# Visualizing Time Series Analysis in Spatial Domain for Detecting Regional Scale **Crash Events** Department of Transportation

Wei Zhang\*, Lin Xiao, Yubian Wang FHWA Office of Safety R&D, 6300 Georgetown Pike, McLean, VA 22101 Tel: 202-493-3317, Fax: 202-493-3417

Email: wei.zhang@dot.gov

### Introduction

Regional scale crash events are those caused by nature force such as snow storm or hurricane, etc. that affect a large geographic area. The hypothesis is that there must be recognizable patterns in roadway crashes that are associated with such types of large scale events. This paper will present a visual analytics tool that reads in multiple years of crash records from a state/region, organizes the data in a very orderly fashion through a graphic interface, and enables the users to quickly identify the dates, locations, and graphic distribution patterns of roadway crashes that were caused by such nature events.

### **Example of regional event**

Following the aforementioned criteria, a series of days are identified as impacted by regional event. Here 12/26/2012 is chosen as an example. It was the day after Christmas, normal crash occurrence is low. However, this particular day is an exception, as in Fig. 2:



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### About the tool

The 2-STEP tool is used to analyze VA's crash data over time span [1]. The original 2-STEP tool pinpoints high risk locations by zooming in in the space dimension (from state level, to area/county level, to block level). While inheriting this function, after slightly adoption, this tool can also zoom in in the dimension of time. Given crash data for an area, 2-STEP can guide the users to pinpoint the high risk time slots (days in this example), as well as locations, in just two steps. Initially, the entire dataset is regrouped and counted by years. By default, the tool highlights the top three years in red, the top four to six years in yellow (the color coding is user editable). Fig. 1 shows the procedure of the two steps:



Figure 2. Visualize crashes from 12/25/12 – 12/27/12

# **Findings and Analysis**

Traffic volume: 12/26/2012 was Wednesday. It was also the day after Christmas. Traffic volume, if not very low, should not exceed normal volume (normal crash frequency) Weather condition: Table 1 [2]

![](_page_0_Picture_15.jpeg)

Figure 1. 2-STEP analysis

# **Time series analysis and regional events**

For a given time series, for example, days in a month, if there is/are "regional scale events" occurred, the impact on crash frequencies for those days should be observable in the second step.

To be such an *observable regional event*, two criteria should be satisfied;

- Extremely high crash frequency, the crash frequency surges from 1. previous day and goes back to normal in the following days
- No periodical pattern 2.

Note that, every "red" days should not be identified as impacted by the events. For example, most Fridays have high crash frequency and are labeled as red. But most of them are not impacted by special events but by periodically increased traffic volume.

### References

[1]. W. Zhang, K. Hancock, Y. Wang, and H. Sardar, Prioritize Safety Projects with

Crash severity: less fatal, serious injury crashes, Fig. 3, and 4

![](_page_0_Figure_26.jpeg)

**Figure 4. Count for six regional events** 

## Conclusions

In this paper, we explained the 2-SETP spatial screening tool for identifying regional event impacting traffic safety. The preliminary analysis results support the following conclusions:

### Confidence Using Two-Step Spatial Screening, 2016 ASCE International

### Conference on Transportation and Development. Houston, TX, June26-29,

![](_page_0_Picture_32.jpeg)

![](_page_0_Picture_33.jpeg)

![](_page_0_Picture_34.jpeg)

### In adverse weather, the crashes are statistically less severe

#### Rain has immediate impact on crash occurrence whereas snow has 3.

![](_page_0_Picture_37.jpeg)