# Paper #21-00078: A Regional Perspective on Safety Performance Function Development and Implementation: National Survey of Current Regional Practices and Evaluation of Crash Predictions for Rural Florida Intersections

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RESEARCH BACKGROUND

The Florida Department of Transportation (FDOT) has developed a context classification system that sorts roads into eight categories based on land use, development patterns, and roadway connectivity.
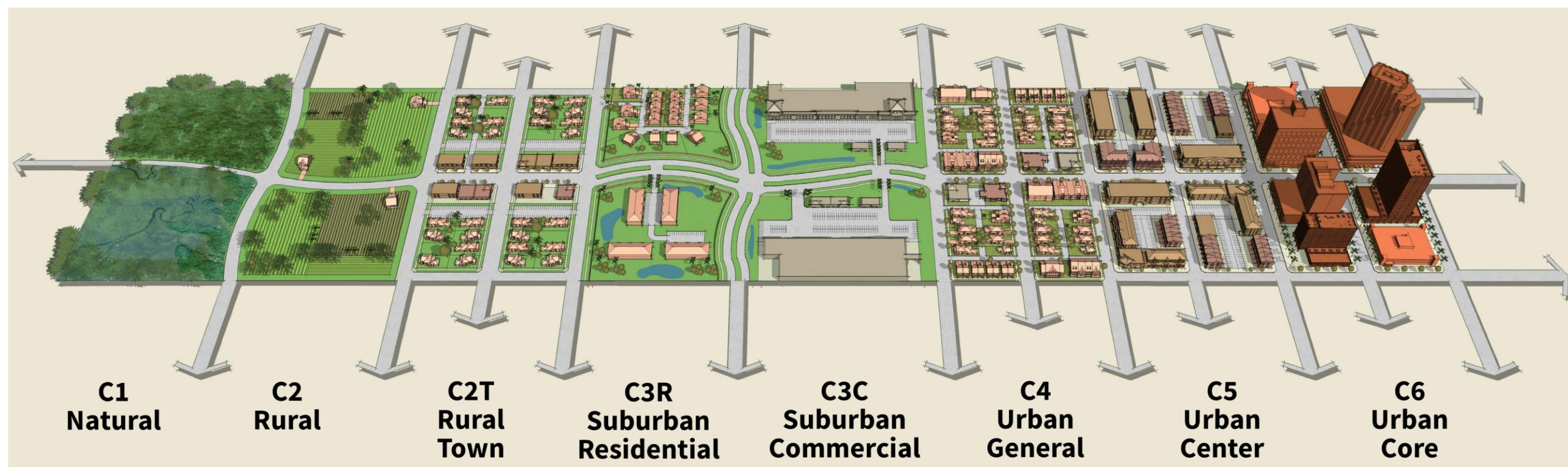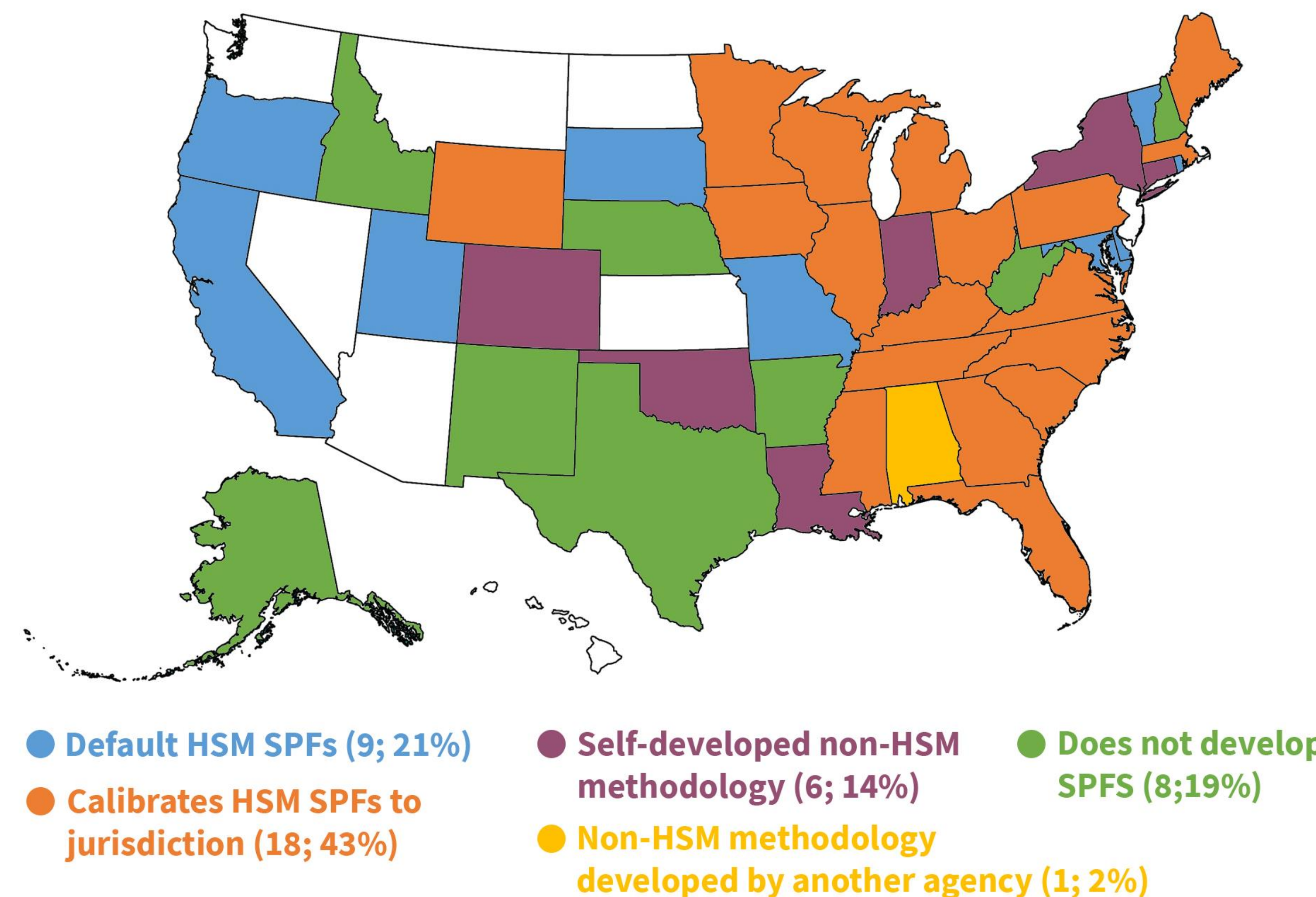

FDOT Context Classification System

- Up to 32 context-specific safety performance functions (SPFs) can be developed for intersections (unsignalized and signalized 3- and 4-leg intersections in each classification).
- In comparison, the Highway Safety Manual (HSM) only has 10 SPFs across three categories (rural, suburban, and urban).
- SPFs are crash prediction models that are used for various reasons, such as network screening or determining crash modification factors (CMFs).

RESEARCH MAIN GOALS

- Understand the state of the practice of SPF development by conducting a national survey of state agencies.
- Determine the interest from other states in using a context classification framework for SPF development.
- Show the benefits of using a context classification framework for SPF development, particularly for showing regional differences in predicted crash frequency.

STATE SPF DEVELOPMENT SURVEY RESULTS

- 16 question digital survey available for 11 months.
- Survey sent to state safety engineers or similar professionals from 51 DOTs (all 50 states and the District of Columbia).
- Received responses from 42 state safety engineers.

- Default HSM SPFs (9; 21%)
- Calibrates HSM SPFs to jurisdiction (18; 43%)
- Self-developed non-HSM methodology (6; 14%)
- Non-HSM methodology developed by another agency (1; 2%)
- Does not develop SPFS (8;19%)

SPF Development of 42 State DOTs

- The seven states that did not use the HSM for SPF development had needs the HSM did not account for.
- 62% had not heard of using context classification for SPFs, but 67% were interested in eventually adopting a similar system.
- Some states wanted to see evidence of the benefits of context classification and understand how it could handle missing or unreliable data before becoming interested in it.
- Oklahoma is the only other state to use a system like context classification, but their system is based on terrain.

CONTEXT-SPECIFIC SPF

- A negative binomial context-specific SPF for C2T-Rural Town signalized four leg intersections was developed using 70 intersections.
- Significant variables in the context-specific model were major and minor road AADT, presence of lighting, and a district variable for if the intersection was in FDOT District 3 (which represents the Florida panhandle).
- The significant district variable captures a regional aspect that the HSM SPFs do not by identifying that C2T intersections in District 3 are expected to have fewer crashes than C2T intersections in other districts.

COMPARING HSM AND CONTEXT SPFs

The HSM SPF for signalized four-leg intersections on rural two-lane, two-way roads was compared with the context-specific SPF using three performance measures: mean absolute error (MAE), root mean square error (RMSE), and mean absolute percentage error (MAPE). Lower values indicate a better fitting model.

Safety Performance Function	MAE	RMSE	MAPE
Base HSM SPF	7.169	12.560	92.6%
HSM SPF with CMFs	9.445	12.500	197.3%
Calibrated HSM SPF with CMFs	8.887	12.401	168.5%
Context-Specific SPF	5.410	10.372	70.2%

- Based on performance measures, the context-specific SPF is the best model for this type of rural Florida intersection.
- HSM SPF with CMFs had the highest values in two of the three performance measures, so the CMFs in the HSM may not be accurate for rural Florida intersections.