

Safety Impact Study of Centerline Rumble Strips in Georgia

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INTRODUCTION

In recent years, centerline rumble strips have become increasingly prevalent as a safety countermeasure on undivided roadways throughout the United States. Within the state of Georgia, nearly 150 miles of centerline rumble strips have been installed in an effort to address the severity and frequency of crashes involving the centerline. This study seeks to comprehensively determine the safety impacts of centerline rumble strips on undivided, rural highway facilities in the state of Georgia. This study also uses a nationwide survey to gather information on potential maintenance issues related to deployments of center line rumble strips.

BACKGROUND

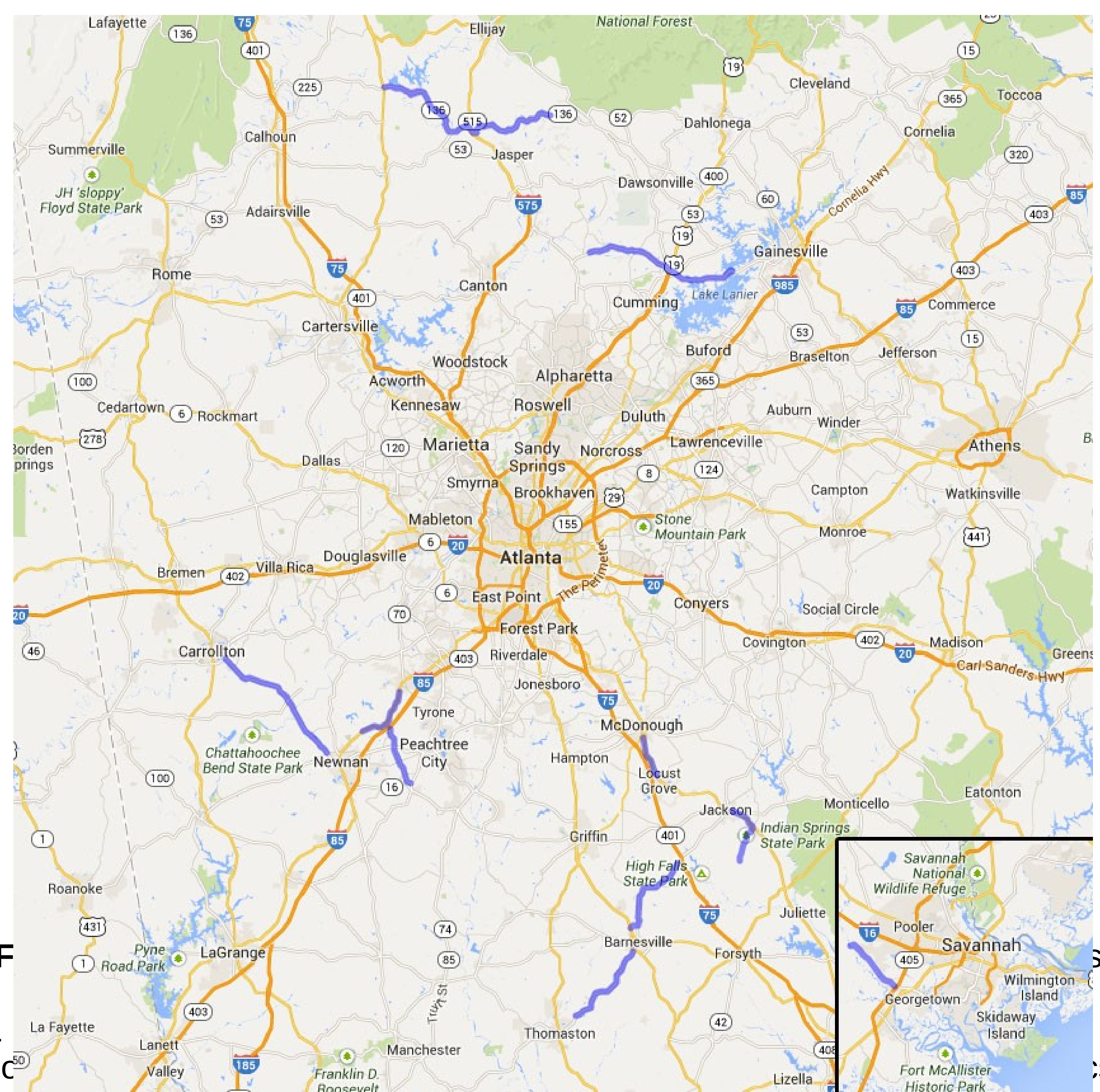
“Crashes that qualify as centerline rumble strips correctable are any cross-centerline (cross-over) crash that begins with a vehicle encroaching on the opposing lane, excluding any crash that began by running off the road to the right and overcorrecting or any crash began by vehicle out of control due to water, ice, snow, etc. before crossing the centerline.” (NCHRP Synthesis 339, 2005)

NATIONWIDE STATISTICS

- Rural roads account for 60% of all fatalities (NHTSA, 2003)
- 90% of all rural fatal crashes occur on two-lane roads (Persaud, 2003)
- 27% of all rural fatal crashes on two-lane roads are head-on or opposite-direction sideswipe crashes (Suzman, 1999)
- Estimated 2,182 miles of centerline rumble strips installed on two-lane two-way roadways in 2005 (Richards and Saito, 2005)
- Estimated 10,119 miles of centerline rumble strips installed on two-lane two-way roadways in 2011 (Karkle, 2011)

GEORGIA STATISTICS

- 126+ miles of roadways with centerline rumble strips¹
- Centerline rumble strips installed in 2005 and 2006
- Average installation cost of \$96,801 per site; \$768.27 per mile



DATA COLLECTION

- Data retrieved from existing sites installed with centerline rumble strips
- Study period: 3 calendar years before and after installation year
- Extensively utilized GDOT databases:
 - STARS for AADT information
 - CARE for incident reports

SAFETY ANALYSIS METHODOLOGY

- Limited data collection to installation sites
- Filtered by non-intersection incidents
- Examined four incident types:
 - Angle
 - Head on
 - Sideswipe-opposite direction
 - Not a collision with a motor vehicle
- Preliminary analysis – direct before-after comparison
- Full analysis – Empirical Bayes analysis; corrects for regression-to-mean bias
 - Determine expected accidents for roadway without centerline rumble strips implementation
 - Correctly accounts for trends in AADT and other factors affecting safety (e.g. weather, driver behavior, vehicle safety)

1. Develop a Safety Performance Function (SPF)
 - Mathematical model that predicts mean crash frequency for untreated locations with similar characteristics
 - Relates crash experience of a site to its traffic and physical characteristics
 2. Develop Crash Modification Factor (CMF)
 - Multiplicative factor used to compute the expected number of crashes *after* implementing a given countermeasure
 - Approximately equal to the actual after period crash count divided by the expected number of crashes without treatment
 - Can be selected based on applicable crash type and/or site condition
 3. Calculate weight
 - Incorporates negative binomial distribution of accident counts to allow fitting of the Empirical Bayes model to the data set through the overdispersion parameter, ϕ
 - Utilizes length of segment, expected number of accidents of similar segments, and overdispersion parameter
3. Compare to actual number of incidents to determine effectiveness

SAMPLE EQUATIONS

MAINTENANCE ANALYSIS

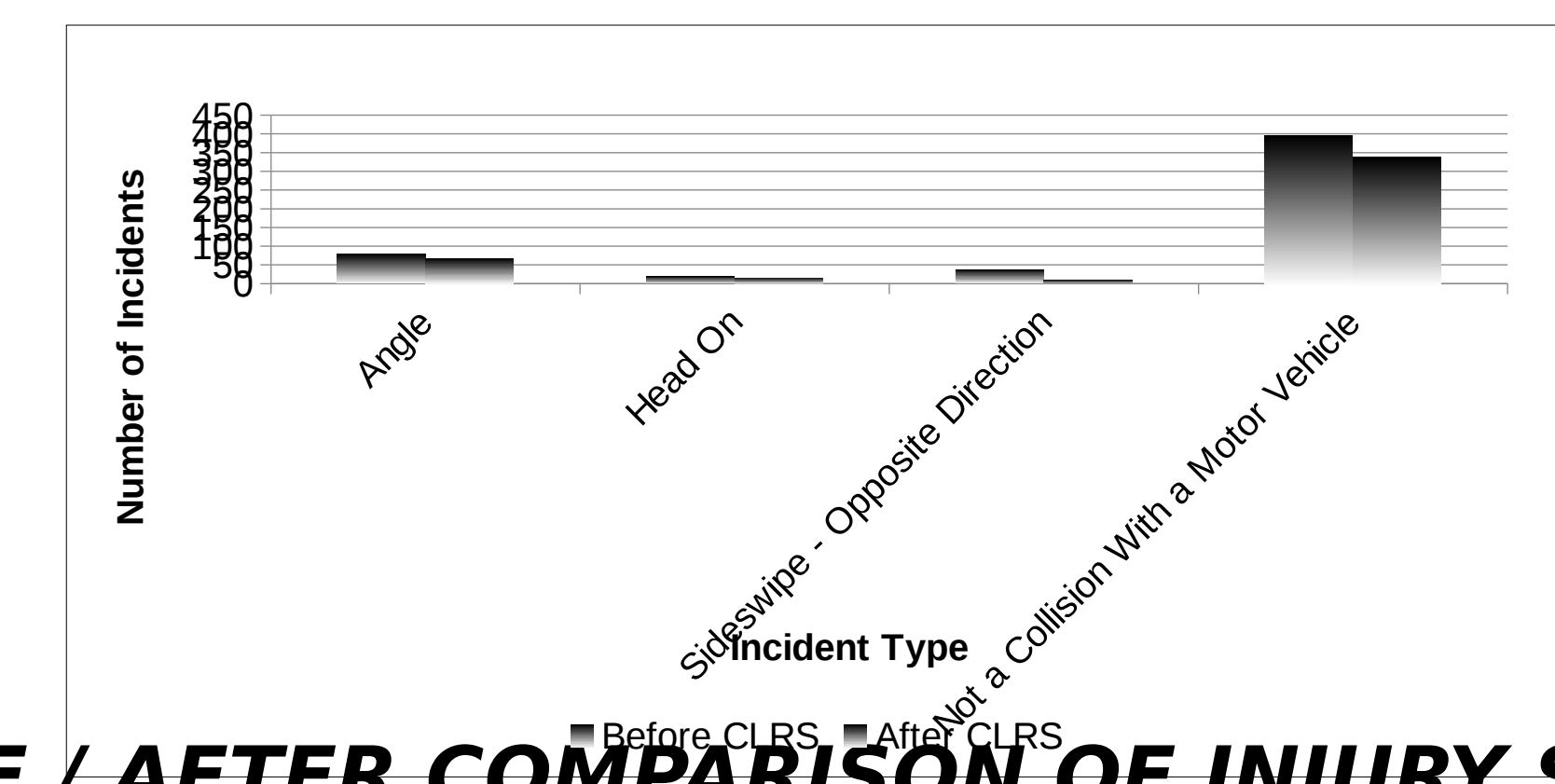
- Conduct literature review on adverse effects of centerline rumble strips
- Sent to 50 state transportation agencies
- Questions cover variety of topics pertaining to agency's jurisdiction:
 - Prevalence of centerline rumble strips
 - Adverse effects of centerline rumble strips
 - Future of centerline rumble strips

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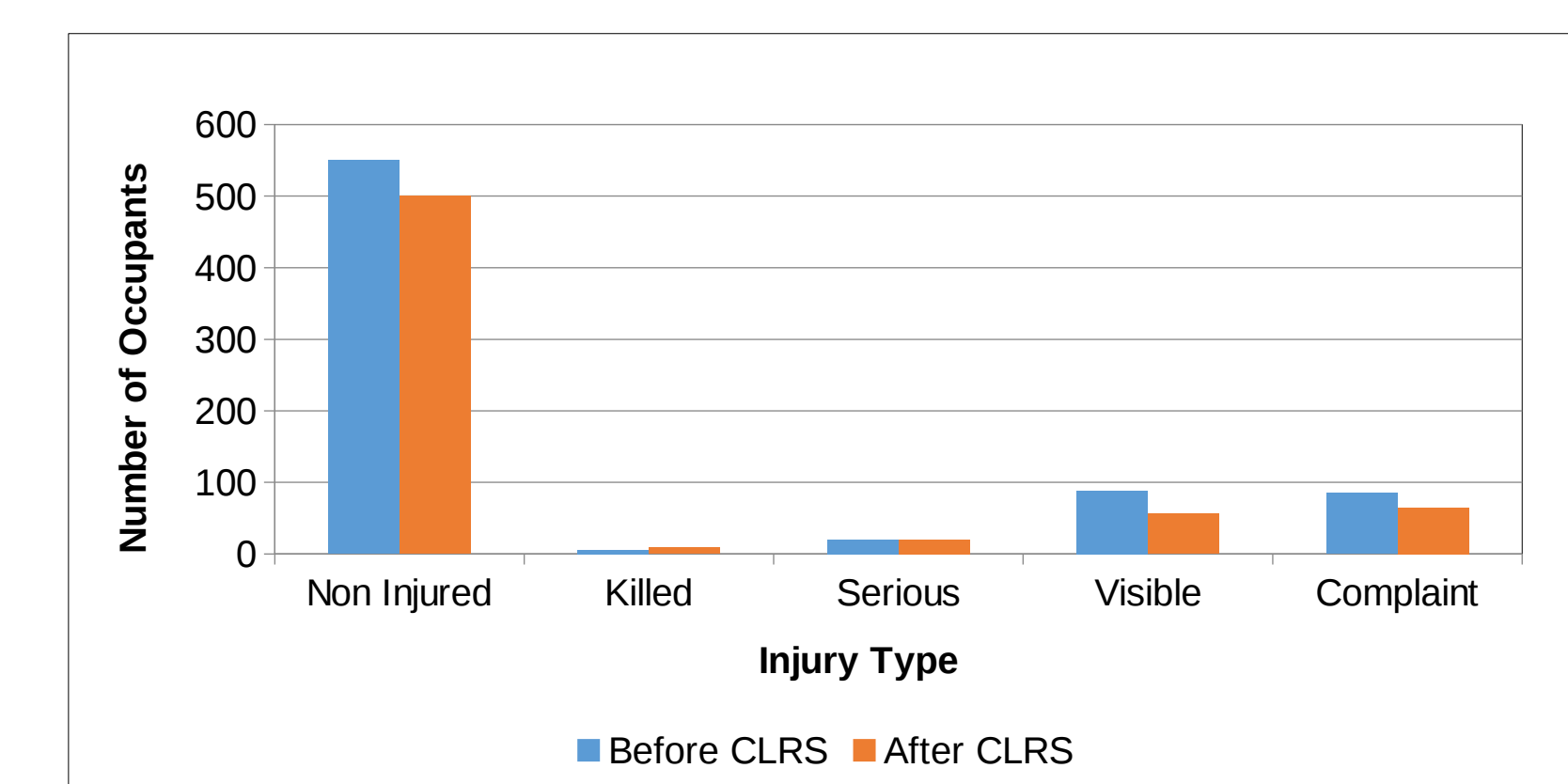
RESULTS

PRELIMINARY SAFETY

- Aggregate of all non-intersection related incidents
 - Does not yet take AADT changes into consideration
- BEFORE / AFTER COMPARISON OF INCIDENT TYPES**

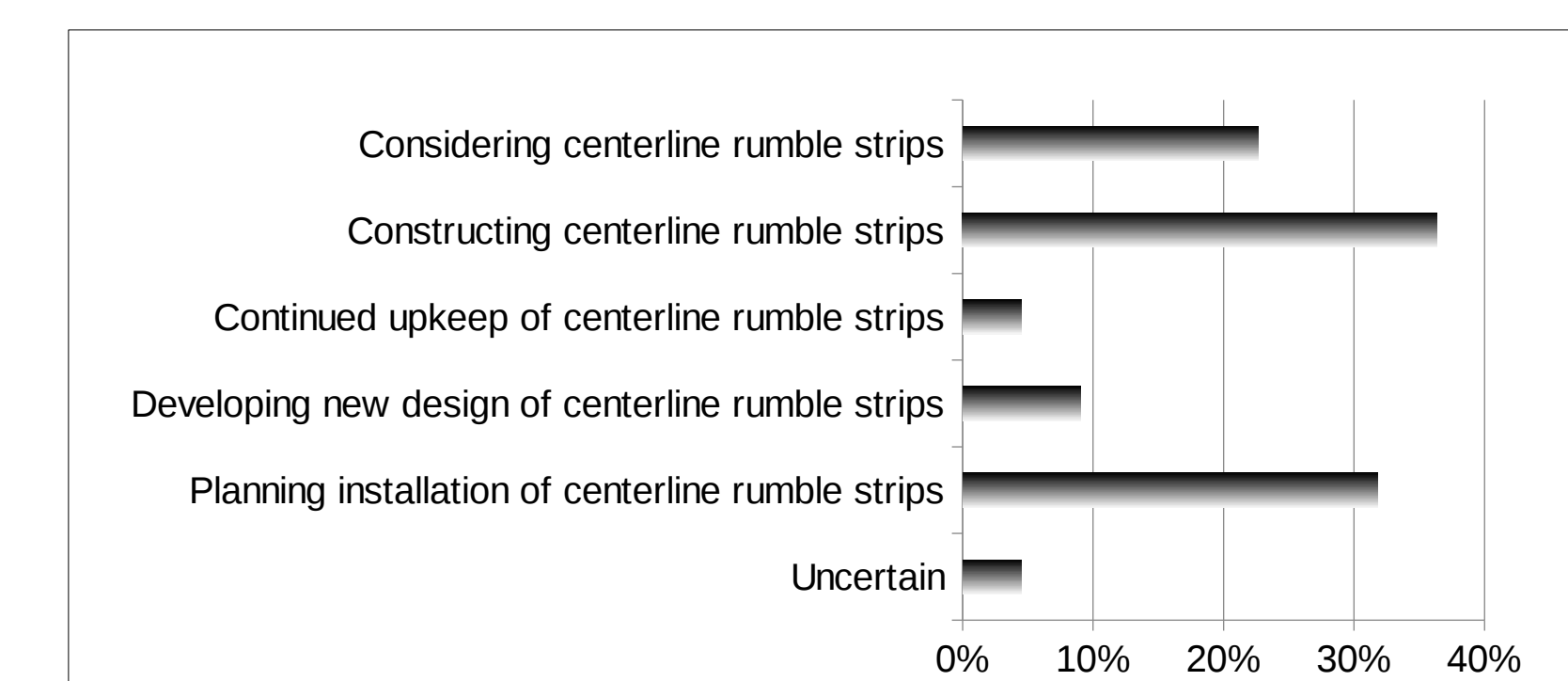


BEFORE / AFTER COMPARISON OF INJURY SEVERITY

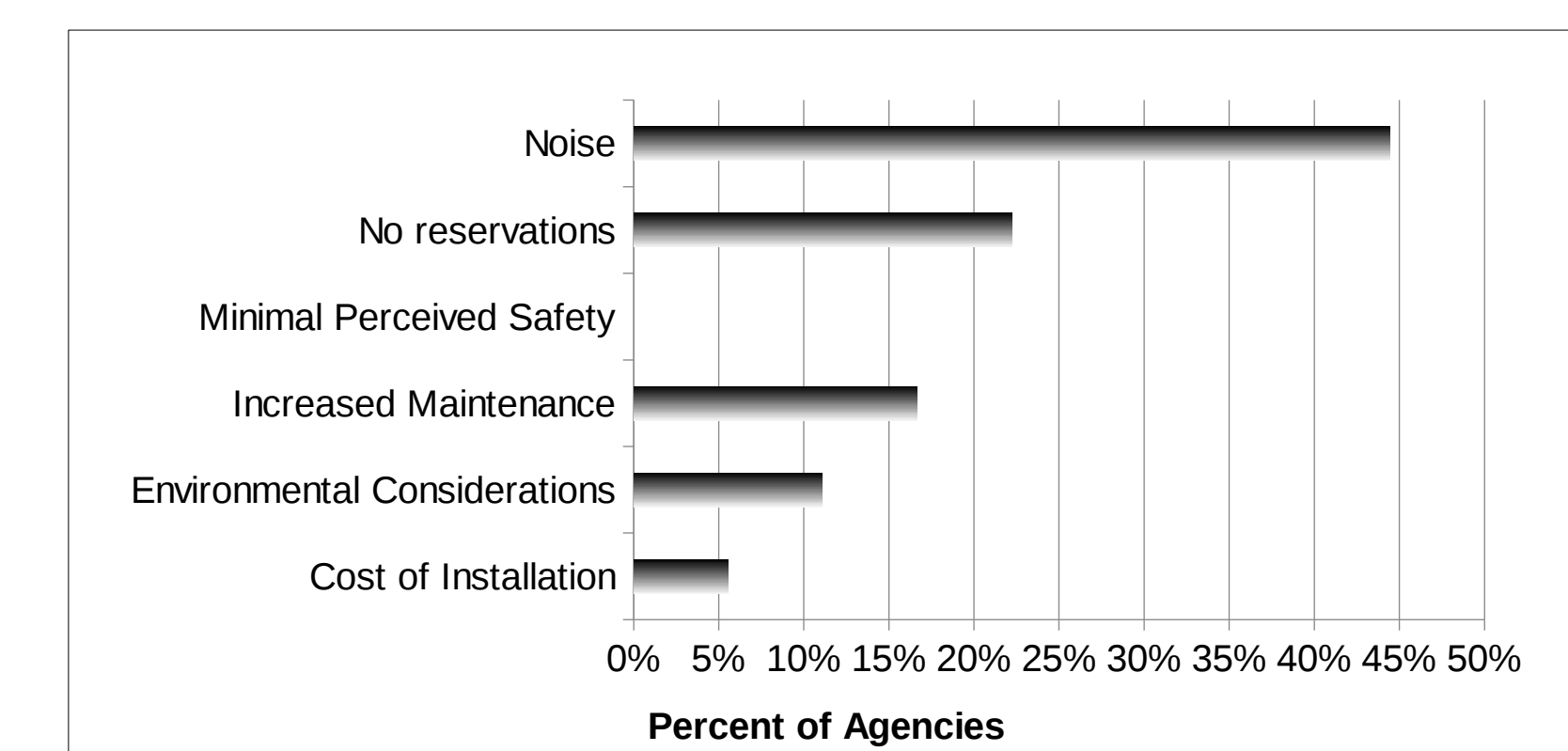


PRELIMINARY SURVEY

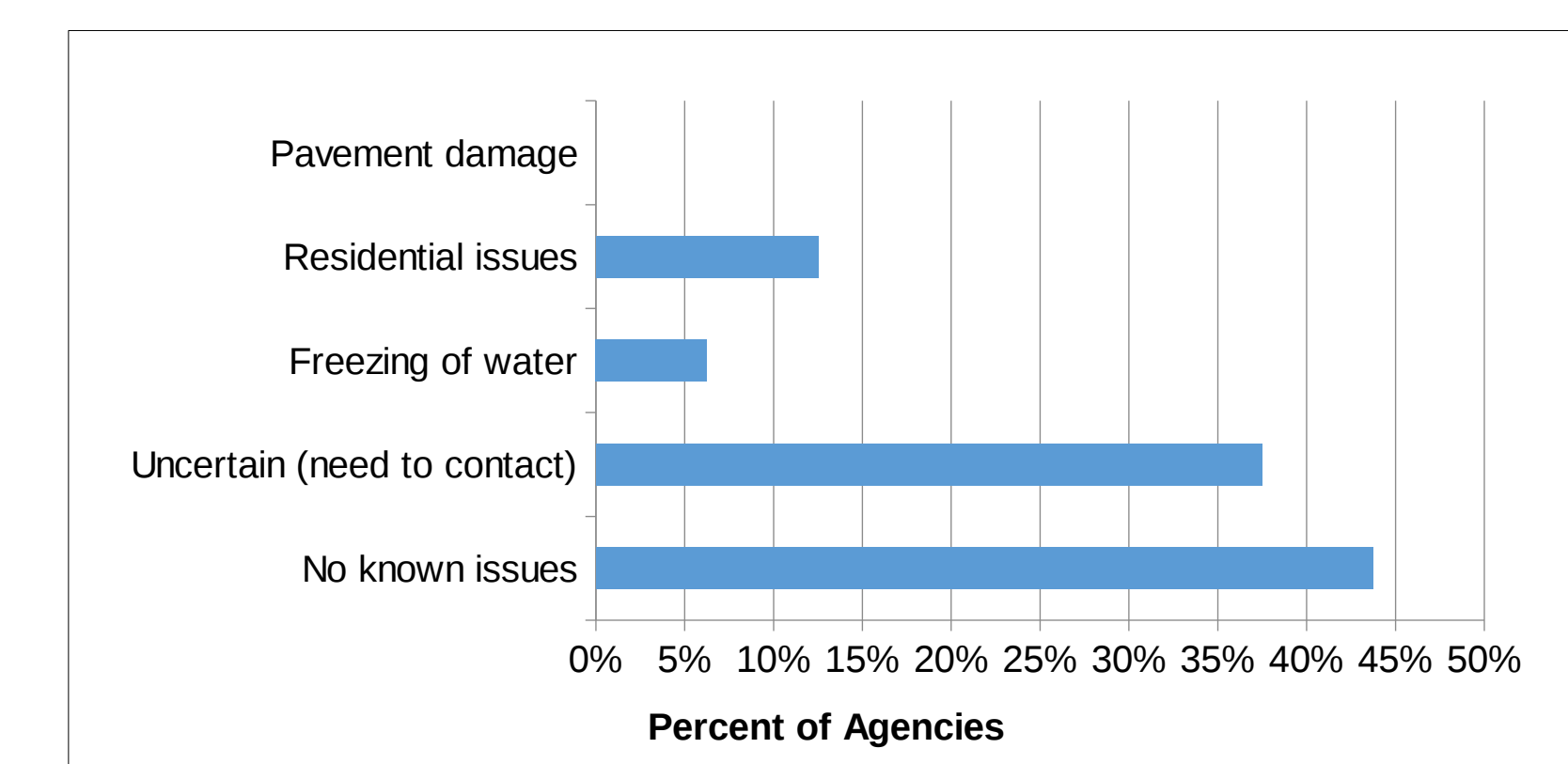
- Survey collection period: 9/17/2013 – 10/4/2013
 - 16 responses as of 9/23/2013
- AGENCY POSITION ON CENTERLINE RUMBLE STRIPS**



AGENCY RESERVATIONS IN INSTALLING CENTERLINE RUMBLE STRIPS



AGENCY MAINTENANCE ISSUES



NEXT STEP

- Perform Empirical Bayes analysis and determine crash modification factor
- Prepare comprehensive report detailing adverse effects and safety benefits
- Suggest recommendations to GDOT for future of centerline rumble strips program in Georgia