

The Impact of Junctions on the Frequency and Severity of Road Crashes in Florida

By:

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Abstract

Transportation is intricately involved with all phases of societal activities, and vital for the global economy. The 41 road infrastructure and traffic operations play a critical role in response to ever-increasing demand in commerce 42 and transportation. Traffic congestion and safety has a negative impact on the economy and on the quality of 43 people's lives. This research aims to investigate the quantitative impact of junctions, in relation to other selected 44 parameters, on the frequency of road crashes in urban areas in the State of Florida, US. Mathematical models 45 were developed with the use of the log-linear analysis method for different traffic volumes in and out of 46 junction. Based on historical crash records, as well as available traffic measurements, the models were 47 developed to highlight the correlation of different design and demand parameters with crash propensity. The 48 analysis has led to several conclusions, such as that angle and left turn collisions have much higher probability 49 of occurrence at junctions, and that crashes which occur at junctions are much more probable for low and 50 medium volumes compared to no-junctions.

Selective Literature Review

Haque et al. (2012): "An investigation on multi-vehicle motorcycle crashes using log-linear models"

Night-time influence increases motorcycles' crash risk, particularly during turning maneuvers at intersections

Many hazardous intersection crashes are related with drivers' errors of noticing a motorcycle and judging correctly their speed/distance

Young et al. (2012): "An on road examination of driving errors at intersections"

Drivers made much more errors at intersections than in mid-blocks; misjudgment, speeding and perceptual/observation errors more commonly noticed at intersections

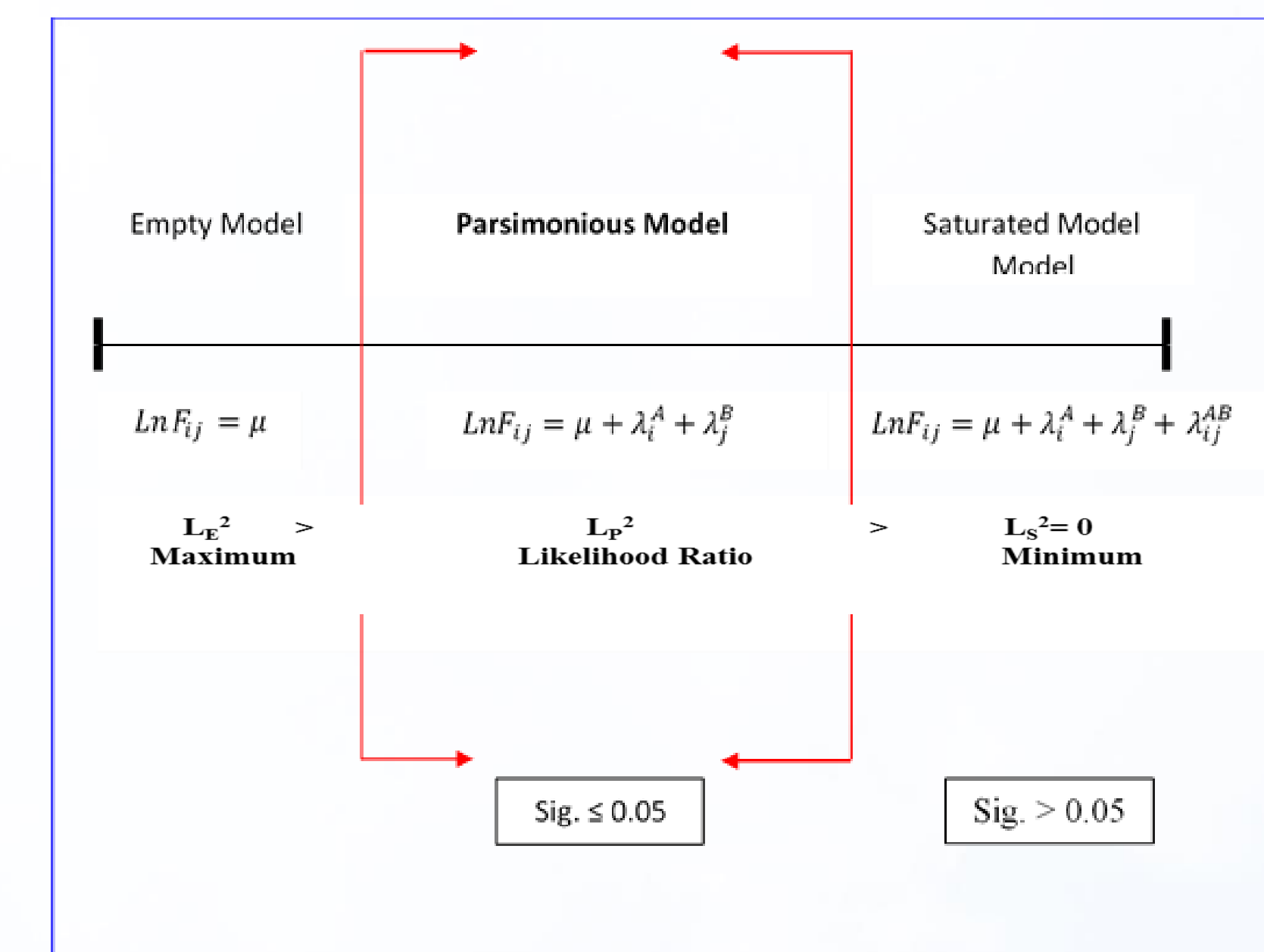
Drivers made more errors at partially signalized intersections compared to fully signalized intersections

Bhat et al. (2013): "A count data model with endogenous covariates: Formulation and application to roadway crash frequency at intersections"

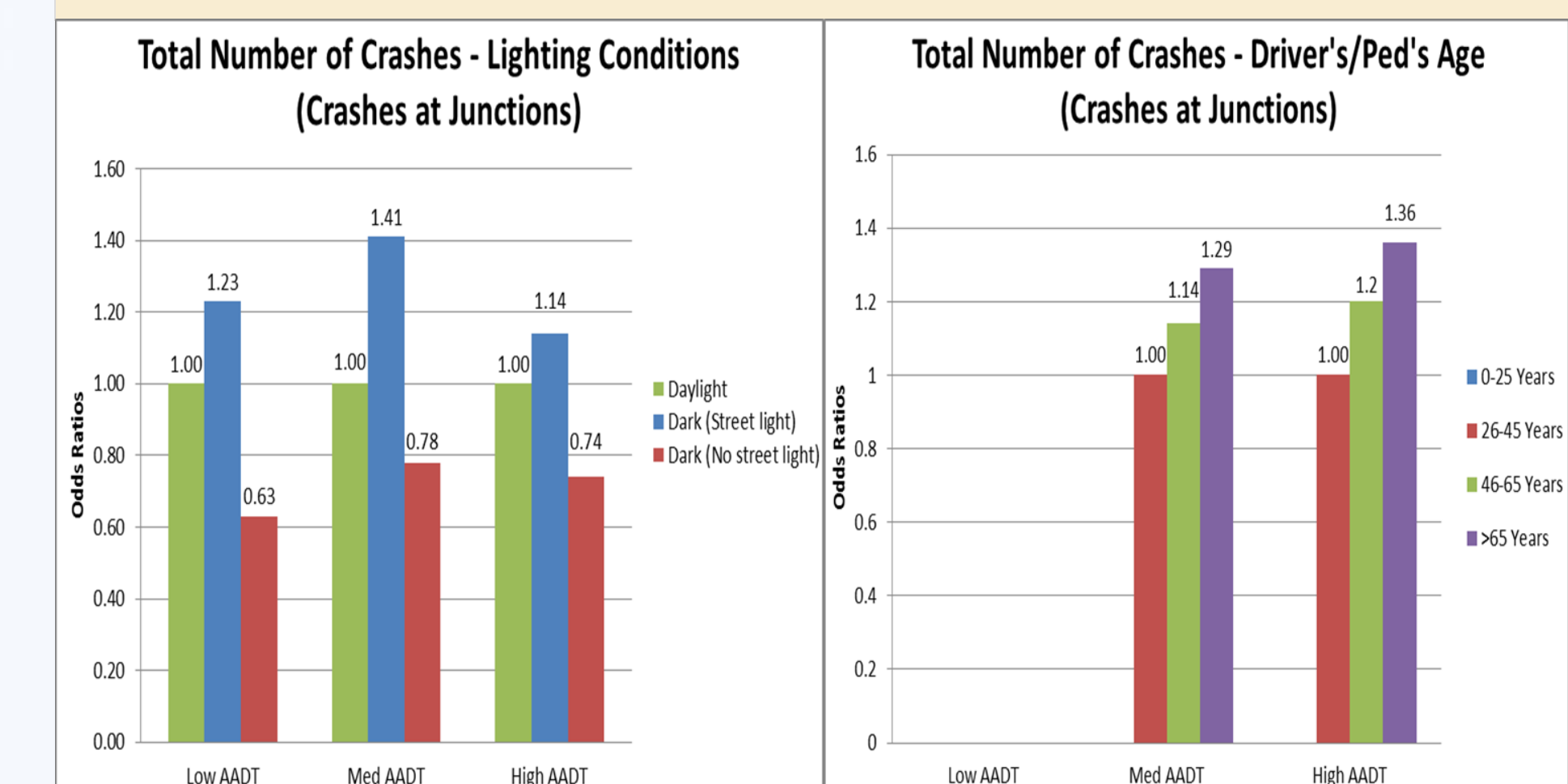
Importance of accounting endogeneity effects in count models

Intersections with crest approach, on frontage road and flashing light-controlled intersections are 2.5-3 times more risky

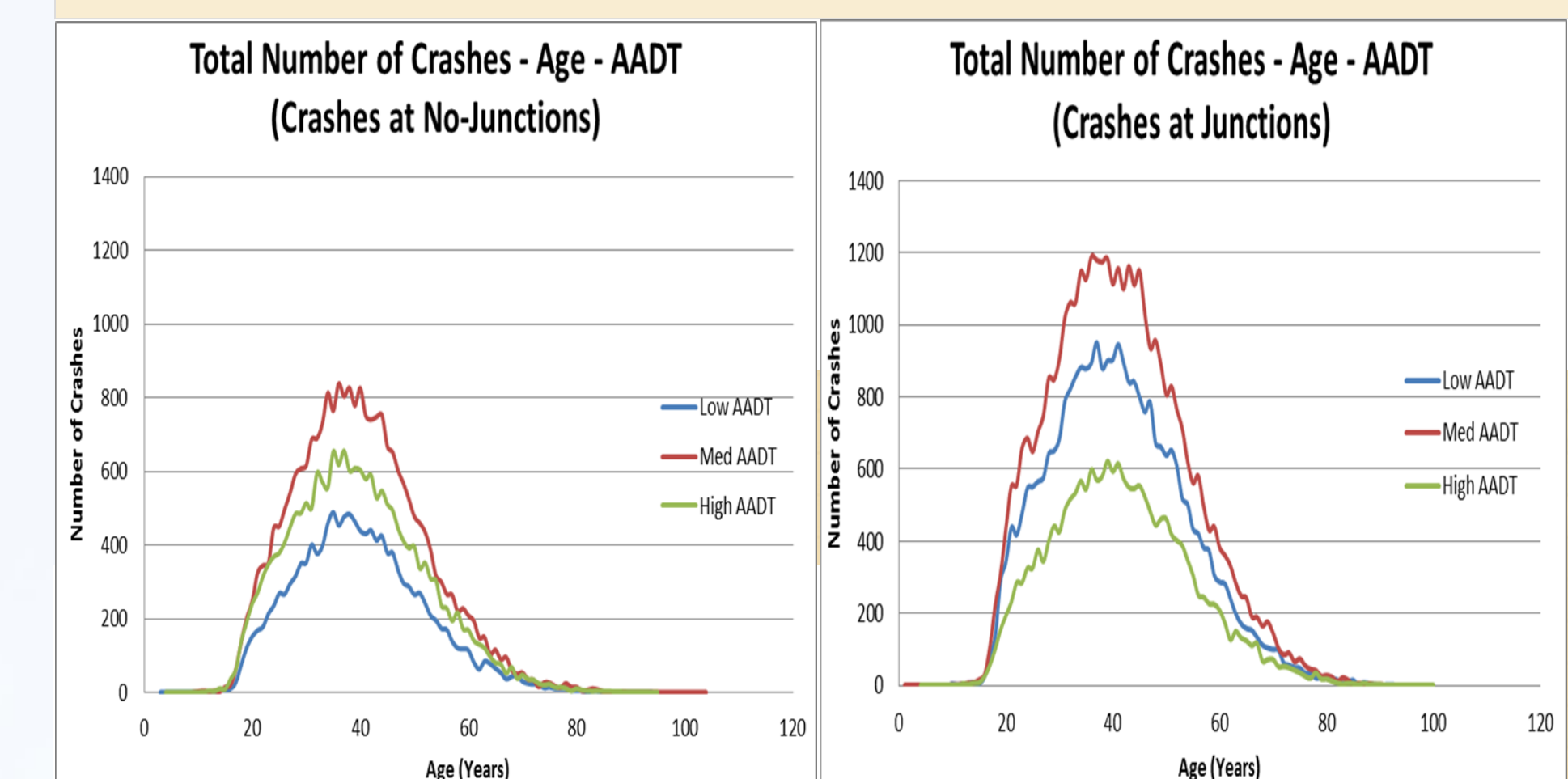
Log-Linear Analysis Strategy



Results – 2- Way Interactions



Sensitivity Analysis



Why is this study Important?

Junctions are among the most **hazardous** components of a road network

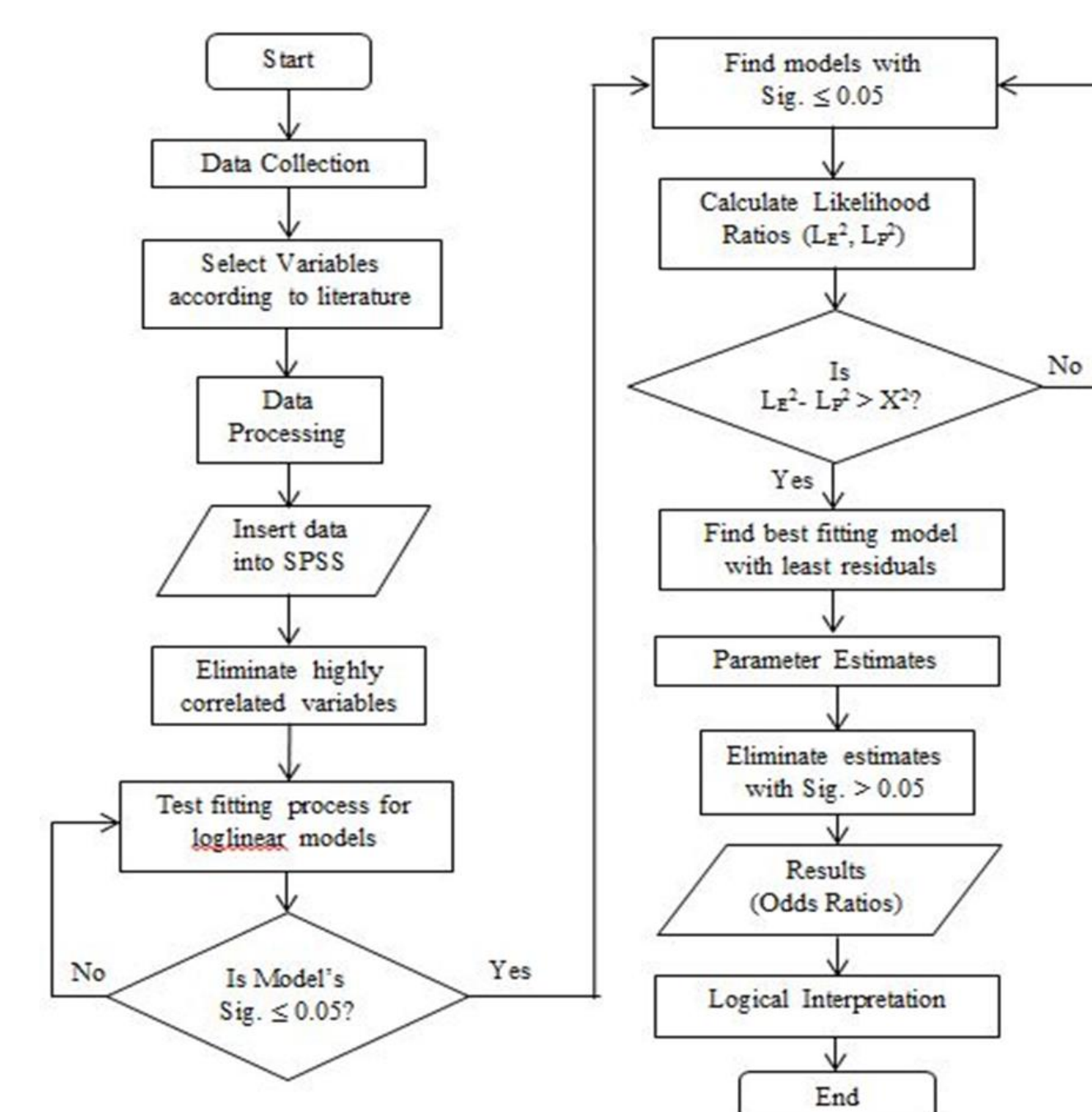
According to FHWA, more than half of the traffic crashes occur at **junctions**

There is a **need** to identify the effect level of the **contributory factors** on traffic crashes

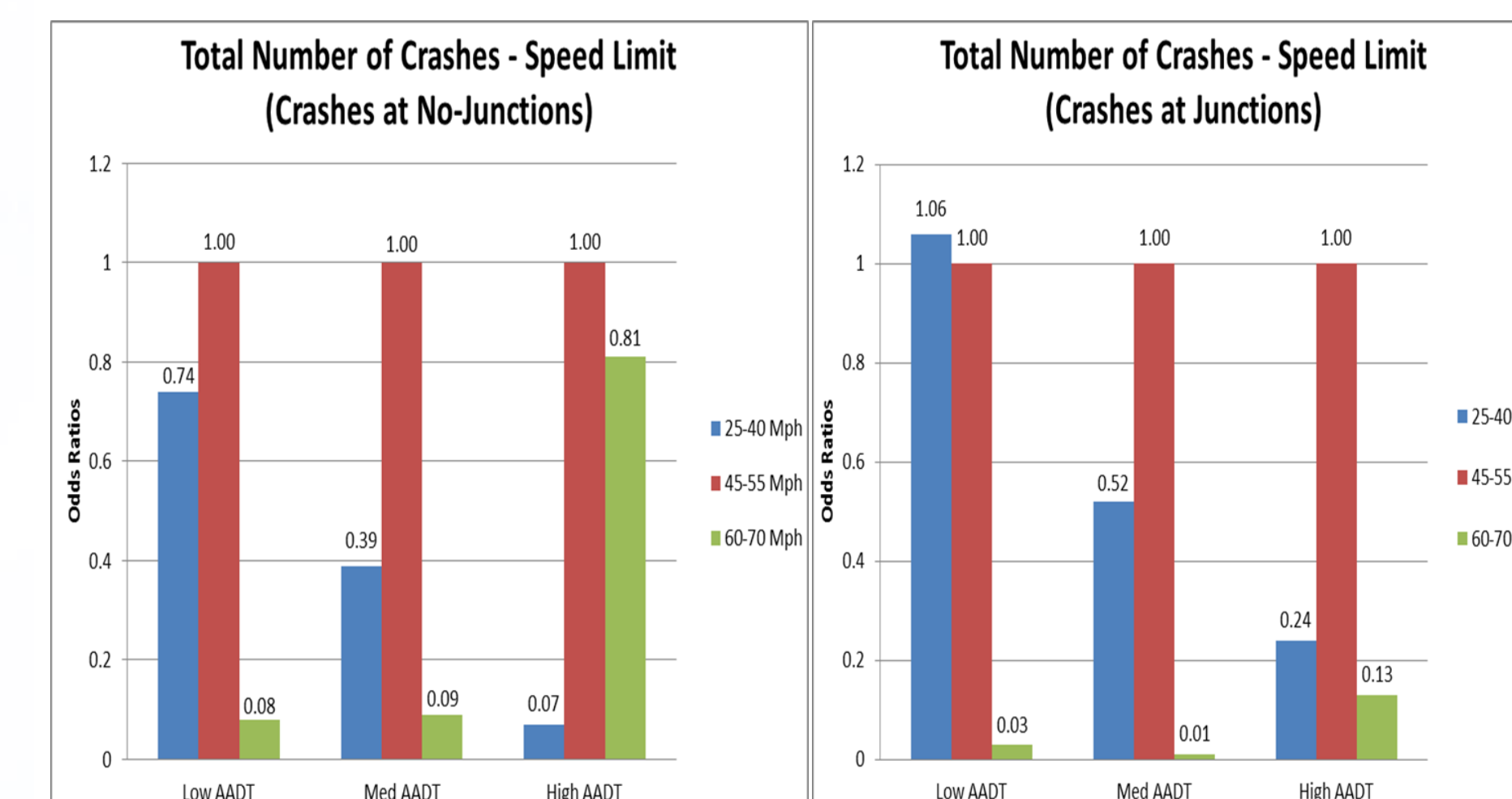


Source: Google Images (2013)

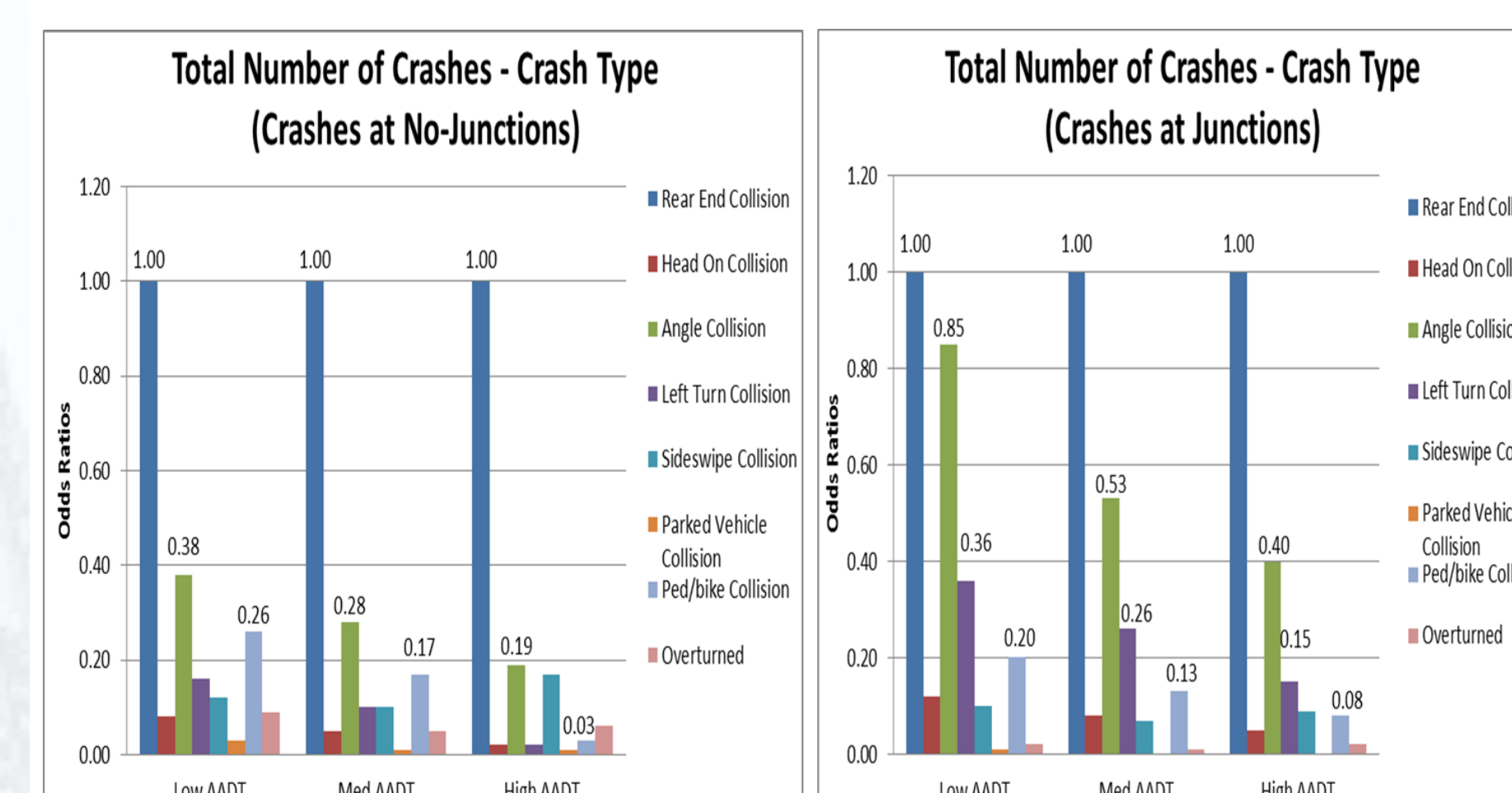
Methodology



Results – Main Effects



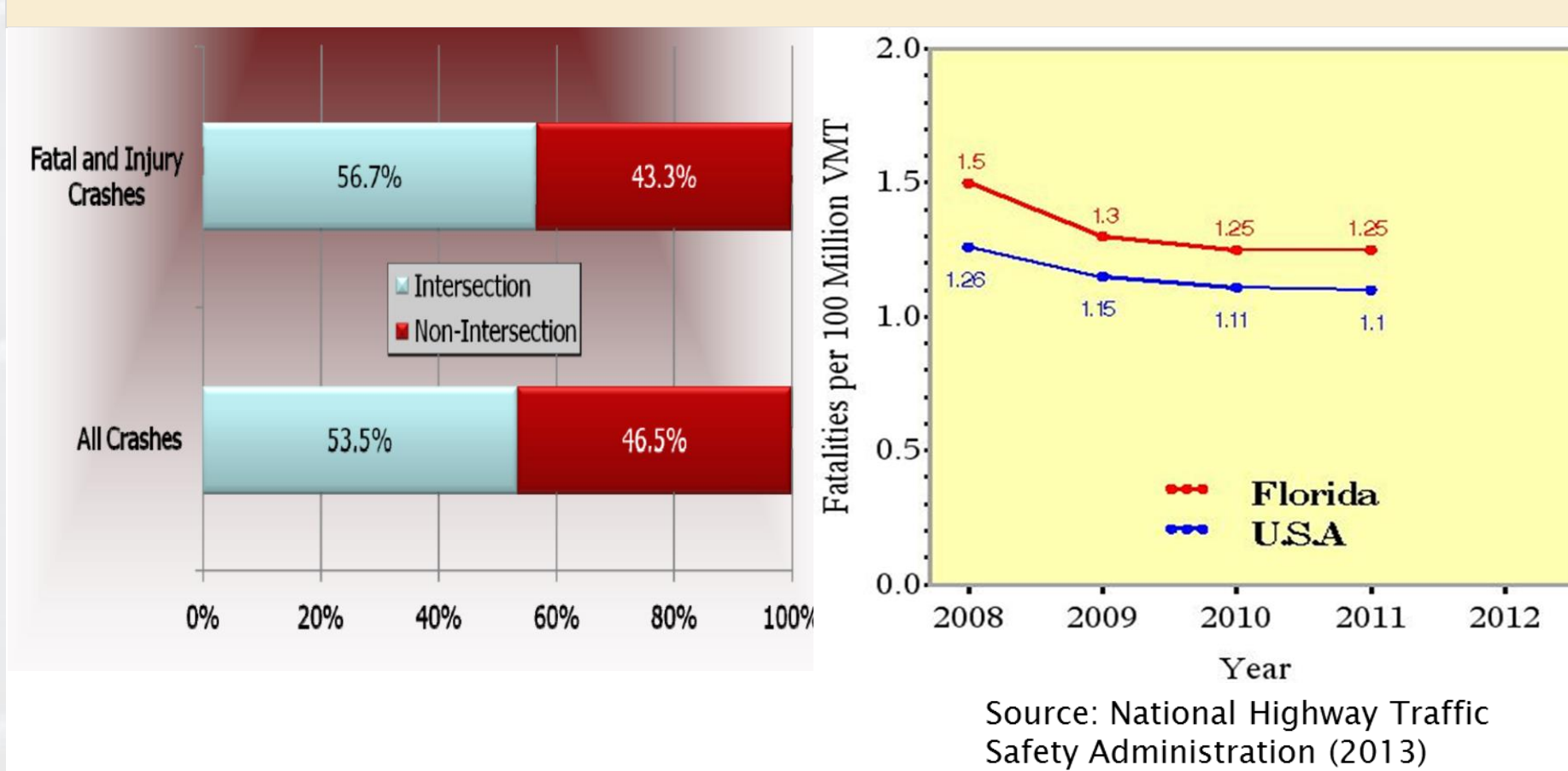
Results – Main Effects (Cont'd)



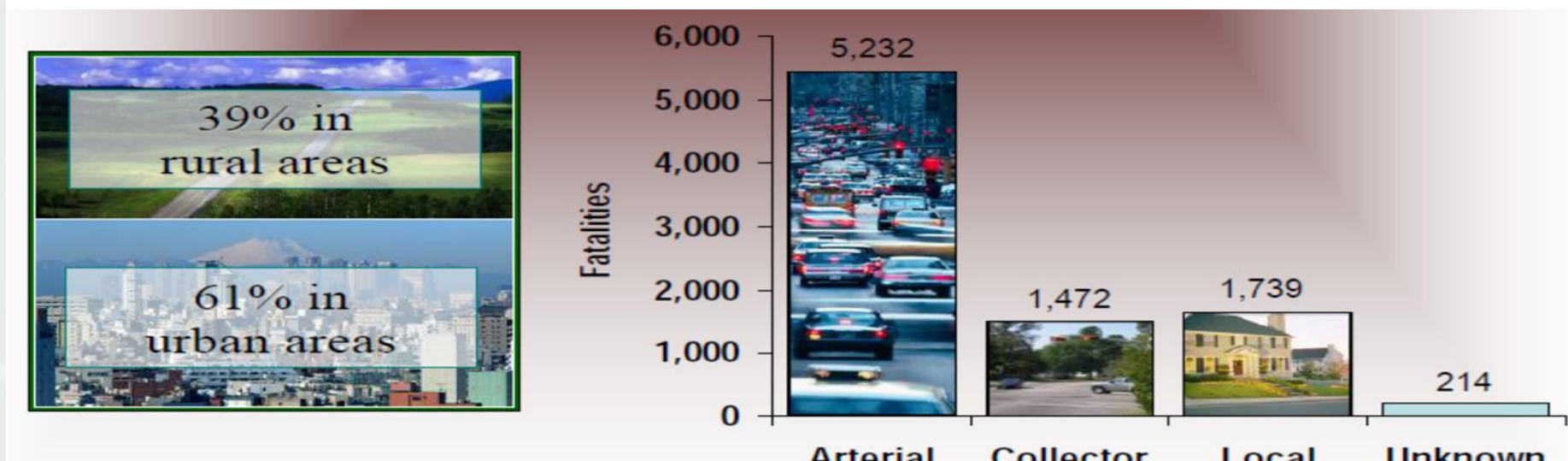
Conclusions

- Crashes at junctions have up to 32% higher probability of crash occurrence compared to non-junctions when speed limit is 25-40 mph
- Angle and left-turn collisions have considerably higher crash probability at junctions compared to non-junctions
- Crashes at junctions have up to 66% lower probability of crash occurrence compared to non-junctions for all heavy vehicle percentages, especially in high AADT.
- Crashes at junctions have slightly (up to 10%) lower crash probability compared to non-junctions for cloudy and rainy weather, especially in high AADT

Introduction



Source: National Highway Traffic Safety Administration (2013)



Methodology (Cont'd)

- Analysis Method
 - General Loglinear Analysis
 - Dependent Variable: Number of Crashes (Scale)
 - Independent Variables: 8 Variables (Nominal)
 - Main Effects Analysis
 - 2-Way Interactions Analysis
- Statistical Assessment
 - Parameter Estimates λ_i
 - Statistical Significance
 - Model Quality (Likelihood Ratio: $L^2 = 2 \sum f_{ij} \ln f_{ij} / F_{ij}$)
 - Parameter Estimates Interpretation (Odds Ratios: e^{λ_i})
 - Confidence Interval: 95%