AASHTO
AASHTO INNOVATION INITIATIVE

AASHTO Innovation Initiative

[Proposed] Nomination of Innovation Ready for Implementation

Sponsor

Nominations must be submitted by an AASHTO member DOT willing to help promote the innovation. If selected, the sponsoring DOT will be asked to promote the innovation to other states by participating on a Lead States Team supported by the AASHTO Innovation Initiative.

1. Sponsoring DOT (State): Florida Department of Transportation (FDOT)

2. Name and Title: Alan El-Urfali, P.E.
State Traffic Services Program Engineer

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Innovation Description (10 points)

The term "innovation" may include processes, products, techniques, procedures, and practices.

3. Name of the innovation:

STRIDES 2 ZERO

4. Please describe the innovation.

STRIDES (State Traffic Roadway and Intersection Data Evaluation System) 2 Zero is a statewide initiative to work toward the vision of eliminating traffic fatalities and serious injuries by implementing technological advances in highway safety engineering. The objectives of the initiative are to enhance highway safety management practices in Florida through a data-driven process and provide engineering-based safety solutions for different transportation facilities and modes. System Analysis and Forecast Evaluation (SAFE) and Safe Mobility for Life (SMFL) are two implemented programs supporting this initiative.

SAFE program employs the most advanced tools and resources of the highway safety management process to improve safety on the State Highway System (SHS) in Florida. This program entails the following strategies: (i) Leverage various data sources and create a repository of roadway segments, intersections, geometry, land use, and traffic volume data, which is updated regularly with latest information; (ii) Apply state-of-the-art predictive analysis methods (e.g., Florida-specific Safety Performance Functions (SPFs)) and network screening performance measures to identify sites with the highest potential for safety improvement; (iii) Develop customized tools to facilitate diagnosis, countermeasure selection, economic appraisal, and project prioritization for safety improvements; (iv) Make sound business decisions based on the reliable estimate of expected benefits from proposed safety improvements; and (v) Monitor safety and operational performance of roadway facilities and evaluate benefits from the dollars FDOT invested. The strategies lead to implementing safety countermeasures at signalized intersections on the SHS. In addition, the platforms for the screening of roadway segments and systemic safety improvements are developed for implementation.

SMFL program is designed to identify intersection crashes that have an over representation of drivers aged 65 and older, giving detailed insights about aging road users in Florida. With predictive models created for the S2Z initiative, engineers and planners can analyze and monitor data trends that directly support the goals of Florida's Safe Mobility for Life Strategic Action Plan. This analysis directly supports both the Program Management & Evaluation and Livable Communities focus areas.

5. What is the existing baseline practice that the innovation intends to replace/improve?

The baseline practice for selecting and prioritizing roadway sites for safety improvements was a crash frequency-based approach, selecting sites having experienced high number of crashes only. The approach is thus a reactive approach and does not necessarily consider sites that may have the greater potential for safety improvement. Another limitation of the frequency-based approach is the regression to the mean bias, which may lead to selecting locations with high crash frequencies over a short period of time, without accounting for the true long-term average crash frequency.

6. What problems associated with the baseline practice does the innovation propose to solve?

The S2Z initiative implements a proactive approach by applying the predictive method from the AASHTO Highway Safety Manual (HSM). The proactive approach incorporates crash predictions estimated from Safety Performance Functions (SPFs)—a regression equation developed using traffic and crash

characteristics from similar sites within a given context class—to obtain a reliable estimate of expected crash frequency. The Excess Expected Average Crash Frequency with Empirical Bayes (EB) Adjustment performance measure, regarded as the most reliable network screening measure, is then applied to account for the random nature of crash occurrence and determine the potential for safety improvement of each site. By using the proactive approach, we are thus able to identify appropriate sites that can be most benefitted from safety implementations and perform a more reliable estimate of the Return-on-Investment (ROI) from the expected benefit.

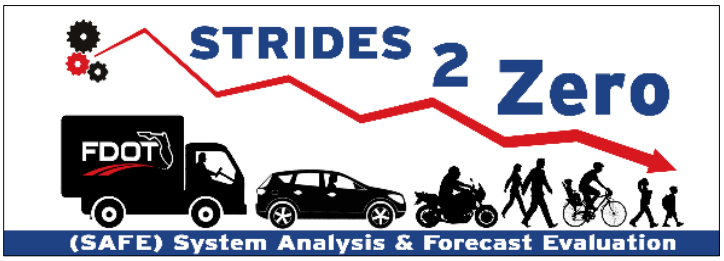
7. Briefly describe the history of its development.

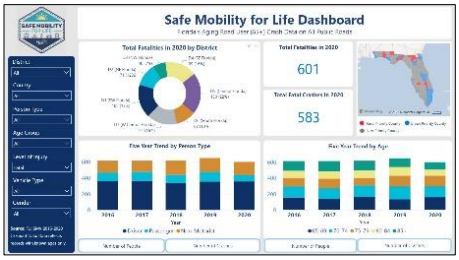
The initiative began in 2018 by identifying gaps in current practice and identifying opportunities to improving highway safety through engineering measures. Then, a workflow documentation was prepared to identify and connect various data sources and eventually, a relational database management system (e.g., SQL Server) was developed for data storage. A GIS-based data collection system was developed to collect required data on the fly. Statistical analysis tools were explored to run the predictive analysis. In 2020, the first analysis was run and both a report and a dashboard were published showing the location of critical signalized intersections with the greatest potential for safety improvement. Since then, the report and the dashboard have been published annually.

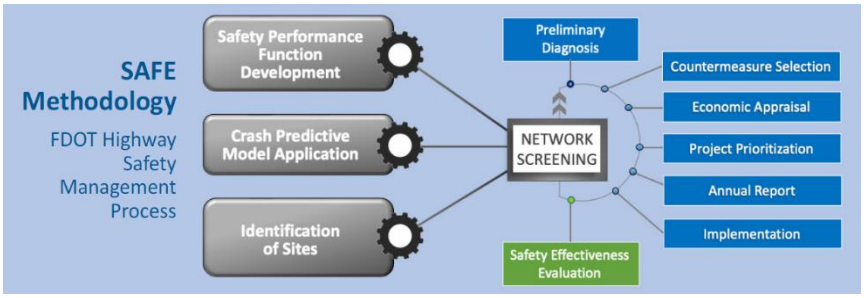
8. What resources—such as technical specifications, training materials, and user guides—have you developed to assist with the deployment effort? If appropriate, please attach or provide weblinks to reports, videos, photographs, diagrams, or other images illustrating the appearance or functionality of the innovation (if electronic, please provide a separate file). Please list your attachments or weblinks here.

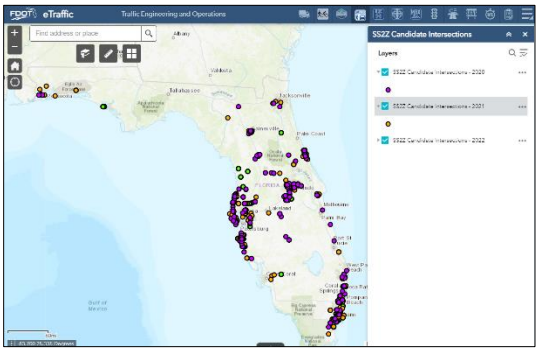
- An in-house documentation of the process
- Technical memorandum (available upon request)
- Meeting Presentations (some can be found here: Presentations (fdot.gov))
- SAFE Dashboard
- SAFE – Annual Reports
- eTraffic Data Repository
- FDOT SPF Tool (permission required)
- SMFL Dashboard
- SMFL Website
- SMFL Strategic Plan

Attach photographs, diagrams, or other images here. If images are of larger resolution size, please provide as separate files.









State of Development (40 points)

Innovations must be successfully deployed in at least one State DOT. The AII selection process will favor innovations that have advanced beyond the research stage, at least to the pilot deployment stage, and preferably into routine use.

9. How ready is this innovation for implementation in an operational environment? Please select from the following options. Please describe.

☐ Prototype is fully functional and yet to be piloted

☐ Prototype has been piloted successfully in an operational environment

☒ Technology has been deployed multiple times in an operational environment

☐ Technology is ready for full-scale implementation

Under the SAFE program, the network screening of signalized intersections on the SHS has been evaluated every year since 2020 using the most reliable network screening performance measure referred to in the AASHTO Highway Safety Manual. This annual network screening process develops Florida-specific Safety Performance Functions (SPFs) each year using the most recent three years of traffic volume (e.g., Annual Average Daily Traffic (AADT)) and crash data of fatal and serious injury crashes and applies the Excess Expected Crash Frequency with Empirical Bayes (EB) Adjustment performance measure to identify and prioritize candidate signalized intersections with the greatest potential for safety improvements. The report has been published for three years now and can be retrieved from the following website: Technical Reports (fdot.gov). A web-based visualization and analysis tool, called FDOT SPF Tool, has also been developed to assess the field conditions at the candidate locations from aerial imagery, evaluate abnormal crash patterns, analyze the effect of potential countermeasures, conduct economic analysis (e.g., benefit-cost ratio), and perform a comparative analysis of candidate locations year-over-year. Also, the tool has the capability to do systematic analysis and before-after safety effectiveness evaluation. In addition to the signalized intersection application, a prototype for network screening of roadway segments has been developed and deployed successfully based on Florida-specific SPFs as a function of AADT, context class, median type, and speed limit. A full-scale implementation of the roadway segment application, which will include diagnosis, countermeasure selection, and economic appraisal, is currently under development. With the SMFL program, a dashboard is developed that shows the distribution of crash severities by risk factors (e.g., age, gender, vehicle group, location) and the location of critical signalized intersections for aging road users.

10. What additional development is necessary to enable implementation of the innovation for routine use?

The department is routinely using the approach for identifying the signalized intersection locations with the highest potential for safety improvement. In the future, the SAFE program tends to include the full-scale implementation of roadway safety management process for other roadway entities, including unsignalized intersections, school zones, midblock crossing zones, railroad grade crossings, and work zones; and for systemic and systematic safety improvements.

11. Are other organizations using, currently developing, or have they shown interest in this innovation or of similar technology?? ☐ Yes ☒ No

If so, please list organization names and contacts. Please identify the source of this information.

Organization	Name	Phone	Email
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Potential Payoff (30 points)

Payoff is defined as the combination of broad applicability and significant benefit or advantage over baseline practice.

12. How does the innovation meet customer or stakeholder needs in your State DOT or other organizations that have used it?

FDOT Districts are using the program output to proactively conduct a road safety audit, identify specific countermeasures, look for opportunities to implement the countermeasures through an existing work program, and if an existing work program is not available, schedule a work program for implementing the countermeasures. With this proactive approach of early identification of candidate locations, the program provides the opportunity to fix the problems earlier, and with the use of the most reliable performance measure, it ensures that the return on investment is optimum from the identified locations.

13. Identify the top three benefit types your DOT has realized from using this innovation. Describe the type and scale of benefits of using this innovation over baseline practice. Provide additional information, if available, using quantitative metrics, to describe the benefits.

Benefit Types	Please describe:
Improved Safety	This proactive approach of identifying and prioritizing critical sites and implementing countermeasures ensures a greater return on investment and eventually moves the needle towards zero fatalities and serious injuries. .
Improved Operation Performance	Proactively identifying the safety issues and taking actions to improve the safety of roadways for all road users eventually lead to an enhanced operational performance of the state highway system.
Organizational Efficiency	The process improves the organizational efficiency by encouraging a timely program management for safety improvements.

Provide any additional description, if necessary:

Click or tap here to enter text.

14 How broadly might this innovation be deployed for other applications. in the transportation industry (including other disciplines of a DOT, other transportation modes, and private industry)?

With this initiative, the roadway safety management process has been implemented for signalized intersections, and roadway segments on state highway systems. Future analysis will include other roadway facilities, including unsignalized intersections, midblock crossings; travel modes, including motorcycle, transit, and connected and autonomous vehicles (CAVs); crash types, including roadway departure crashes, distracted driving crashes, and speeding-related crashes; and safe systems. The program output under this initiative will guide Operations, Roadway Design, Safety, System Implementation, and Multimodal Planning Offices to incorporate safety measures within their projects and programs. The consultant industry will provide support to other agencies across the country for the implementation of the programs under the initiative or the initiative itself.

Market Readiness (20 points)

The AII selection process will favor innovations that can be adopted with a reasonable amount of effort and cost, commensurate with the payoff potential.

15. What specific actions would another organization need to take along each of the following dimensions to adopt this innovation?

Check boxes that apply	Dimensions	Please describe:
☒	Gaining executive leadership support	The leadership will provide the direction for allocating and managing the best resources, which are indispensable for adopting the program.
☒	Communicating benefits	Coordinate with stakeholders and present the success stories in statewide meetings.
☒	Overcoming funding constraints	The programs can be funded through Highway Safety Improvement Program (HSIP) funds, as it promises to reduce traffic fatalities and serious injuries.
☒	Acquiring in-house capabilities	Programmers, analysts, engineers, and program managers require have a solid understanding of the overall process.
☐	Addressing legal issues (if applicable) (e.g., liability and intellectual property)	Click or tap here to enter text.
☐	Resolving conflicts with existing national/state regulations and standards	Click or tap here to enter text.
☐	Other challenges	Click or tap here to enter text.

16. Please provide details of cost, effort, and length of time expended to deploy the innovation in your organization.

Cost: $450,000.00

Level of Effort: Annual Process

Time: Click or tap here to enter text.

17. To what extent might implementation of this innovation require the involvement of third parties, including vendors, contractors, and consultants? If so, please describe. List the type of expertise required for implementation.

- Database Administrators to develop the database tools
- GIS Programmers to collect and analyze geospatial data
- Engineers, including Subject Matter Experts, to develop and run statistical analysis and build related applications

STRIDES 2 Zero INITIATIVE

STRIDES (State Traffic Roadway and Intersection Data Evaluation System) 2 Zero is a statewide initiative to work toward the vision of eliminating traffic fatalities and serious injuries by implementing technological advances in highway safety engineering. The objectives of the initiative are:

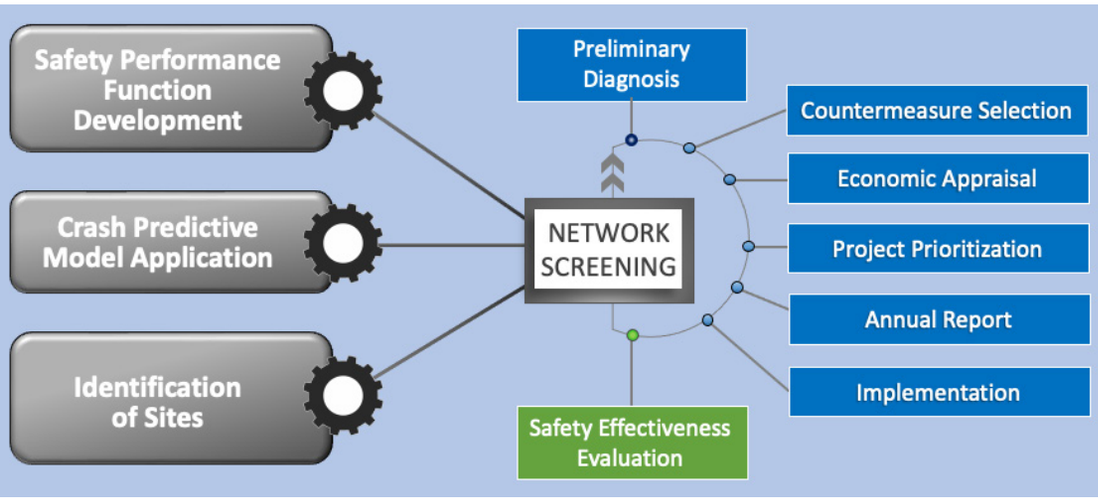
- Enhance highway safety management practices in Florida through a data-driven process
- Provide engineering-based safety solutions for different transportation facilities and modes

System Analysis and Forecast Evaluation (SAFE)

- SAFE program employs the most advanced tools and resources of the highway safety management process to improve safety on the State Highway System (SHS) in Florida.
- This highway safety management process utilizes several data sources, including roadway context class, geometry, traffic, intersection, and crash and applies the state-of-the-art method to increase the accuracy of crash predictions estimated from Safety Performance Functions (SPFs) for operational and safety improvements.
- The approach helps making sound business decisions through a reliable estimate of expected safety benefits.

SAFE Methodology

FDOT Highway Safety Management Process



Current SAFE Implementations:

- Signalized intersections
- Roadway Segments
- FDOT SPF Tool
- Systemic Safety

Forthcoming SAFE Implementations/Future Additions:

- Unsignalized Intersections
- Midblock Crossings
- School Zones and Speed Zones
- Safe Systems

Safety Performance Function

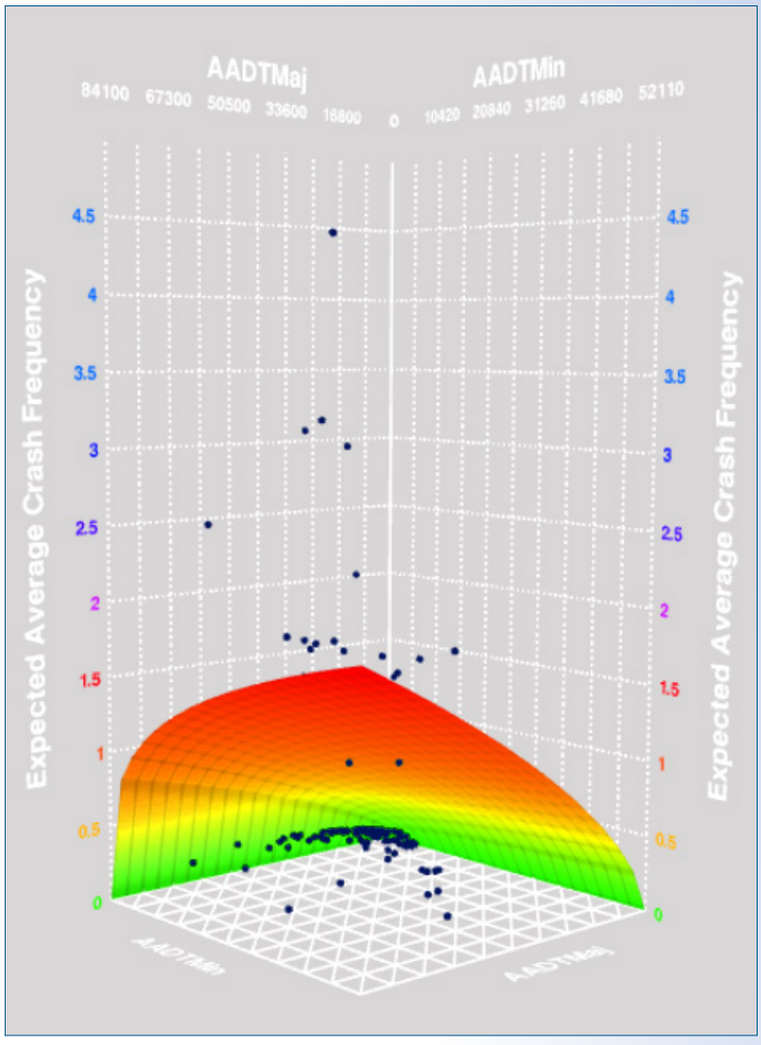
- An equation to predict the average number of crashes per year at a location
- Function of exposure and intersection characteristics
- Multiple-dimension curve surface

$$N_{predicted} = e^{a} \times AADT_{major}^{b} \times AADT_{minor}^{c}$$

$N_{predicted}$: Predicted crashes (intersection)

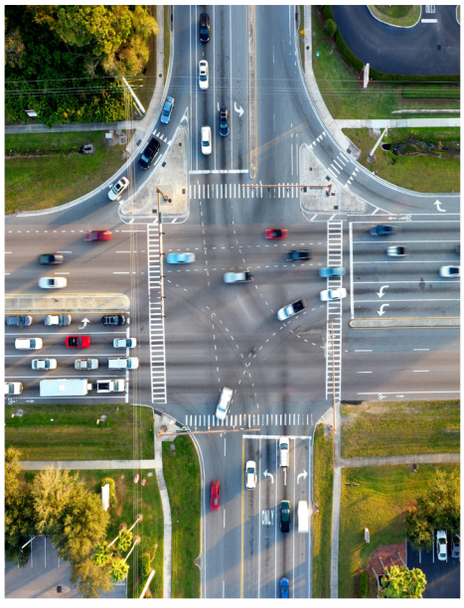
$AADT_{major}$: AADT for major road

$AADT_{minor}$: AADT for minor road



Safe Mobility for Life (SMFL)

SMFL program is designed to identify intersection crashes that have an over representation of drivers aged 65 and older, giving detailed insights about aging road users in Florida. With predictive models created for the S2Z initiative, engineers and planners can analyze and monitor data trends that directly support the goals of Florida's Safe Mobility for Life Strategic Action Plan. This analysis directly supports both the Program Management & Evaluation and Livable Communities focus areas.



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