

# COMMERCIAL VEHICLE CRASH LOCATION ANALYSIS

GIS Analysis of Geocoded Crash Information and  
Review of CMV Location Data Quality

Prepared for the



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## **INTRODUCTION**

The identification of specific commercial vehicle crash locations can greatly assist commercial vehicle program planners in identifying roadway segments with high crash frequencies. This information can then be used to develop and implement education, enforcement and engineering countermeasures to reduce the incidence of commercial motor vehicle (CMV) crashes. Targeting countermeasures to specific locations can lead to more effective use of limited resources – both human and fiscal – as well as greater impact on the overall CMV safety picture by addressing the areas that need the most help.

As part of the Massachusetts Commercial Vehicle Data Quality project, location information for commercial vehicle crashes was reviewed and analyzed in an effort to provide commercial vehicle programmers with this type of detailed location information for use in program planning and evaluation. This review and GIS analysis of CMV location data was conducted in two phases.

Phase 1 was a review of the quality of the location data. Until relatively recently, the only crash location information that has been available for the entire crash data set has been at the town level; additional information might be gathered from the diagram or narrative but this was a time-consuming process. MassHighway now has crash location information that includes an XY coordinate and a road segment ID number that allows the crash location to be tied to information in the roadway inventory file. This detailed location information allows researchers and analysts not only to locate the crash as a point on a road but also allows for the gathering and analysis of information about that roadway. Preparing the data for the location analysis included identification of CMV crashes, linkage with data in the Registry of Motor Vehicle (RMV) Crash Data System (CDS), and identification of CMV crash location information in the MassHighway geocoded data set. As part of the data preparation, there were ongoing dialogues with MSP CVES and MassHighway to understand accuracy issues as well as why certain crashes were not located.

The result of this four-step process is a dataset that includes the MCMIS crash number, all information on that crash as stored in CDS, and the detailed location information stored in the MassHighway geocoded dataset.

Phase 2 was the actual analysis of the dataset resulting from Phase 1. Initial analyses included a review of crash locations with a focus on injury severity. These included mapping actual crash locations as well as determining Equivalent Property Damage Only (EPDO) rates for each of the road segments. These results were presented to the CMV Advisory Board and additional areas of interest were identified. These additional areas of interest included maps with the injury severity levels separated out, time of day, interstate vs. intrastate trucks, and maps with data at the troop level. In addition, several areas of interest were identified that could not be examined at this time; these included intersection type, rates per lane mile or vehicle miles traveled and vehicle direction information. The results of these analyses are presented in the form of maps which provide a visual description of where crashes are happening and allow viewers to identify different characteristics associated with crashes and their locations. These maps are described in more detail below.

## MAPS OF CMV CRASH LOCATIONS AND CHARACTERISTICS

These maps include CMV crashes occurring in 2003 and 2004 and are an initial review of location data, conducted by MassSAFE, based on preliminary geolocated crash information provided by MassHighway. The maps show only Interstate routes, U.S. routes, and state routes. Crashes occurring on other routes appear on the map as dots not located on a road.

### CMV Location Data by Crash Severity, 2003-2004

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The study of CMV crash location data by injury severity includes six maps: one map for the whole state, and five smaller maps one for each Police Troop Division. Maps Included:

1. Massachusetts
2. Troop A
3. Troop B
4. Troop C
5. Troop D
6. Troop H

Red dots represent **major injury crashes** which include fatal crashes and incapacitating injury crashes. Blue dots represent **minor injury crashes** and include non-incapacitating injury crashes, possible injury crashes, Property Damage Only (PDO) crashes, and those with unknown injury severity. Injury severity was obtained from the Massachusetts CDS and the definitions for injury levels are based on the KABCO scale as follows:

- K- Fatal Injury
- A- Incapacitating Injury
- B- Non-Incapacitating
- C- Possible Injury
- O- Property Damage Only

### Findings of Note

CMV crashes do not appear to be exclusively an Interstate problem in Massachusetts; the map shows crashes spread out across the Commonwealth and a fair amount of them are located on U.S. and state routes.

- The western side of Massachusetts shows fewer CMV crashes than the eastern side. This is to be expected as there is greater traffic volume in the eastern portion of the state.
- While it is expected that the Boston area would show clusters of CMV crashes because of higher traffic volumes in this area, it is interesting to note the cluster of crashes in the Worcester area. In particular, Interstate 190 in Worcester shows a high density of crashes involving commercial vehicles.
- There seems to be no consistent trend for the presence of commercial vehicle crashes on interstate routes that cross a border with another state. I-84 South and I-190 South do not show high concentrations of crashes while I-195 and I-91 have clusters at the borders with Rhode Island and Connecticut respectively.
- When comparing barracks, it is interesting to note that Barrack D1 has a high proportion of major injury crashes. While in most Barracks, minor injury crashes far outnumber major injury crashes, this is not the case in Barrack D1.

## **CMV Location Data by Time of Day, 2003-2004**

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The study of CMV crash location data by time of day includes one map for the whole state. The data are grouped in four 6 hour periods: midnight to 5:59 am (red dots); 6 am to 11:59 am (yellow dots); noon to 5:59 pm (blue dots); 6:00 pm to 11:59 pm (green dots). Maps Included:

7. Time of Day

### **Finding of Note**

- While most of the crashes occurred between 6 am and 5:59 pm (yellow and blue dots), Interstate highways, especially the Mass Pike, show higher number of crashes occurring during nighttime hours (red and green dots).

## **CMV Location Data by Interstate/Intrastate Trucks 2003-2004**

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The study of CMV crash location data by interstate/intrastate CMV includes two maps; one for crashes involving intrastate trucks and one for crashes involving an interstate truck. Maps Included:

8. Intrastate CMV
9. Interstate CMV

### **Findings of Note**

- Most commercial vehicle crashes involve Interstate trucks: 82% involved Interstate CMVs; 17% involved Intrastate CMVs; and less than 1% of crashes involved at least one Interstate and one Intrastate CMV in the same crash.
- Looking at the Intrastate CMV map, most crashes are located in the Boston area and they are far less common on major Interstate highways.
- Looking at the Interstate CMV map, crashes are spread out across the State and a fair amount of them are located on Interstate highways and major routes.

## **Location Data of CMV with Hazardous Materials 2003-2004**

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The study of CMV crash location data for hazardous materials includes one map showing those crashes involving a truck carrying hazardous materials. Trucks carrying hazardous materials were identified through the information included in CDS. First, all trucks where HazMat Placarded=Yes were included. In addition, the field describing the type of materials being carried was checked to ensure that no truck carrying hazardous materials was missing the HazMat Placarded flag. Maps Included:

10. Hazardous Materials

### **Findings of Note**

- In Massachusetts, 4% of CMV crashes involved trucks with hazardous materials. The similar national percentage is 2%.  
(<http://www.ai.volpe.dot.gov/CarrierResearchResults/PDFs/LargeTruckCrashFacts2003.pdf>)
- There were two noticeable small clusters of HazMat crashes. One cluster is located just southeast of Boston and the other is located in the southeast section of Massachusetts around I-195 by the Rhode Island border.

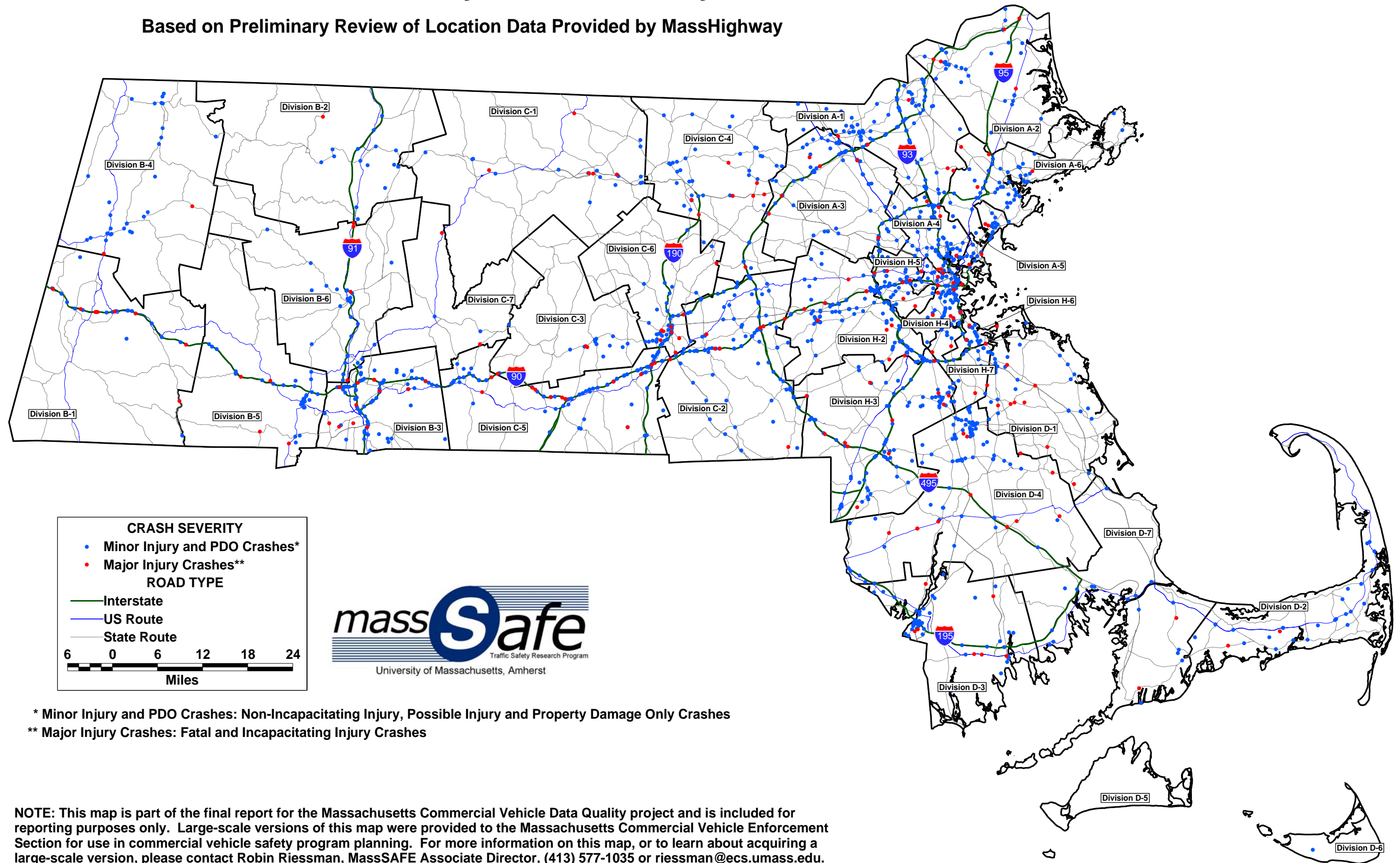
## **NEXT STEPS**

While this initial review of geolocated CMV crashes has provided valuable information on several areas of interest, a second phase of this study would allow for further analysis of characteristics of CMV crashes in relation to their location. This expanded analysis would provide additional information including analysis of other fields on the crash report form and the consideration of roadway inventory information. Some possible areas of analysis are as follows:

- CMV crashes by crash type: angle, rear-end, head on;
- CMV crashes by jurisdiction;
- CMV crashes by road classification: rural vs. urban;
- Identification of a feasible rate for analysis such as lane miles or vehicle miles traveled;
- Intersection analysis for CMV crashes;
- Detailed Troop-level analysis (time of day/day of week, weather conditions, etc); and
- Analysis of citations associated with CMV crashes to identify possible causes associated with crashes.

# CMV Crash Locations by Crash Severity, 2003-2004

Based on Preliminary Review of Location Data Provided by MassHighway

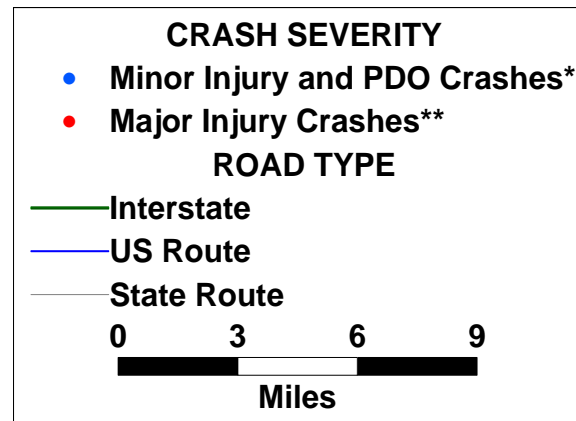


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# CMV Crash Locations by Crash Severity, 2003-2004

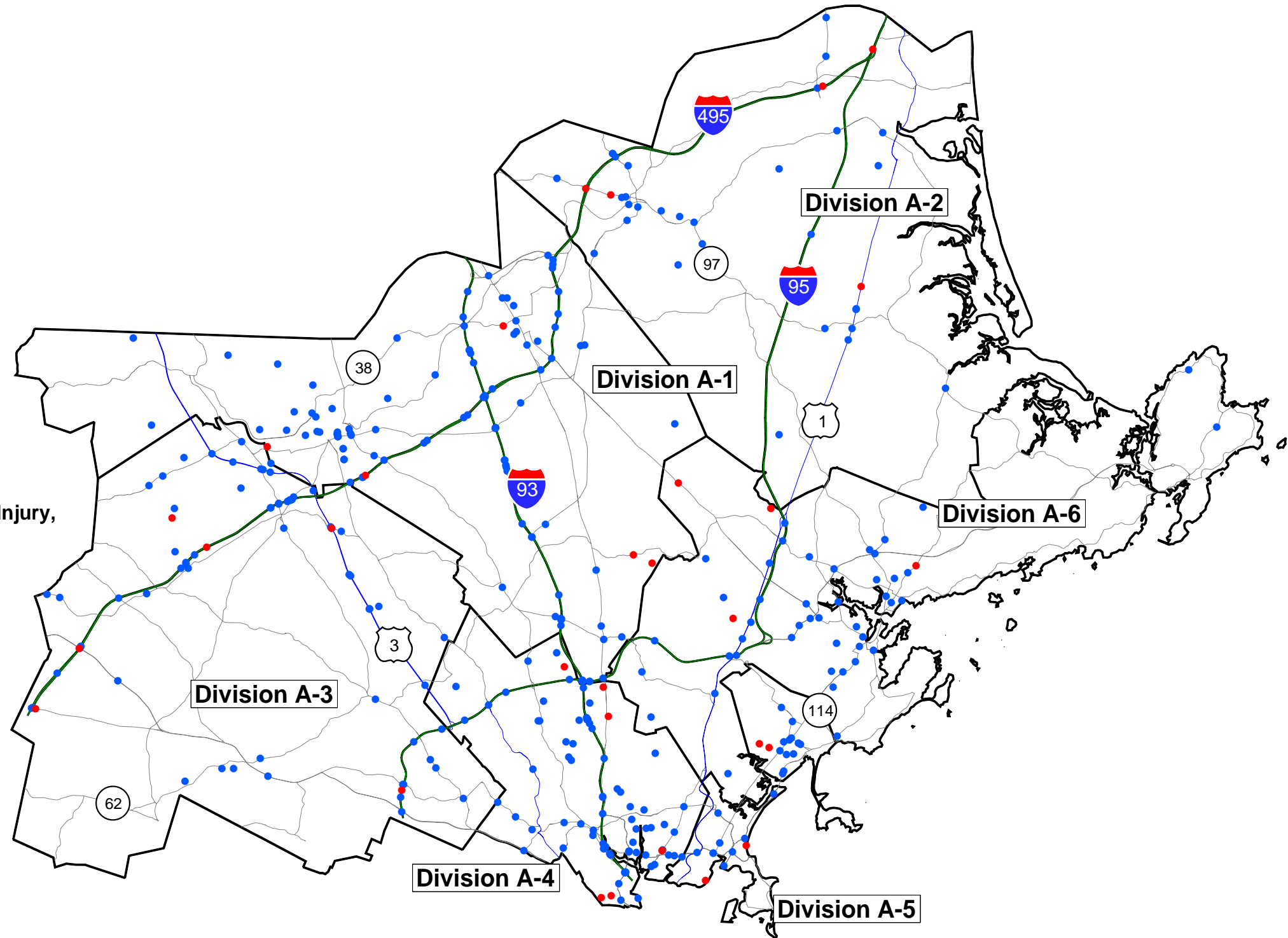
## TROOP A

Based on Preliminary Review of Location Data Provided by MassHighway



\* Minor Injury and PDO Crashes: Non-Incapacitating Injury, Possible Injury and Property Damage Only Crashes

\*\* Major Injury Crashes: Fatal and Incapacitating Injury Crashes



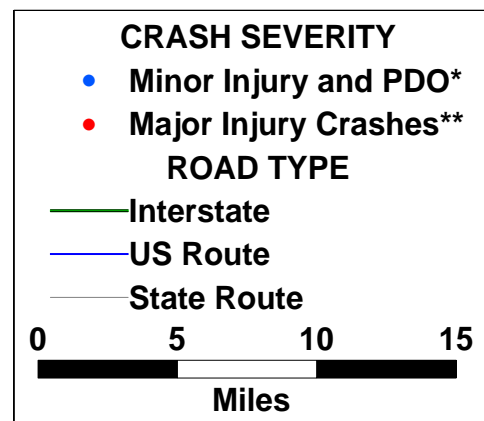
March, 2006



# CMV Crash Locations by Crash Severity, 2003-2004

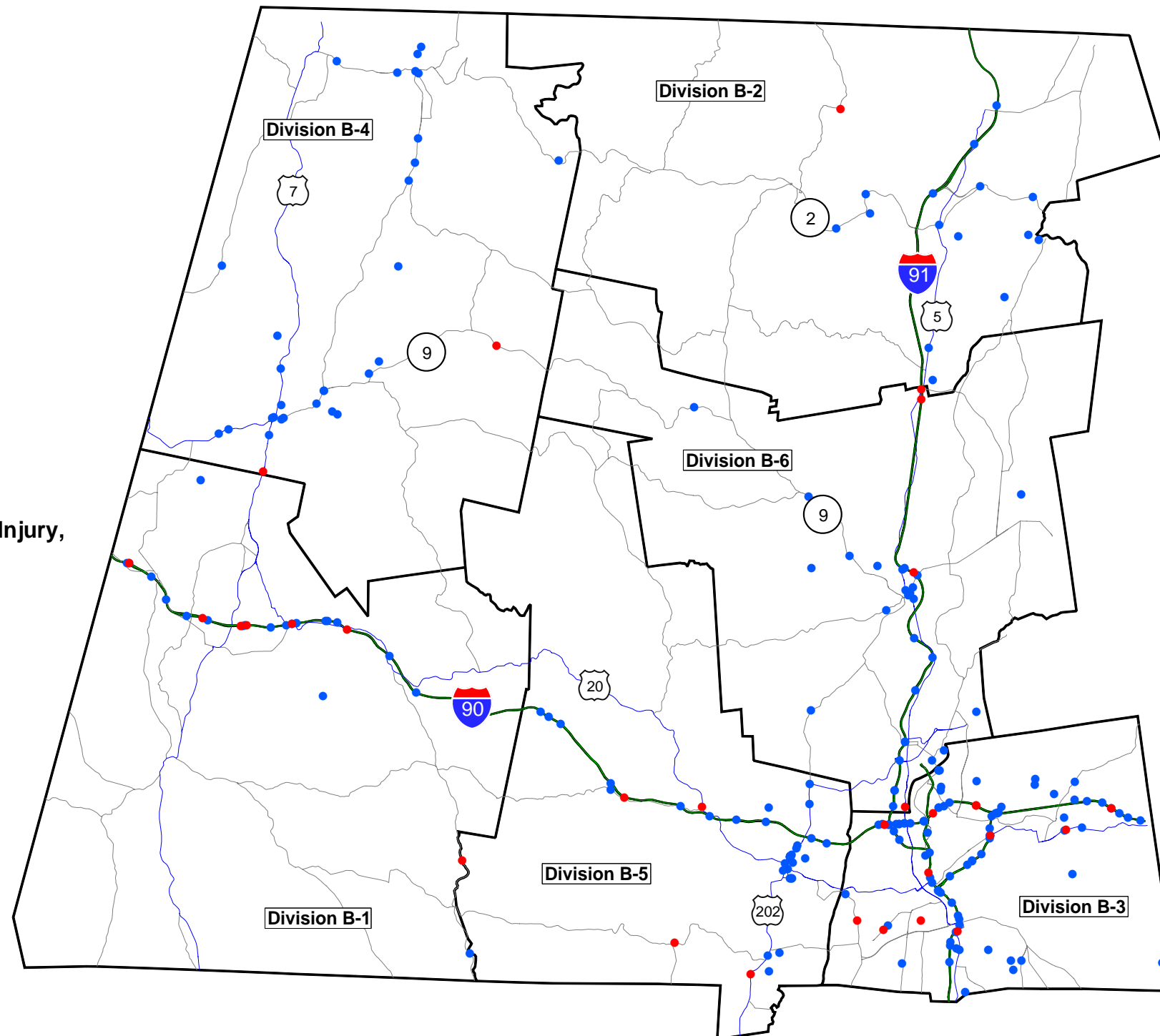
## TROOP B

Based on Preliminary Review of Location Data Provided by MassHighway



\* Minor Injury and PDO Crashes: Non-Incapacitating Injury, Possible Injury and Property Damage Only Crashes

\*\* Major Injury Crashes: Fatal and Incapacitating Injury Crashes



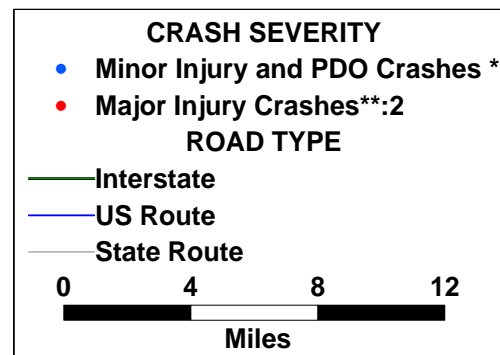
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# CMV Crash Locations by Crash Severity, 2003-2004

## TROOP C

Based on Preliminary Review of Location Data Provided by MassHighway



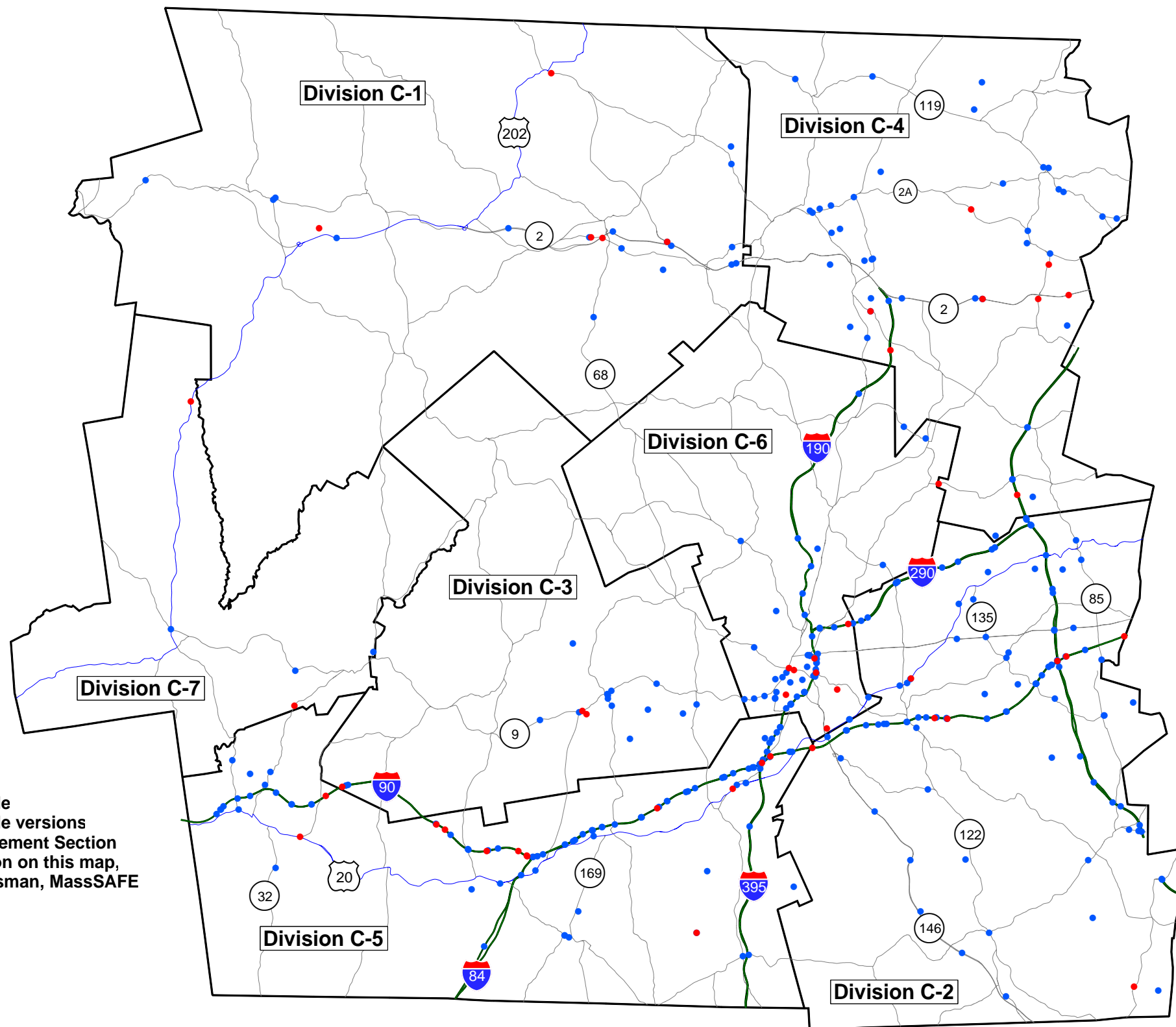
\* Minor Injury and PDO Crashes: Non-Incapacitating Injury, Possible Injury and Property Damage Only Crashes

\*\* Major Injury Crashes: Fatal and Incapacitating Injury Crashes



This map is part of the final report for the Massachusetts Commercial Vehicle Safety Program. This map was provided to the Massachusetts Commercial Vehicle Enforcement Section for use in commercial vehicle safety program planning. For more information on this map, to learn about acquiring a large-scale version, please contact Robin Riessman, MassSAFE Associate Director, (413) 577-1035 or riessman@ecs.umass.edu.

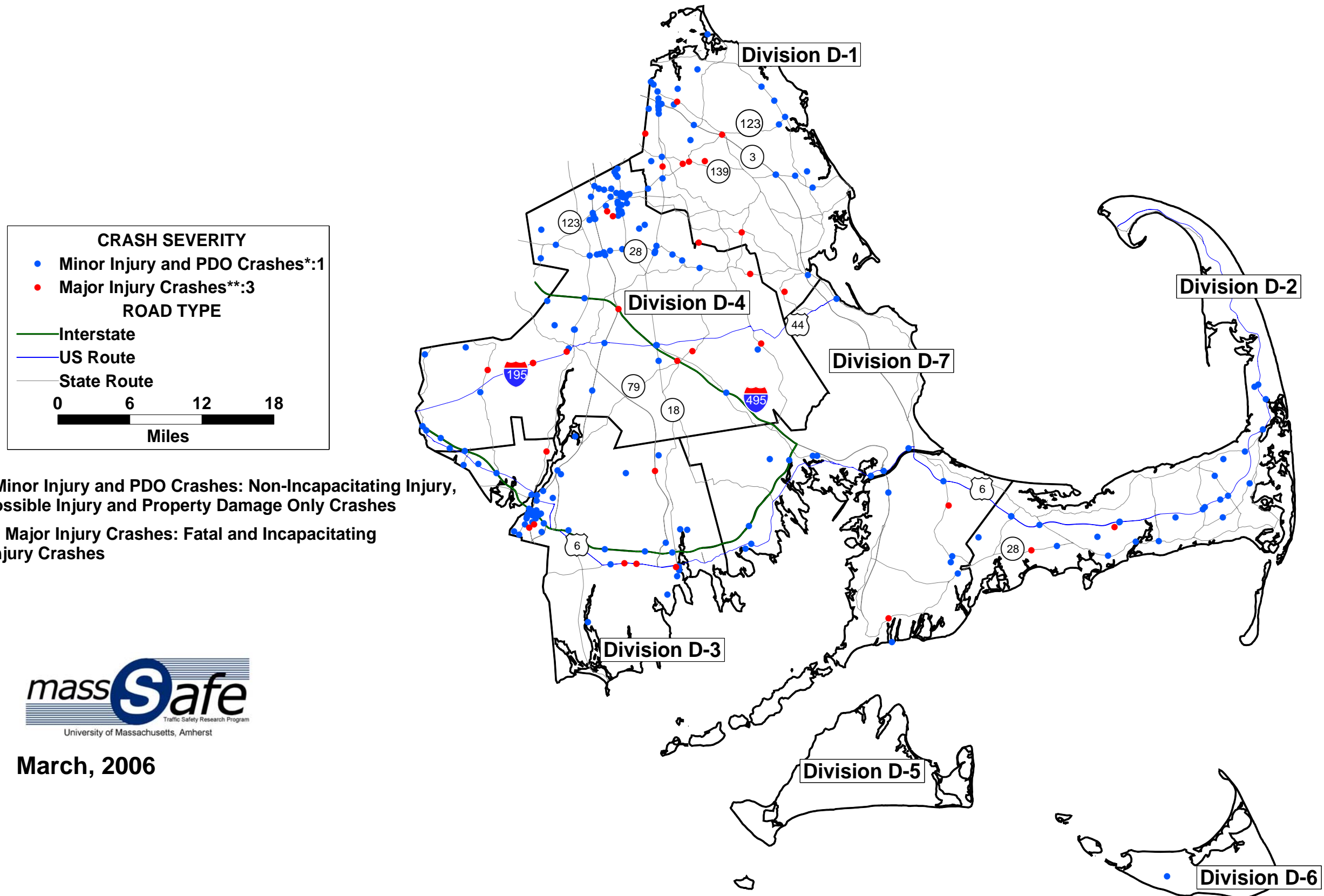
March, 2006



# CMV Crash Locations by Crash Severity, 2003-2004

## TROOP D

Based on Preliminary Review of Location Data Provided by MassHighway



\* Minor Injury and PDO Crashes: Non-Incapacitating Injury, Possible Injury and Property Damage Only Crashes  
 \*\* Major Injury Crashes: Fatal and Incapacitating Injury Crashes

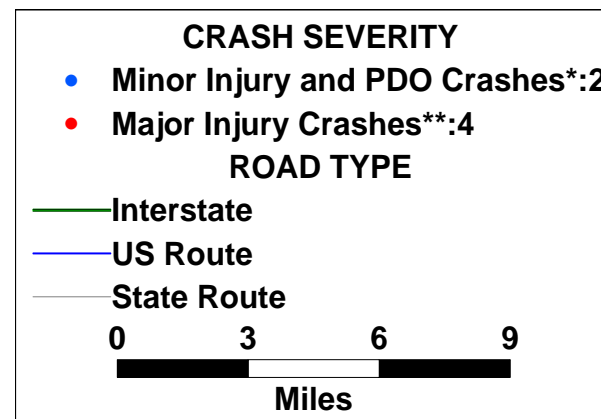


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# CMV Crash Locations by Crash Severity, 2003-2004

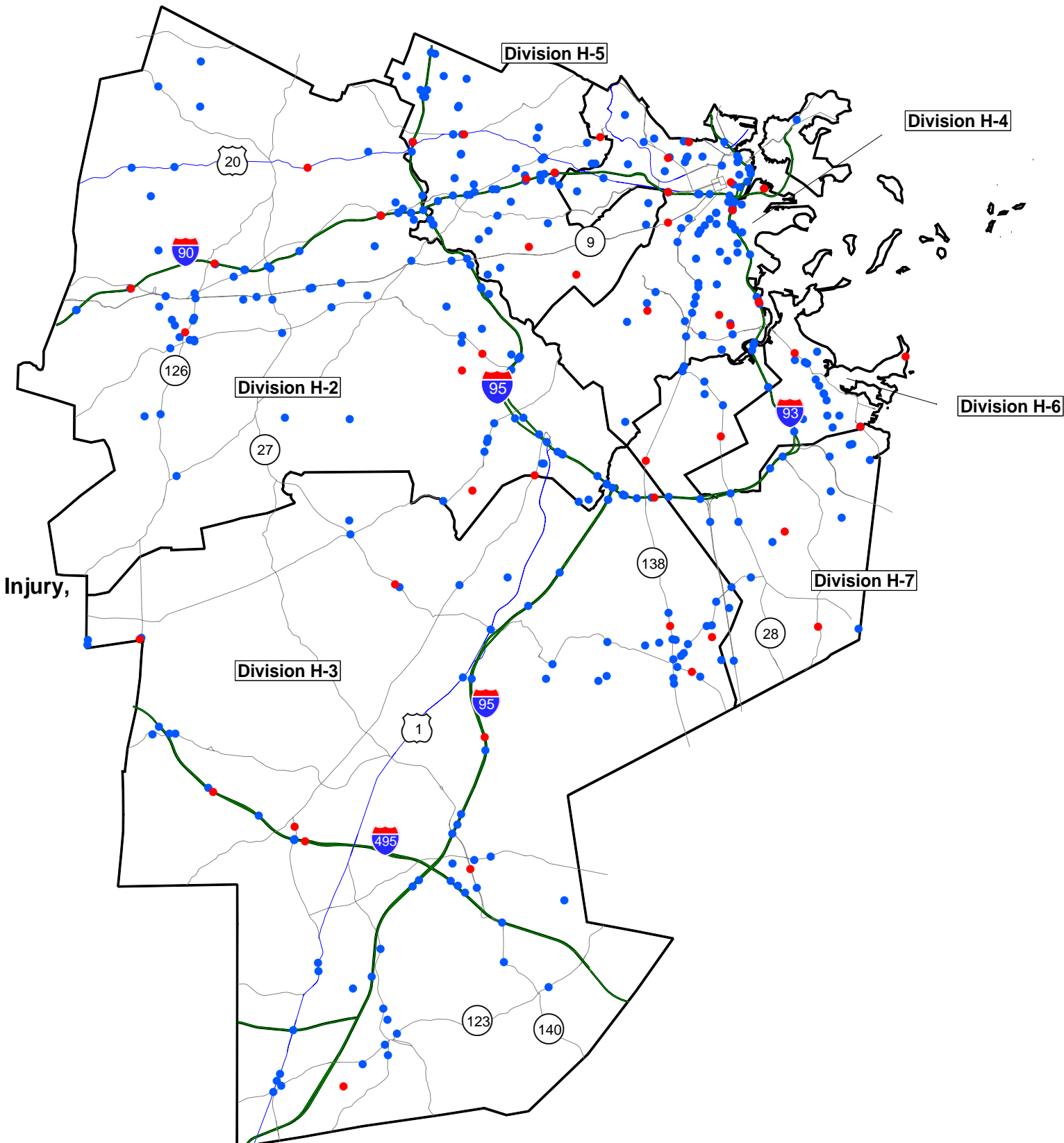
## TROOP H

Based on Preliminary Review of Location Data Provided by MassHighway



\* Minor Injury and PDO Crashes: Non-Incapacitating Injury, Possible Injury and Property Damage Only Crashes

\*\* Major Injury Crashes: Fatal and Incapacitating Injury Crashes

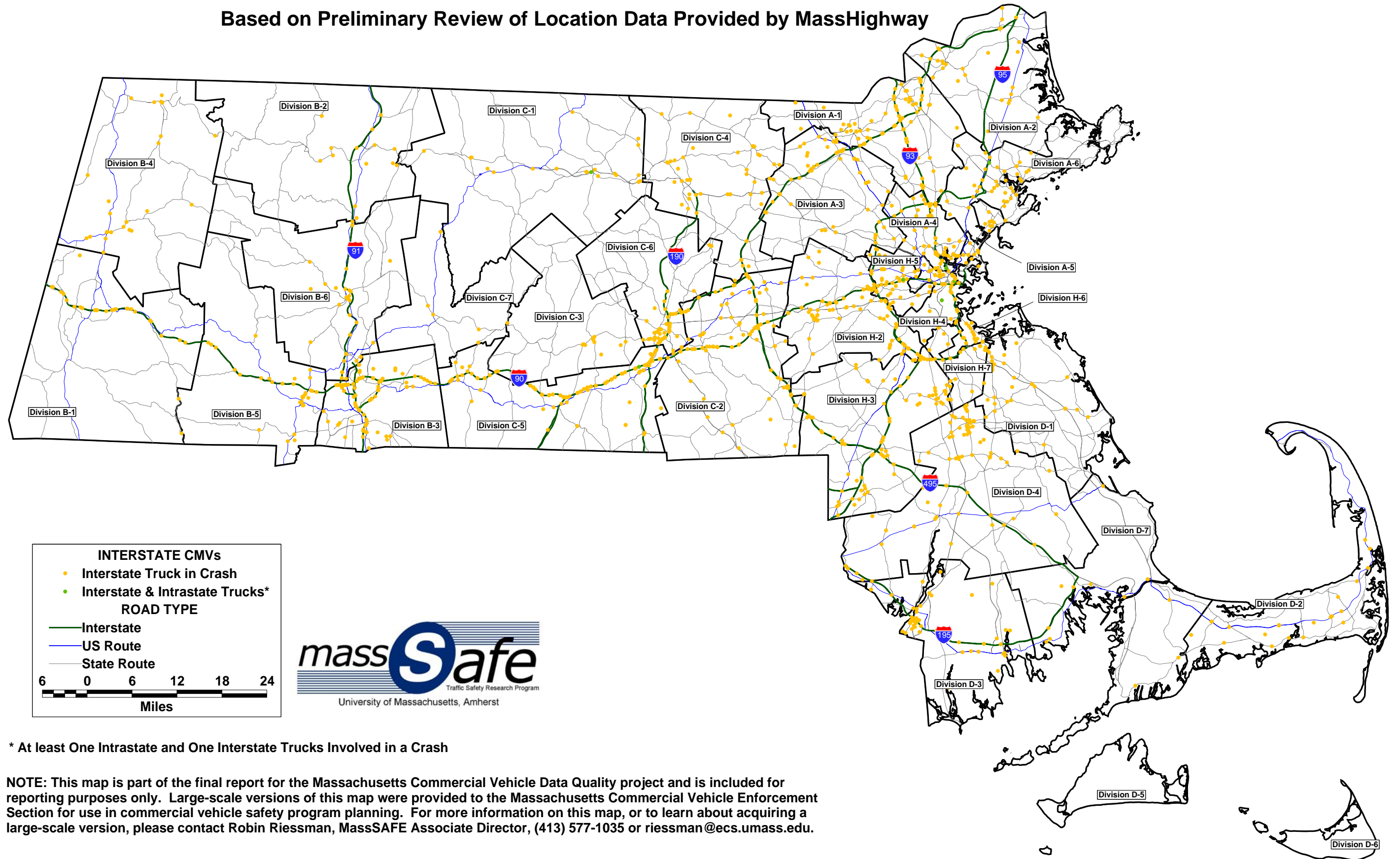


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# Interstate CMV Crash Locations, 2003-2004

Based on Preliminary Review of Location Data Provided by MassHighway



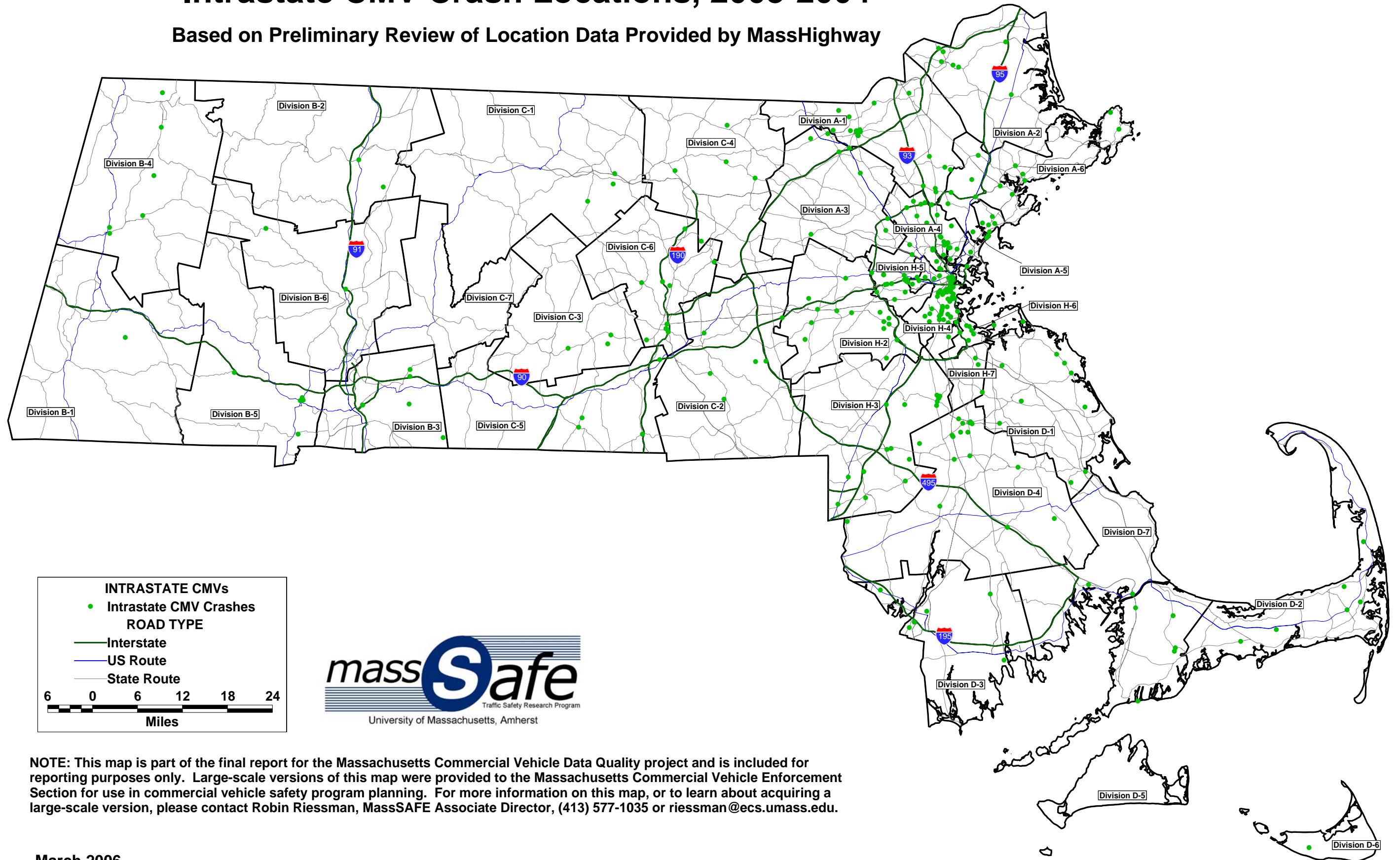
\* At least One Intrastate and One Interstate Trucks Involved in a Crash

**NOTE:** This map is part of the final report for the Massachusetts Commercial Vehicle Data Quality project and is included for reporting purposes only. Large-scale versions of this map were provided to the Massachusetts Commercial Vehicle Enforcement Section for use in commercial vehicle safety program planning. For more information on this map, or to learn about acquiring a large-scale version, please contact Robin Riessman, MassSAFE Associate Director, (413) 577-1035 or riessman@ecs.umass.edu.

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# Intrastate CMV Crash Locations, 2003-2004

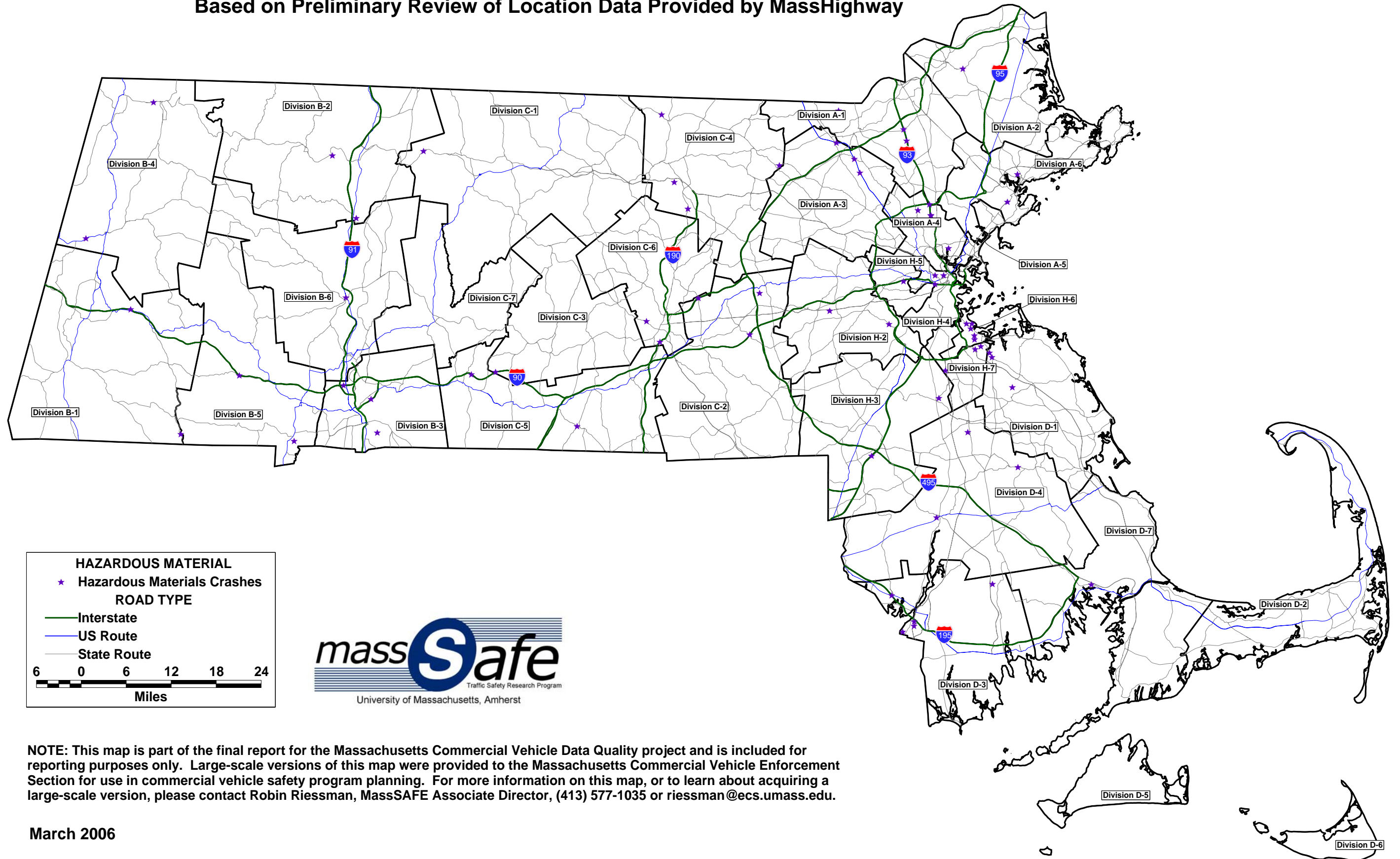
Based on Preliminary Review of Location Data Provided by MassHighway





# Crash Locations of CMV with Hazardous Material, 2003-2004

Based on Preliminary Review of Location Data Provided by MassHighway



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# CMV Crash Locations by Time of Day, 2003-2004

Based on Preliminary Review of Location Data Provided by MassHighway

