

Analysis of Hazardous Material Incidents in the Gulf Coast: A Case Study of Houston, Texas

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Panel 4 : Surface Transportation Security

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- The NTSCOE-P is under the Department of Homeland Security Science and Technology Directorate.

Outline

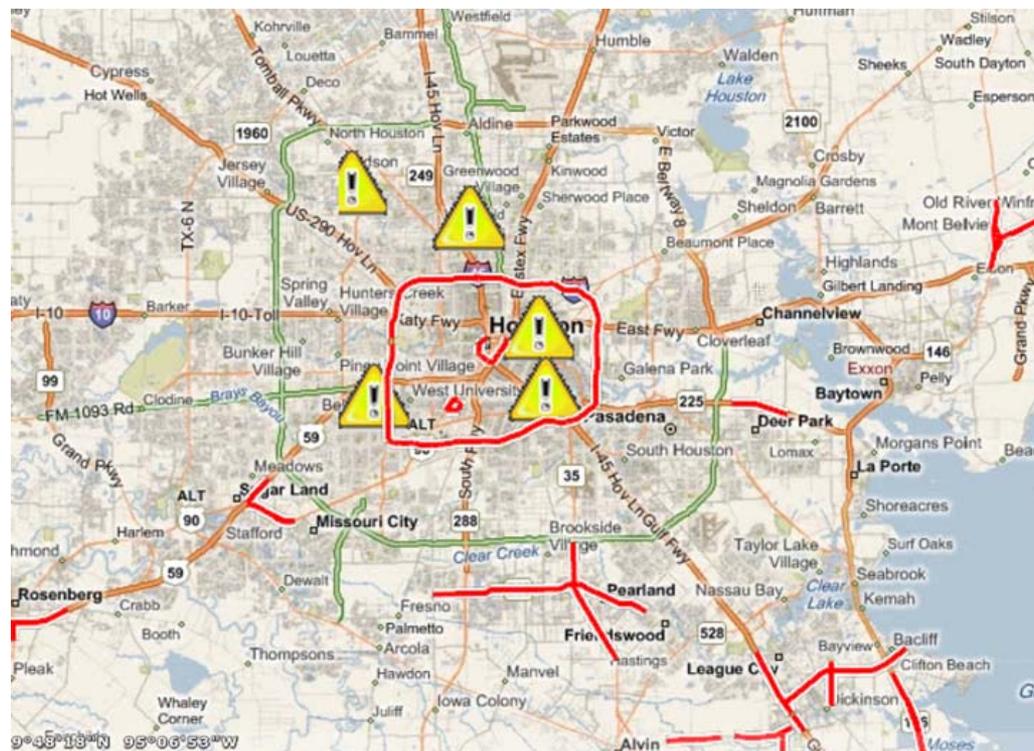
- Background
- Research Objectives
- Literature Review
- Methodology
- Results
- Summary

Background

- Hazardous material goods are moved on the United States' transportation network daily.
- HAZMAT Incident: An unintentional release of a hazardous material or the discharge of any quantity of hazardous waste.*
- An estimated 800,000 shipments of HAZMAT occur every day in the United States.

*Federal Motor Carriers Safety Administration, Department of Transportation, 2005

- Data analyses and simulations can indicate patterns of incidents by using several different variables in the transport of these chemicals.



Vulnerabilities

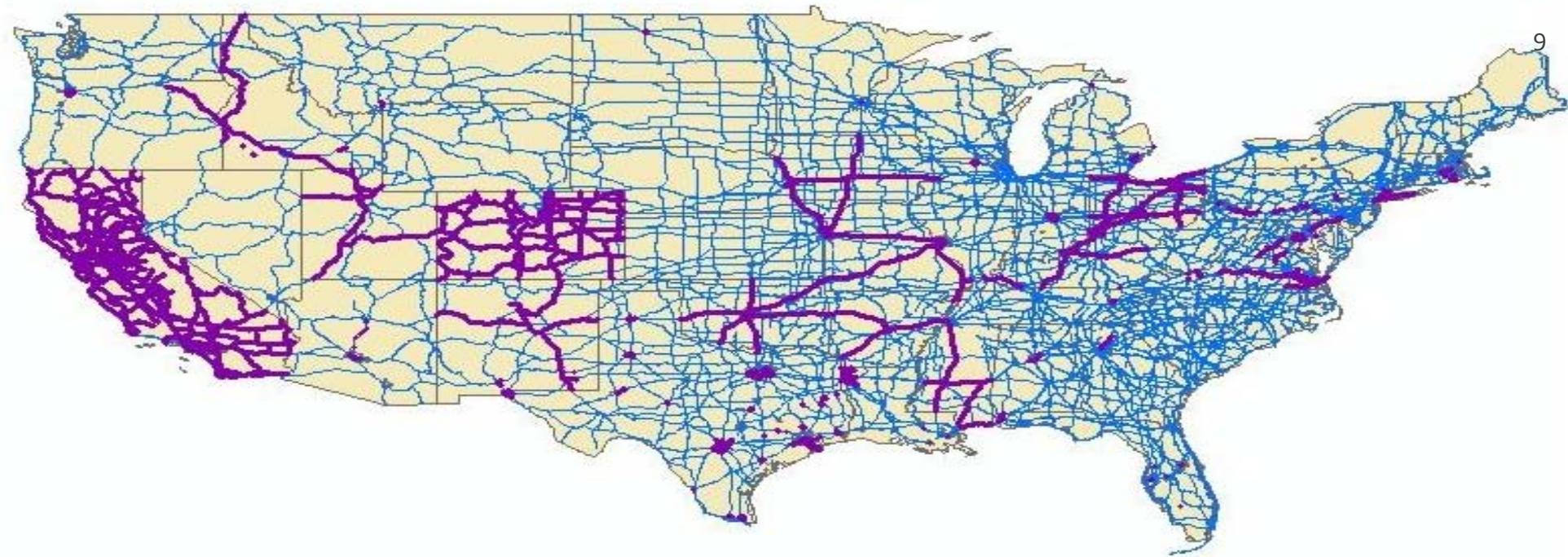
- Catastrophic interruption in the movement of goods.
- Ability to route vehicles and use them against the civilian population in a mal intent manner.
- Limited observation of components in the transportation system that can be utilized weapons against the public.

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Research Objectives

- When are heavy occurrences of incidents happen?
- Is there a seasonal relationship to incidents?
- How will visual displays of the geographic distribution of incidents affect our understanding?

Route Selection



Hazardous material routes



National highway system

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Literature Review Summation

- The literature review indicates very little public information of historical incident data on individual states.
- The information provided is not currently up to date with a gap in case studies of about 20 years.
- There is also no apparent data on specific incident case studies for individual cities detailing specific incidents areas.

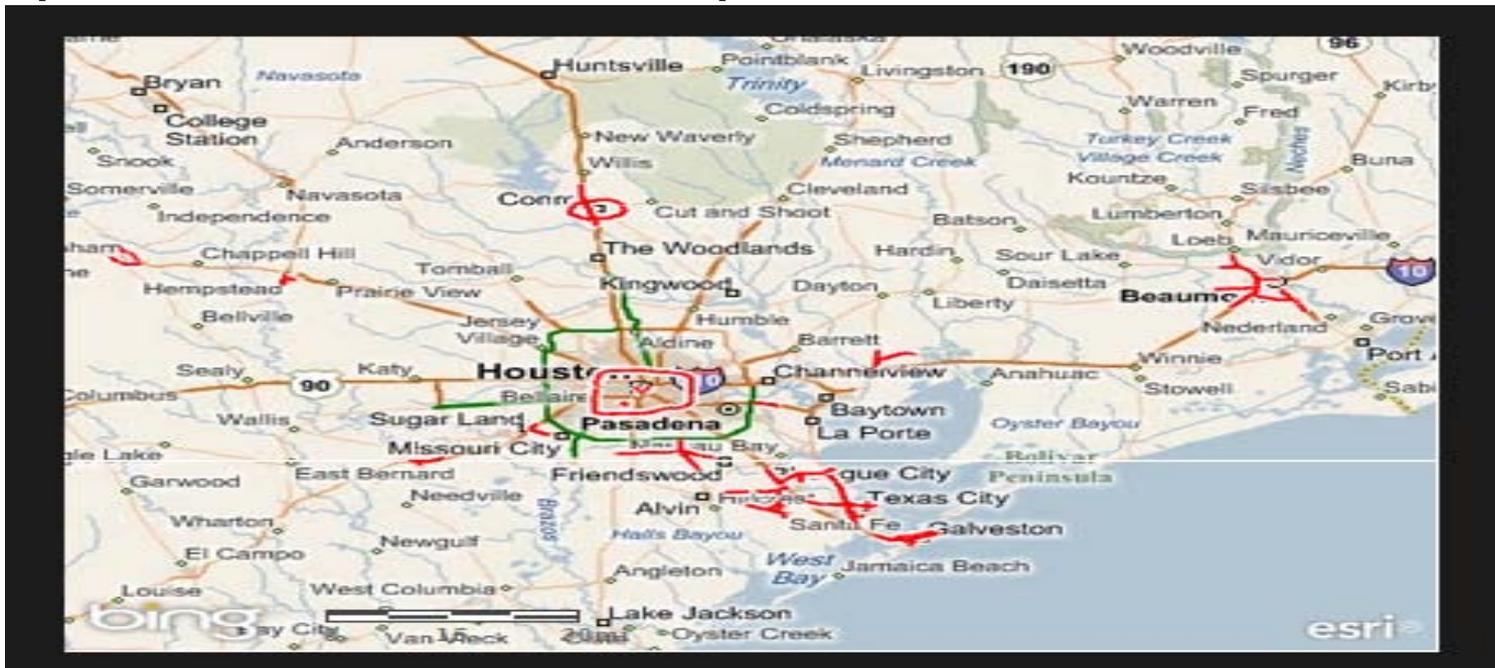
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Methodology

Annual data are analyzed from the Pipeline and Hazardous Material Safety Administration (PHMSA), an agency that protects the public and environment by insuring the safe and secure movement of hazardous material goods.

Study Area

This research is a case study on Houston, Texas, the fourth largest city in the United States and home to a large concentration of petrochemical companies.



Methodology continued...

- Analysis of events of the HAZMAT incident database.
- Data will be compiled for the analyses in a statistical software program. (SPSS, EXCEL)
- Statistics will be presented for an overall analysis in Houston zip codes.

Data Categories

- Incident Route
- Date of Incident
- Hazard Class

TIME

- 0000 – 0600 = early morning
- 0601-1159 = morning
- 1200 – 1700 = afternoon
- 1701 – 2000 = early evening
- 2001 - 2359 = evening

- Mode of Transportation
- Time of Incident

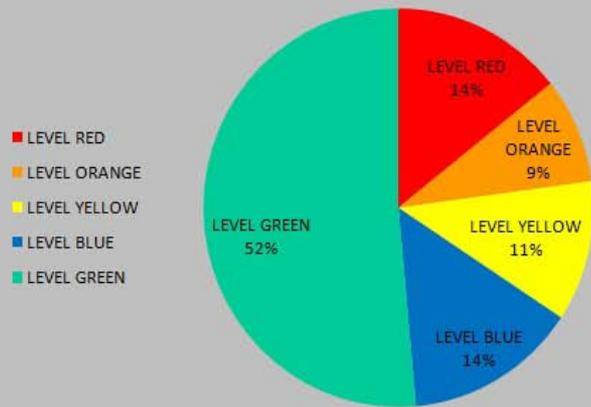
SEASONAL

- December – February = Winter
- March – May = Spring
- June – August = Summer
- September – November = Fall

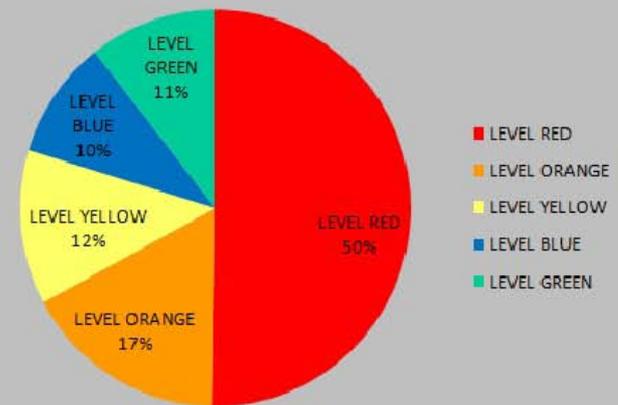
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High Incident Zones

All Zip Codes By Color Level



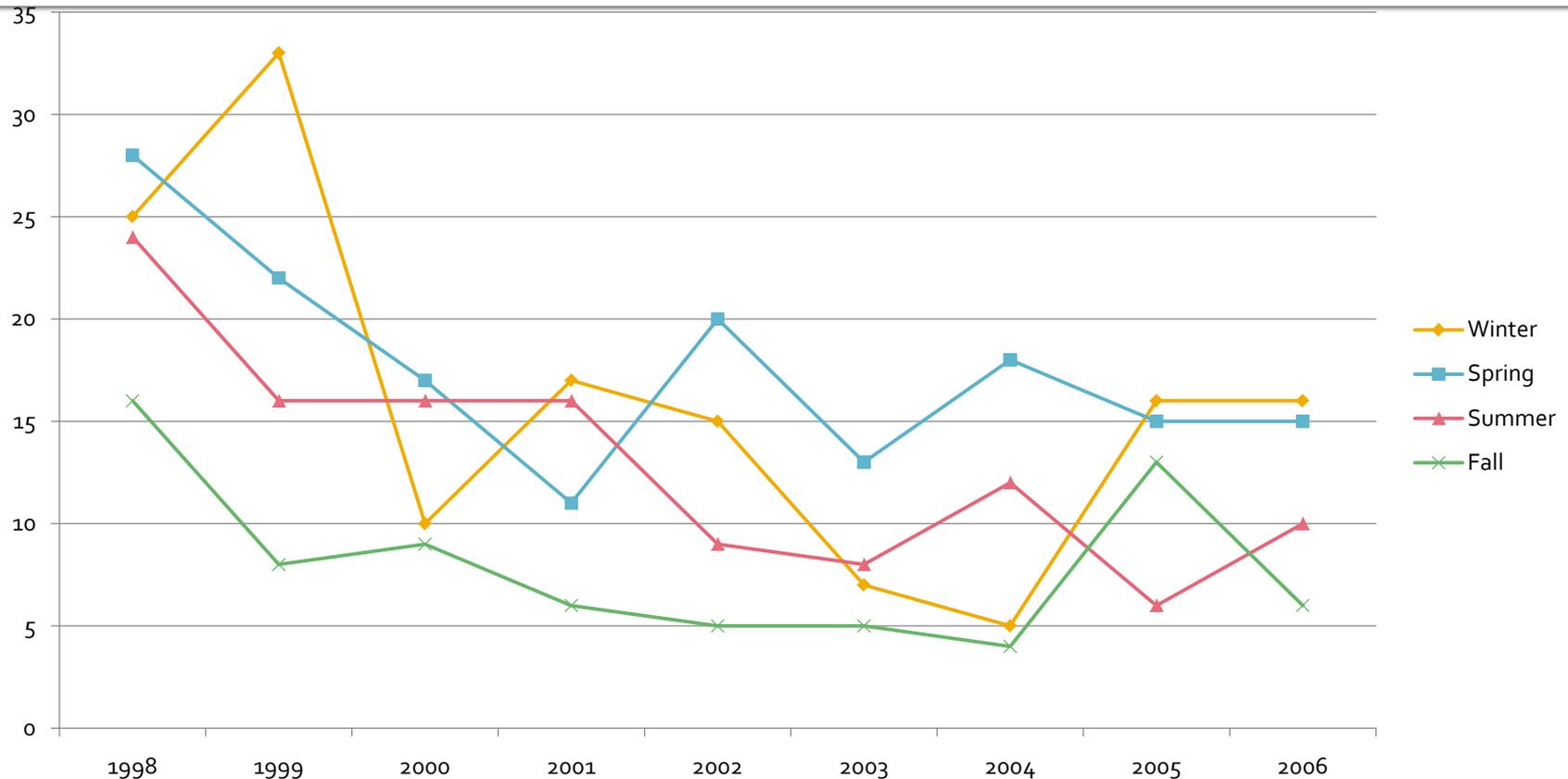
Total Incident By Color Level



Level	Total	Zip Code Count
LEVEL RED	104	5
LEVEL ORANGE	35	3
LEVEL YELLOW	26	4
LEVEL BLUE	20	5
LEVEL GREEN	22	18
TOTAL	207	35

- Level red contains only 14% of all zip codes, although 50% of all incidents fall within this area.

Seasonal Incidents



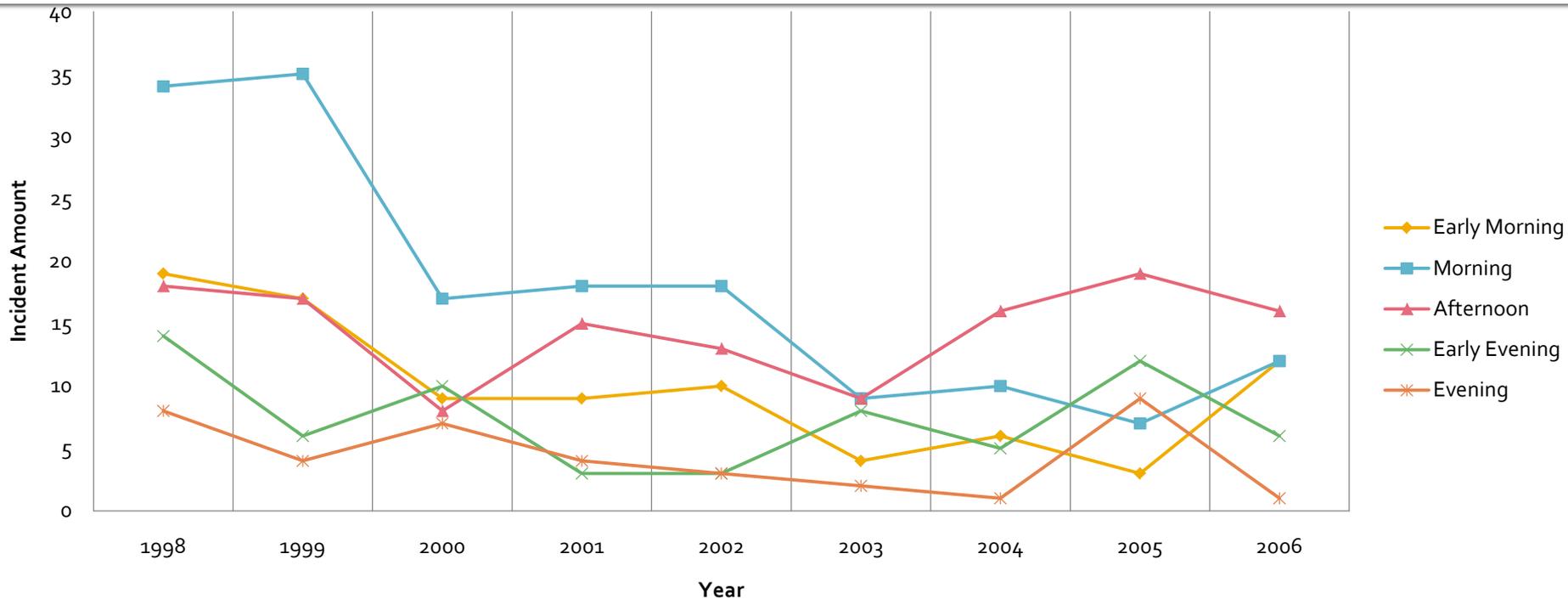
- Seasonal evidence shows erratic incident occurrences.
- Winter and Spring have the largest number of incidents.

Incident Example



The rail cars somehow left the track causing major traffic back up at the location during early morning hours. This picture taken around 11:00am still shows the massive clean up needed and traffic affected.

Incidents Time of Day



- Morning has the largest decrease in incidents.
- Evening incidents occurrences throughout the data set is relatively low.

Geographic Information System In-transit



Haz 1.wmv



- Most incidents happen at one location - typically a freight logistic or storage company.
- The highest concentration of incidents occur in the northeast area of Houston, Texas.

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Seasonal Summary

QUESTION

- When are the heavy occurrences of incidents?

CONCLUSION

- Assumptions for the season were inconclusive because there is not a clear and consistent incident pattern involving the season throughout the dataset.
- Winter and Spring, are the two seasons that tend to have the largest numbers of incidents throughout the dataset.

Time Summary

QUESTION

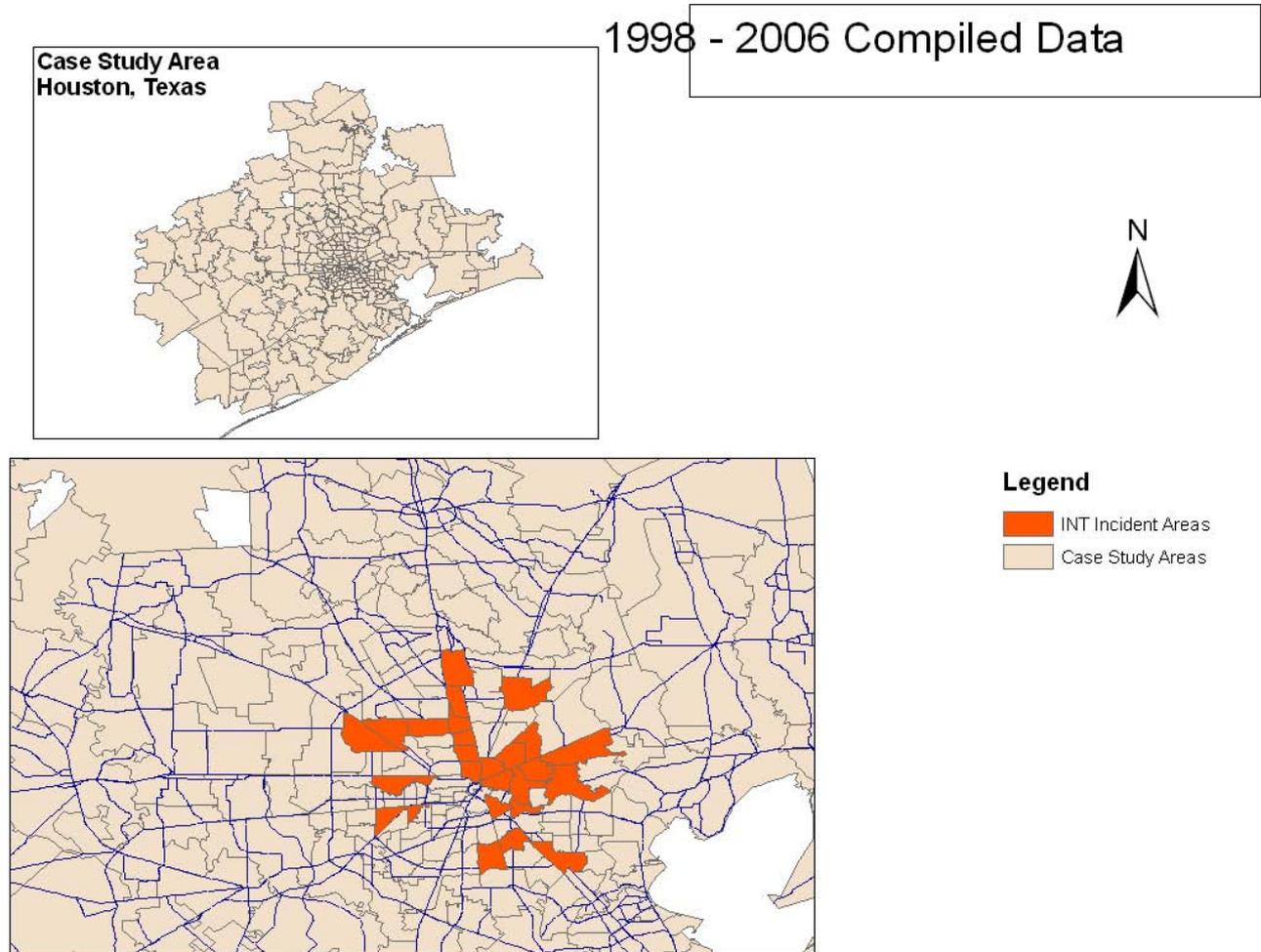
- What time period contains the most occurrences of incidents?

CONCLUSION

- Time assumptions are not completely invalid, because the 2004-2006 datasets agree with the assumptions that more accidents occur during rush hour segments.
- During the 1998-2002 data period, the largest number of incidents occurs in the morning (6:01a.m. - 11:59 a.m.). A gradual change over time transitions the incidents from morning in earlier years to afternoon in later years.

Hazardous Material Incidents

The image to the right provides an visualization of affected zip codes based on repeat incident locations



GIS In-Transit Incidents Summary

QUESTION

- Is there a pattern in hazardous material incidents?

CONCLUSION

- Providing a visual display allowed for patterns to be discerned for locations of incidents.
- A noticeable trend occurred in the I-10/I-610 area

Limitation of Research

- The study only used data from selected years 1998 -2006.
- There are significant structure problems inside the data, when comparing years earlier than 2004, to more recent years such as post 2005.

Recommendations

Further Investigation is needed to better interpret the data in the following categories:

- Incident location
 - To street level
- Adding additional study years
 - Updating the recently release data
- Comparison to other major metropolitans
 - Comparing the 5 most populous cites and cities that move a large quantity of hazardous material goods.

Thank You!

- Questions?