



UAA College of Engineering
UNIVERSITY of ALASKA ANCHORAGE

Alaska Department of Transportation & Public Facilities

Highway Patrol Investment Levels vs. Crash Outcomes

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Goals of Research

- Establish methodology to maximize the benefits as a result of enforcement investments to reduce the frequency of crash instances;
- Establish infrastructure to host databases and analysis services;
- Determine most appropriate statistical analysis;
- Observe characteristics of collected data;
- Generate procedure for benefit/cost analysis; and
- Provide recommendations for the future project.



Data Collection

- Particular patrol vehicles are equipped with sensors that ping information every 20-seconds.
- Information from the sensors are readily available from the Verizon Network Fleet database in the form of detailed patrol vehicle activity reports.
- Coordination with Alaska State Troopers and DOT&PF for downloading latest crash incidents and citation reports.



Verizon NetworkFleet



[Map](#) [Vehicle](#) [Fleet](#) [Reports](#) [Admin](#) [Support](#)

Choose a Report Type: Activity Detail

Input Report Parameters:

Filter by: ☒ Vehicle ☐ Group ☐ Driver ?

Vehicle Attributes: Matches Any: All Attributes ?

Vehicles: * <None Selected> ?

Include Sensor Activity: ☐

Start Date: * 3/29/16 ?

Time Window Start: * 12 AM 00

Time Window End: * 12 AM 00 ?

Landmark Privacy: All Landmarks

Collapse parameters on submit: ☒

Clear All Submit

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Crash Data

TraCSPrdKey	CaseNumber	CrashDate	CrashTime	Latitude	Longitude	StreetHighway
Form12-200.1.fjacrockett154020702015094945105730161	AK14087056	2/7/2015	12:20:00	61.584408	-149.631139	Mile 73 Glenn Highway
Form12-200.1.faagorn15801180201504103564830306	AK15004131	1/17/2015	12:05:00	61.485272	-149.123586	Old Glenn Hwy
Form12-200.1.faagorn15801180201504103564830306	AK15004131	1/17/2015	12:05:00	61.485272	-149.123586	Old Glenn Hwy
Form12-200.1.faagorn15801180201504103564830306	AK15004131	1/17/2015	12:05:00	61.485272	-149.123586	Old Glenn Hwy
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Form12-200.1.faagorn15801180201504103564830306	AK15004131	1/17/2015	12:05:00	61.485272	-149.123586	Old Glenn Hwy
Form12-200.1.frjsawyer154020502015050528278350043	AK15009007	2/5/2015	17:06:00	61.534725	-149.2519	Glenn Hwy
Form12-200.1.frjsawyer154020502015050528278350043	AK15009007	2/5/2015	17:06:00	61.534725	-149.2519	Glenn Hwy
Form12-200.1.fmakessler154020502015092040897490354	AK15009062	2/5/2015		61.613911	-149.306542	BOGARD
Form12-200.1.fmakessler154020502015092040897490354	AK15009062	2/5/2015		61.613911	-149.306542	BOGARD
Form12-200.1.fmjwertanen70102070201505260368040069	AK15007756	2/7/2015	18:54:00	60.693522	-151.321097	Island Lake Rd
Form12-200.1.fmjwertanen70102070201505260368040069	AK15007756	2/7/2015	18:54:00	60.693522	-151.321097	Island Lake Rd
Form12-200.1.fnlblakesle154021102015065446261410296	AK15005733	1/23/2015	20:03:00	61.552806	-149.526444	KNIK GOOSE BAY ROAD



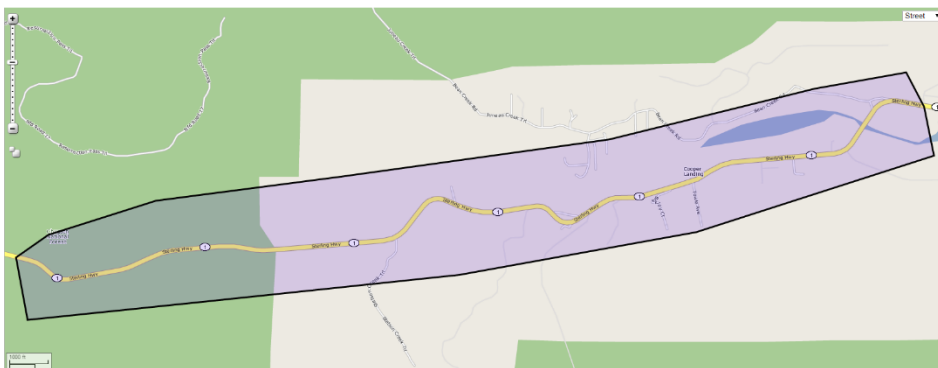
Database Infrastructure

Microsoft SQL Server is used to automatically download, store and organize data based on database templates.

- Patrol vehicle spatial information is stored in one database;
- Crash incident and citation data is stored in another database; and
- Scripts are written to filter databases to include only necessary information relevant to the research analysis.

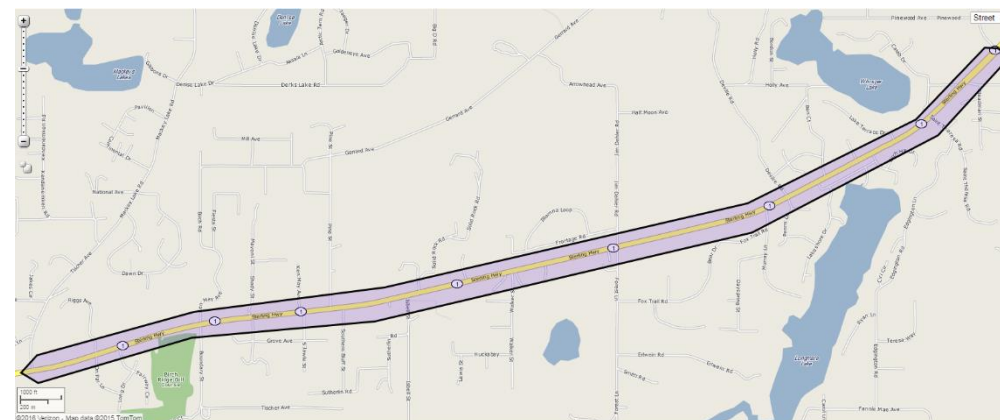


Geofences Illustrated



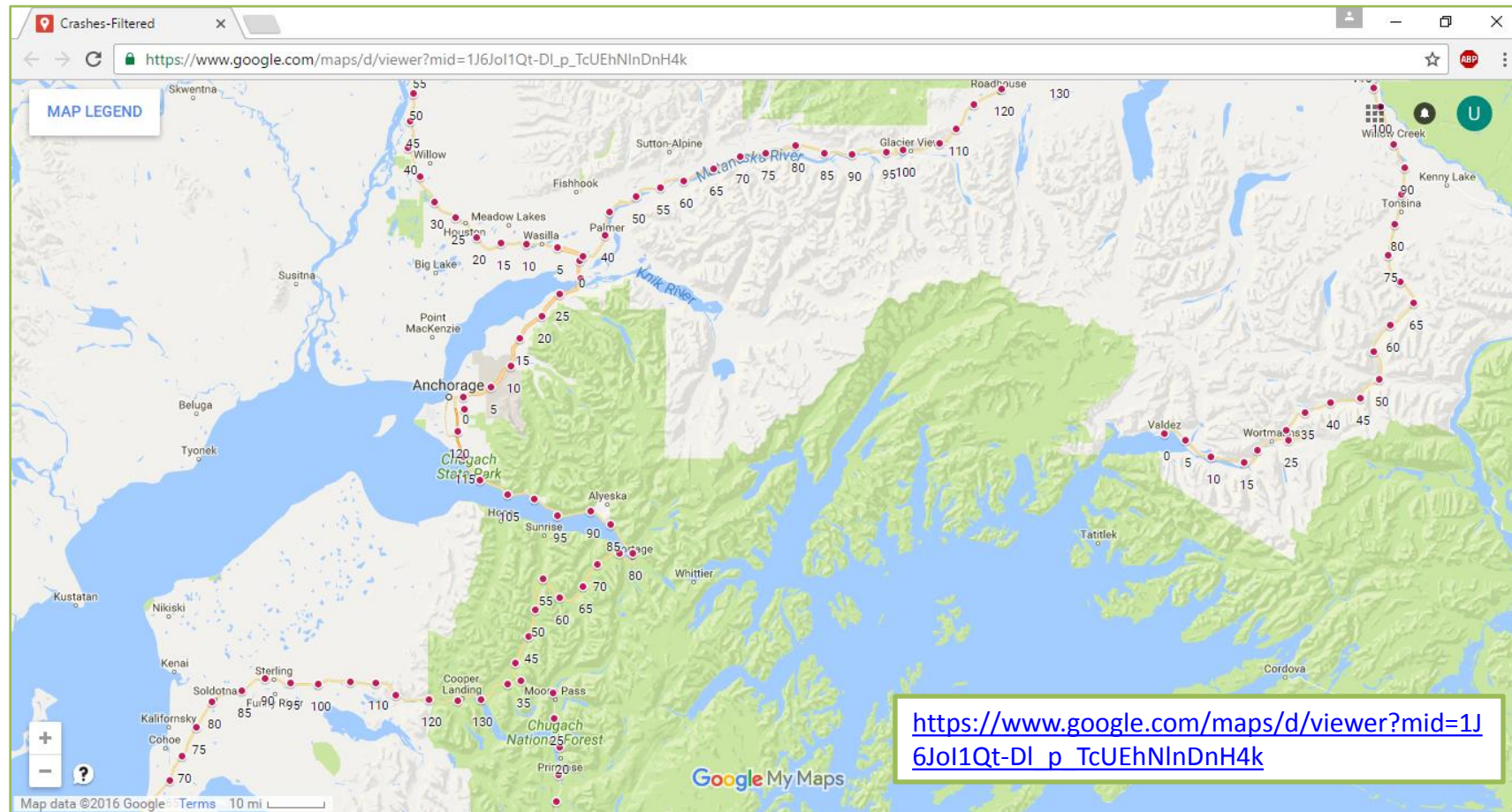
Sparse sections have large fences

Dense sections have narrow fences



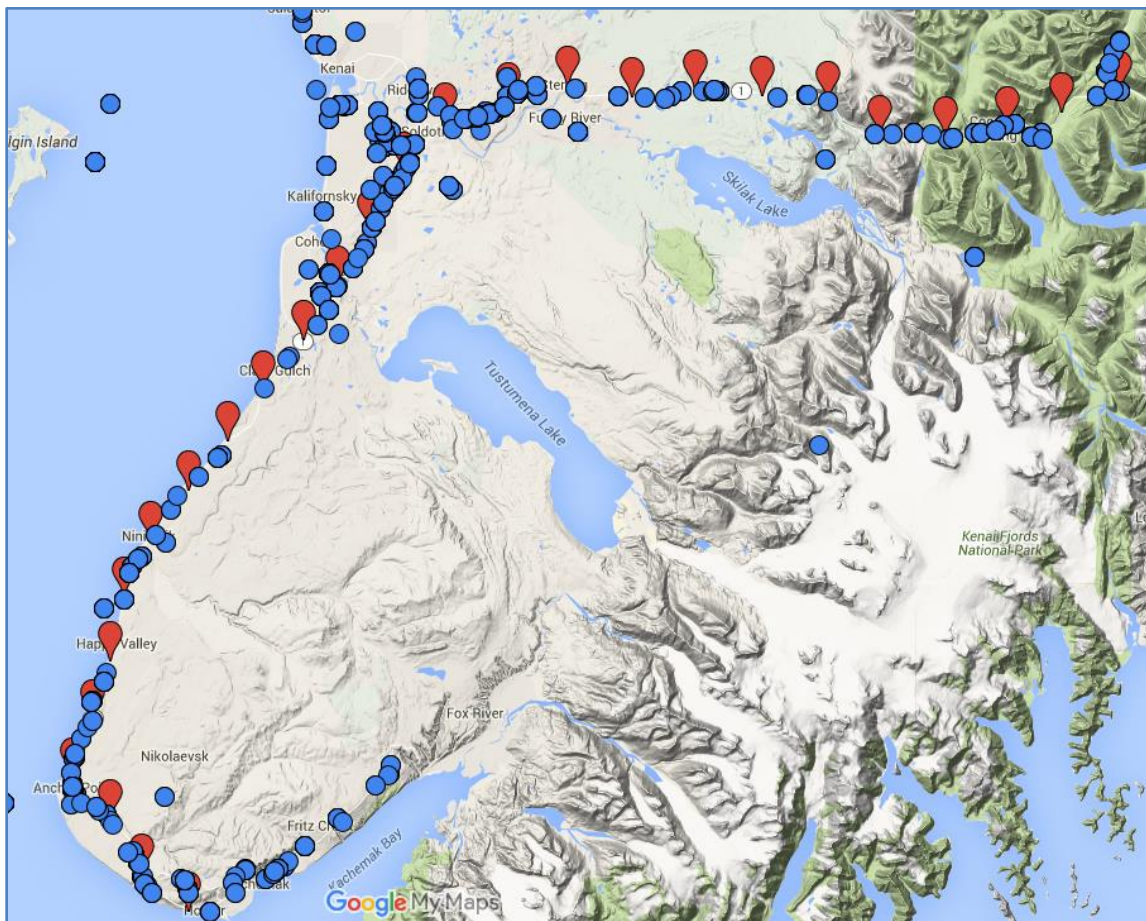


Milepost Locations

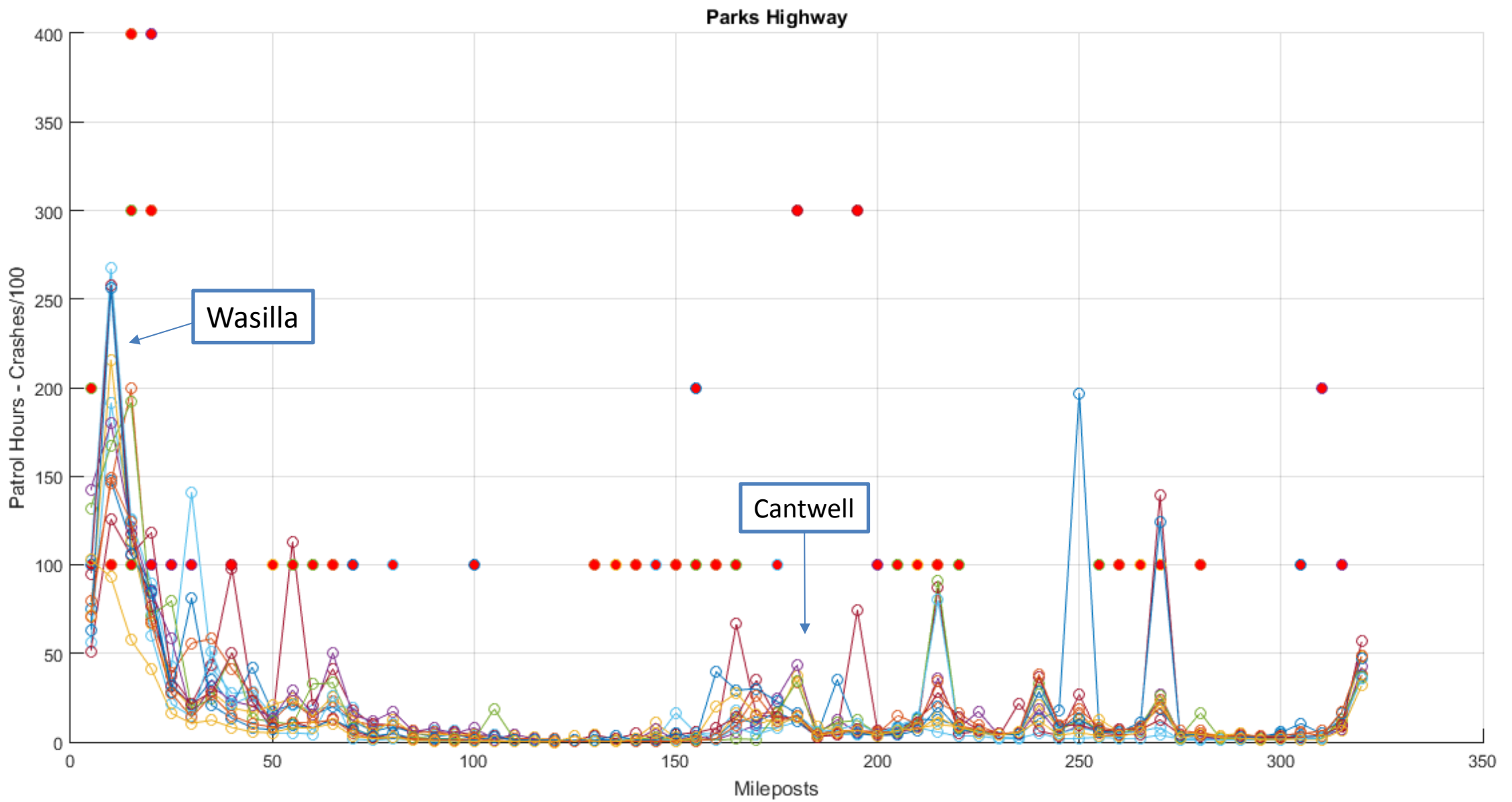




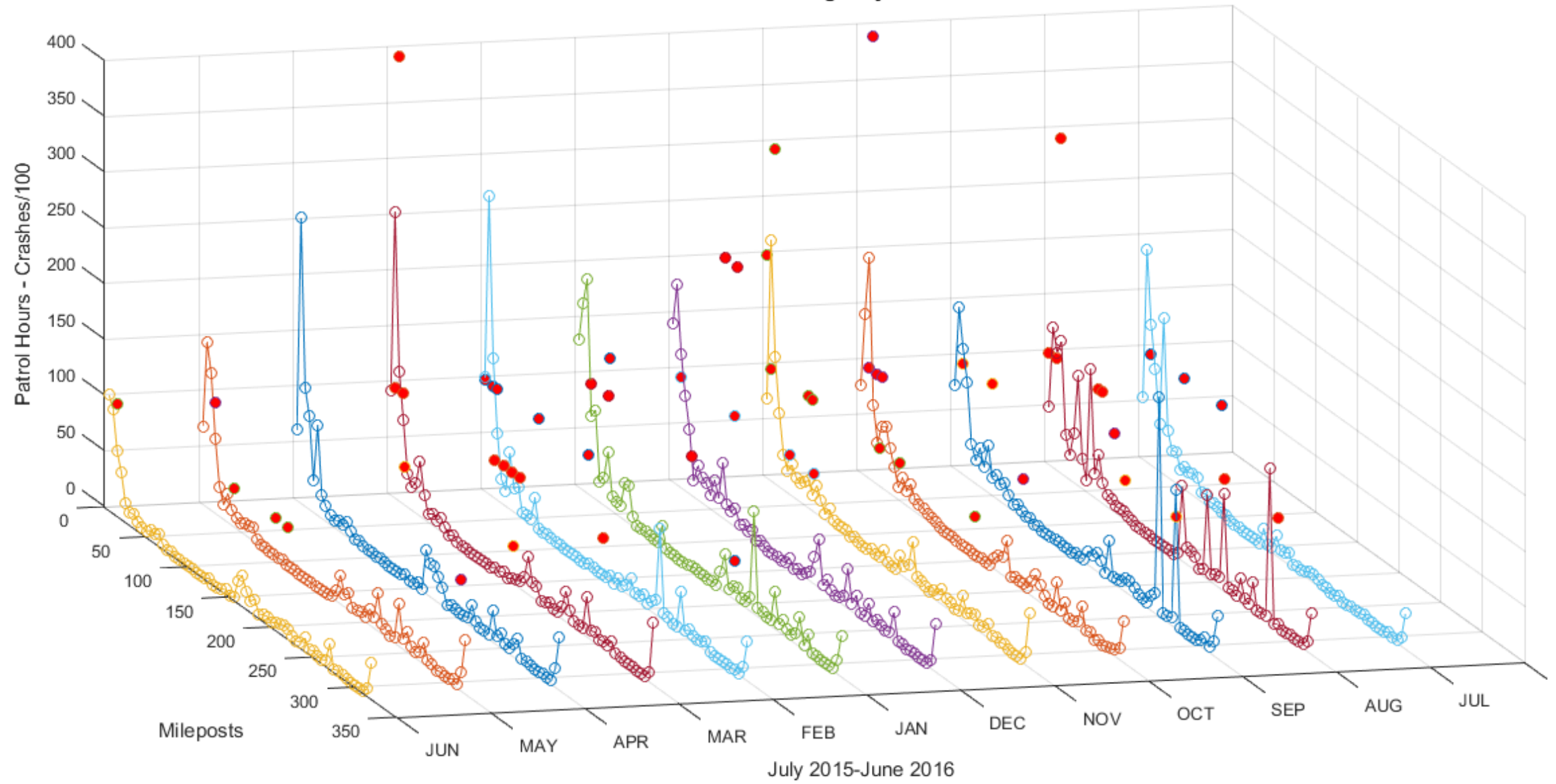
Example of Crash Data

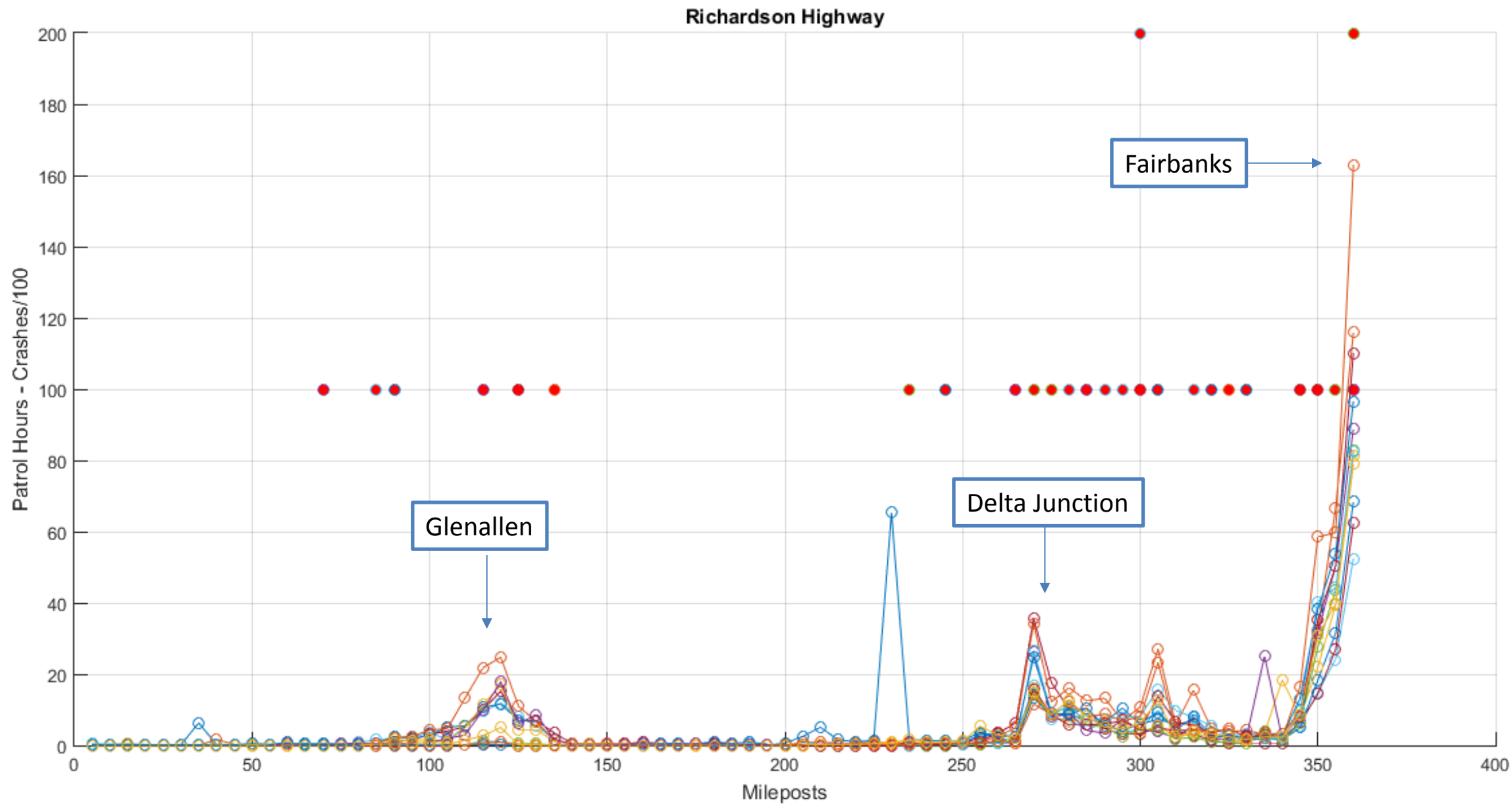


- Sterling Highway
- Red markers represent 5-mile sections
 - Blue markers indicate crash locations

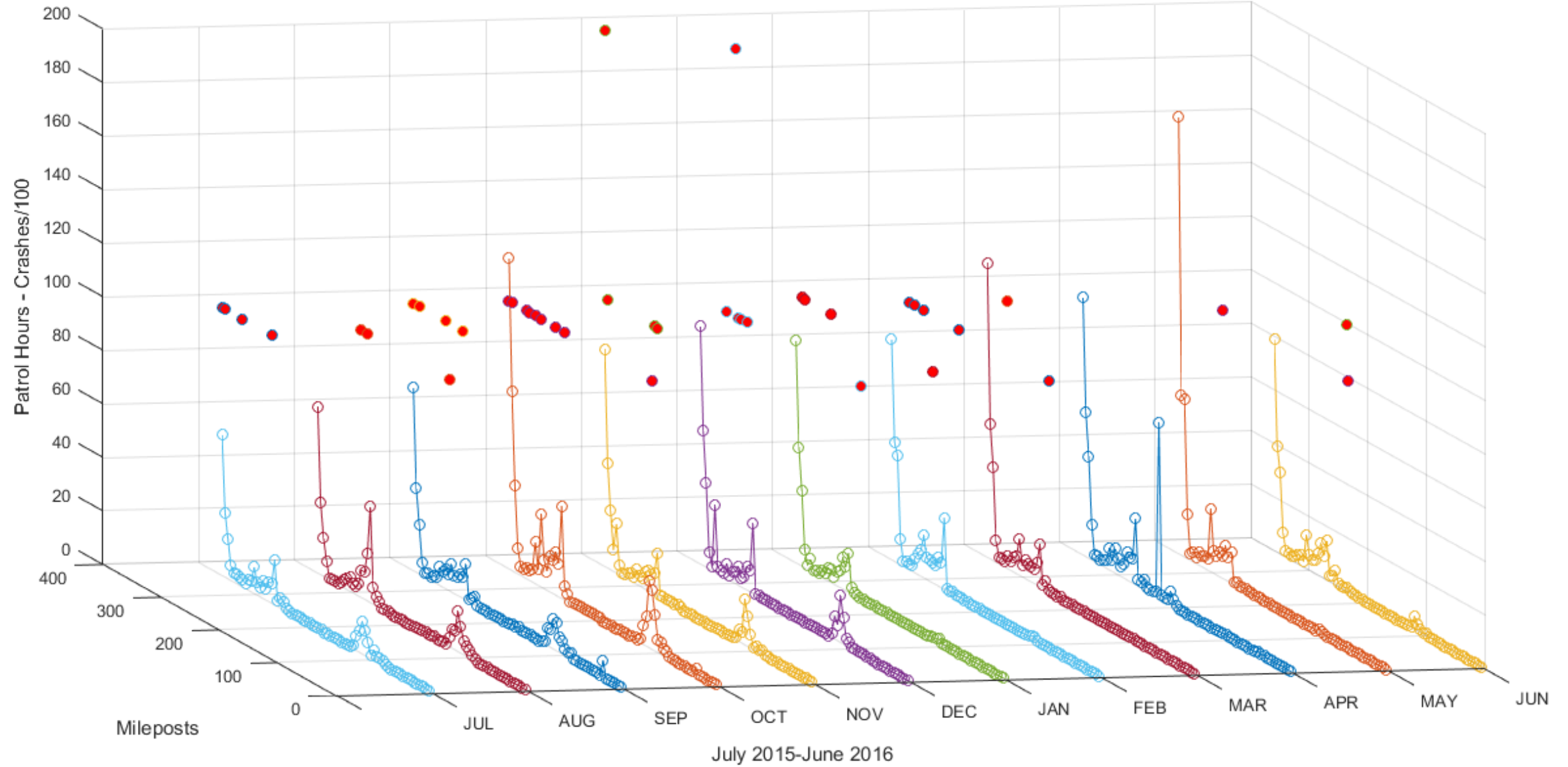


Parks Highway

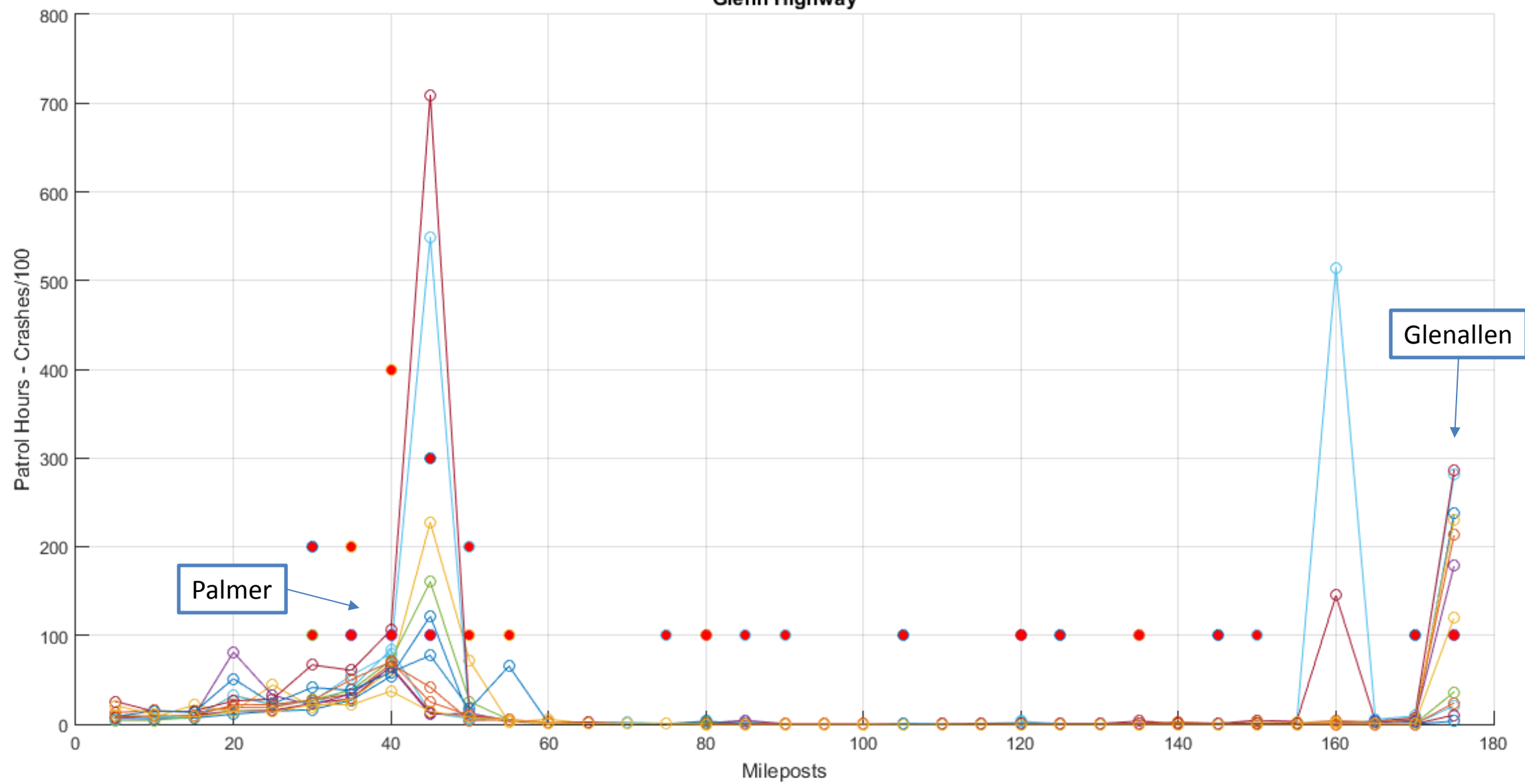




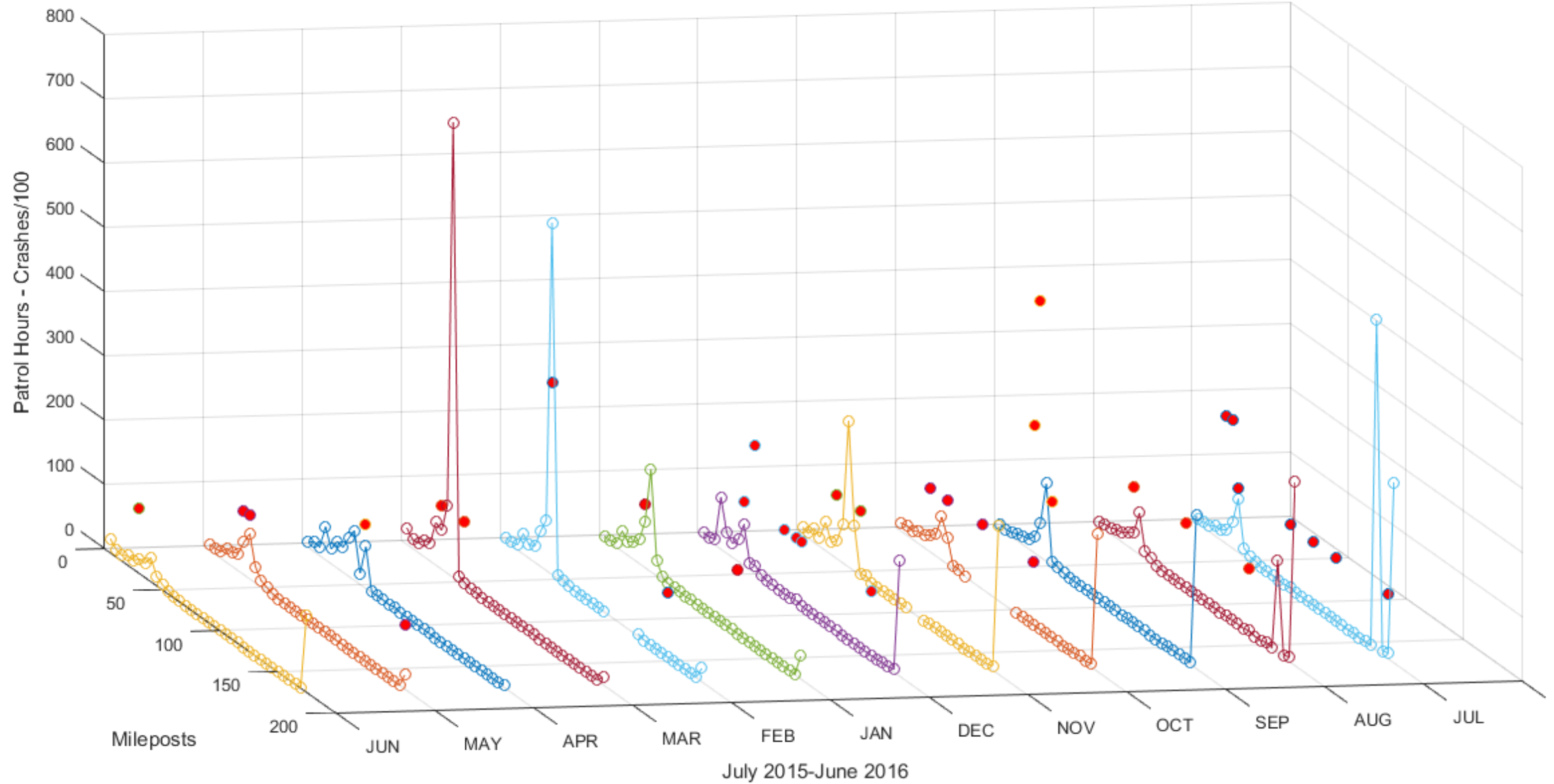
Richardson Highway

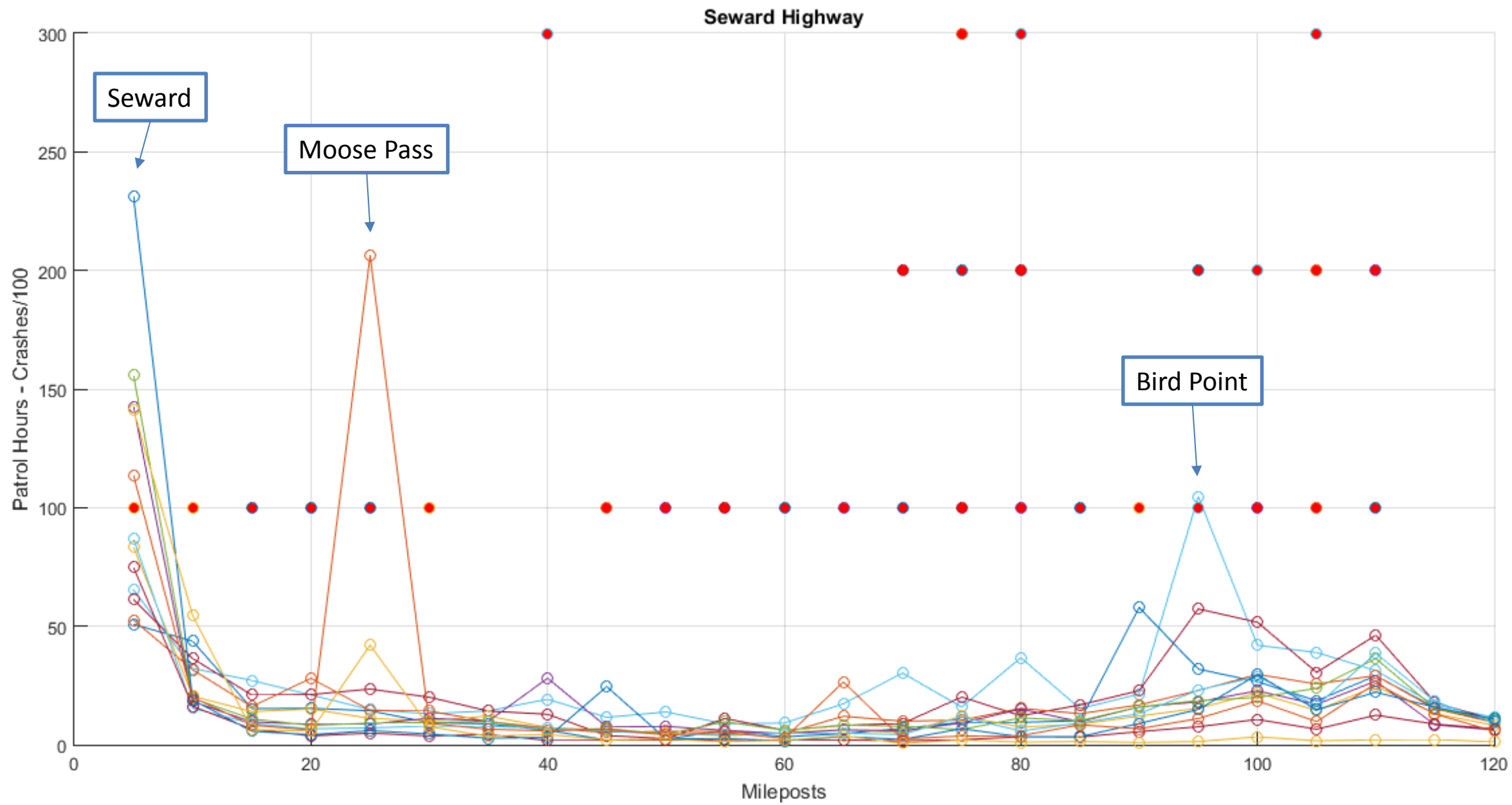


Glenn Highway

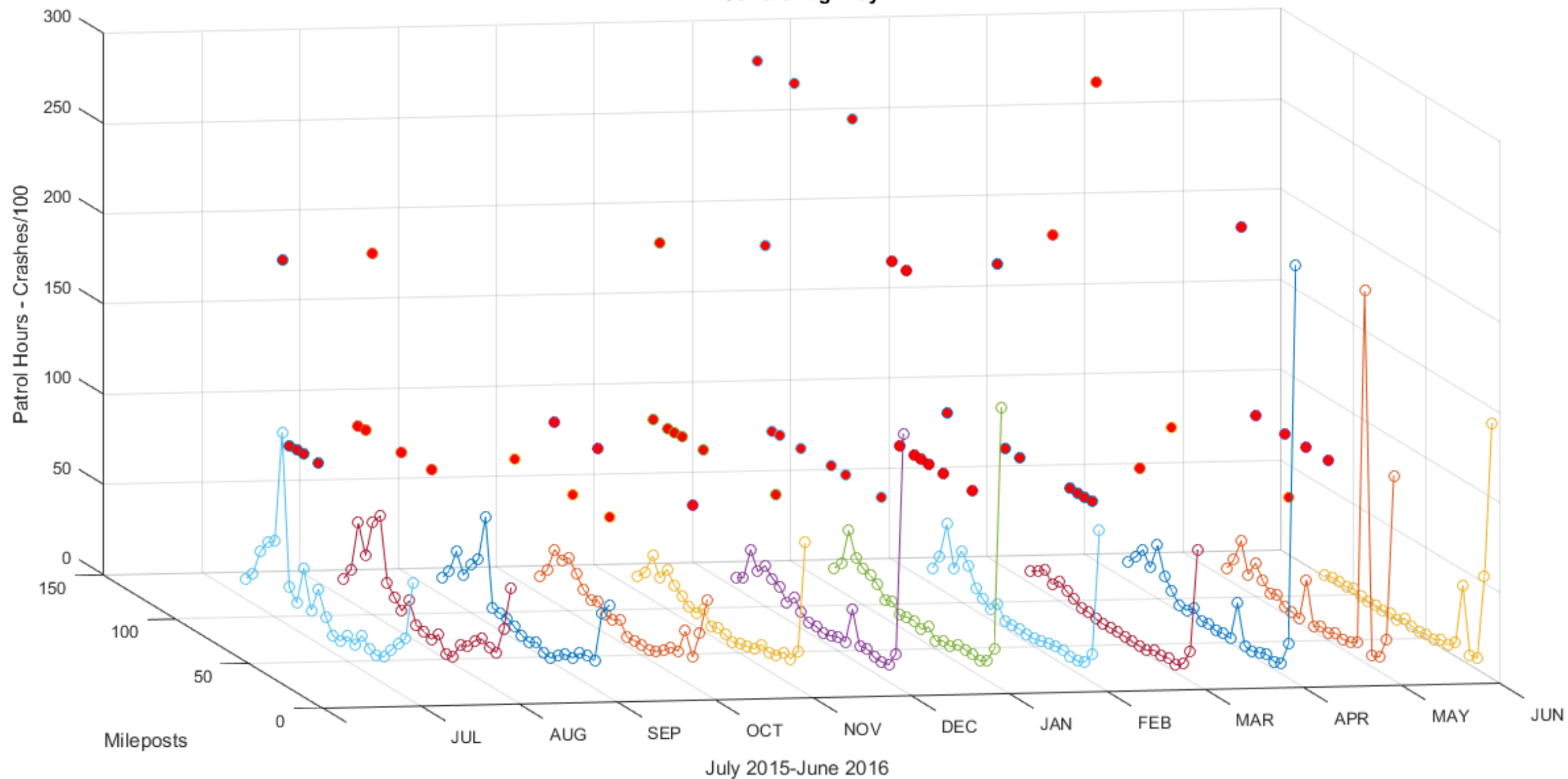


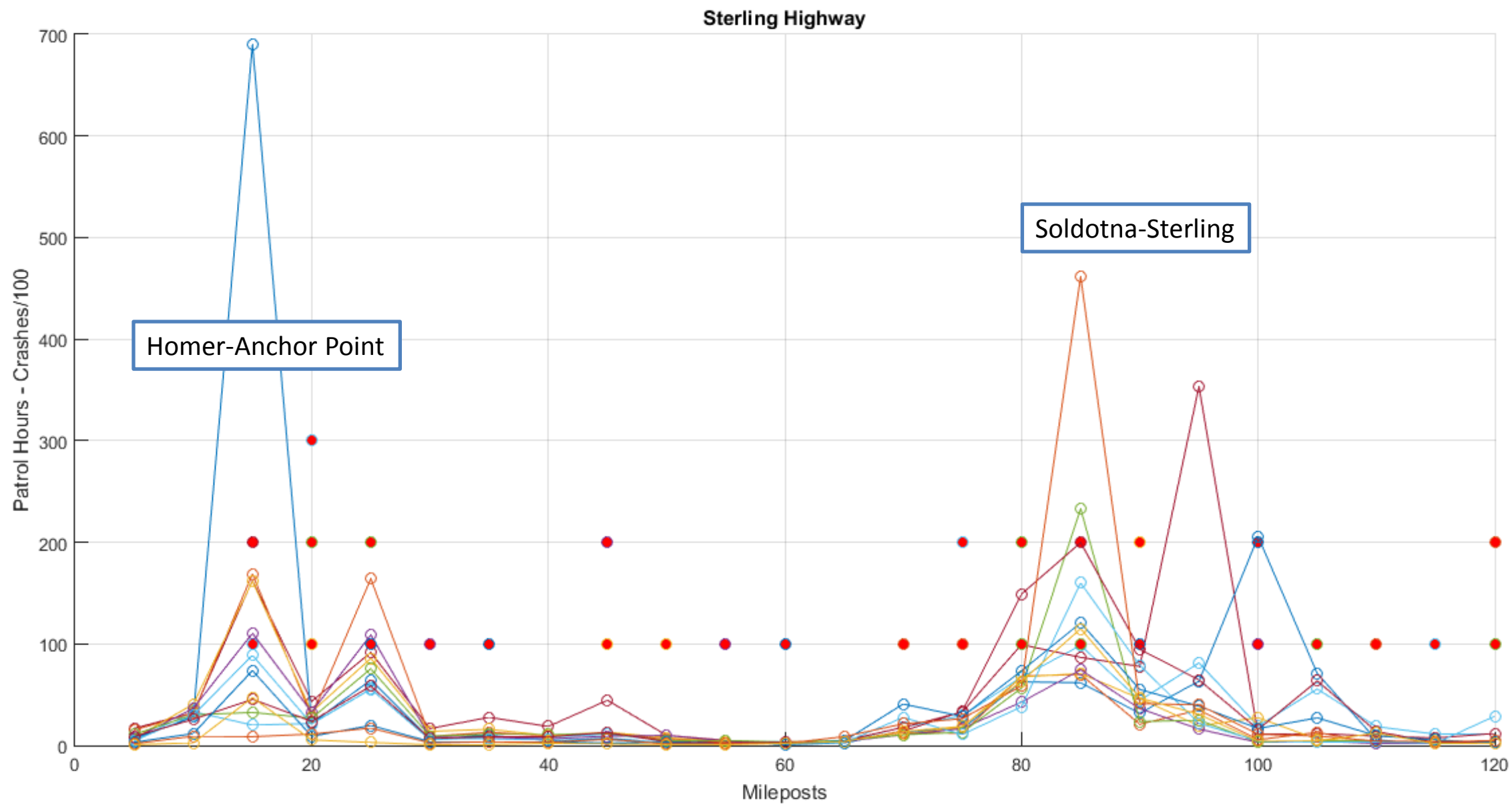
Glenn Highway



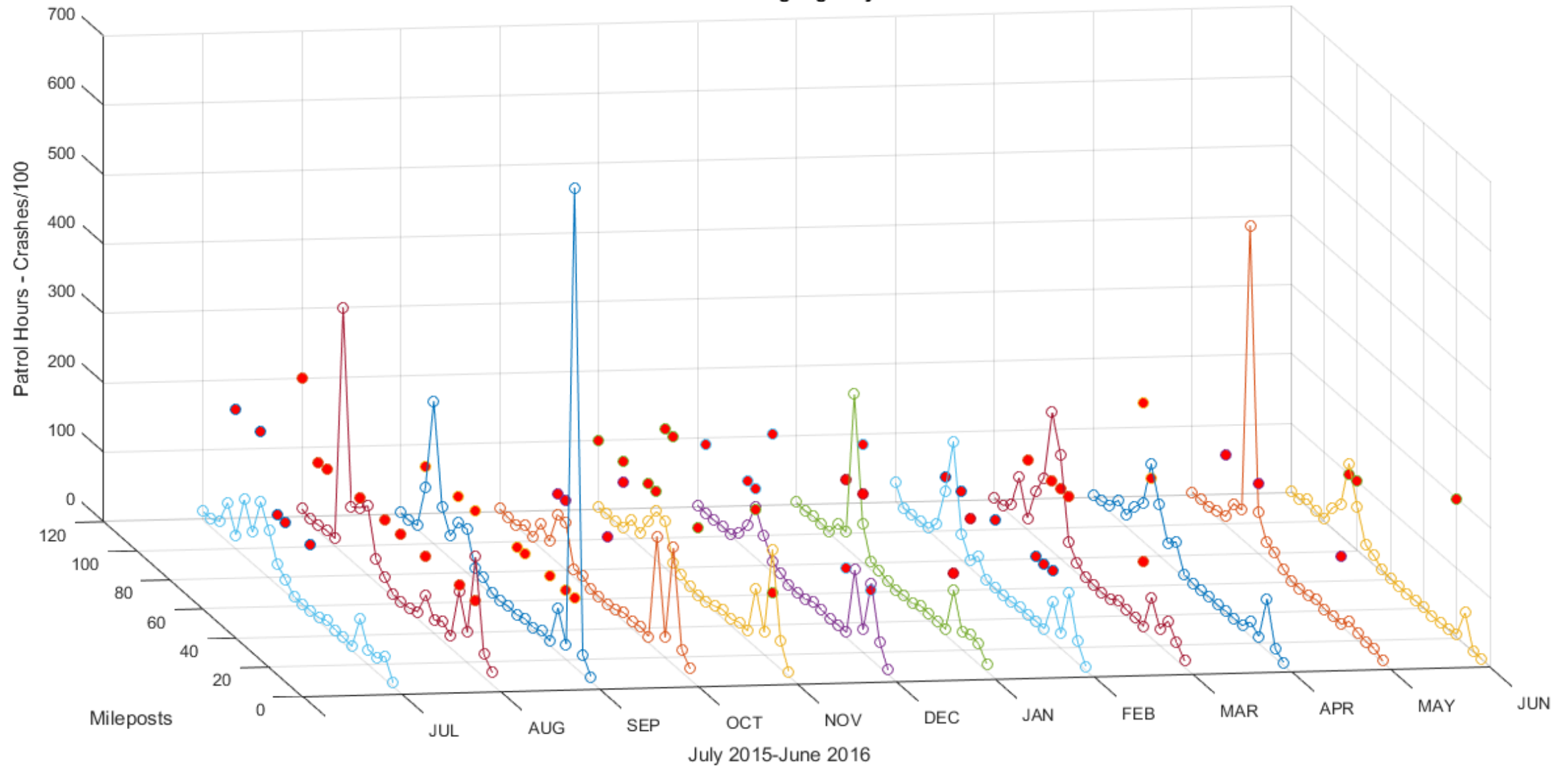


Seward Highway





Sterling Highway





Statistical Analysis

- Primary Objective
 - Determine if statistical significant interactions exist between the presence of patrol vehicles and crash occurrences.
- Levels of Analysis
 - Micro (*ideal*)
 - Intermediate
 - Macro
 - Combined



Statistical Analysis Findings

- Challenges
 - Limited number of sample data points for certain study corridors can affect accuracy of statistical results
 - 5-mile geofence areas can limit the model in observing a variety of situations to assess interactions
 - Only two contributing factors were included in the data inputs. This may not be enough to accurately describe how enforcement presence interacts with crash occurrences



Benefit/Cost Procedure

- Procedure generated to use the results of the statistical analysis to estimate the monetary benefit of enforcement. Steps are similar to procedure used in Queensland study, though they used a log-linear model.
- Estimate the monetary cost of enforcement based on an hourly patrol cost and the total time of presence
- Compare both values to determine the benefit/cost ratio, which helps transportation agencies optimize enforcement levels



Research Recommendations

- Continue data collection efforts for a longer period of time (3 to 4 years potentially)
- Include other contributing factors such as roadway conditions and intersecting side street volumes
- Reduce geofence areas from 5-mile segments to 1-2 mile segments along each highway
- Coordinate with other local agencies to collect more collision reports



Research Recommendations

- Once sample sizes are increased, the binomial logistic regression analysis should be used for the macro, intermediate and micro levels
- Greater variances in patrol vehicle placement allows the model to account for a variety of situations
- Also include “Combined” analysis, in which the sample data sets of all study corridors are combined to determine common themes and interactions along highways in Alaska.



Any Questions?