STREETLIGHT

VALIDATION

# Hard Braking Events as a predictor of crash risk

University of Georgia and Georgia DOT independently evaluated StreetLight's Hard Braking & Acceleration Events data to determine whether the spatial distribution of braking-related events corresponds to the spatial distribution of crash frequency, establishing a foundation to use the events data as a substitute or complement to traditional crash data.

**Third-party validated by the University of Georgia and the Georgia Department of Transportation — a rigorous, independent assessment of StreetLight's Hard Braking & Acceleration Events data against official statewide crash records.**

THE DATA

## What was evaluated

Two complementary datasets were spatially matched to a common roadway reference network of over 158,000 segments, each no longer than 200 meters, using HERE Maps as the shared spatial index.

StreetLight Hard Braking & Acceleration Events

HARD BRAKING EVENT DATA

**Derived from high-fidelity connected vehicle data, capturing deceleration and acceleration events accross the roadway network.**

A one-week sample (Nov 10–16, 2025) comprising over **1.8 million individual event records** across Georgia. Analysis focused on three braking-specific event classes: Hard Braking, Severe Braking, and Very Hard Braking, with recorded deceleration magnitudes from 0.30 to 2.14 g. Each event is GPS-tagged, enabling precise segment-level spatial assignment.

Georgia DOT Crash Records

STATEWIDE CRASH DATA

Official GDOT crash records filtered to five crash types with behavioral relevance to braking conflicts: Angle, Head-On, Rear-End, Sideswipe–Opposite Direction, and Sideswipe–Same Direction. Evaluated under two temporal windows: a **weekly dataset** (Nov 11–17, 2024) and a **quarterly dataset** (Oct–Dec 2024) to assess the effect of data volume on correlation strength.

METHODOLOGY

## How the analysis was conducted

Both braking events and crash records, each represented as GPS point observations, were spatially matched to HERE map roadway segments using a 30-meter matching radius in ArcGIS, with a one-to-one nearest-segment assignment rule. This created directly comparable, segment-level counts for both datasets. Statistical correlation was measured using **Spearman rank correlation** and **Kendall's (τ)** nonparametric methods well-suited to the skewed, zero-heavy nature of crash and event counts. The analysis was conducted across six dimensions to stress-test the relationship:

- Temporal window (weekly vs. quarterly)
- Functional class (interstate, freeway, arterial)
- Area type (urban vs. rural)
- Crash type (rear-end, angle, head-on)
- Social Vulnerability Index (SVI)
- Regression modeling (negative binomial)

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# Key findings at a glance

Across every test dimension, the relationship between hard braking intensity and crash frequency was **positive and statistically significant.**

### Longer time windows give a stronger correlation

Correlation between hard braking events and crash frequency was notably stronger using a quarterly crash dataset versus a single-week snapshot. With more crash observations per segment, the underlying relationship becomes clearer and more statistically robust.

### Consistent across all road types

Strong, statistically significant alignment was found on interstates, freeways, and arterials alike. Interstates showed the strongest correlation, as braking behavior is a more sensitive indicator of crash risk in high-speed environments.

### Urban and rural areas both show alignment

Urban areas showed stronger overall network-level correlation, driven by denser crash and event activity. In rural areas, the correlation strengthened meaningfully when focusing on segments where crashes actually occurred.

### Statistically significant trends with angle and rear-end crash data

Alignment was highest when comparing hard braking events against crash types most mechanistically linked to braking behavior, particularly rear-end crashes. Angle-only crashes showed a lower but still statistically significant correlation.

### Holds across all socioeconomic contexts

Using the CDC's Social Vulnerability Index (SVI) to stratify communities, the positive association between hard braking events and crashes was consistently significant across all 10 SVI bins, confirming the signal is not limited to any particular community type.

### A statistically significant crash predictor

In a regression model controlling for traffic volume, speed, roadway geometry, pavement condition, and weather, hard braking remained one of the strongest positive predictors of crash frequency. Adding hard braking data significantly improved model fit.

## Hard Braking & Acceleration Events data is a credible, behavior-driven safety signal

Accross six independent analytical dimensions, StreetLight's Hard Braking & Acceleration Events data consistently aligned with observed crash frequency patterns at the roadway segment level. **Hard braking data is a statistically significant predictor of crash frequency even after controlling for traffic volume, speed, roadway geometry, pavement condition, and weather.** Adding hard braking data to crash models meaningfully improved their explanatory power, making it a high-potential dataset for proactive safety programs that can act before crashes accumulate.

HOW AGENCIES CAN PUT THIS TO WORK

### Proactive safety screening

Flag high-risk segments earlier, before crashes occur, using braking intensity as a leading indicator of danger.

### Supplement sparse crash data

Where crash records are thin or delayed, hard braking data provides a timely behavioral signal to fill the gap.

### Network-wide prioritization

Rank and prioritize safety investments across thousands of segments using consistent, scalable behavioral data.