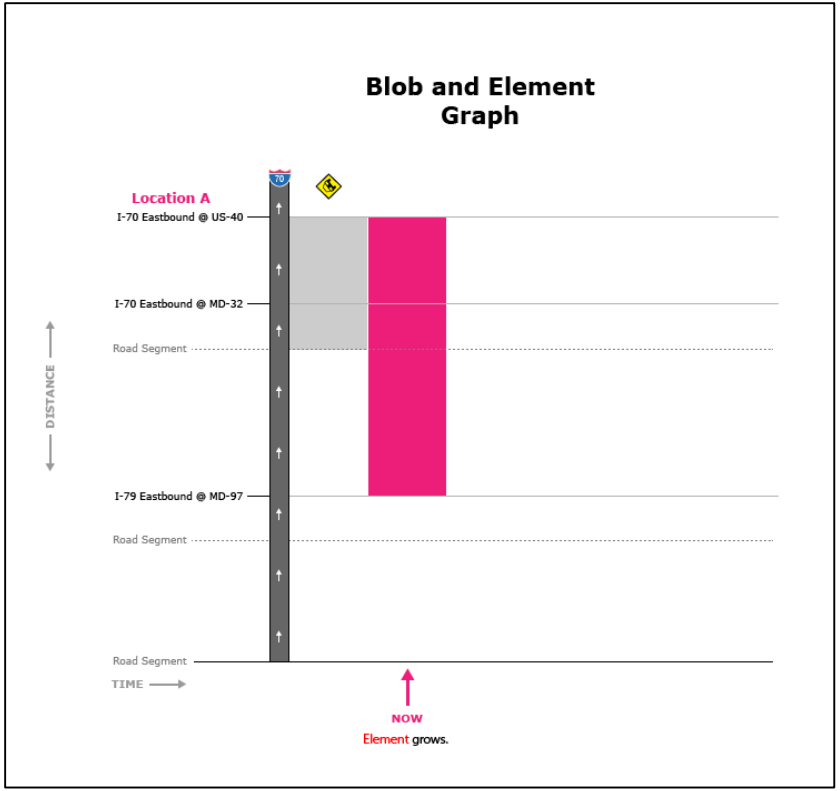




Blob moving back

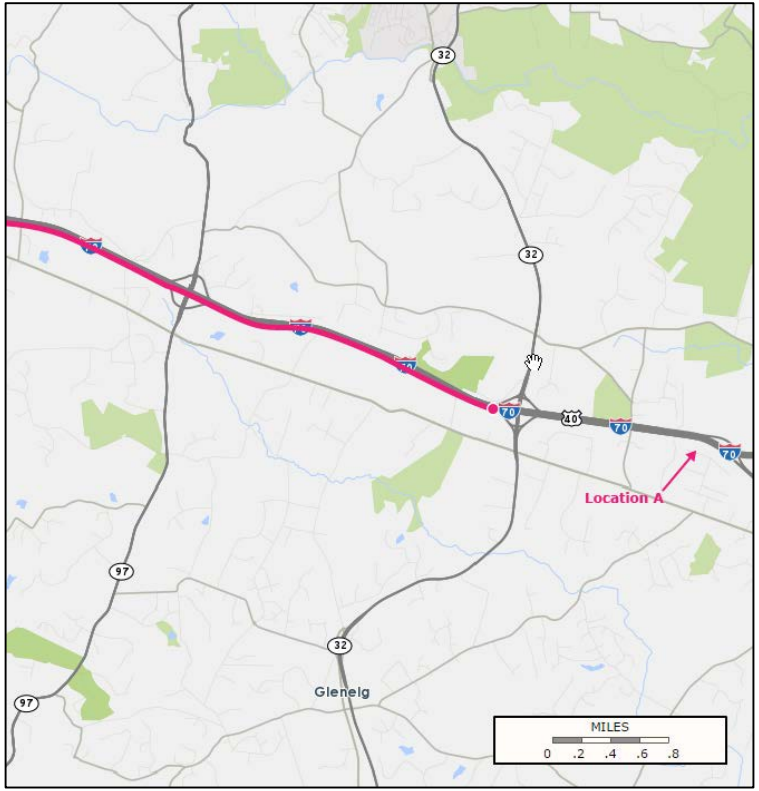
The lane is still closed so congestion continues to build.

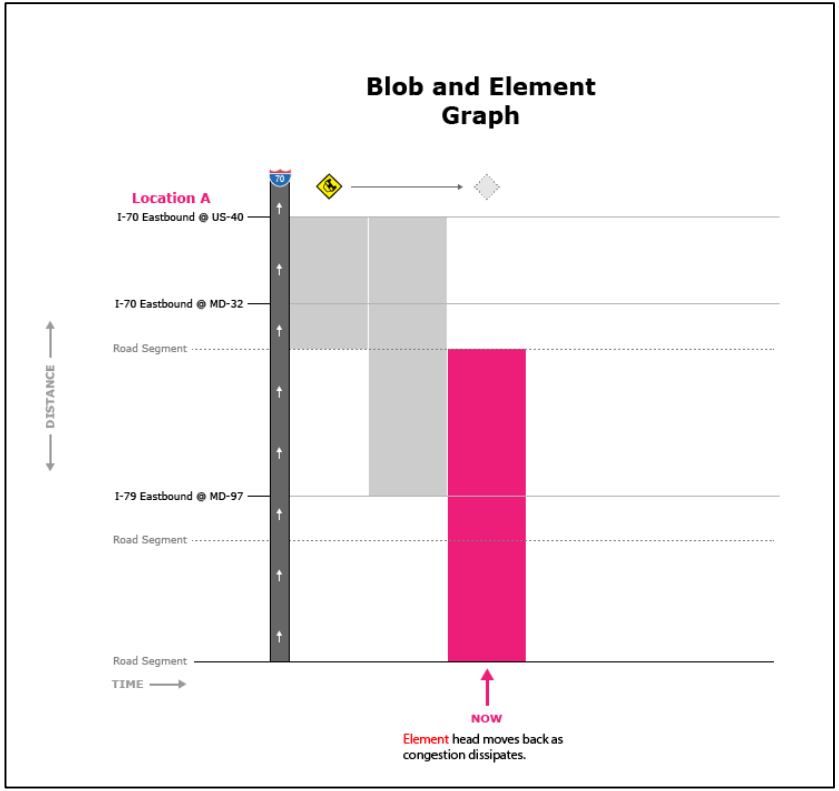




Blob moving back

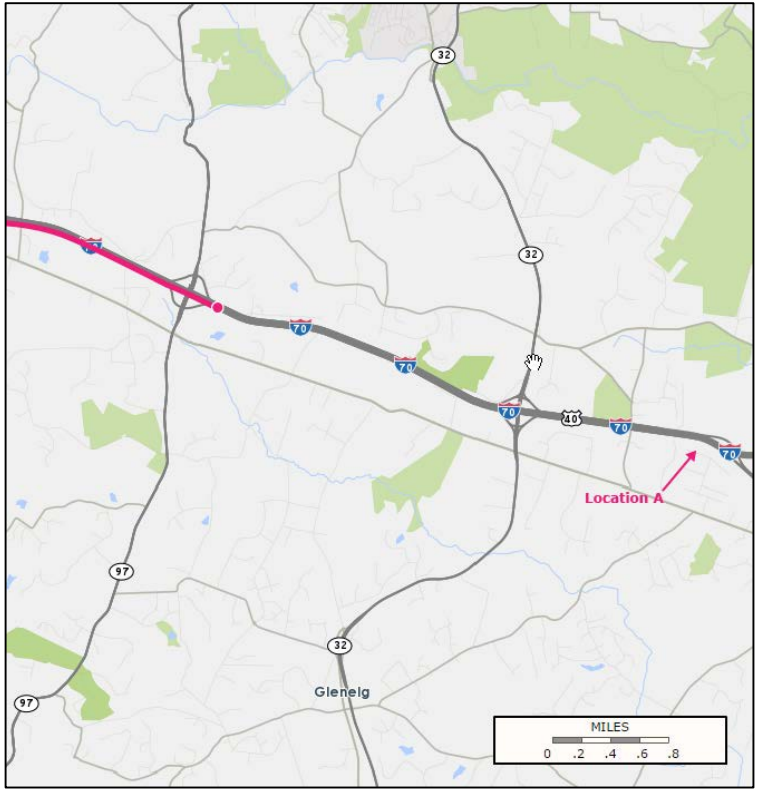
The incident is cleared and all lanes opened. Traffic starts flowing normally at Location A. Residual congestion remains just upstream and continues to build.

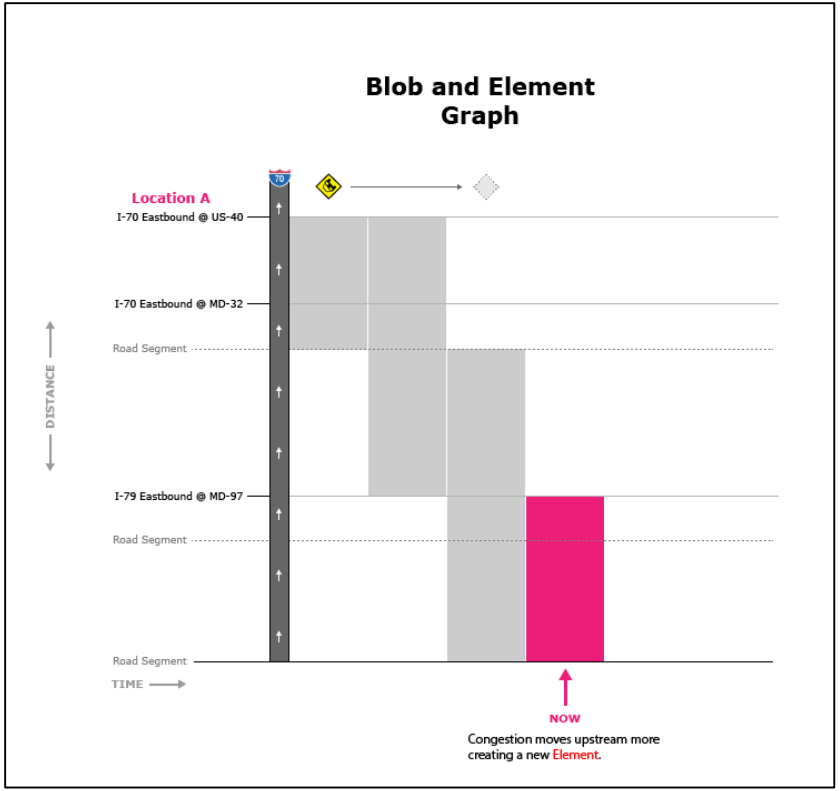




Blob moving back

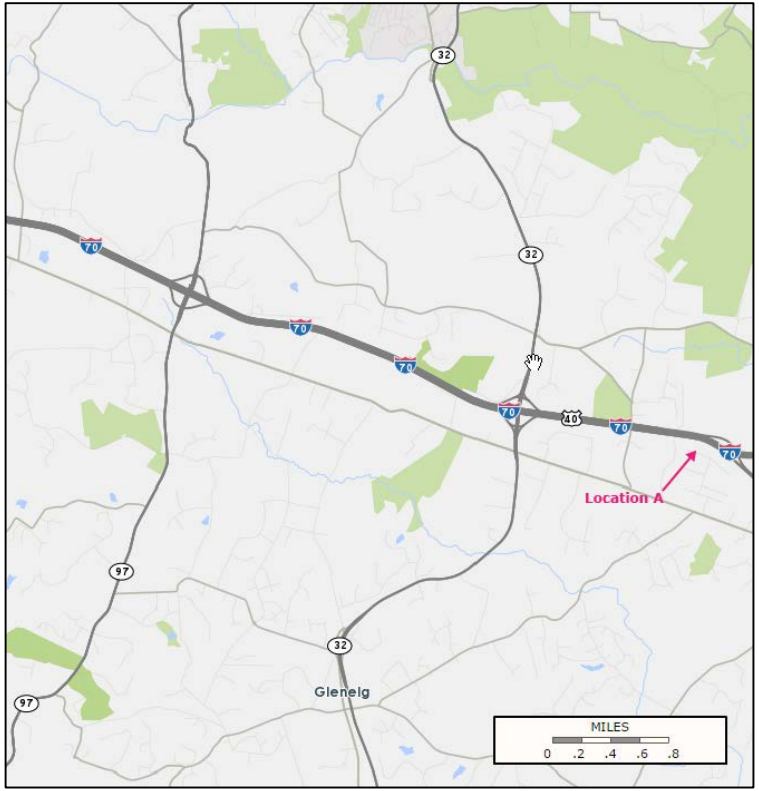
Residual congestion lessens as traffic begins to normalize.

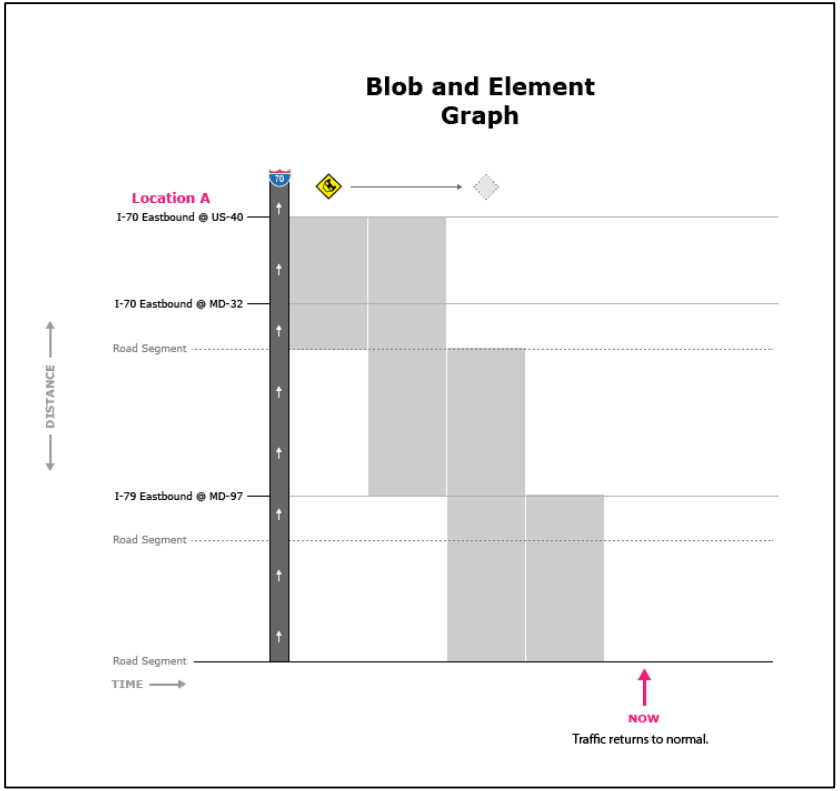




Blob moving back

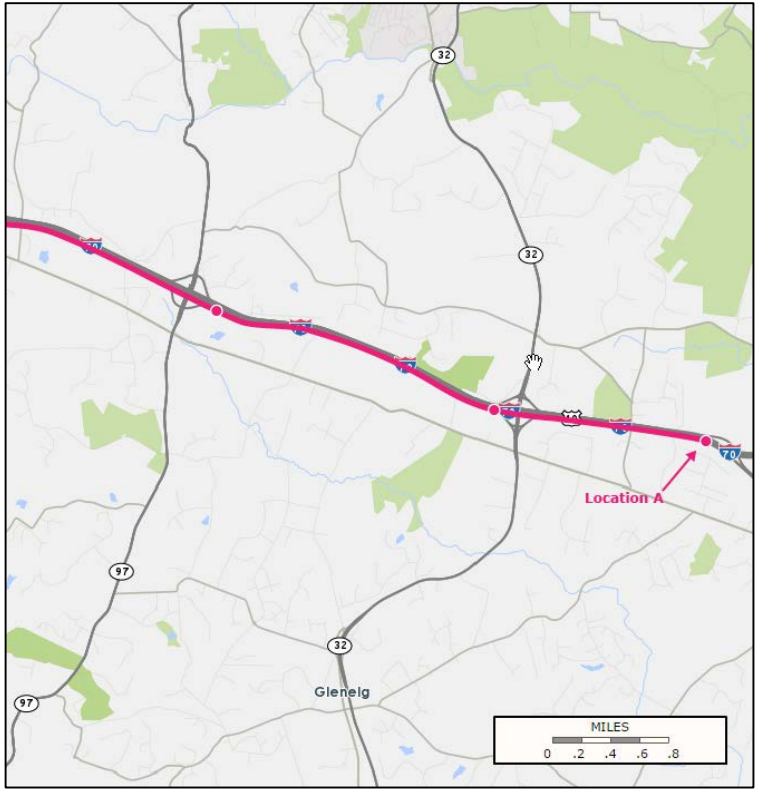
All traffic is flowing normally.

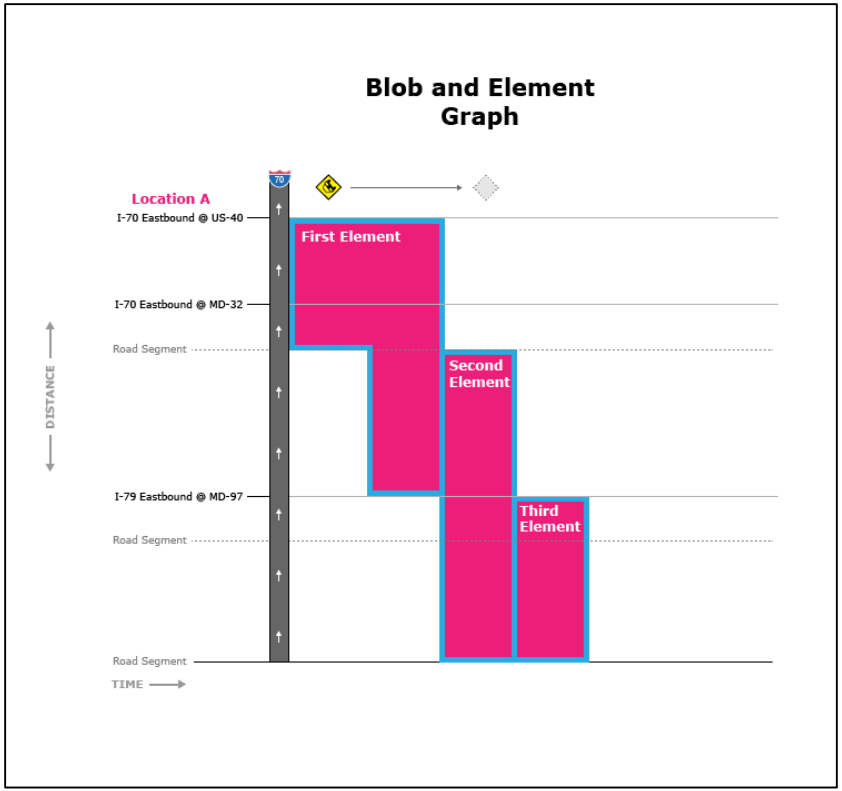




Blob moving back

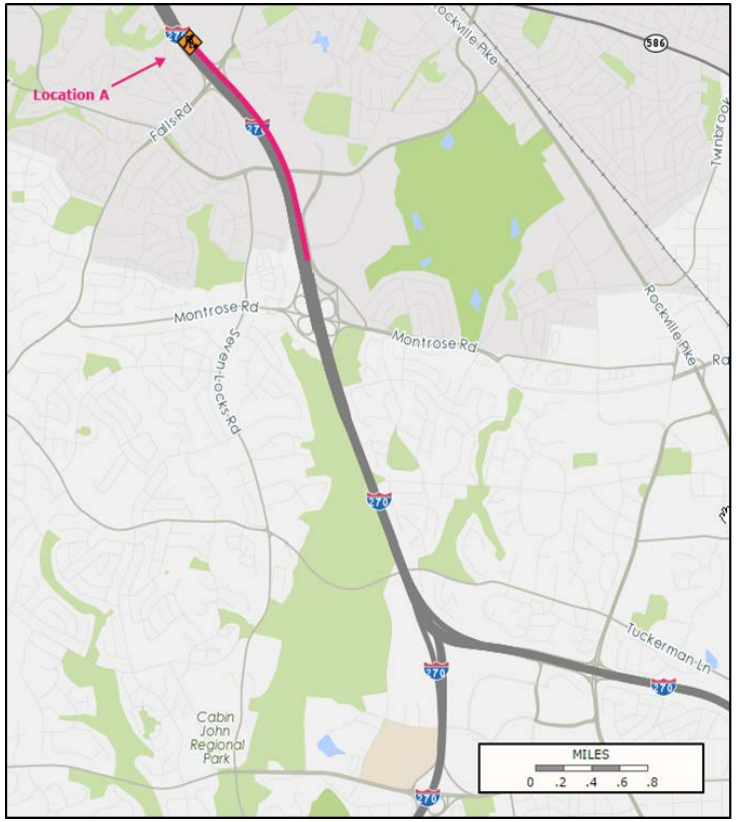
This is what the Blob looked like.

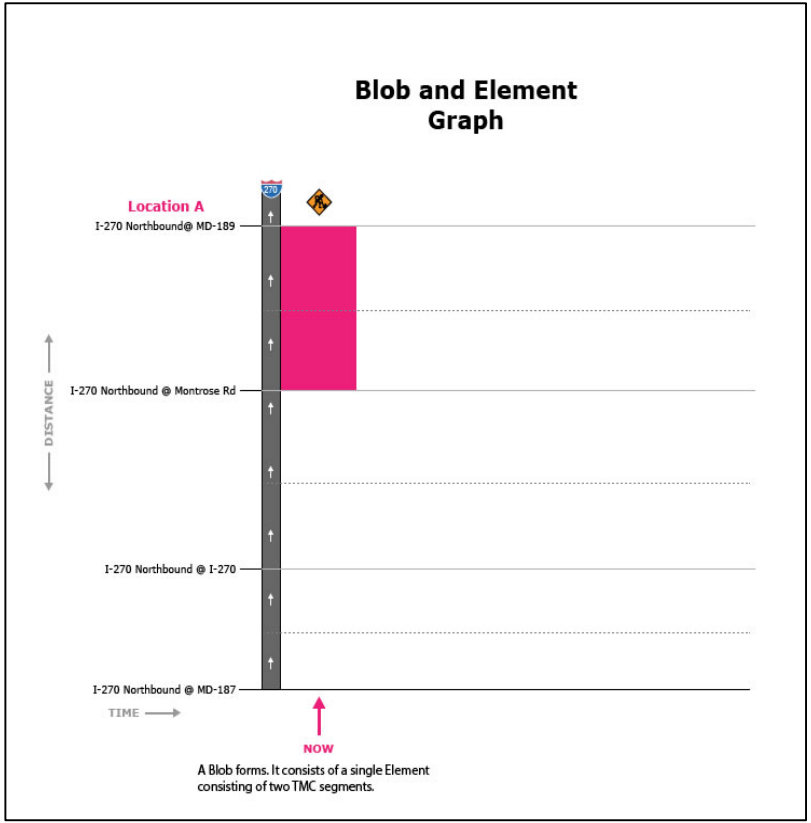




Blobs merging

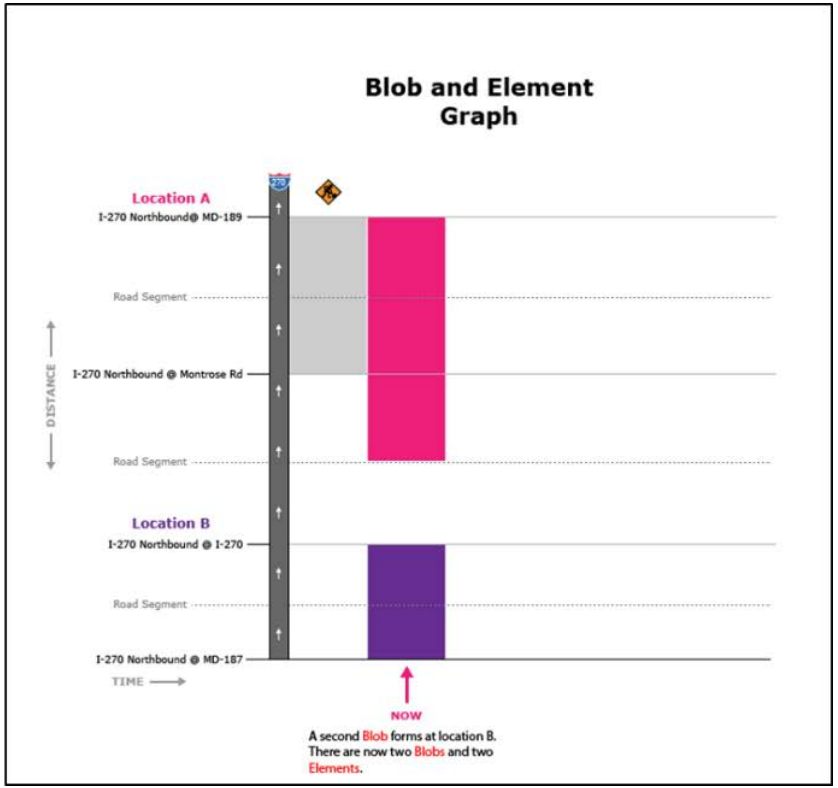
A work zone at Location A causes congestion due to a lane closure





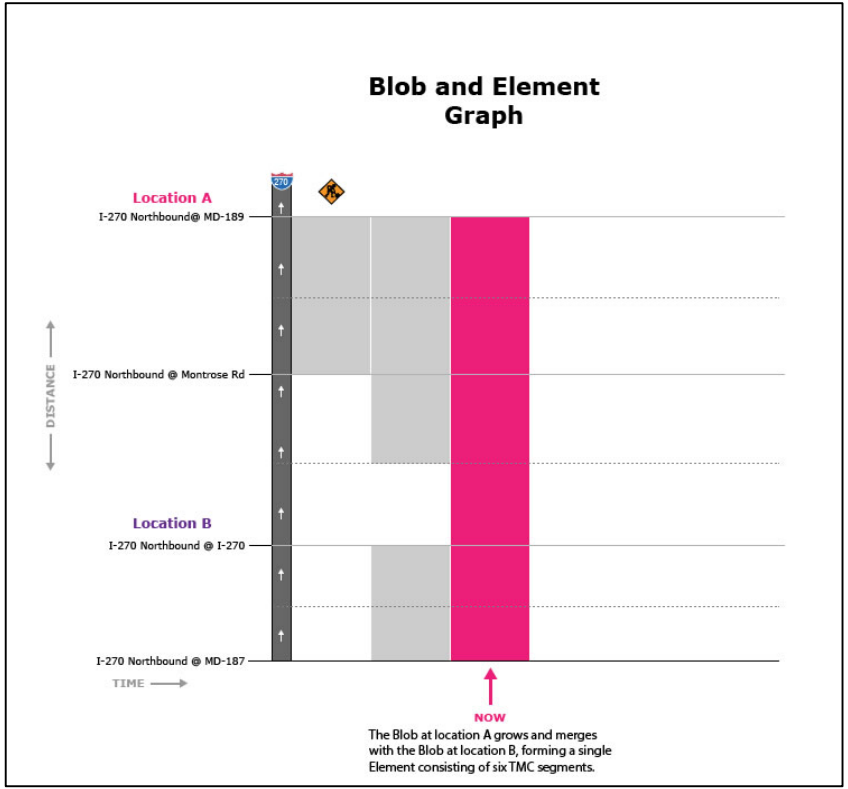
Blobs merging

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.



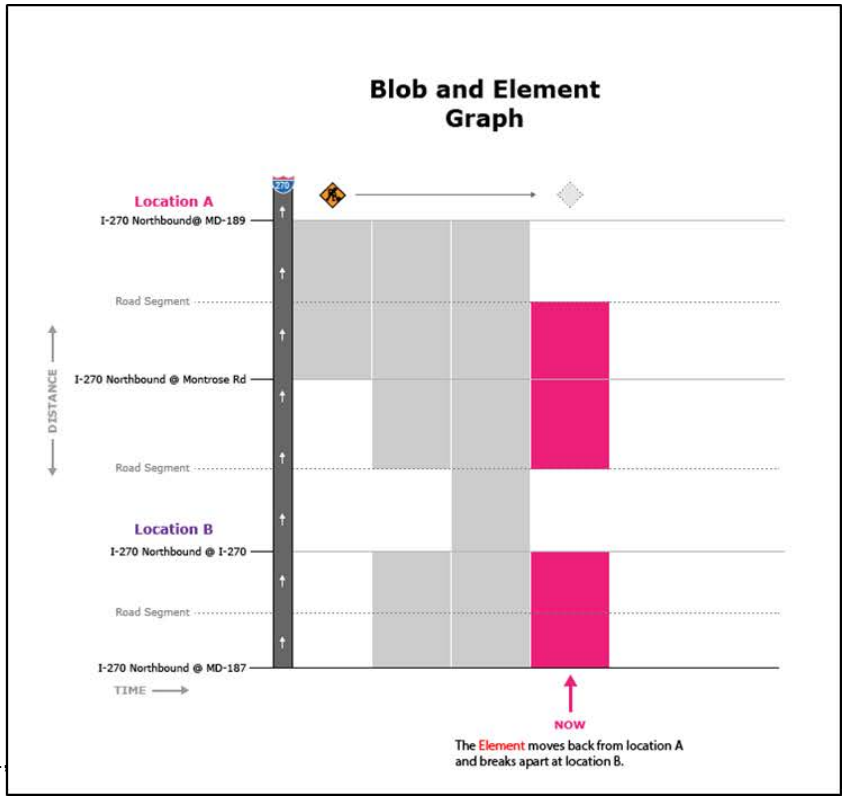
Blobs merging

Congestion from Location A continues to build upstream, merging with congestion from Location B.



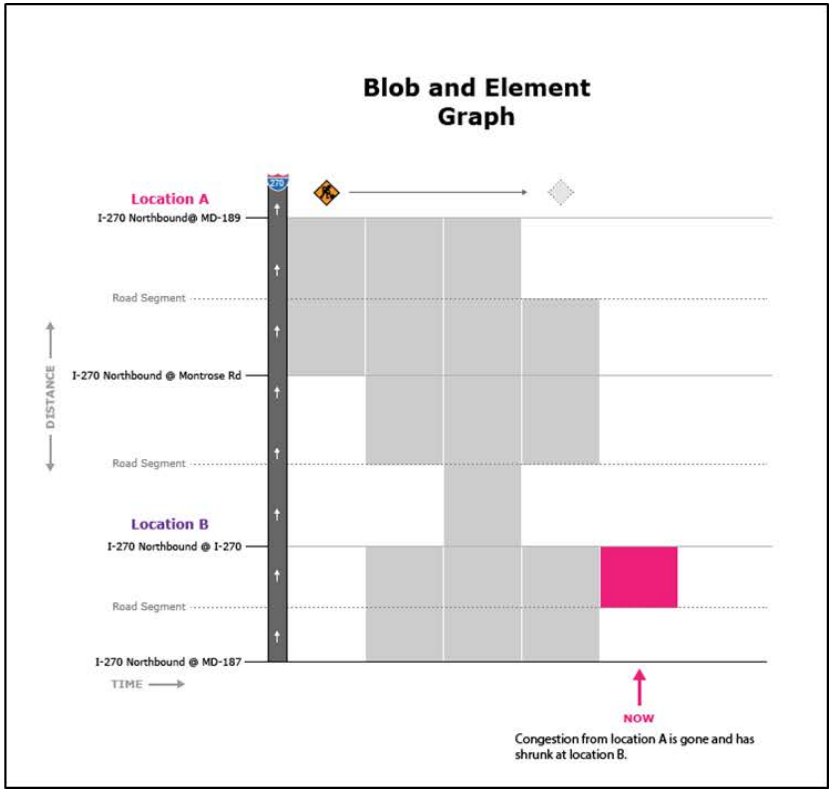
Blobs merging

The work zone at Location A is removed and traffic begins to dissipate. Meanwhile congestion at Location B persists.



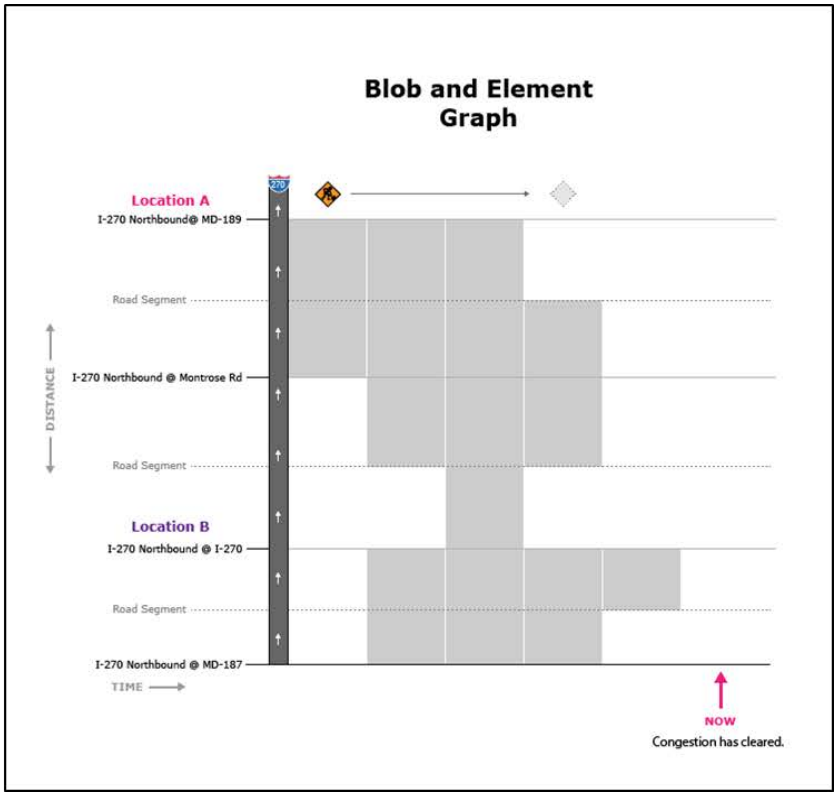
Blobs merging

Rush hour comes to an end and traffic returns to normal at Location B. here is still some residual congestion.



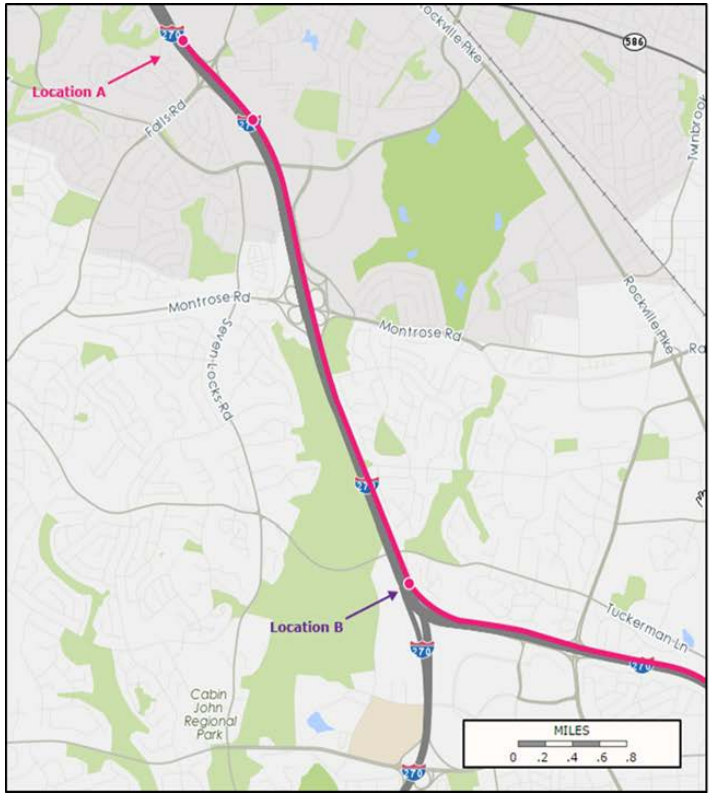
Blobs merging

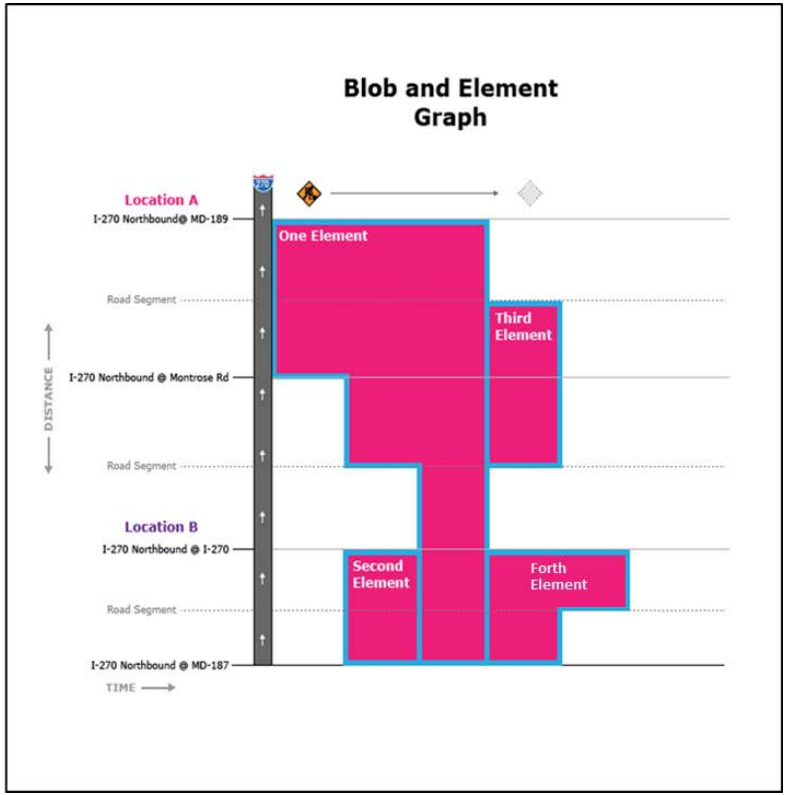
Rush hour comes to an end and traffic dissipates at Location B. There is still some residual congestion.



Blobs merging

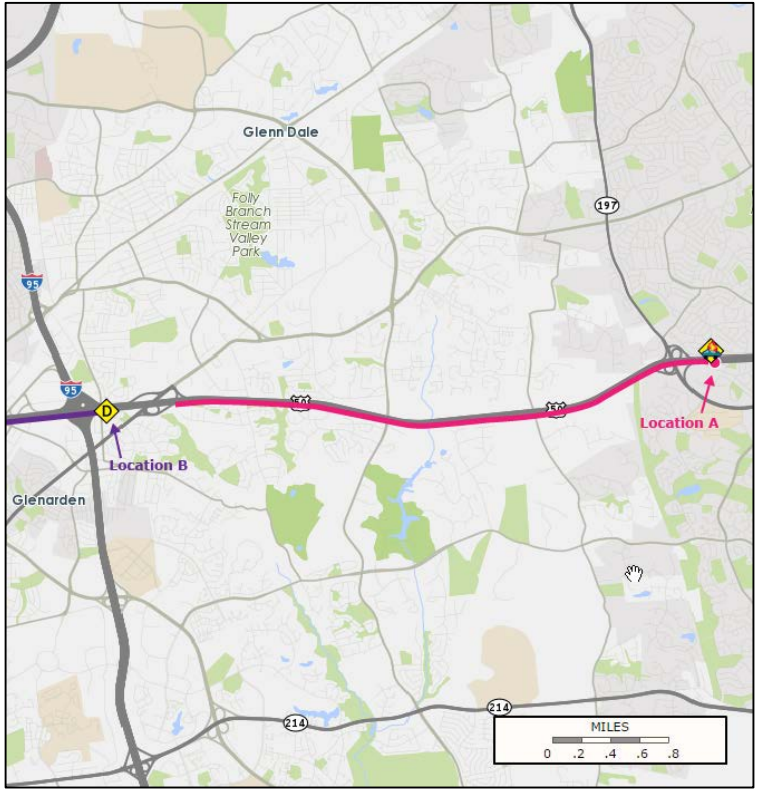
This is what the resultant Blob looked like:

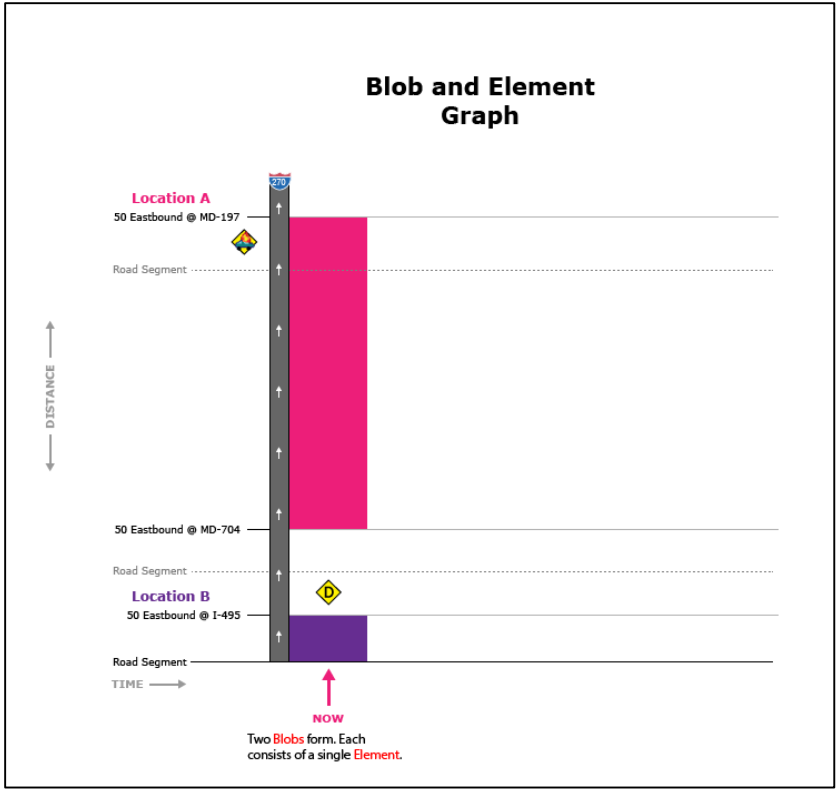




Separate Blobs

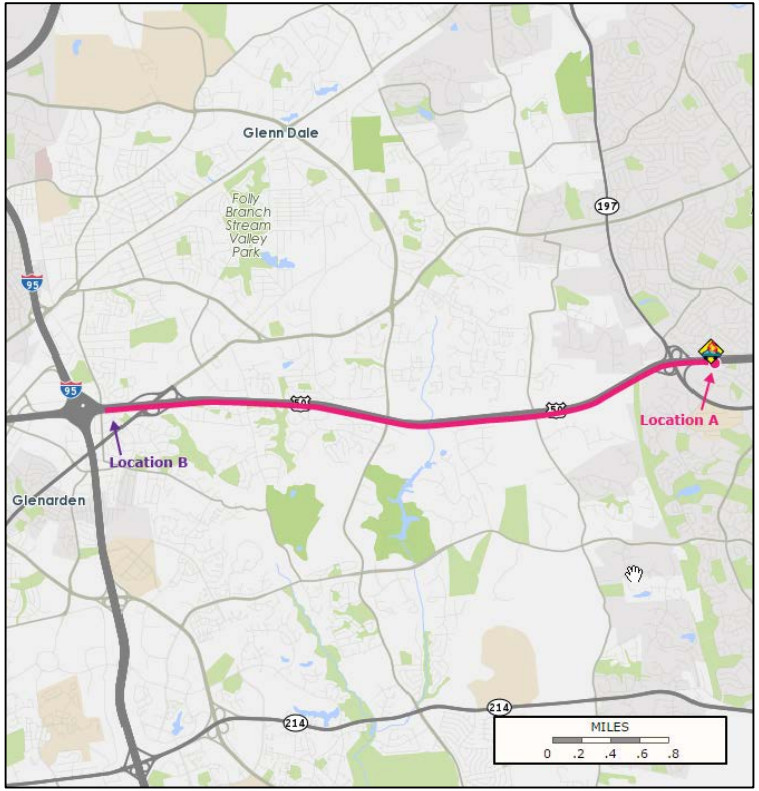
A disabled vehicle blocking a lane at Location B causes backup. A vehicle fire in the westbound lanes causes rubbernecking at Location A.

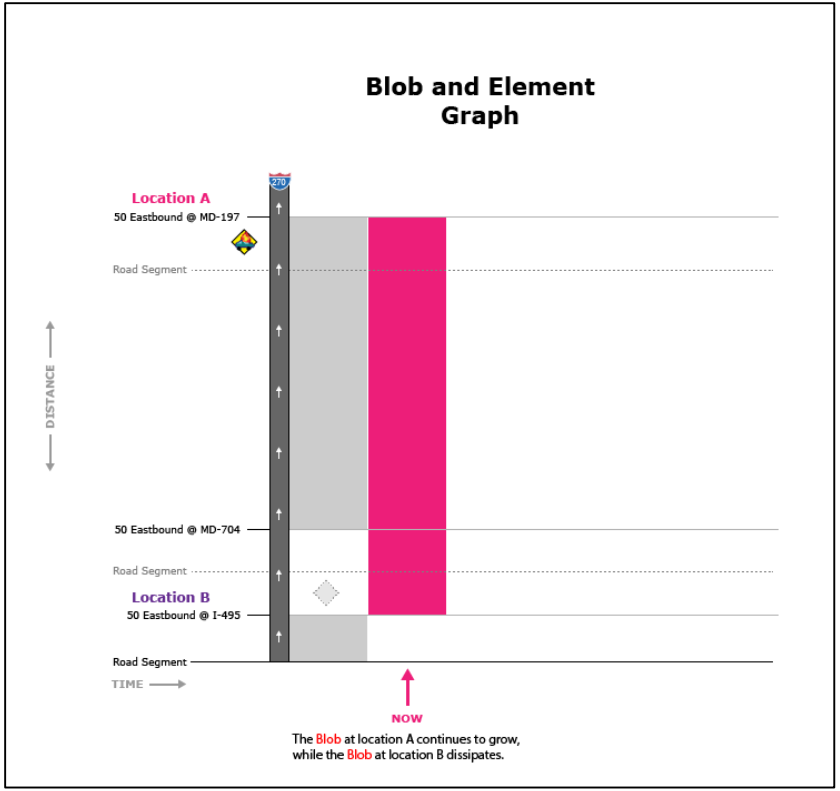




Separate Blobs

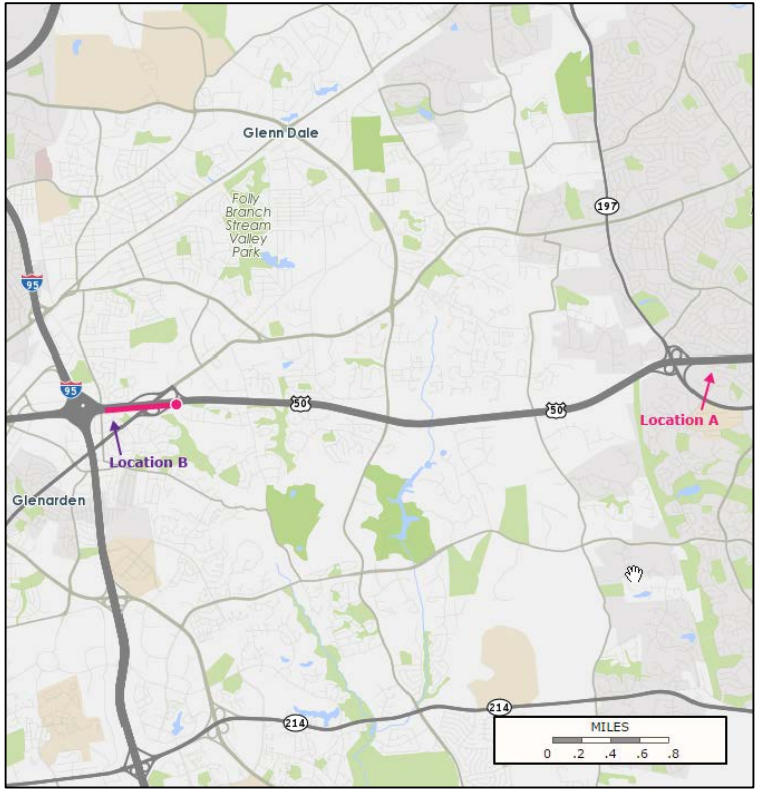
**The disabled vehicle is removed from the roadway, clearing traffic at Location B.
Rubbernecking congestion continues to back up.**

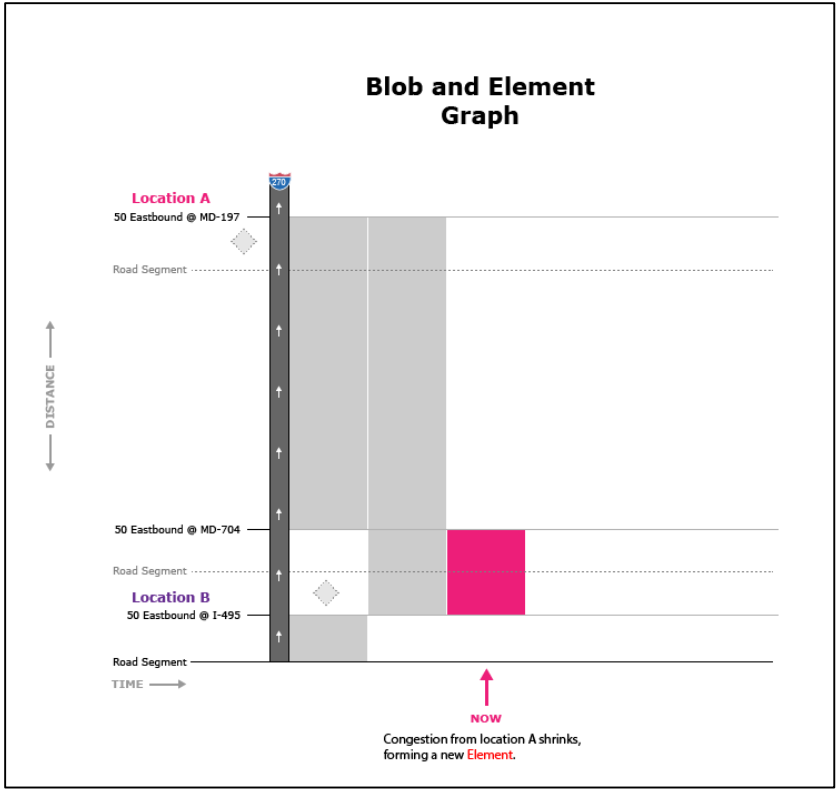




Separate Blobs

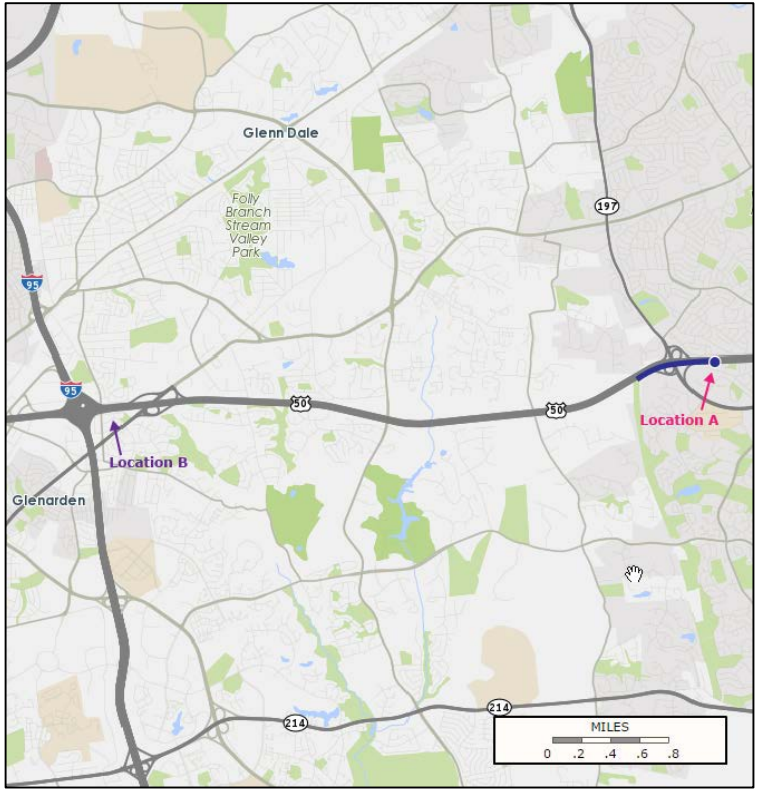
The vehicle fire is cleared in the Westbound lanes. There is no longer anything to see so congestion clears in the Eastbound lanes.

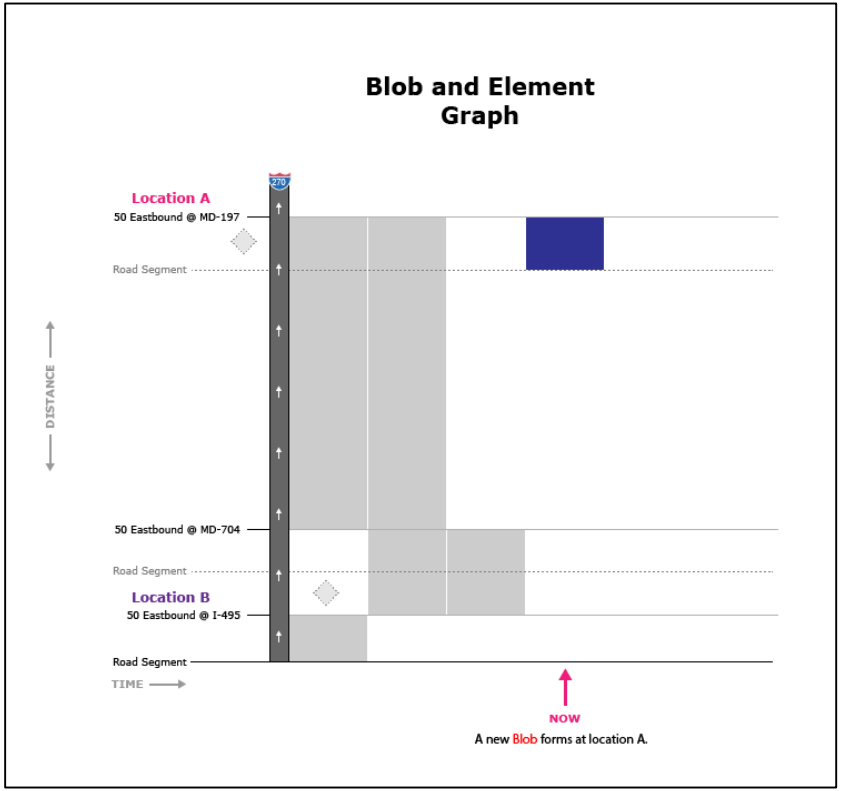




Separate Blobs

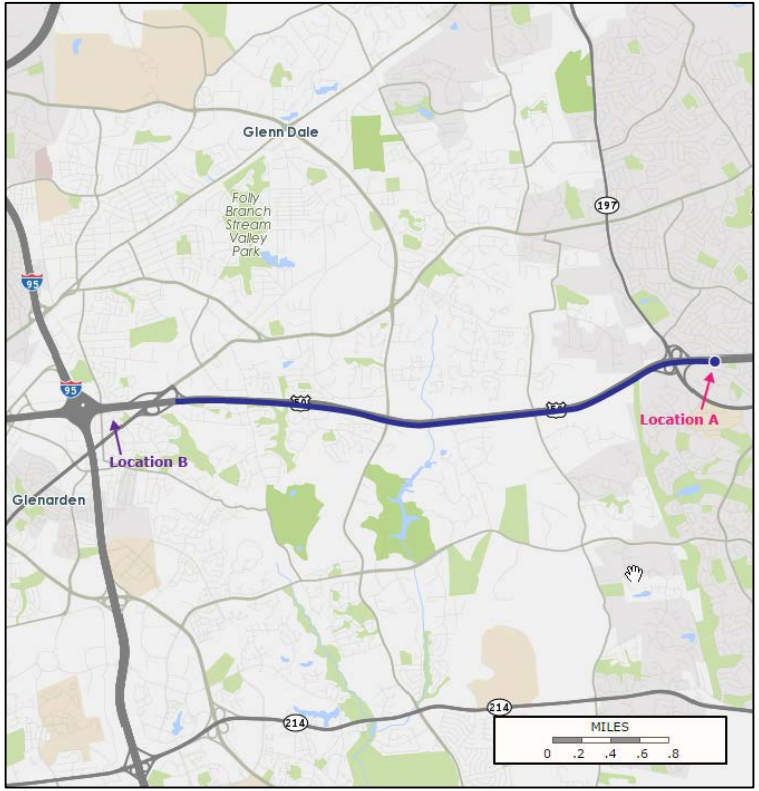
Increased traffic due to rush hour causes congestion to build at Location A.

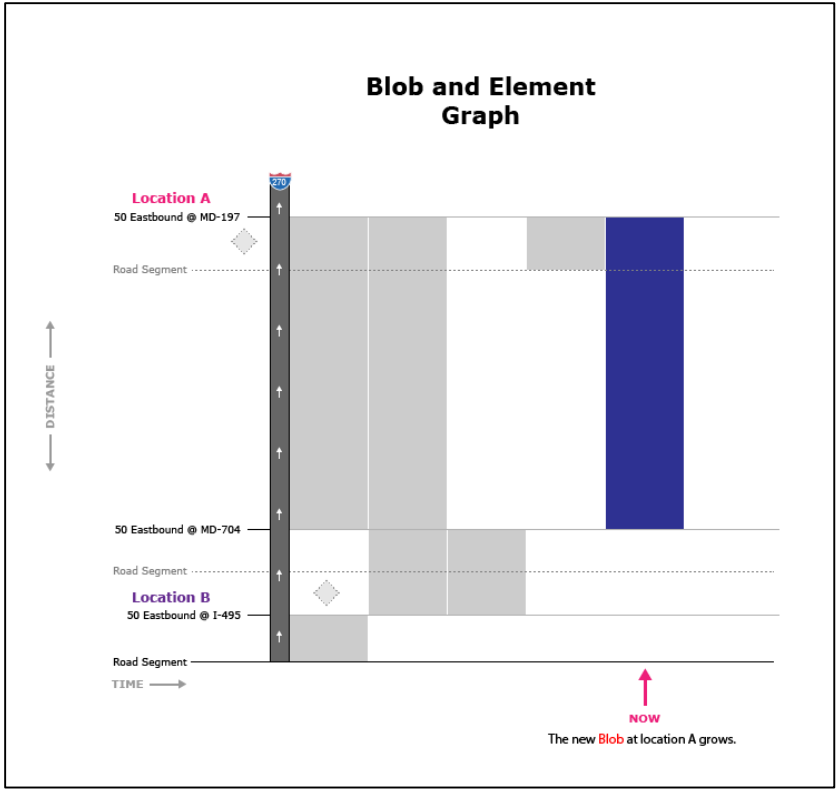




Separate Blobs

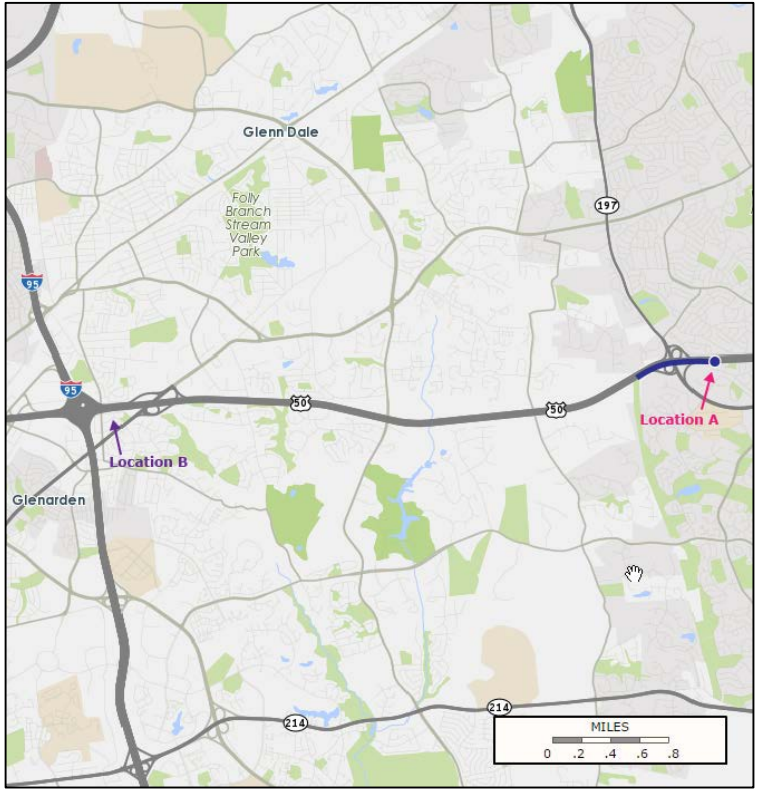
Congestion continues to build up at Location A.

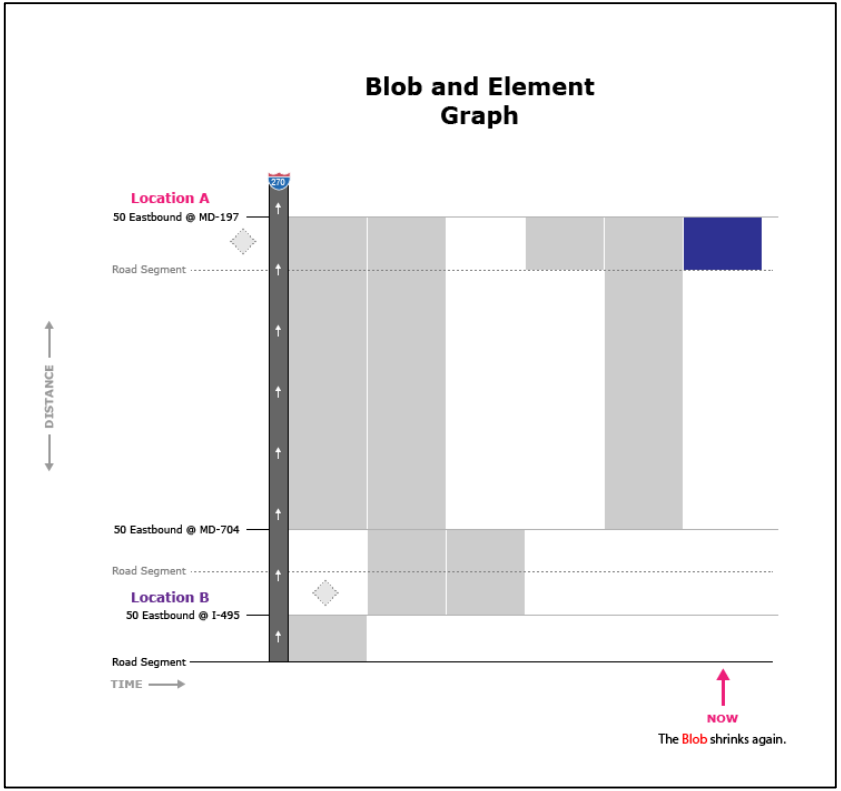




Separate Blobs

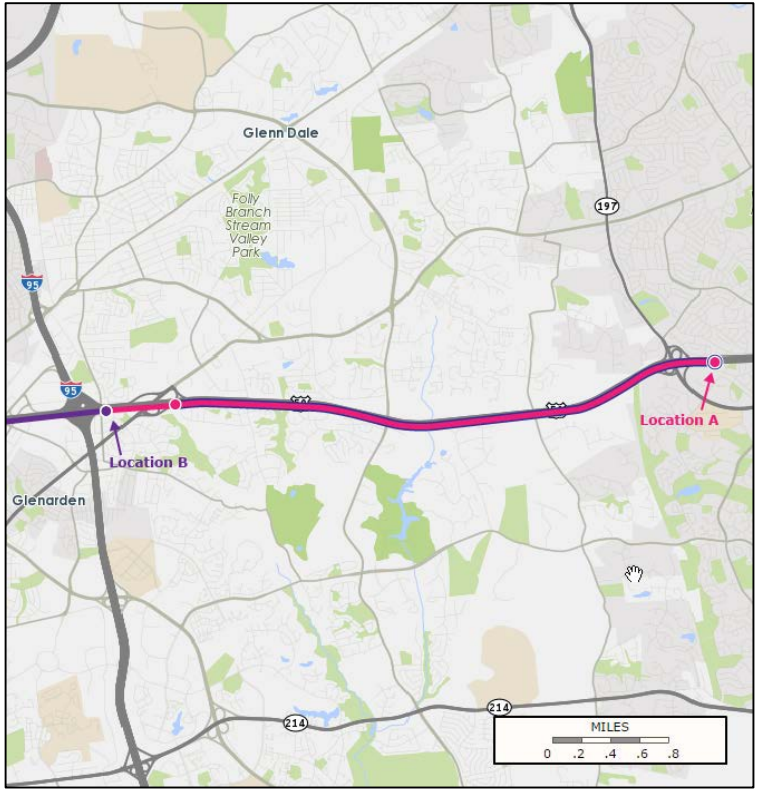
The rush hour ends and traffic clears.

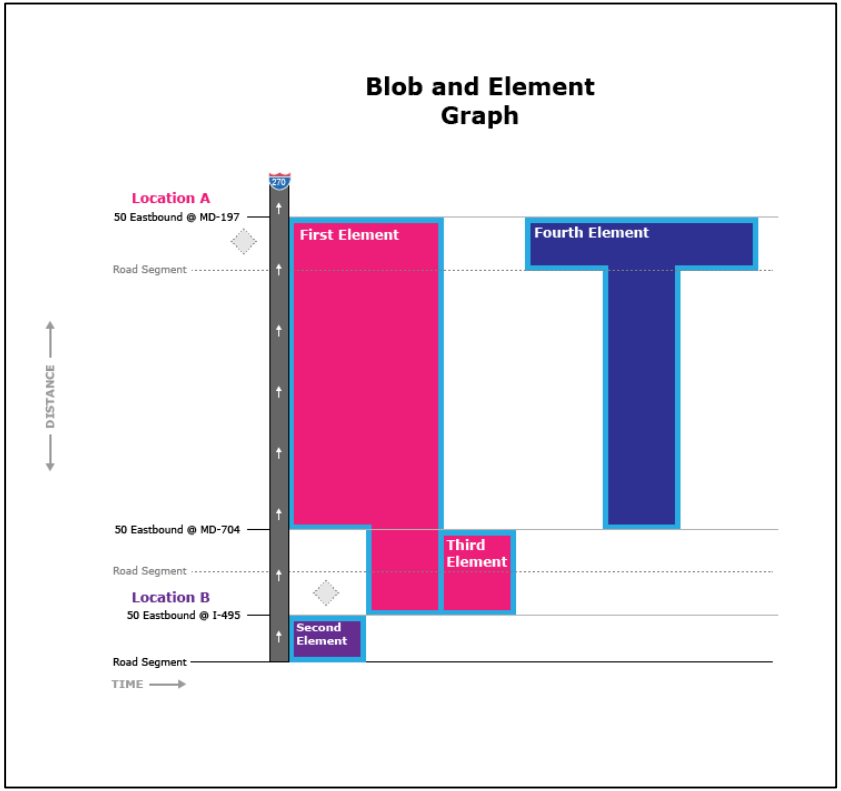




Separate Blobs

This is what the three Blobs looked like.



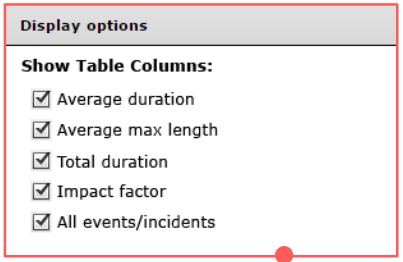


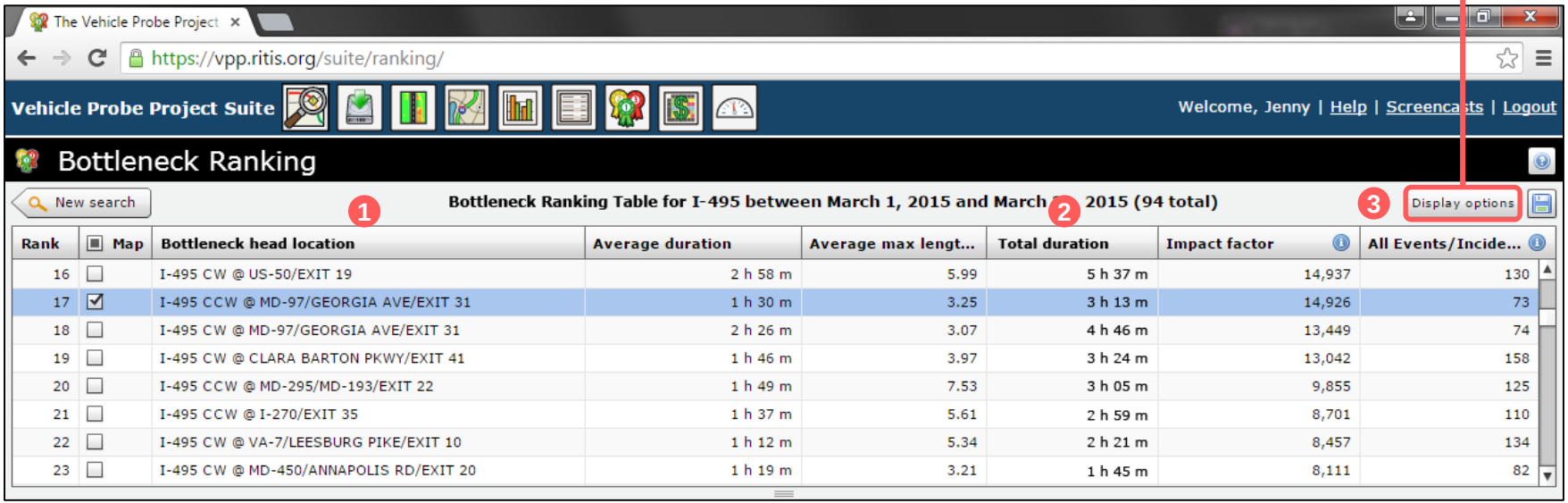
Changes & New Features

Changes to the Bottleneck Ranking Table

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



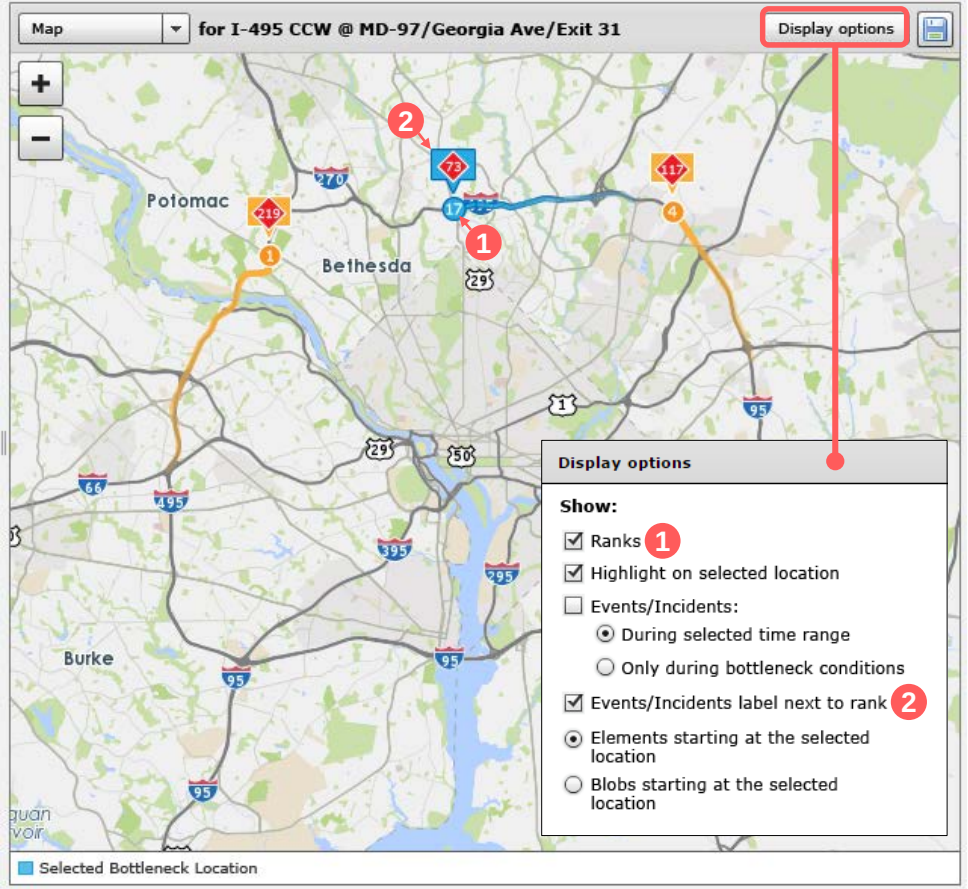


Rank	Map	Bottleneck head location	Average duration	Average max lengt...	Total duration	Impact factor	All Events/Incide...
16	☐	I-495 CW @ US-50/EXIT 19	2 h 58 m	5.99	5 h 37 m	14,937	130
17	☑	I-495 CCW @ MD-97/GEORGIA AVE/EXIT 31	1 h 30 m	3.25	3 h 13 m	14,926	73
18	☐	I-495 CW @ MD-97/GEORGIA AVE/EXIT 31	2 h 26 m	3.07	4 h 46 m	13,449	74
19	☐	I-495 CW @ CLARA BARTON PKWY/EXIT 41	1 h 46 m	3.97	3 h 24 m	13,042	158
20	☐	I-495 CCW @ MD-295/MD-193/EXIT 22	1 h 49 m	7.53	3 h 05 m	9,855	125
21	☐	I-495 CCW @ I-270/EXIT 35	1 h 37 m	5.61	2 h 59 m	8,701	110
22	☐	I-495 CW @ VA-7/LEESBURG PIKE/EXIT 10	1 h 12 m	5.34	2 h 21 m	8,457	134
23	☐	I-495 CW @ MD-450/ANNAPOLIS RD/EXIT 20	1 h 19 m	3.21	1 h 45 m	8,111	82

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.



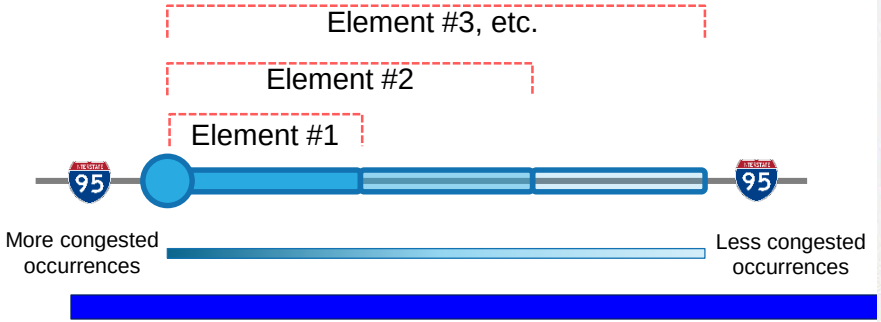
Changes to the Bottleneck Map (cont'd.)

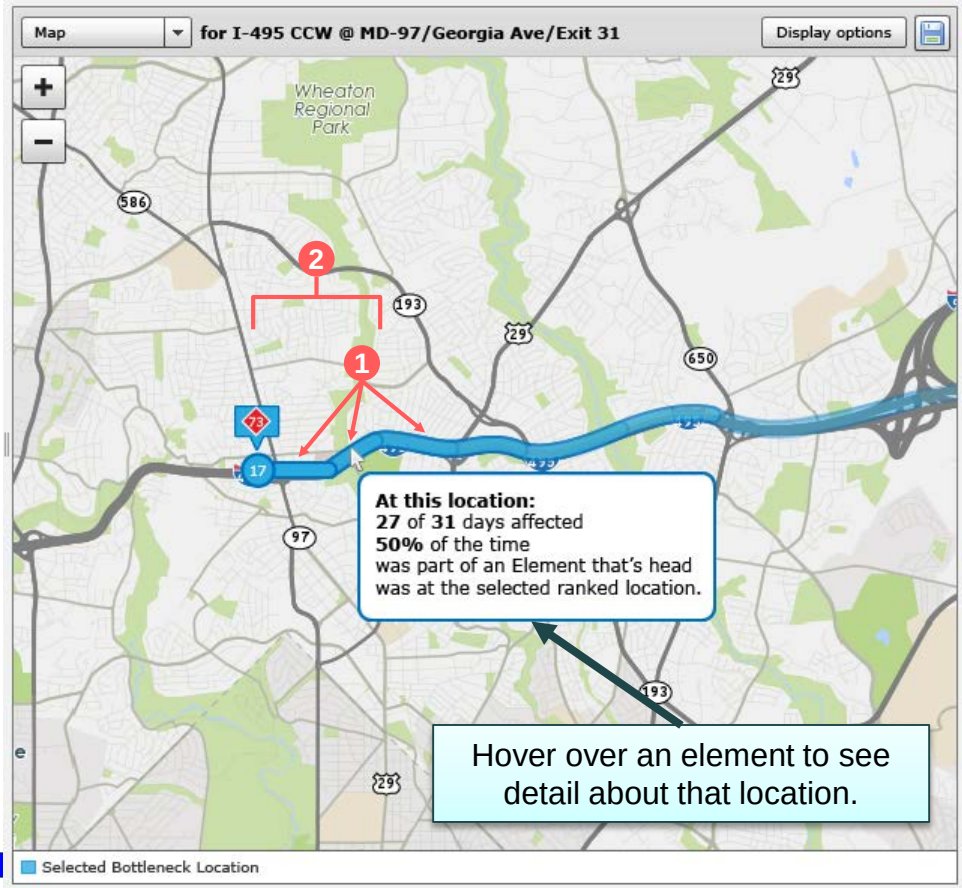
Displaying elements:

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:

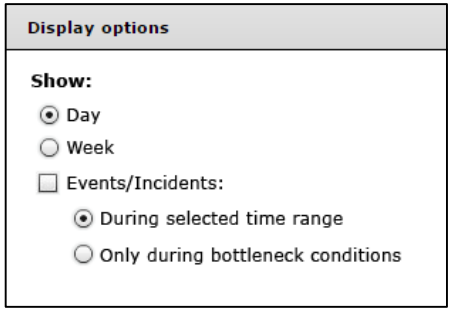


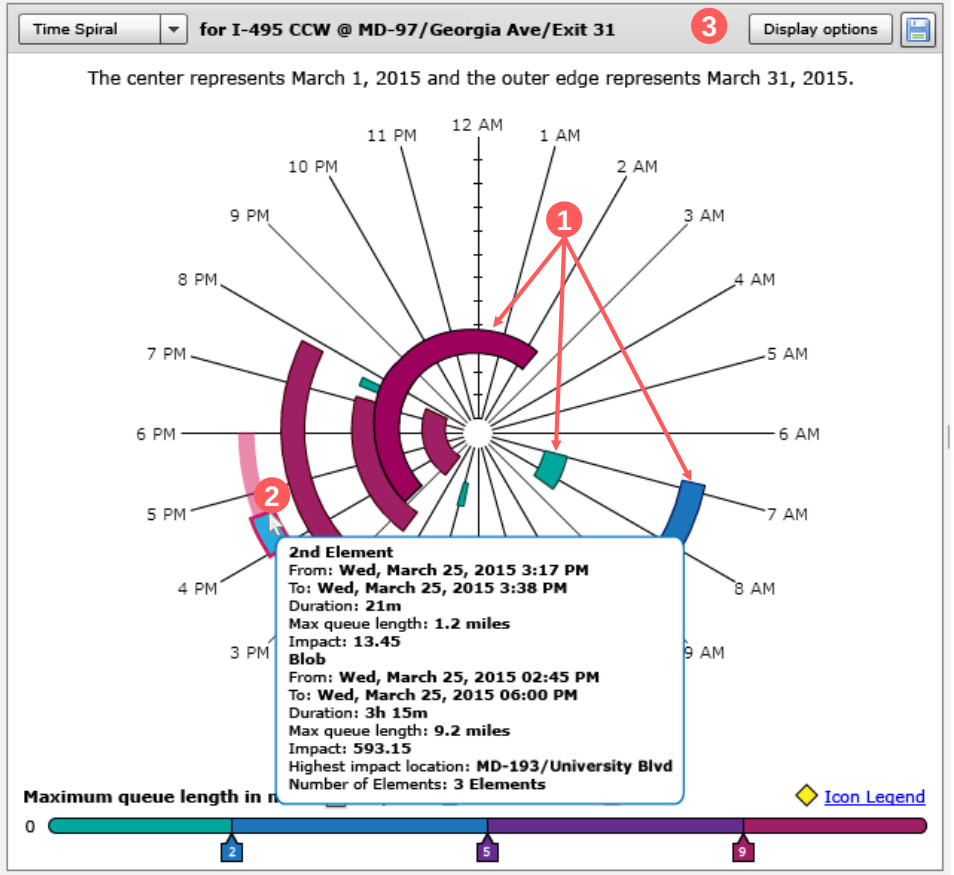


Changes to the Bottleneck Time Spiral

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:

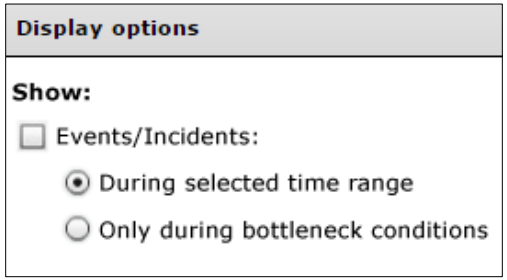


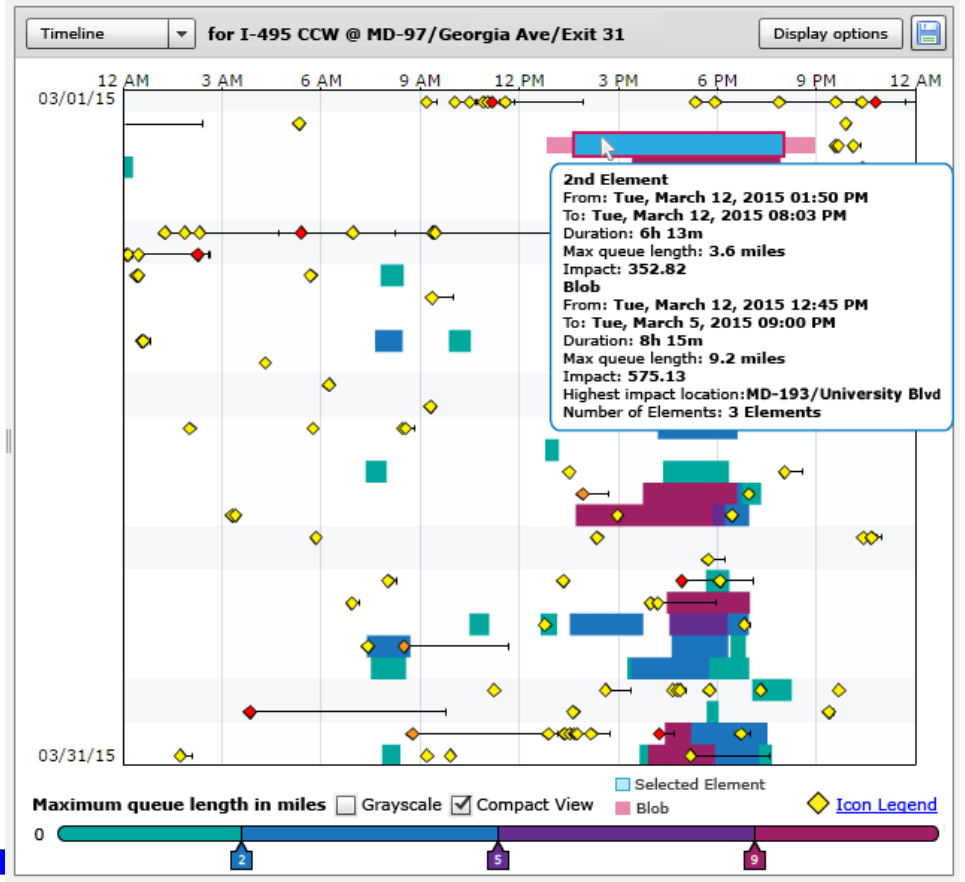


Changes to the Bottleneck Line Graph

Displaying elements:

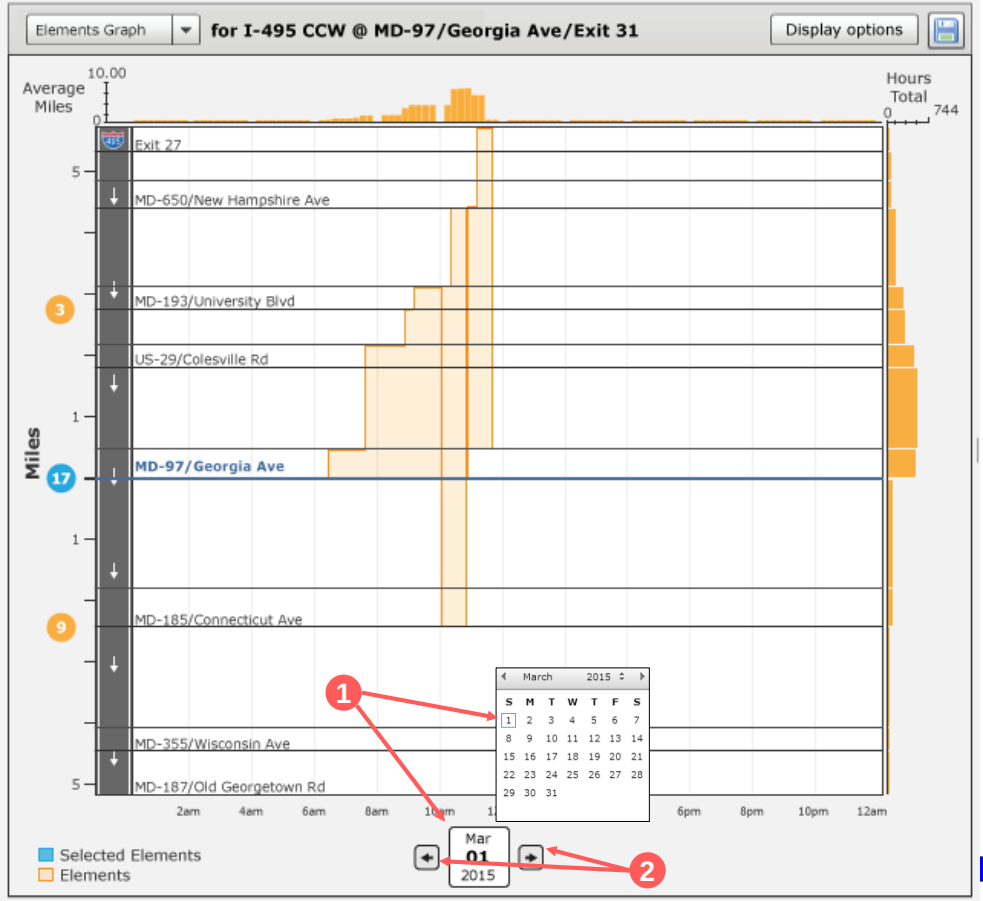
1. The Timeline will show elements that had the selected location as their head.
2. Hovering over an individual element will show information about that element, as well as the associated blob.
3. A **Display options** button has been added:





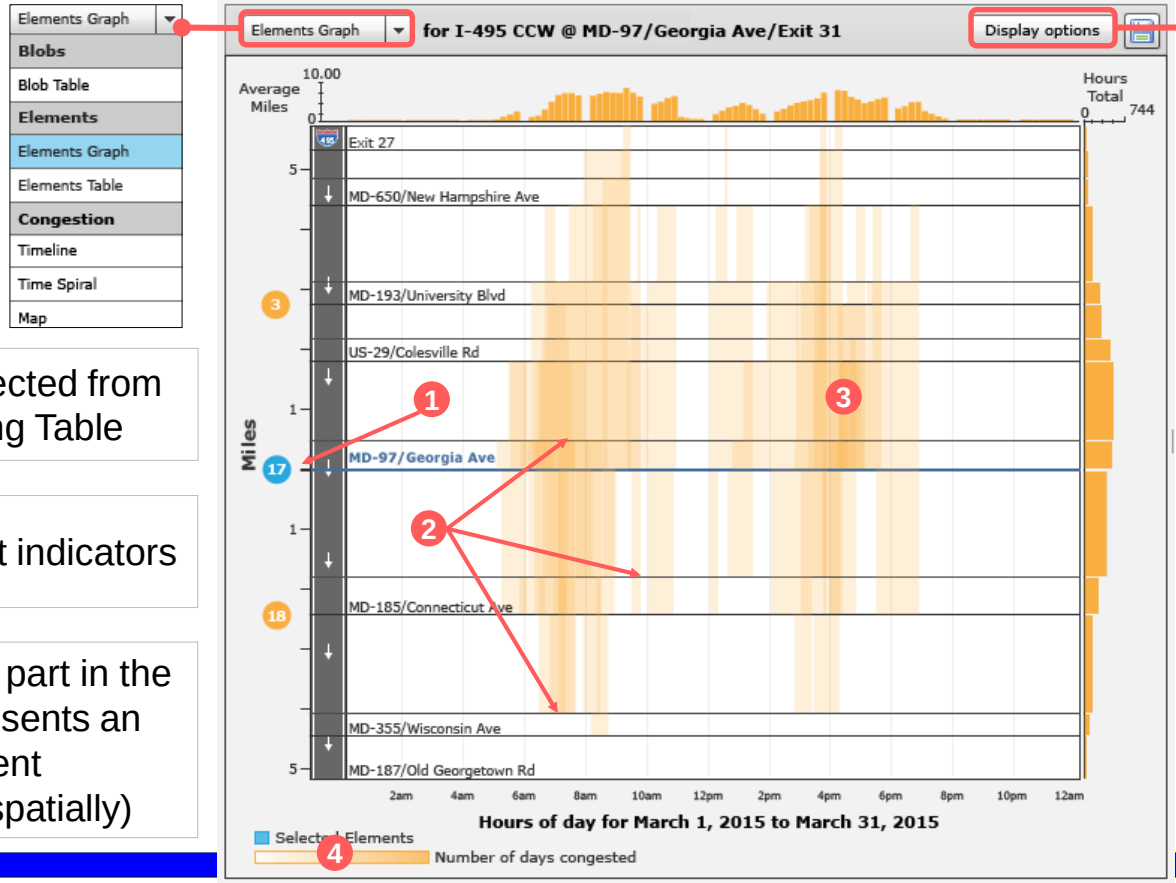
New! Elements Graph – Single Day

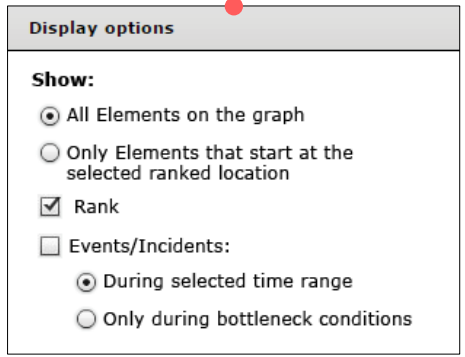
1. Click on the date to bring up a calendar for quick selection



2. Use the arrow buttons to move the date forward or back

New! Elements Graph - Overview





1. Location selected from the Ranking Table

2. TMC segment indicators

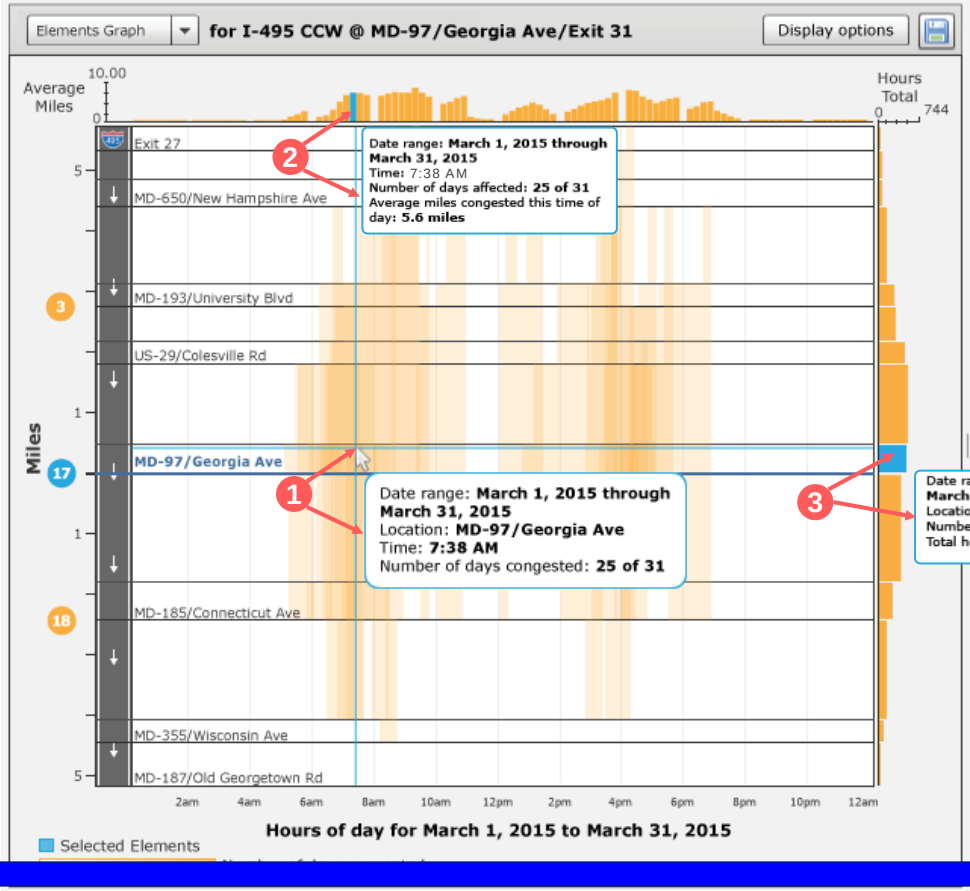
3. Each colored part in the graph represents an element (temporal/spatially)

4. Number of days congested
Darker the color = more congested days

New! Elements Graph - Features

1. Hover over graph to see a tooltip with element detail

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



3. Hover over the right bar graph, **Hours Total**, to see total hours congested

4

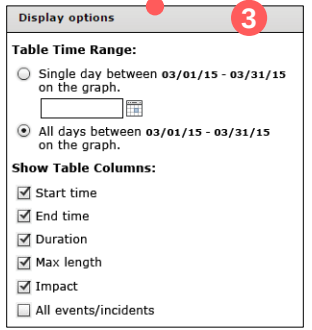
New! Elements Table

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

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

Elements Table 1 for I-495 CCW @ MD-97/Georgia Ave/Exit 31 — Display options

Start time ▼	End time 2	Duration	Max length (miles)	Impact
Sun 3/1/15 12:46 PM	Sun 3/1/15 12:47 PM	1 m	1.64	1.64
Sun 3/1/15 02:45 PM	Sun 3/1/15 02:47 PM	3 m	3.24	6.48
Sun 3/1/15 02:47 PM	Sun 3/1/15 02:49 PM	3 m	3.60	7.21
Sun 3/1/15 02:50 PM	Sun 3/1/15 02:53 PM	3 m	2.46	7.40
Mon 3/2/15 06:26 AM	Mon 3/2/15 06:28 AM	2 m	1.02	2.04
Mon 3/2/15 06:28 AM	Mon 3/2/15 10:04 AM	3 h 36 m	4.16	521.66
Mon 3/2/15 10:58 AM	Mon 3/2/15 11:07 AM	9 m	4.84	43.56
Tue 3/3/15 06:33 AM	Tue 3/3/15 07:03 AM	30 m	5.41	144.88
Tue 3/3/15 07:03 AM	Tue 3/3/15 07:04 AM	1 m	5.78	5.78
Tue 3/3/15 07:04 AM	Tue 3/3/15 07:05 AM	1 m	5.41	5.41
Tue 3/3/15 07:05 AM	Tue 3/3/15 07:15 AM	10 m	5.78	57.83
Tue 3/3/15 07:15 AM	Tue 3/3/15 07:27 AM	12 m	5.41	65.01
Tue 3/3/15 07:27 AM	Tue 3/3/15 07:33 AM	6 m	5.78	649.68
Wed 3/4/15 06:23 AM	Wed 3/4/15 06:31 AM	8 m	3.79	26.50

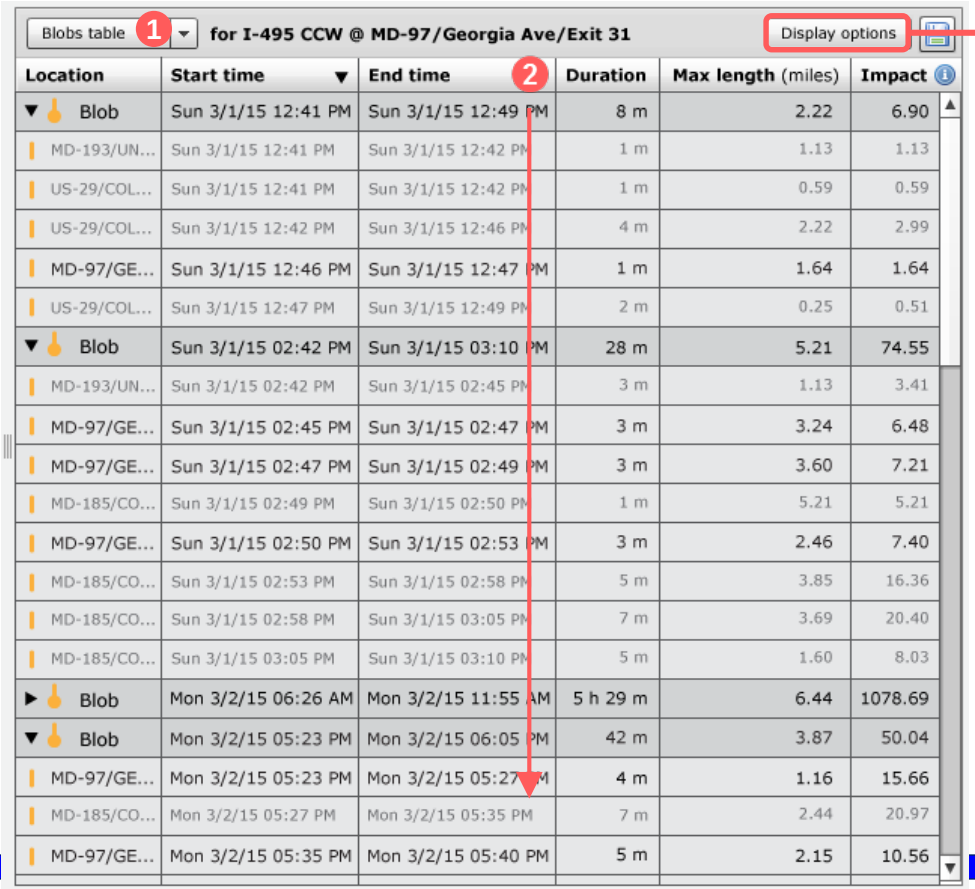


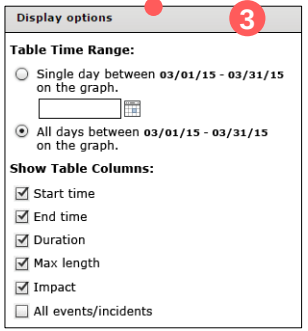
3. Sort the table using this dropdown.

New! Blob Table

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

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





3. Sort the table using this dropdown.

Blob icon

Element icon

Thanks!

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301.405.0722 (office)