



# Struck-By Sentinel

## Abridged Technical Brief

Data Governance, Verification, and Economic Risk Modeling  
for Roadway Occupational Struck-By Incidents



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## Purpose

The Struck-By Sentinel (SBS) is a specialized analytics framework designed to improve how roadway occupational struck-by incidents are identified, verified, categorized, and economically modeled.

SBS is not intended to replace existing state crash reporting systems. It functions as a secure analytics overlay that can help transportation agencies, public safety partners, and highway safety coalitions quantify the operational, economic, and societal impacts of incidents involving responders, towing and recovery operators, Safety Service Patrol personnel, DOT crews, public works employees, and authorized roadway contractors.

**Boundary Principle:** SBS applies a strict right-of-way occupational boundary. The focus is limited to incidents involving personnel or strategic assets actively performing official duties within the roadway, shoulder, or designated work zone environment. This prevents dilution by broader civilian crash data and preserves the integrity of specialized occupational-risk analysis.

## 1. Data Integrity and the Tri-Tier Schema

A core design principle of SBS is that every data point must be traceable, defensible, and clearly categorized. To support auditability, each record is organized using a tri-tier schema with confidence labeling.

Field Type	Confidence Approach	Examples
Retrieved	High confidence / unalterable	Official lookup tables, valuation figures, approved cost references, procurement references
Extracted	High confidence / verifiable	Closure duration, injury severity, unit type, location, roadway/corridor identifier
Estimated	Labeled / modeled	Long-tail indirect costs, projected insurance impacts, disability or backfill estimates

## 2. Human-in-the-Loop Verification

SBS relies on a required human verification process before records are approved for economic modeling or policy-grade reporting. This is a deliberate safeguard because roadway occupational struck-by incidents often involve operational nuance that automation alone may not reliably interpret.

- Domain Expert Review: Each record is reviewed by an incident management or roadway safety domain expert to determine whether it meets the occupational right-of-way inclusion criteria.
- Flagging and Disagreement Resolution: Records may be approved, rejected, or flagged for additional review. Uncertain records can be held out of final analysis until resolved.
- Immutable Audit Trail: Once approved, the reviewer identity, timestamp, and review action are permanently associated with the record. Raw source data is preserved and not overwritten.

## 3. Economic Lookup and Cost Categorization Framework

After verification, SBS organizes economic impact into three broad categories. This allows agencies to distinguish immediate financial loss from longer-term operational and societal burden.

Cost Category	Representative Cost Elements
Direct Costs	Emergency medical response; apparatus or vehicle damage; equipment replacement; scene remediation; recovery operations; immediate overtime and backfill.
Indirect Costs	Workers compensation; disability claims; physical rehabilitation; behavioral health support; increased insurance premiums; procurement delays; loss of institutional knowledge.
Societal Costs	Road user delay; freight disruption; secondary crashes; extended closure impacts; municipal support burden; line-of-duty death logistics.

**Methodology Protection:** This abridged brief describes the categories and governance logic. Detailed computational scripts, implementation workflows, and proprietary modeling logic are maintained internally.

## 4. Strategic Data Vectors

The SBS schema includes specialized data vectors that capture operational and policy relevance beyond standard crash-reporting fields.

Data Vector	Strategic Value
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EV Battery Fire Flag	Identifies incidents requiring specialized remediation, extended closure tracking, and atypical fire suppression or recovery timelines.
Move Over Law Violation	Supports correlation between struck-by incidents and potential legislative or behavioral compliance failures.
Mutual Aid Required	Captures cross-jurisdictional resource drawdown and multi-agency operational burden.
Secondary Civilian Injury	Tracks additional human harm resulting from the initial struck-by event or related closure conditions.
Towing Company Type	Helps distinguish municipal, contracted, and independent towing impacts, especially where small businesses absorb significant financial loss.

## 5. Safe System and Post-Crash Care Alignment

SBS directly supports the Safe System Approach, particularly the Post-Crash Care pillar. Post-Crash Care depends on the ability of emergency responders, towing operators, DOT crews, Safety Service Patrols, and other roadway workers to safely access, manage, and clear incidents.

When those personnel or their protective assets are struck, the response system is weakened. SBS helps agencies quantify that vulnerability by identifying where responder strikes, secondary crashes, prolonged closures, and damaged apparatus create measurable operational and economic consequences.

This supports investment decisions around TIM training, digital alerting, blocker vehicles, queue warning, quick clearance programs, and responder protection strategies.

## 6. Governance, Privacy, and Legal Protection

The SBS framework is designed to respect agency data ownership, privacy, and legal sensitivity.

- Federated Data Stewardship: Participating agencies retain control of source data while approved metadata supports analysis.
- Zero-PII Operating Principle: Names, private medical information, driver identity, and other sensitive details are excluded or removed from analytical outputs wherever possible.
- Aggregated Reporting: Outputs emphasize macro-level risk profiles rather than case-specific legal blame, preserving the system as a safety, planning, and investment tool.

## Recommended FHWA-Facing Positioning

A specialized, human-verified analytics overlay that improves the identification, classification, and economic valuation of roadway occupational struck-by incidents while supporting national TIM, Safe System, Post-Crash Care, and data-driven safety investment goals.

This framing emphasizes data quality, standards alignment, human verification, economic defensibility, privacy protection, operational usefulness, and policy-grade outputs without disclosing proprietary scripts or implementation details.

## Technical Guidance and Data Architecture Support

The Struck-By Sentinel concept has been developed with technical guidance and data architecture support from Kelly Ortega, CEO of Suave Droning. Her contributions have helped shape the system approach to structured data intake, schema discipline, verification workflows, auditability, and future-ready analytics design.

This abridged technical brief is intended to summarize the system governance, verification, and data integrity concepts at a high level. Detailed computational methods, technical scripts, implementation workflows, and proprietary modeling logic are maintained internally to protect the integrity and future development of the platform.

## Closing Statement

The Struck-By Sentinel gives transportation agencies and safety partners a structured way to move beyond anecdotal struck-by reporting and toward verified, economically defensible risk intelligence. By combining domain-expert review, confidence-labeled data, privacy-conscious governance, and validated cost categorization, SBS can help agencies better understand the true cost of roadway occupational struck-by incidents - and make stronger, data-driven investments to prevent them.