Washington College GIS Program/MHSO Customer Survey Report

EXECUTIVE SUMMARY

Washington College GIS Program and Maryland Highway Safety Office (MHSO) collaborates together to provide support to MHSO, Law Enforcement, and other government agencies to improve traffic safety and impaired driving analysis. The program provides different services related to both traffic and impaired: maps of crashes, citations, impaired, and speed; increased completeness and accuracy of statewide data improvement; professional training on the use of GIS analytical tools; access to web mapping application.

This report summarizes the statistical modeling and analysis results associated with the Washington College GIS Program Customer Satisfaction study as requested by MSHO. This customer survey will be performed once a year or by request. The purpose of this report is to document how customers feel about the products that are being requested and produced. The report will give a better understanding of the ways the Washington College GIS Program can continue to improve services provided to different customers.

CUSTOMER'S BACKGROUND

Examining who Washington College GIS Program/ MHSO serves is a key component to understanding the needs of the customer's which will allow a better understand of how the clientele view all service(s)/product(s). As seen in Figure 1, over one-third of those who were surveyed work as MHSO Program Managers, over one-third were under the "Other" Category, and one-fourth were either Law Enforcement or Researcher/Analyst. Additionally, there are a significant number of respondents who selected "Other". Surveyors who selected "Other" wrote in the following positions that best descripted their positions; Liquor Board, MHSO Management, Wicomico Board of License Commissioners/ Liquor License Dept., Allegany County Liquor Board, Advertising Agency for MHSO, and Licensing Board.

CUSTOMER'S EXPERIENCE

Overall, customers were satisfied with the service(s)/ product(s) that were requested and provided (seen in Figure 2).16 out of 16 indicated no negative feedback on the survey towards the satisfaction of the following: quality, helpfulness, and response time of any service(s)/product(s). In total, 31% of survey respondents indicated that they have used one of our services/products within the last month, 13% within the past three months, while 38% of respondents said they received a serve/product more than six months ago.

#	Question	Very Satisfied	Somewhat Satisfied	Neutral	Somewhat Dissatisfied	Very Dissatisfied	Total Responses
1	Quality of Product	8	3	4	0	0	15
2	Quality of Service	9	2	4	0	0	15
3	Timely Response	8	1	6	0	0	15
4	Helpfulness of Staff	9	1	5	0	0	15
5	Overall Satisfaction	7	4	4	0	0	15

Figure 2: Rating of Experience

The survey requested the review of three products Washington College GIS creates on a consistent basis (Post Patrol Analysis, Monthly ETIX Analysis, and DDACTS) and the results concluded that the customers preferred the Post Patrol Analysis over the other two. The product that received the least positive reviews was the Monthly ETIX Analysis reports, although there are minimal differences between it and the Post Patrol Analysis. The top three products out of all products produced were the following: Crash Hot-Spot Maps (92.7% approval rating), Info-Graphics (91.4% approval rating), and DDACTS (90% approval rating). Overall, Washington College obtained an 85.4% approval rating for the products produced. There were a high percentage of people who did not use certain products because not all customers receive every product that is produced.

#	Question	Very Useful	Useful	Neutral	Not Useful	Not Very Useful	Do not use	Total Responses
1	Cover Sheet	2	4	1	0	0	9	16
2	Info-graphics	4	3	0	0	0	9	16
3	Post Patrol Analysis	3	0	1	1	0	11	16
4	Monthly ETIX Reports	4	2	0	1	0	9	16
5	Holiday Analysis	3	2	1	0	0	10	16
6	Crash Hot-Spot Maps	9	0	2	0	0	5	16
7	DDACTS	4	1	1	0	0	10	16
8	Liquor License Reports	4	0	2	2	0	8	16
9	Web Map Application	3	0	2	0	0	11	16
10	Other Product(s)	2	0	2	0	0	12	16

CUSTOMER FEEDBACK

Feedback is an essential component to understanding the mind of the customer (seen in Figure 4 and 5). Overall, there was a high percentage of positive feedback regarding the Washington College GIS Program's relationship with the current customers. Customers were "very comfortable" with the service(s)/ product(s) that Washington College provided. One surveyor said "The maps provided by Washington College are very easy to understand and provide ample support for the beginning steps of Problem Identification." The products that were received by the customers also had a high percentage of comprehension and understandability. Overall customer feedback was positive and the services provided by Washington College are successful.

CONCLUSION

Overall, the customers using the current service(s)/ product(s) are satisfied with Washington College GIS Program. One thing to add to the survey for next year is to have "Liquor Board" and "MHSO" as one of the selectable occupations to lower the number of "Other" responses. One to thing to improve on is to reach out to customers and make sure that the service (s)/product(s) we are providing are clear and understandable. One thing to continue is improving our products visually. One thing that was not in this survey was the introduced was the temporal topology for the time and day analysis. All communications with the customers that have received the temporal topology have been impressed with the product and the customers continue to make more requests for it. The Washington College GIS Program will continue to provide high quality service(s)/product(s) to customers, while continuing to improve current products and to introduce new and improved products.

Washington College

Maryland Highway Safety Office

Challenges Mapping Aggressive Driving

Josh Hyde & Sean Lynn

Data

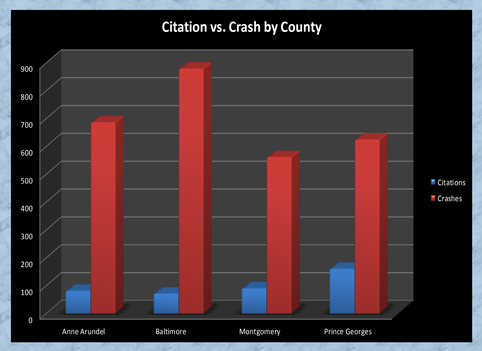
JPORTAL ETIX Citation Data — 2013

SHA Crash Data — 2013

What's the Challenge?

Aggressive Driving has become a pressing issue in the realm of highway safety, and officers are becoming increasingly aware of the infractions associated with aggressive driving. However, there is a discrepancy in the state of Maryland as it pertains to what constitutes aggressive driving with a citation versus a crash. By looking in the traffic data in 2013, we begin to find even more questions as to how this puzzle fits.

Differences by County



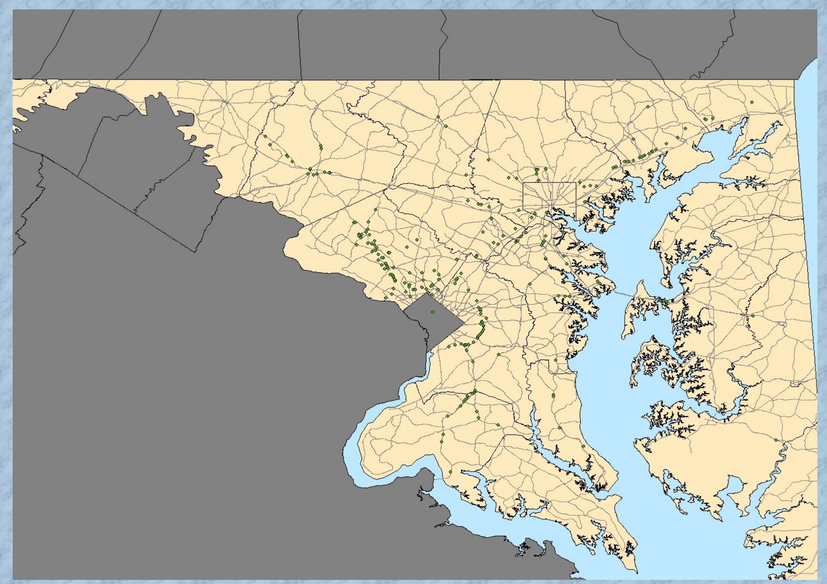
When doing side by side comparisons, it is clear that the citation numbers are not corresponding to the crash data when taking the top 4 counties by crash # into account. How is it that Baltimore County can have the least number of citations but the most crashes?

SHA Aggressive Driving Counts

SHA Violation Codes	Count of Primary Violation
11	615
12	269
14	300
15	197
16	7
17	38
18	301
21	1526
22	1309
24	293
26	121
Grand Total	**4976**

Crashes in Maryland, according to the Safety Highway Administration (SHA), show a staggering increase in the number of crashes related to aggressive driving.

Citation vs. Crash Data



A map highlighting the 620 ETIX citations for aggressive driving in Maryland for 2013. This number appears to be significantly low, considering that 232,052 ETIX citations were written out for violations associated with aggressive driving.

Alternative Example of Crash Data Use

Count of Violations to County	County Codes																								
SHA Violation Code	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Grand Total
11	1	109	127	9	2	13	9	14	7	18	5	20	41	0	55	58	10	15	2	8	11	12	8	61	615
12	5	26	56	4	0	5	3	12	6	7	2	9	11	6	15	15	4	11	2	6	4	12	6	42	269
14	0	51	79	5	0	4	2	15	2	6	0	10	35	0	18	25	2	6	1	5	5	8	1	20	300
15	1	25	42	6	1	12	3	8	0	4	2	9	17	2	17	11	1	6	0	1	7	4	3	15	197
16	0	0	3	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	1	0	0	1	7
17	0	5	4	0	0	0	0	1	0	1	0	1	4	0	1	5	0	1	0	0	1	2	0	12	38
18	4	43	34	5	1	5	2	13	1	13	5	15	12	0	23	51	3	9	0	1	4	8	7	42	301
21	4	193	240	17	3	29	17	50	2	68	7	92	100	1	192	255	9	25	3	34	38	21	21	105	1526
22	3	178	182	26	2	19	32	83	0	51	2	85	71	4	186	162	11	68	1	19	26	27	18	53	1309
24	1	36	74	1	0	3	2	7	1	2	1	11	15	0	49	37	3	7	0	4	3	3	6	27	293
26	1	20	38	1	1	2	2	7	0	4	1	2	4	1	4	5	1	5	2	2	1	1	2	14	121
Grand Total	20	686	879	74	10	92	72	210	19	174	25	254	310	14	561	624	44	154	11	80	101	98	72	392	4976

Some of the ways we can implement the crash data include looking at what contributing factors are glaring issues in a given county. In the pivot table above, our common contributing factors (21 and 22) are shown in Prince Georges and Montgomery counties. However, Anne Arundel and Baltimore counties see a high number of factors 11 and 12, which can be seen in our definitions section.

Time and Day	Hour in Day (0 = 12AM)																								
Day of Week	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	Grand Total
Sun	18	13	28	12	9	7	6	5	7	14	18	20	38	40	41	37	32	29	29	23	20	21	15	17	499
Mon	10	13	14	3	3	9	20	38	34	44	27	31	36	32	41	56	69	63	54	15	25	21	12	12	682
Tue	3	7	5	6	6	7	29	52	60	53	34	27	29	43	51	62	68	61	61	36	23	21	16	6	766
Wed	14	8	4	3	5	10	26	69	66	45	28	28	23	25	39	45	57	82	45	34	23	15	25	8	727
Thu	12	7	9	6	4	16	26	51	50	35	24	33	34	30	38	44	68	78	50	27	28	25	23	7	725
Fri	12	6	7	4	3	14	20	40	56	43	33	40	58	42	64	85	76	96	49	45	26	33	24	24	900
Sat	10	15	23	12	9	5	10	12	15	22	32	47	40	49	58	54	42	37	36	32	28	32	27	29	676
Grand Total	**79**	**69**	**90**	**46**	**39**	**68**	**137**	**267**	**288**	**256**	**196**	**226**	**258**	**261**	**332**	**383**	**412**	**446**	**324**	**212**	**173**	**168**	**142**	**103**	**4975**

We can also see the days and time in which aggressive crashes are occurring frequently. As expected, rush hour (3:00pm to 5:00pm, row labels 15 to 17) during the weekday sees a spike in the number of crashes.

Conclusion

The result of our work with mapping aggressive driving is that there are still other questions needed to be answered in order to provide concise reports. While crash data can be implemented in several different analyses, the lack of citation data available makes providing true comparisons difficult to manage.

Questions to Explore

1. **Is it up to the discretion of the officer what constitutes aggressive driving?** Crashes are hard to dispute when it comes to contributing factors. Perhaps some citations, such as following too closely or passing, are being ignored.
2. **Are their variations in the violations themselves that result in aggressive driving citations not being written?** Most citations have a letter variation such as 21-202.C (Failure to stop at green signal) to 21-202.H (Failure to stop at red signal). These variations may be of higher priority or indicator of aggressive driving.
3. **Are their differences in how the counties view aggressive driving compared to the state?**

Aggressive Driving & County Definitions

The discrepancy in aggressive driving comes from the distinction from a citation versus a crash

Citation

According to the Maryland Transportation Article 21-901.2, Aggressive Driving is committing 3 or more of the following violations.

Citation Codes	Description
21-202	Traffic lights with steady indication
21-303	Overtaking and Passing vehicles
21-304	Passing on right
21-309	Driving on laned roadways
21-310	Following too closely
21-403	Failure to yield right of way
21-801.1	Exceeding speed limit

Crash

According to the SHA , one of the violation codes related to aggressive driving must be a primary and secondary contributing circumstance in the crash report.

SHA Code	Description
11	Failed to yield right of way
12	Failed to obey stop sign
14	Failed to obey other traffic control
15	Failed to keep right of center
16	Failed to stop for school bus
17	Wrong way on one way road
18	Exceeded the speed limit
21	Too fast for conditions
22	Followed too closely
24	Improper lane change
25	Improper backing
26	Improper passing

Counties:

Maryland Transportation has a list of codes to identify counties.

Code	County Name		
1	Allegany	13	Howard
2	Anne Arundel	14	Kent
3	Baltimore	15	Montgomery
4	Calvert	16	Prince Georges
5	Caroline	17	Queen Annes
6	Carroll	18	St Marys
7	Cecil	19	Somerset
8	Charles	20	Talbot
9	Dorchester	21	Washington
10	Frederick	22	Wicomico
11	Garrett	23	Worcester
12	Harford	24	Baltimore City

Using GIS to Identify Areas for DUI Enforcements and Analyzing Impacts

Michael McGahee

Washington College, Maryland Highway Safety Office, Maryland State Police

Introduction

Washington College is supporting the Maryland State Police's DUI team with geographic data and analysis to reduce impaired driving in the Baltimore and D.C. metropolitan areas of Maryland. We are using multiple data sources (citations, crashes, liquor licenses, etc.) to develop a model to make risk projections for linear roads. The goal is to help identify road segments that should be targeted for saturation patrols in order to reduce DUI incidents. Washington College has also developed a Liquor License database for the state of Maryland that can be used in conjunction with law enforcement to help maintain a safe environment for the public. With this database, we are able to target drinking establishments with liquor license violations, identify the areas served by these establishments, and locate potential crash hotspots. Using network analyst, all data have been transformed to linear road segment based data. Citation data have been routed from the location of the DUI to the offender's home address, crash data have been aggregated by 1 mile road segments, and liquor licenses have been prioritized and given service areas (a network based radius of roads with possible DUI traffic). Our model will consider each of these factors and return high risk road segments for DUI traffic enforcement.

The MSP DUI detachment team's media campaign advertised these images on websites, billboards, gas station pumps, and bus stop shelters.

Data

There are three main data sets that are used in this project. We are grouping the data in three to five year increments to provide a representative time frame for our model.

Citations

- Our source for DUI citation data is the Maryland Judiciary and District Courts Web Portal Electronic Traffic Information Exchange (E-TIX). We have gathered statewide E-TIX data and selected out those citations with offense codes related to impaired driving and DUIs.

Crashes

- All crash data comes from the State Highway Administration of Maryland.

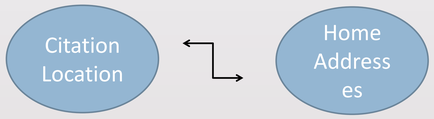
Liquor Licenses

- We have obtained liquor license data from county liquor boards and license commissioners throughout Maryland. Our data continues to be updated as we receive new information from each of our liquor contacts.

Methods

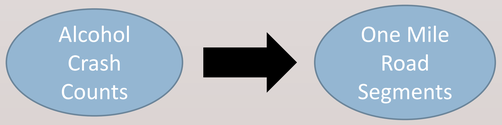
DUI Citation Route Density

A network route data layer was created that connects the DUI citation location to the violator's home address based on the fields collected in the data. This was accomplished by running a python script with the Network Analyst Extension tool in ArcMap. After pathways were mapped between the citation location and violator's home address, a linear density analysis using spatial joins of the route layer was completed. (Figure 1)



Crash Counts by 1 Mile Road Segments

A state road file was first segmented into 1 mile long road segments using a custom python script. Then, alcohol-involved crashes are joined to the road segments to create a crash count for each 1 mile segment. Alcohol-involved crashes are defined as incidents where a driver was determined to be alcohol-impaired through the driver condition, blood alcohol content, substance use detected and contributing factor fields on the Maryland crash report. (Figure 2)



Liquor License Service Areas

We identified bars and restaurants that close before 10pm as low priority, those that close between 10pm and midnight as medium priority, and those that are open past midnight as high priority, based on closing times for Friday and Saturday nights. The priority thresholds were established based off of impaired crash data time of incident which showed peak crashes occurring Friday and Saturday nights from midnight to roughly 4:00am. Utilizing network analyst, we then created 15 minute service areas for each high priority location. Index values were then assigned to road segments based on how many high priority liquor license service areas overlapped. (Figure 3)

Note: In order to protect sensitive information, the location data shown has been randomly created for these examples.

Maps

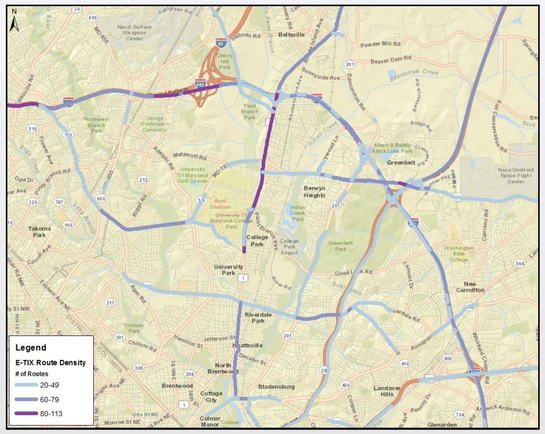


Figure 1. After running the E-TIX routing python script, routes have been created connecting ticket locations with the corresponding home addresses.

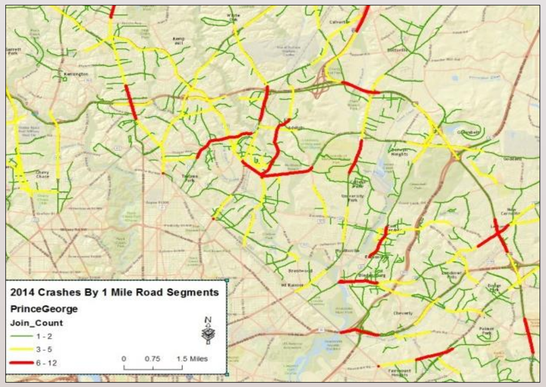


Figure 2. The routes were then used to clip the road network and were spatially joined to create road segments with a count of overlapping routes.

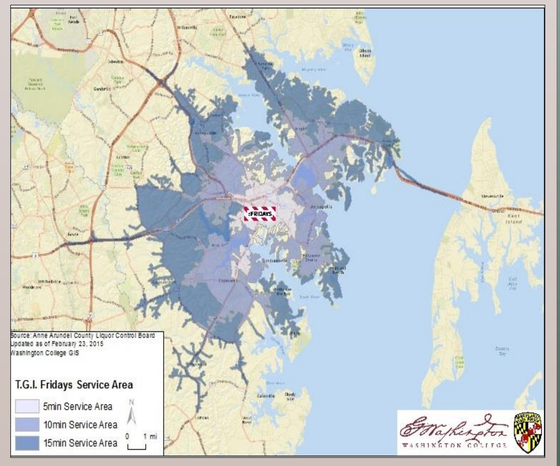


Figure 3. The TGI Friday's In Annapolis shown with 5 min, 10 min and 15 minute service areas.

Results

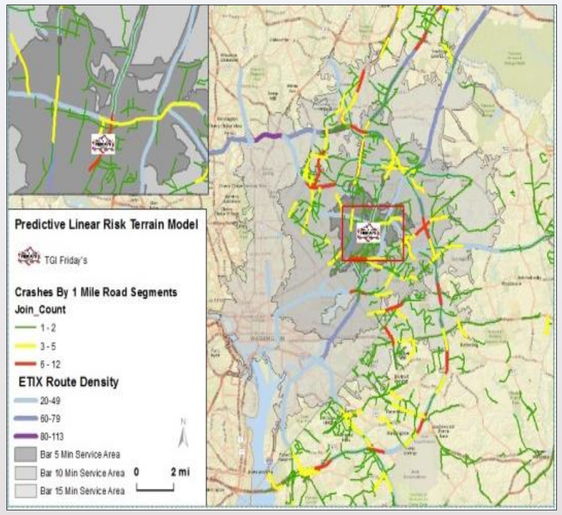


Figure 4. Predictive Linear Risk Terrain Model

The final product is an Predictive Linear Risk Terrain Model for DUI Enforcement. (Figure 4). This shows the number of DUI related E-TIX routes that overlap on each road segment; a hotspot display for five, ten and 15 minute area around a national bar; and Crash Counts by one mile road segment data. Using graduated color symbology, only road segments with 20 or more overlapping routes are shown on this map. Road segments with a higher density of overlapping routes are darker in color. Dark purple shows the highest density road segments, implying that these segments present the highest risk of DUI traffic. The service area within a five minute radius are displayed in a darker color. In that area a higher chance at impaired drivers exists. The color scheme gets lighter displaying a decreased chance at impaired drivers from the bar used in this model. Using this analysis, Washington College can inform the Maryland Highway Safety Office and the Maryland State Police where high risk roads segments for DUI traffic exist, and help target these areas for DUI enforcement saturation patrols.

Acknowledgements

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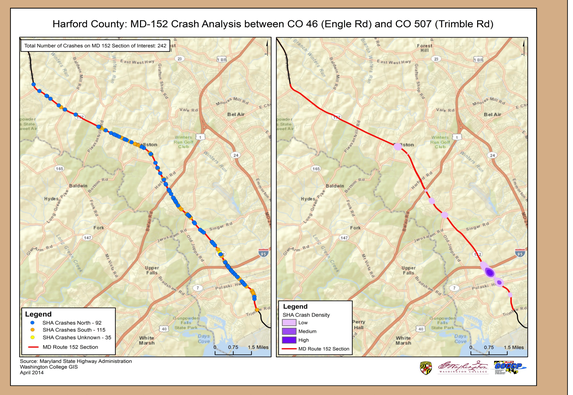
Transforming Linear Route Maps into Infographics

Josh Hyde

"An Infographic is defined as a visualization of data or ideas that tries to convey complex information to an audience in a manner that can be quickly consumed and easily understood." - Mark Smiciklas*

Introduction

This poster will exhibit the processes of converting a vector map of points occurring on a linear route into a segmented infographic. This method of data visualization presents information in an easily accessible way, requiring little cartographic knowledge to fully comprehend the analysis being performed.



An example of Segmented Crash Analysis in Harford County, MD displayed on a traditional map.

Data

JPORTAL ETIX Citation Data 2011 - 2013

MHSO Crash Data 2011 - 2013

SHA Line Route MD 2013

SHA Mile Markers MD 2013

Methodology

Line Segmentation

- Definition Query applied to SHA Line Route "ID_RTE_NO" = Target Route Number
- Select from Attribute Table 2 ObjectID's for polyline representing entire route in both directions traveled and export as new 'Target Route' layer
- Segment new 'Target Route' Layer in Editor Mode using Split Tool at each intersecting route
- Select Segments making up Section of Target Route and Export as new Segmented Layer
- Add ID field to Segmented Layer attribute Table and assign each segment a unique ID value

Crash Point Selection

- For alcohol related crashes, the definition query applied to SHA Crash Data was "ACC_COND" = "A, and B"
- For alcohol related citations, the definition query applied to ETIX was TA 21 902(A1) - 21 903(C)
- Selection by Location applied with Target Layer: MHSO Crash Data and Source Layer: Segmented Route Layer
- Export Selected MHSO Crashes that occurred on Segmented Route as new layer

ETIX Point Selection

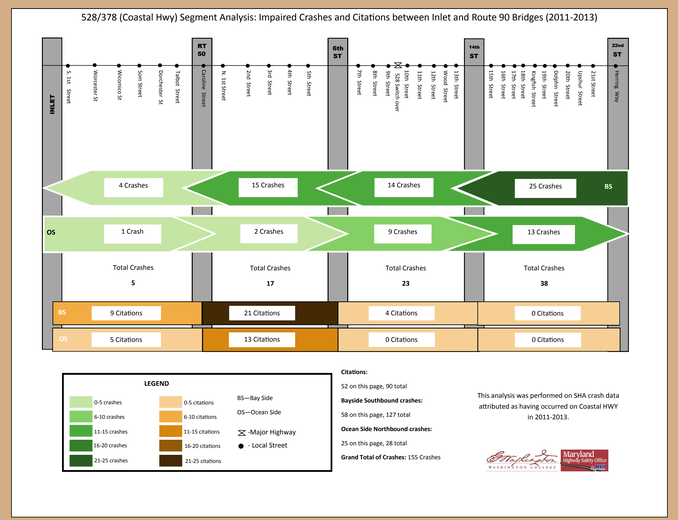
- Selection by Location applied with Target Layer: JPORTAL ETIX, Source Layer: Segmented Route Layer, and Search Distance: .01 Miles
- Export Selected JPORTAL ETIX as new layer

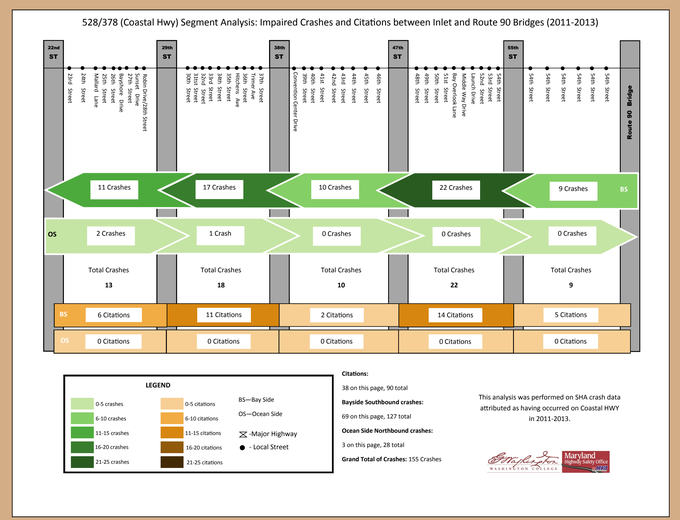
Join Points to Segmented Route

- Perform Spatial Join on Segmented Line to Crash/ETIX Points and choose option in which 'each point is given attributes of line closest to it'
- Summarize ID field in Attribute Table for new Join Point Layer to get Point totals per segment

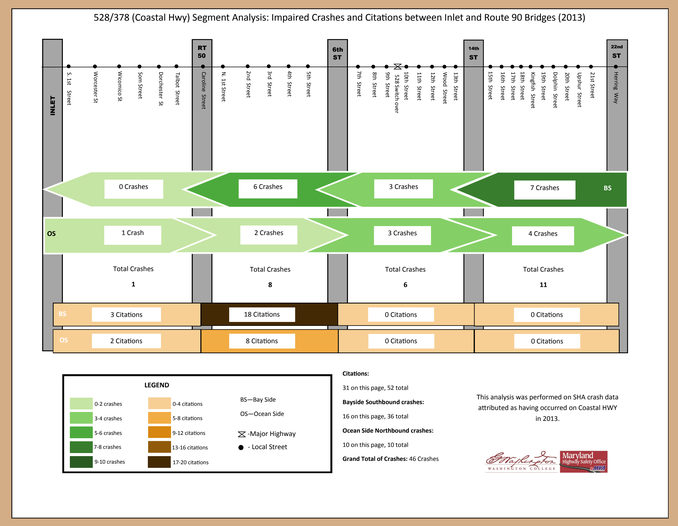
Intersecting Routes Segmentation

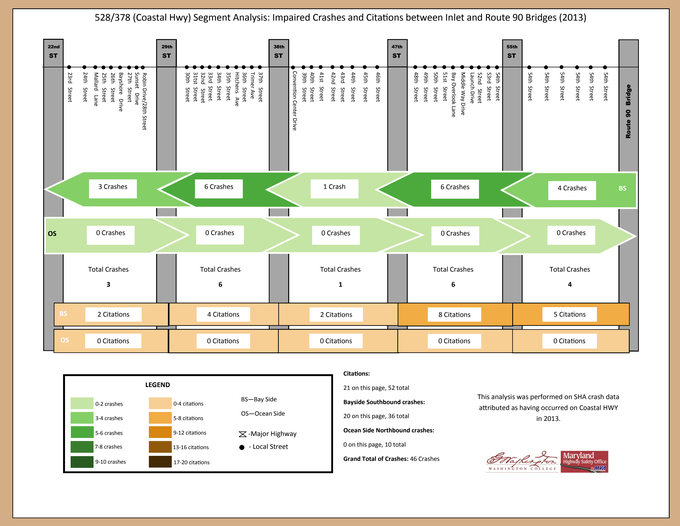
Impaired Crash Analysis 2011-2013





Impaired Crash Analysis 2013





Results

The result of the road map to infographic conversion process is an organized and focused graphical analysis that can be comprehended with ease. This method of data visualization has become a crucial addition to the products Washington College has available to various law enforcement organizations throughout the state of Maryland.

ETIX totals are approximate and more reflective of trends compared to precise totals. Unlike SHA crashes which are plotted based on SHA's log mile system, ETIX data are placed based on a GPS reading where the ticket was issued. Also unlike the SHA Crash Data, ETIX data does not contain a field within the attribute table with the Route Number which can be queried down to.

Further Research

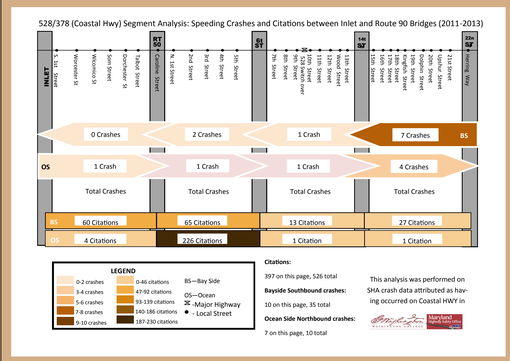
Infographics provide excellent identification of route segments with high incidences but what causes such high crash/ticket rates? Further analysis of data within these layer's attribute tables can provide insight into trends and explanations. Currently, the Washington College GIS Lab is implementing Day and Time Chart Analysis combined with our Infographics to identify and answer some of these questions.

Date/ Time	0000	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	Grand Total
Monday	8	16	7	4	7	20	30	39	40	33	29	36	32	39	39	42	62	50	35	34	27	23	28	12	692
Tuesday	19	14	13	8	6	20	22	51	40	28	42	27	35	42	50	55	65	68	35	31	16	21	21	14	743
Wednesday	11	9	8	4	7	9	35	53	39	39	18	30	39	32	39	53	62	56	39	26	29	27	16	17	697
Thursday	18	13	12	4	7	15	19	46	29	29	21	36	46	28	50	64	63	55	37	29	27	23	14	17	702
Friday	16	19	8	9	7	12	28	43	29	20	23	34	37	55	56	52	60	65	48	41	25	21	23	16	747
Saturday	30	35	29	12	8	11	6	11	16	21	31	41	34	42	34	47	35	31	27	32	27	38	25	23	646
Sunday	35	32	24	15	11	9	13	11	16	13	24	22	29	20	23	27	36	30	24	13	22	16	21	13	499
Grand Total	137	138	101	56	53	96	153	254	209	183	188	226	252	258	291	340	383	355	245	206	173	169	148	112	4726

Alternative Infographic Example

Speed Related Segmentation

Segmentation Analysis and Infographics can display a plethora of information, such as speed-related incidents.



Mile Marker Segmentation

Mile Marker Segmentation is more effective when tasked with creating an infographic of a large section of roadway with many intersecting routes, instead of choosing which route intersection to segment at, the roadway can be cut at each Mile Marker; this also ensures equidistant segments.

The Maryland Mile Marker shapefile provided by Maryland SHA only contains information for the following route types: Interstate, US highway, and Maryland Highway. Any infographic segmenting a County Road will need to be completed using the intersecting roadway method of segmentation.

Road Features Line

Since Mile Marker Segmentation is split based on a specific location based on distance, intersecting roadway information needs to be incorporated into the infographic in an alternative way: The Road Features Line. Above the directional segment totals bar is a line noting the location of specific geographic features that could impact traffic trends. These features are listed and categorized by one of three symbols representing: Roadways, Roadway On or Off Ramps, and Non-Roadway Features.

* Smiciklas, M. (2012). Infographics 101. *The Power of Infographics: Using Pictures to Communicate and Connect With Your Audiences* (17). Indianapolis: Que Publishing.