Exploring Predictive Network Screening Tools
April 16, 2021 1PM EST

Stephen Read, Virginia DOT & AASHTO Highway Safety Manual Steering Committee Chair
Kerry Wilcoxon & Saroja Devarakonda, Arizona DOT
Exploring Predictive Network Screening Tools

This webinar series features innovative software tools for predictive network screening employed by state transportation agencies around the United States.

Kick-off webinars provide a high-level overview of the tools using a speed-dating format and subsequent webinars will provide a more detailed description and demonstration.

Stephen Read, Virginia DOT & AASHTO HSM Steering Committee Chair
Kerry Wilcoxon & Saroja Devarakonda, Arizona DOT
Exploring Predictive Network Screening Tools (Part 1)

Stephen Read, Virginia DOT & AASHTO HSM Steering Committee Chair
Kerry Wilcoxon & Saroja Devarakonda, Arizona DOT
Exploring Predictive Network Screening Tools (Part 2)

Stephen Read, Virginia DOT & AASHTO HSM Steering Committee Chair
Kerry Wilcoxon & Saroja Devarakonda, Arizona DOT
Background

Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU)

- Passed in 2005
- Section 1401 amended Section 148 of Title 23 USC and created HSIP
- Required states to annually submit to FHWA a list of no less than 5% of highway locations with most pressing needs
- The IDOT 5% Report was created
  - BSPE was the Bureau of Safety Engineering, small
  - Used consultants to develop (CH2MHiHill > Jacobs)
Safety Tier History

First 5% Report released in 2006 for state roadways
- Highway Safety Manual (HSM) and Safety Analyst (SA) were not released until 2010
  - 2006, 2008, 2009, 2010 did not use HSM or SA
- Methodology used was similar to their eventual approaches
- Safety Performance Functions (SPFs) were developed and used to calculate Potential for Safety Improvement (PSI) based on weighted KAB crashes
- 5% Local Report in 2014
- Introduced Safety Tiers in 2015 State Report
  - 2017 Local Report included Safety Tiers for local locations
  - 2020: Added CCOF, eliminated ‘5%’ term
What Are Safety Tiers?

Based on PSI values, locations classified as:
- Critical (Top 5%)
- High (5 – 10%)
- Medium (10 – 25%)
- Low (25 – 50%)
- Minimal (all others)

Allowed for districts/local agencies to be more proactive than reactive
- Increase project boundaries
- Identify new projects (systemic)
5% to Safety Tiers Difference
Deliverables

Report (how tiers were calculated, how to use, changes from previous tiers)

Complete Excel intersection spreadsheet and segment spreadsheet (100% Report)

GIS shapefiles
  - IDOT makes available through ArcGIS Online
Safety Tiers: 2020 and beyond

Responded to feedback, critical locations no longer make up 5% of all locations

Introduced Crash Characteristic Overrepresentation Flag (CCOF)

- Locations with crash histories of overrepresentation of high-priority crash types
  - Angle, pedestrian, turning, ROR
  - Compared to other locations within their peer group and district
  - Locations might not be critical or high, but could be if crashes aren’t addressed
  - Help identify systemic projects

Available only for 2020 State Report

- Update for local locations in development
- Always open to feedback from districts and local agencies to meet their needs and use
Central Office contact information:

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Colorado DOT Network Screening with DiExSys: Vision Zero Suite (VZS)
Safety Performance Functions (SPF)

Colorado Specific SPFs created from Colorado Crash Data (5 to 10 years) by facility type (urban/rural terrain, lanes, highway/freeway)

12 segments types
20 intersection types
5 interchange ramp intersections

Each type has an SPF for total crashes (KABCO) and an SPF for injury and fatal crashes (KABC)

74 total models, more in development
Level of Service of Safety (LOSS)

LOSS 1 - Low potential for crash reduction (Below 20th Percentile)

LOSS 2 - Low to moderate potential for crash reduction (20th Percentile to Mean/Expected)

LOSS 3 - Moderate to high potential for crash reduction (Mean/Expected to 80th Percentile)

LOSS 4 - High potential for crash reduction (Above 80th Percentile)
Crash Query Program Features:

- Search by Linear Referencing System (LRS, Highway/Milepoint)
- Search by crash data location fields (Off System Locations)
- Summaries/Listings
- Graphs/Charts
- Economic Analysis (Benefit Cost)
- Crash Mitigation/Reduction Factors

All customized to agencies crash and roadway data
Safety Analysis Features:

- SPF Analysis
- Empirical Bayes Corrected
- Diagnostics Norms
- Crash Pattern Analysis
DiExSys: VZS Program

Safety Analysis Features Supporting Network Screening:

• SPF/LOSS or Freeway/Highway Corridors

• Crash Pattern Analysis or Freeway/Highway Corridors
DiExSys: VZS Program

Safety Analysis Features
Supporting Network Screening:

- SPF/LOSS or Freeway/Highway Corridors
- Crash Pattern Analysis or Freeway/Highway Corridors
- Create Batch Files

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<th>Bmp</th>
<th>Exp</th>
<th>Beg_date</th>
<th>End_date</th>
<th>Polec</th>
<th>Inq</th>
<th>Fat</th>
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<th>ADRt</th>
<th>Pot_dev_tLoss_a</th>
<th>Loss_t</th>
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</table>
Colorado Network Screening (LOSS)
Colorado Network Screening (Crash Patterns)
Contact Information and Links

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Traffic Safety and Engineering Services
David.Swenka@state.co.us

https://www.codot.gov/safety/traffic-safety/programs-and-analysis
https://cdot.maps.arcgis.com/home/index.html

Thank you!
WYDOT Network Screening

A quick review of notable agency predictive network screening tools
Agency Overview

• Wyoming Department of Transportation (WYDOT)
• Keri Bohlmann
  • WYDOT
  • Keri.Bohlmann@wyo.gov
  • 307-777-4257
• Joe McCarthy
  • Traffic Records Project Manager
  • Joe.McCarthy@wyo.gov
  • 970-412-4022
Tool Overview

• Company: ITIS Corp – OnSafety Portal
• Specific Tools: HSM Network Processor, SMS, report engine
• In use for 5+ years
• Oracle based processing, Web-based access
• Applies HSM Predictive to entire roadway network
Key Features

• Main features of the HSM Processing
  • Applies HSM Predictive on entire network; segments and intersections
    • Facility types to identify models
    • Have used non-HSM models
    • Applies available site-specific CMFs
    • EB correction – calculates expected (future) crashes
  • Annual update; 5-year history, re-calibration
  • Weighted severity scores segments and intersections
  • Calculates expected crash reduction for treatments
Key Features

• Main capabilities of the Safety Management System
  • Screening – crash concentrations (segment and intersection)
  • Diagnosis – historical crash types and risk features
  • Visualization
  • Prioritizing locations to consider (highest potential for reduction)
  • Prioritizing safety treatments (based on expected B/C, crash reduction)
• Three levels of information and visualization
  • On-screen info
  • 1-click reports
  • Analysis tools
WYDOT Screening Approach

• Looking for “worst” 1-mile segments and intersections
  • Worst-of-the-worst
    • Highest concentration of fatal/serious crashes and/or of all crashes
  • Grouped by facility type, e.g.
    • Rural/urban
    • Signalized/non-signalized

• Specific studies also done
  • Run-off-road, High speed rural intersections, winter-weather, wild animal
### Populating the HSM Table

<table>
<thead>
<tr>
<th>Public Road LRS</th>
<th>Roadway Feature Tables</th>
<th>Crash Data System</th>
<th>HSM Predictive Processing</th>
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</thead>
<tbody>
<tr>
<td>One row for each 1/10th mile of public roadway network</td>
<td>Route, From, To</td>
<td>Roadway Features</td>
<td>Crash History (breakdowns)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Facility Type</td>
<td>SPF Results</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>CMF Results</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Predicted Results (SPF and CMFs)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Expected Results (EB-Corrected)</td>
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</tbody>
</table>

**Table Legend:**
- **Public Road LRS:**
  - One row for each 1/10th mile of public roadway network

**Diagram:**
- Diagram illustrating the process of populating the HSM Table, with arrows connecting the sources of data to the resulting columns.

**Additional Notes:**
- The diagram includes a visual representation of the process flow, with each step connected to the next, indicating the flow of information.
- The diagram shows how data is aggregated from different sources to populate the HSM Table.

**References:**
- WYDOT HSM & SMS - Keri Bohltmann & Joe McCarthy
- AASHO
Example of HSM Output
WYDOT’s SMS — Safety Locations

• Location
• Context
• HSM Scores
• Risk factors (from HSM CMFs)
## Diagnostic Visualization

<table>
<thead>
<tr>
<th>Category</th>
<th>Data</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>URBAN/RURAL</strong></td>
<td>Rural</td>
</tr>
<tr>
<td><strong>POSTED SPEED LIMIT (AADT)</strong></td>
<td>30</td>
</tr>
<tr>
<td><strong>ACCESS LOCATIONS &amp; DENSITY</strong></td>
<td></td>
</tr>
<tr>
<td><strong>HORIZONTAL CURVES</strong> (COLOR BY RADIUS)</td>
<td>1.5</td>
</tr>
<tr>
<td><strong>SHOULDER WIDTH</strong></td>
<td>8</td>
</tr>
<tr>
<td><strong>TRAFFIC VOLUME</strong></td>
<td></td>
</tr>
<tr>
<td><strong>REPORTED CRASHES</strong> (LAST 3 YEARS BY SEVERITY)**</td>
<td>100</td>
</tr>
<tr>
<td><strong>HSM PREDICTIVE</strong> (MODEL &amp; HISTORY CRASHES/YEAR)</td>
<td>5</td>
</tr>
<tr>
<td><strong>ROADSIDE HAZARD RATING (1-7)</strong></td>
<td>2</td>
</tr>
</tbody>
</table>

### Collision Diagram

**Intersection ID:** 104315  
**Intersection Names:** DELL RANGE BLVD @ CONVERSE AVE

Crash types are based on a grid format and are not indicative of crash location.

![Collision Diagram](image-url)

33
WYDOT’s SMS — Treatment Locations

- Location
- Proposed treatment
- Expected lifecycle cost
- Expected crash reduction
- Expected B/C
- Feeds programming
- Captures completion
Selecting Effective Treatments

Statewide Safety Status

Treatment Cumulative Benefits vs Cumulative Costs

Cumulative Lifecycle Costs ($M)

Cumulative Lifecycle Benefits ($M)
Conclusions

• The tools support strategic directions
  • Data driven optimization
  • Performance measure

• Systematic HSM calculations
  • Integrated into hot spots, scoring, benefit calculations
  • Screening, treatment selection, programming

• Actual benefits of the tools:
  • At all project kick off and recon meetings, the safety report is reviewed and discussed. Safety discussions are driven by the HSM safety scores. (A low score means little or no discussion takes place.)
  • By forcing everyone to review the safety report and data, it helps engineers make safety related decisions (in theory).
    • Unfortunately, some of the engineers try to make the report fit their wants.
    • It does, however, give others the tools to say no, that treatment is not justified.
  • Having the tool is forcing the safety conversation on every project.
Questions?

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• OnSafety Portal by ITIS Corp.
Network Screening Speed Dating
Tool Overview
Key Features
<table>
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<tr>
<th>Rank</th>
<th>Route / Mile</th>
<th>Crashes</th>
<th>Fatal Crashes</th>
<th>Chart</th>
<th>Notes</th>
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<td>80</td>
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<td>0</td>
<td>OTL 144.7</td>
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<td>0</td>
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<td>112215.6</td>
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</table>

(Note: The table contains data related to crashes and fatalities on various routes within a specific area. The notes column contains specific identifiers or codes for each entry, possibly indicating further details or categorizations.)
Predictive Analysis – EB / SPF Creation
## Potential Candidates

New candidates by revised Sliding Window analysis

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<tr>
<th>Name</th>
<th>County</th>
<th>Route</th>
<th>Limits</th>
<th>Length (mi)</th>
<th>Notes</th>
<th>2013 - 2021 February</th>
<th>ePDQ per mile</th>
<th>KAB-ePDQ per mile</th>
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<tr>
<td>Ped</td>
<td>Dougherty</td>
<td>1 SR 520 Bus / W Oglethorpe Blvd</td>
<td>from S Madison St to N Broadway St</td>
<td>1.1</td>
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<td>0.0</td>
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<td></td>
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<tr>
<td>Int / Ped</td>
<td>Dougherty</td>
<td>2 SR 520 (major intersections)</td>
<td>from SR 500 to S County Line Rd</td>
<td>0.9</td>
<td></td>
<td>0.0</td>
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<td></td>
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<tr>
<td>New</td>
<td>Dougherty</td>
<td>3 SR 520 Bus / W Oglethorpe Blvd</td>
<td>from S Cleveland St to S Monroe St</td>
<td>0.9</td>
<td></td>
<td>0.0</td>
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<tr>
<td>Ped</td>
<td>Tattnal</td>
<td>4 SR 520 / 5th St</td>
<td>from S Central Ave to Harold Couch Rd</td>
<td>0.9</td>
<td></td>
<td>0.0</td>
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<tr>
<td>Ped</td>
<td>Dougherty</td>
<td>5 SR 520 / N Spalding Blvd</td>
<td>from Liberty Hwy to ramp to 14th Ave</td>
<td>0.9</td>
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<td>0.0</td>
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<td></td>
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<tr>
<td>Ped</td>
<td>Dougherty</td>
<td>6 S Mock Rd (off system)</td>
<td>from McNutt Ave to Doctman Rd</td>
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<td></td>
<td>0.0</td>
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<td></td>
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<tr>
<td>New</td>
<td>Dougherty</td>
<td>7 SR 244 / Glidewell Rd</td>
<td>from N Woodruff Bl to N Dalewood Dr</td>
<td>0.9</td>
<td></td>
<td>0.0</td>
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<td></td>
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<tr>
<td>Ped</td>
<td>Dougherty</td>
<td>8 SR 45 / SR 520</td>
<td>from Mechanicsville St to S Main St</td>
<td>0.9</td>
<td></td>
<td>0.0</td>
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<td>Sliding W</td>
<td>Dougherty</td>
<td>9 SR 19 Bus / SR 244</td>
<td>from Perry Rd to Meredith Dr</td>
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<td></td>
<td>0.0</td>
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<td>Ped</td>
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<td>12 SR 78U</td>
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<tr>
<td>Int</td>
<td>Dougherty</td>
<td>13 SR 38 / S Pine St</td>
<td>from SR 244 to E Pine St</td>
<td>0.9</td>
<td></td>
<td>0.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sliding W</td>
<td>Dougherty</td>
<td>14 SR 7 / S Patterson St</td>
<td>from Old US 41 to Copeland Rd</td>
<td>0.9</td>
<td></td>
<td>0.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Int</td>
<td>Lowndes</td>
<td>15 SR 36 / S Hill Ave</td>
<td>from Northside Dr to S Park Rd</td>
<td>0.9</td>
<td></td>
<td>0.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Int</td>
<td>Dougherty</td>
<td>16 SR 115 / S Sherman St</td>
<td>from SR 244 to S Sherman St</td>
<td>0.9</td>
<td></td>
<td>0.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Int</td>
<td>Dougherty</td>
<td>17 SR 35 / Tallahassee Hwy</td>
<td>1 mile stretch north and south of intersection at Woodhull Rd</td>
<td>0.9</td>
<td></td>
<td>0.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ped</td>
<td>Dougherty</td>
<td>18 SR 51 / S Park Rd</td>
<td>from River Rd to Brierwood Rd</td>
<td>0.9</td>
<td></td>
<td>0.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Int</td>
<td>Lowndes</td>
<td>19 SR 26 / S Hill Ave</td>
<td>from Sherman St to Blanche St</td>
<td>0.9</td>
<td></td>
<td>0.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Int</td>
<td>Lowndes</td>
<td>20 SR 125 / Sesame Rd</td>
<td>from Skipper Bridge Rd to Hidden Hills Rd</td>
<td>0.9</td>
<td></td>
<td>0.0</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
COMPARISON REPORT

Speed Dating Demo

Created on April 8, 2021
Created by Ramual Harris
Data analysis: January 1, 2018 to December 31, 2019

Applied Filters

<table>
<thead>
<tr>
<th>Functional Class</th>
<th>Interstate</th>
<th>Pedestrian Related</th>
<th>State</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Time frames:</th>
<th></th>
<th>94 Crashes</th>
</tr>
</thead>
<tbody>
<tr>
<td>January 1, 2018 - December 31, 2018 (365 days)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>K = (K) Fatal Injury, A = (A) Suspected Serious Injury, B = (B) Suspected Minor/Visible Injury, C = (C) Possible Injury/Complaint, D = (D) No Injury</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>18 (19.1%)</td>
<td>21 (22.3%)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Change Overview (annualized)</th>
</tr>
</thead>
<tbody>
<tr>
<td>-19 (100%) Serious Crashes</td>
</tr>
<tr>
<td>-18 (100%) Fatal Crashes</td>
</tr>
<tr>
<td>$245,114 (100%) Crash Cost</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Crash Costs &amp; Cost (annualized)</th>
<th>1</th>
<th>2</th>
<th>+/-</th>
</tr>
</thead>
<tbody>
<tr>
<td>(K) Fatal Injury</td>
<td>18</td>
<td>0</td>
<td>-18</td>
</tr>
<tr>
<td>(A) Suspected Serious Injury</td>
<td>18</td>
<td>0</td>
<td>-18</td>
</tr>
<tr>
<td>(B) Suspected Minor/VISIBLE Injury</td>
<td>21</td>
<td>0</td>
<td>-21</td>
</tr>
<tr>
<td>(C) Possible Injury / Complaint</td>
<td>21</td>
<td>0</td>
<td>-21</td>
</tr>
<tr>
<td>(D) No Injury</td>
<td>14</td>
<td>0</td>
<td>-14</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Top Differentiators</th>
<th>1</th>
<th>2</th>
<th>+/-</th>
</tr>
</thead>
<tbody>
<tr>
<td>GDOT Summary: Pedestrian</td>
<td>100%</td>
<td>0%</td>
<td>-100%</td>
</tr>
<tr>
<td>GDOT Summary: Total Crashes</td>
<td>100%</td>
<td>0%</td>
<td>-100%</td>
</tr>
<tr>
<td>Manner of Collision: Not a Collision with Motor Vehicle</td>
<td>82.9%</td>
<td>0%</td>
<td>-82.9%</td>
</tr>
<tr>
<td>Operator / Driver Contributing Factor: No Contributing Factors</td>
<td>93.8%</td>
<td>0%</td>
<td>-93.8%</td>
</tr>
<tr>
<td>Location at Impact: On Roadway - Non-Intersection</td>
<td>52.1%</td>
<td>0%</td>
<td>-52.1%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>GDOT Summary</th>
<th>1</th>
<th>2</th>
<th>+/-</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bicyclist</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>CMV Related</td>
<td>2.1%</td>
<td>0%</td>
<td>-2.1%</td>
</tr>
<tr>
<td>Distracted Driver (Confirmed)</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
</tr>
</tbody>
</table>
SHSP Focus Areas

For an explanation of the SHSP Areas, please see our GDOT - SHSP Focus Area Filters Article.

Note: Crashes can overlap and be counted within multiple SHSP focus areas.
Crash Reporting

GDOT Crash Data Dashboard

The GDOT Crash Data Dashboard provides crash and vehicle data from crashes that occurred on Georgia's public roads, as well as information regarding the various safety campaigns throughout the state of Georgia. The dashboard provides data visualizations, crash mapping, and easy-to-use filtering, which allows you to further crash data for any city, county, or region. Additionally, crash types like pedestrian or bicycle involved, distracted driver involved, and more. This dashboard contains crashes that occurred over the last 3 years.

New enhanced overview of associated is featured.

Request Your Crash Report

Police crash reports are available through the GDOT Crash system.

[Submit Request]

A crash report can be purchased directly via the Crash Report or by submitting a request to GDOT via the GDOT Request Form.

Coordinate with Our Technical Team

Georgia DOT is the designated state agency for managing and disseminating crash reports in the GEARS database. Users can use the link to request access to GEARS crash data, request support for local Law Enforcement, or request technical assistance.

Contact Us via: [email] or [phone number].

GDOT
Georgia Department of Transportation
The data displayed in this dashboard includes the years 2015-2019 by default. This can be modified by changing or removing the date filter in the filter bar above. Additionally, users can click on any chart to filter further. All data presented is based upon applied filters.

User Tip: System response is improved when an Area filter (County or City) is applied.

Total Crash Count for All Filtered Crashes: 1,997,395

Fatal Crash Count for All Filtered Crashes: 7,086

Number of Injuries for All Filtered Crashes: 725,748

Number of Fatalities for All Filtered Crashes: 7,672

To view Georgia's Strategic Highway Safety Plan click Here
Conclusions

- Why was the tool selected?
- What are the benefits of the tool?
- How has the tool impacted decision-making?
Questions?

Samuel Harris, PE
State Safety Engineering Manager
sharris@dot.ga.gov
404.635.281
Discussion

For additional information go to www.highwaysafetymanual.org or contact Kelly Hardy, P.E. at khardy@aashto.org

Stephen Read, Virginia DOT & AASHTO HSM Steering Committee Chair
Kerry Wilcoxon & Saroja Devarakonda, Arizona DOT
Exploring Predictive Network Screening Tools (Part 1)

Stephen Read, Virginia DOT & AASHTO HSM Steering Committee Chair
Kerry Wilcoxon & Saroja Devarakonda, Arizona DOT
Exploring Predictive Network Screening Tools (Part 2)

Stephen Read, Virginia DOT & AASHTO HSM Steering Committee Chair
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Exploring Predictive Network Screening Tools
.... The Next Generation Coming Soon!

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