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Identifying Secondary Crashes on Freeways Using Real-Time Traffic Data

Angela Kitali, Graduate Research Assistant
Priyanka Alluri, Assistant Professor
Florida International University

Thobias Sando, Associate Professor
University of North Florida

Project Manager:
Pete Vega, P.E.
Florida Department of Transportation

Presentation Overview

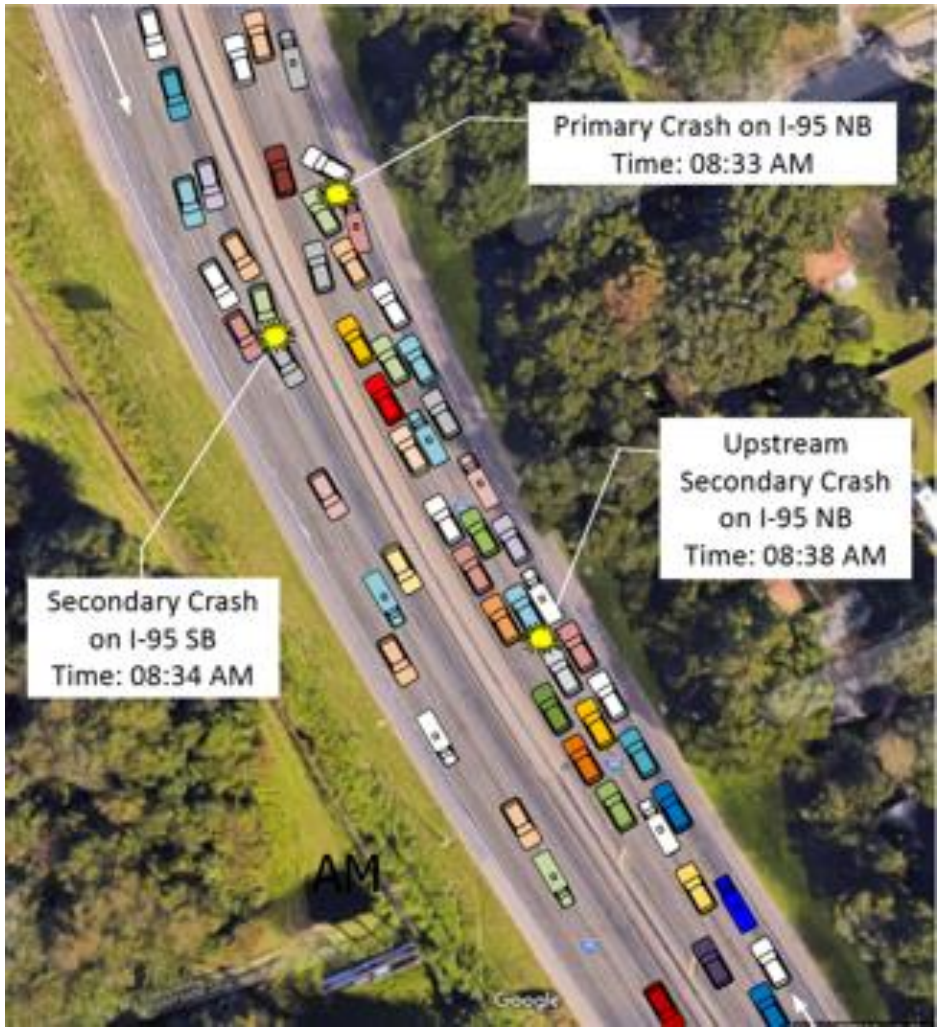
- Background
- Research Objective
- Data Sources
- Methodology
- Preliminary Findings
- Concluding Remarks

Secondary Crash

A traffic incident is considered a secondary crash if it occurred as a result of a prior incident.

Secondary crashes occur:

- At the scene of the primary incident
- Within the queue
  - Upstream of the primary incident
  - In the opposite direction of the primary incident due to driver distraction



Challenges with Identifying Secondary Crashes

- No specific definition of secondary crashes
- No consistent approach to identify secondary crashes
- Identification of secondary crashes is a function of several variables
  - Traffic flow parameters, i.e., speed, flow, density
  - Spatio-temporal relationship with the primary incident

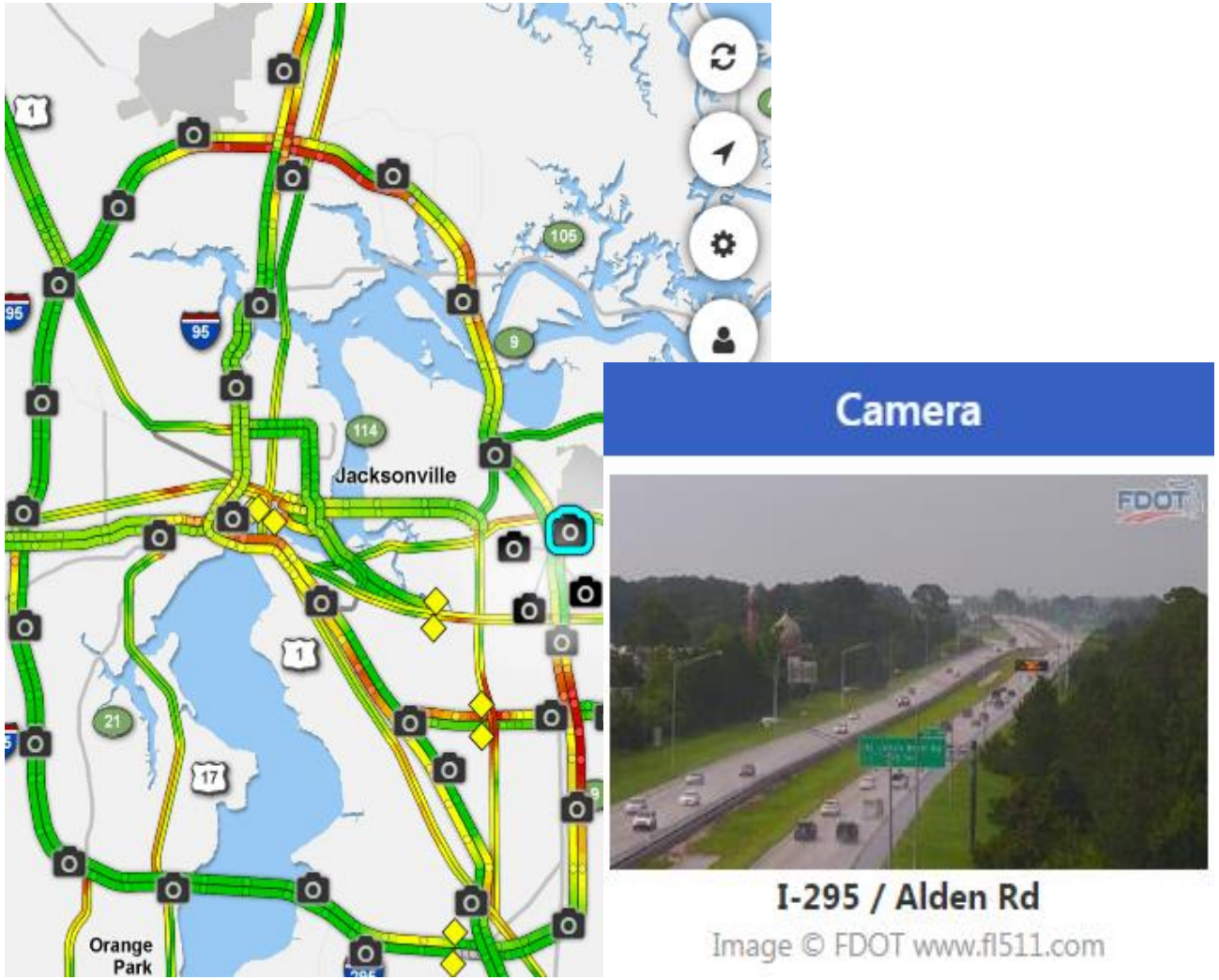
Manual Method

Identify secondary crashes:

- Onsite
- Offsite

Limitations

- Subjective
- Random
- Inconsistent
- Unreliable
- Inefficient

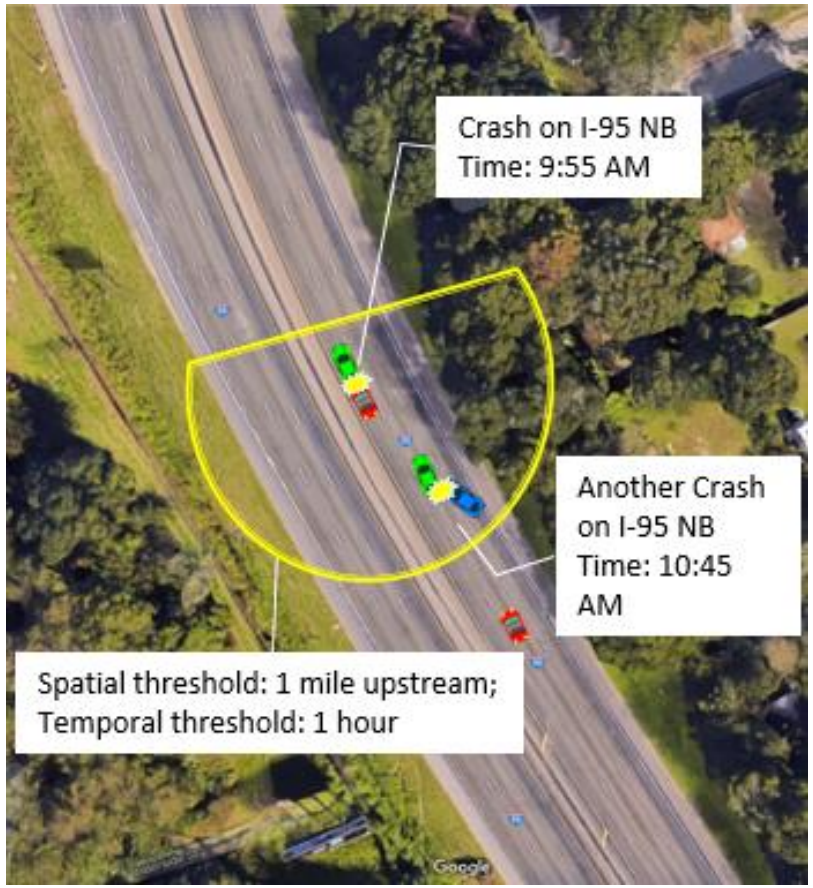


Static Method

Determine secondary crashes based on fixed spatio-temporal thresholds

Limitations

- Does not consider queue length
- Subjective assumptions on fixed spatio-temporal parameters.
- Incidents with incorrect/missing location information are excluded.
- Cannot capture incidents unreported in the database.

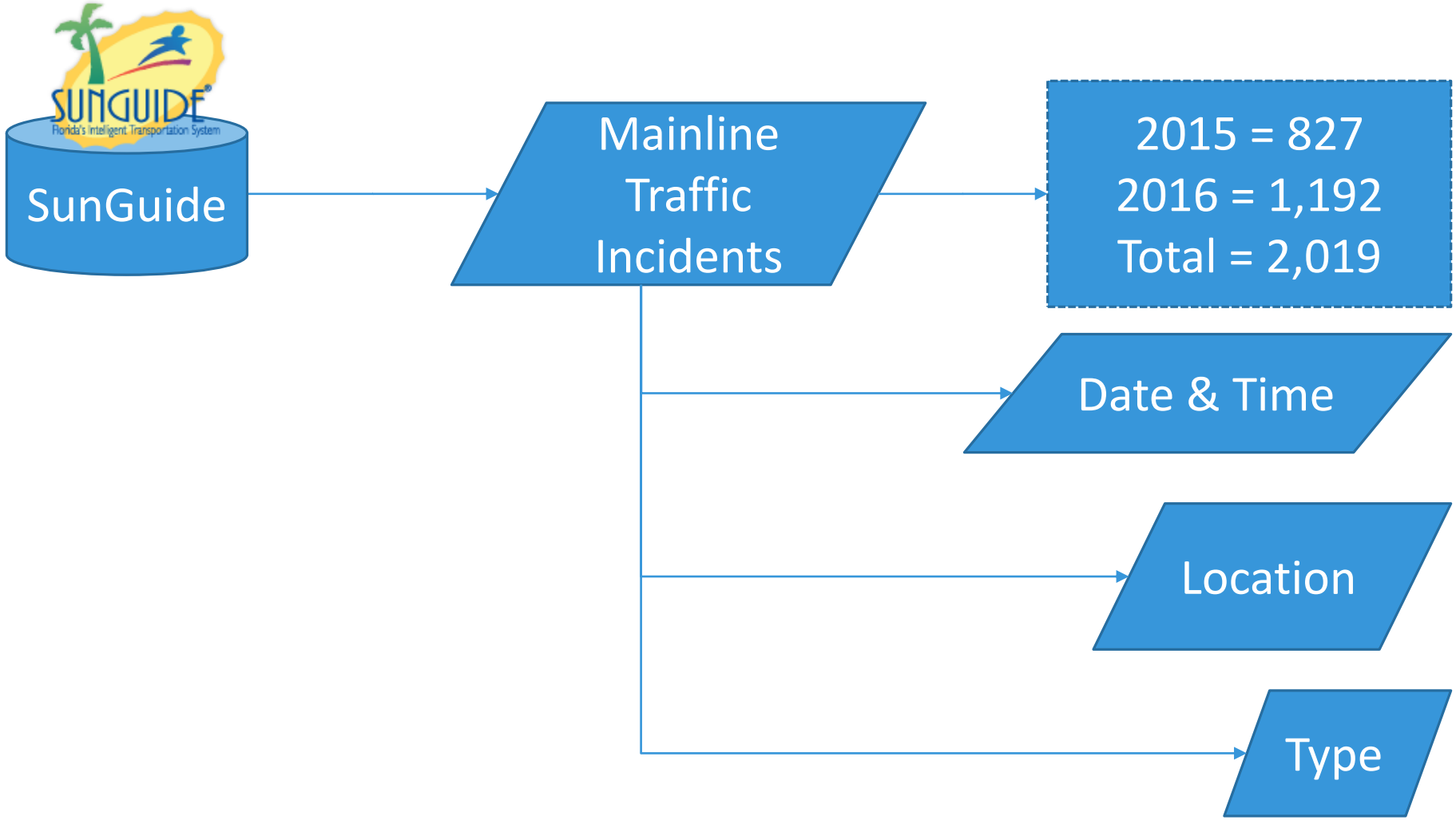


Research Objective and Study Location

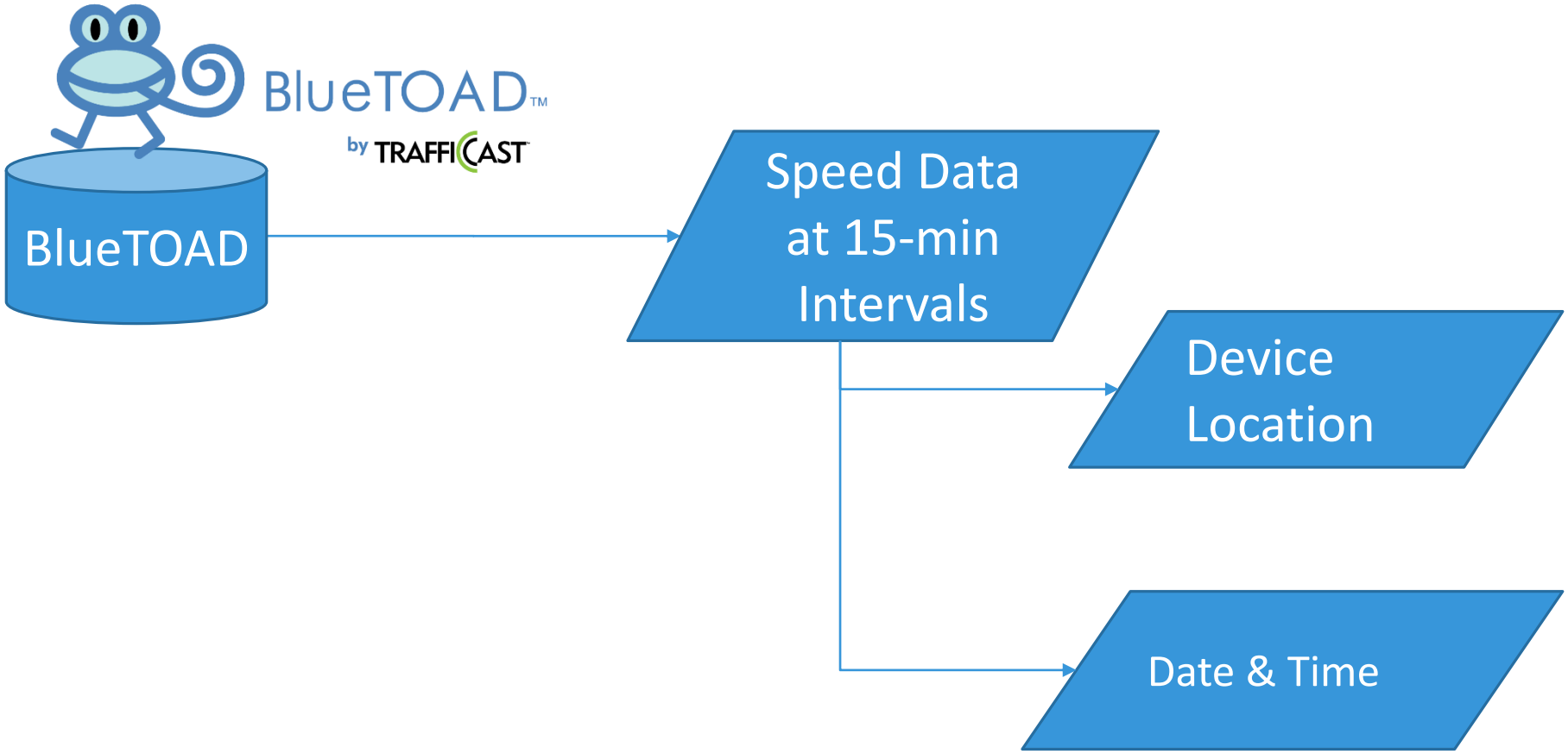
Objective: Explore the feasibility of using real-time traffic data to identify secondary crashes on freeways

- 25-mile section on I-95, Jacksonville
- 31 active BlueToad pairs (16 NB & 15 SB)
- Average spacing ~ 1.7 miles
- 55-70 mph speed limit

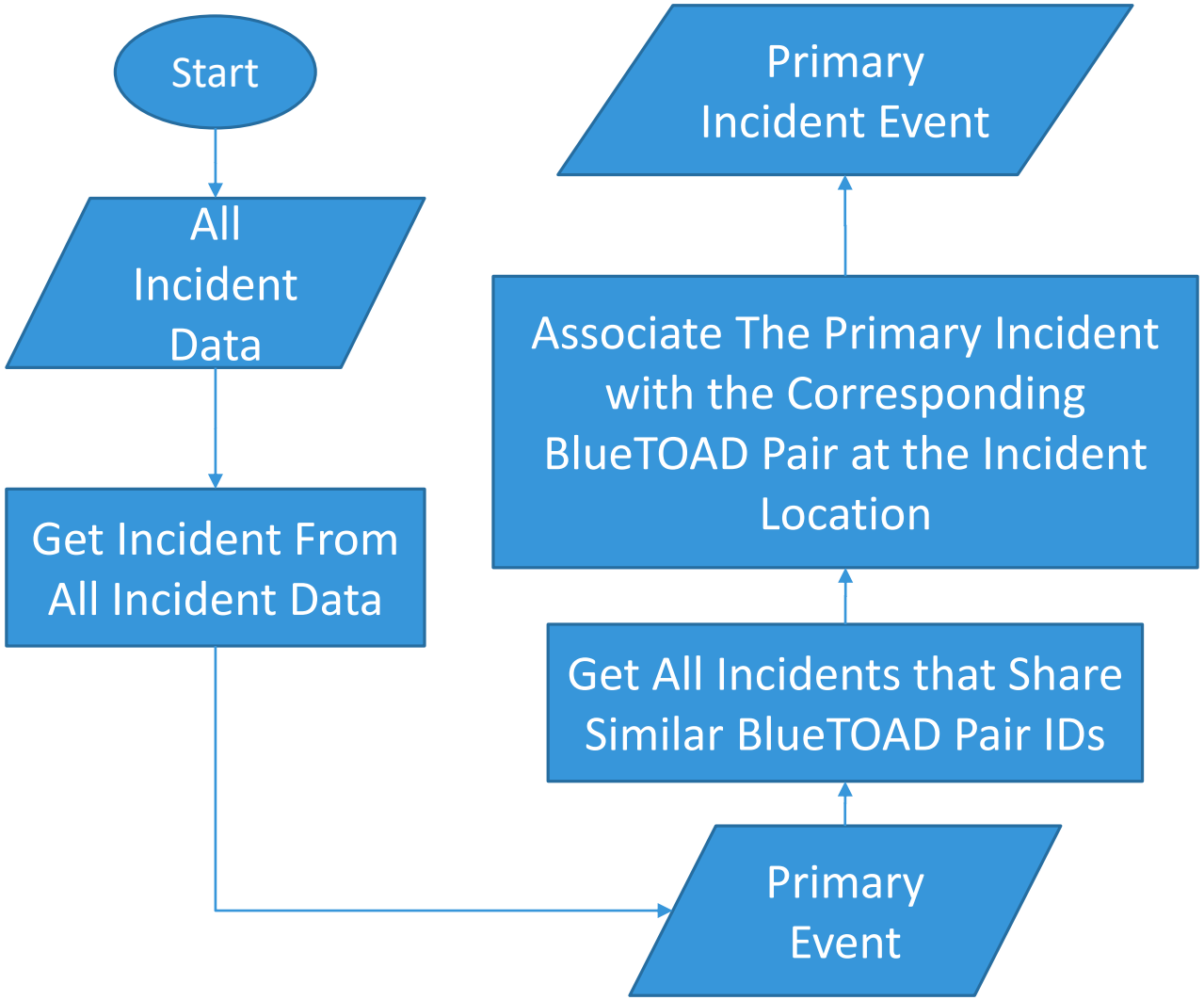
Data Source for Incidents

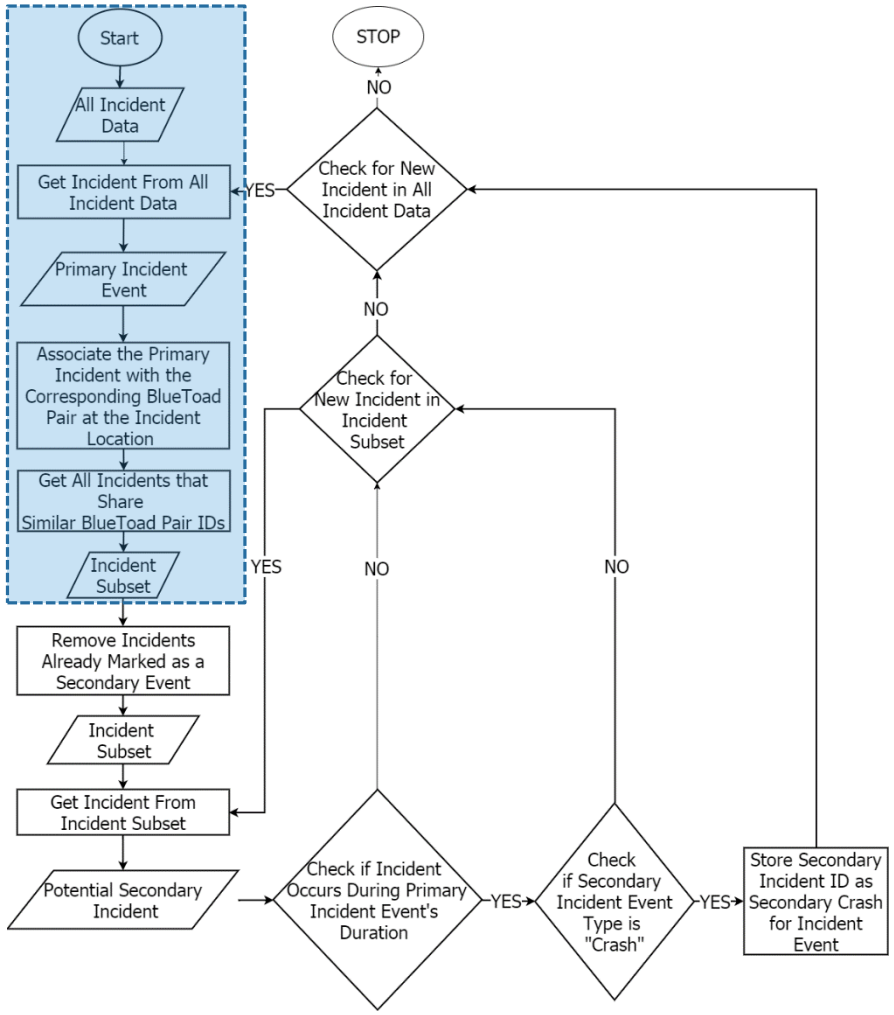


Data Source for Real-time Traffic Information

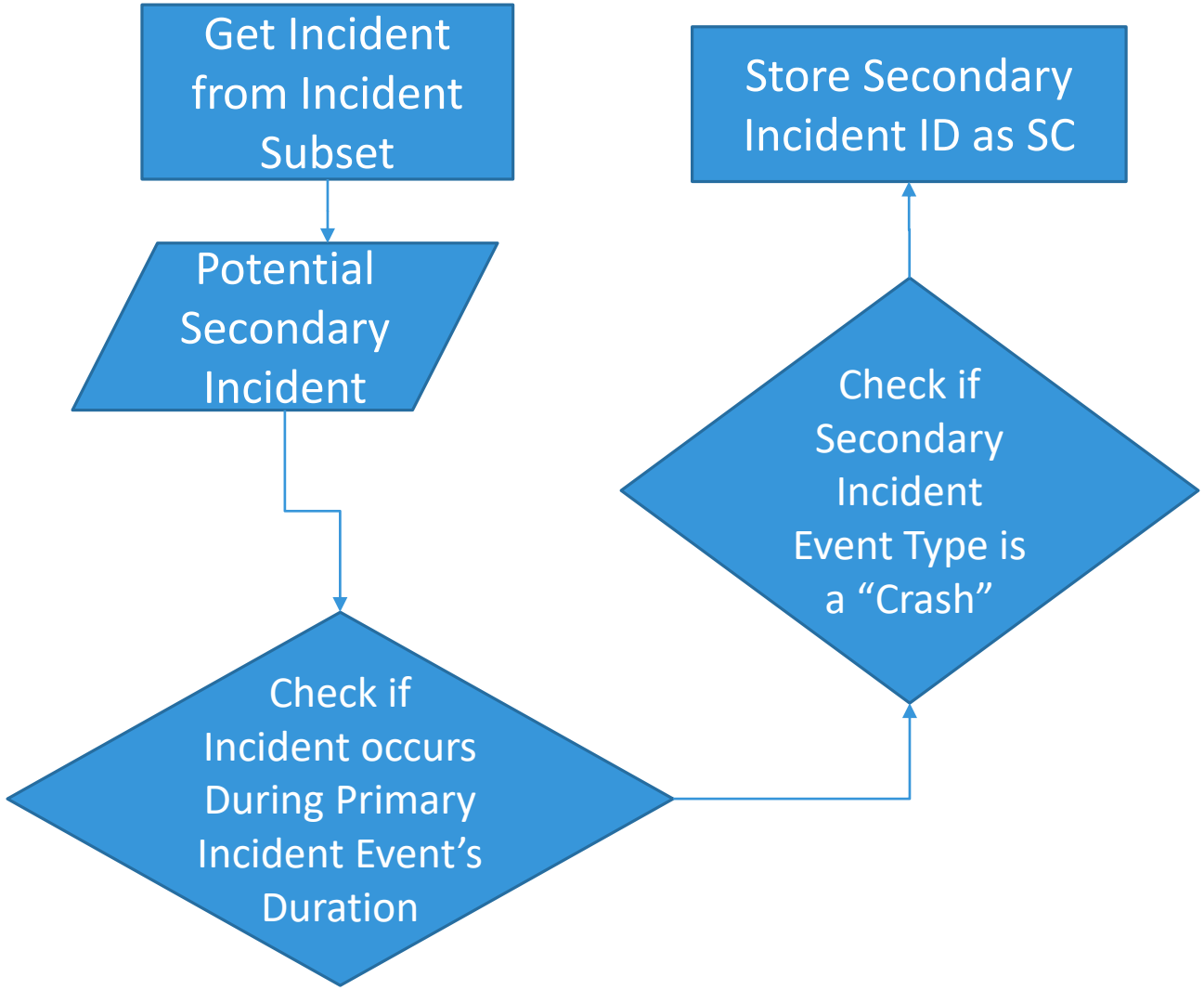


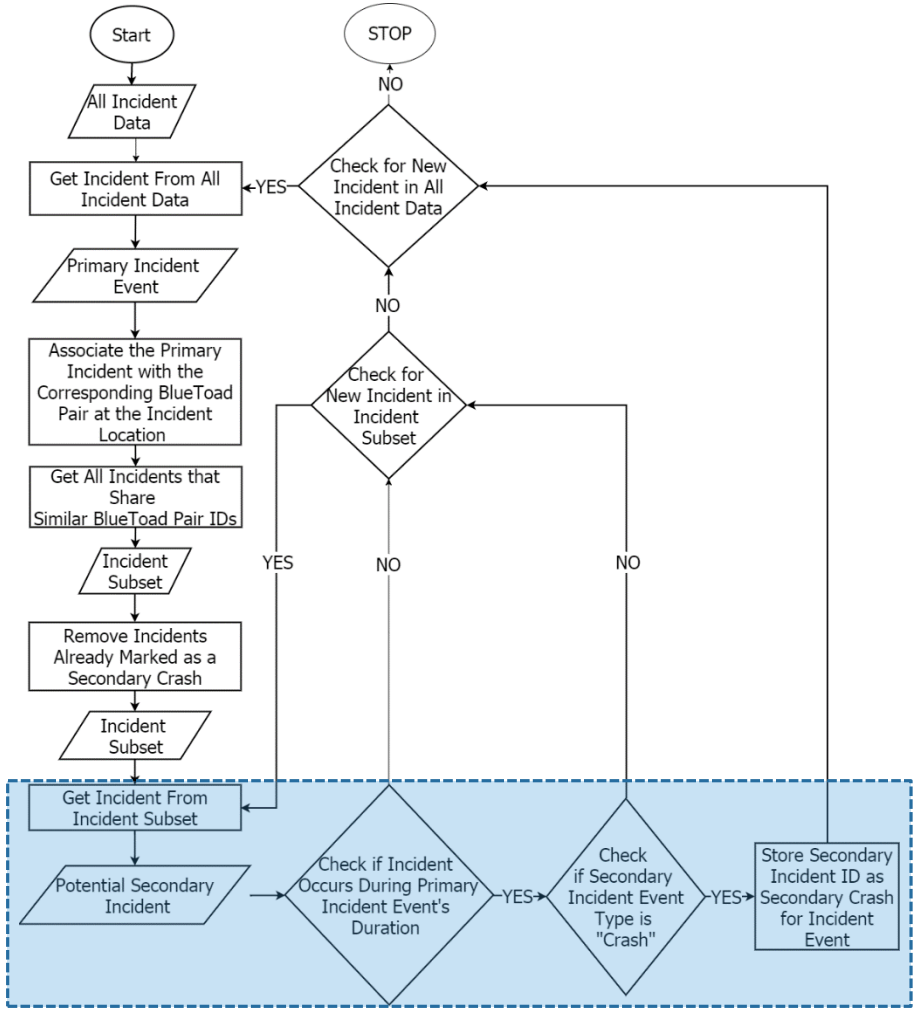
Step 1: Create Incident Subset





Step 2: Identify Secondary Crashes

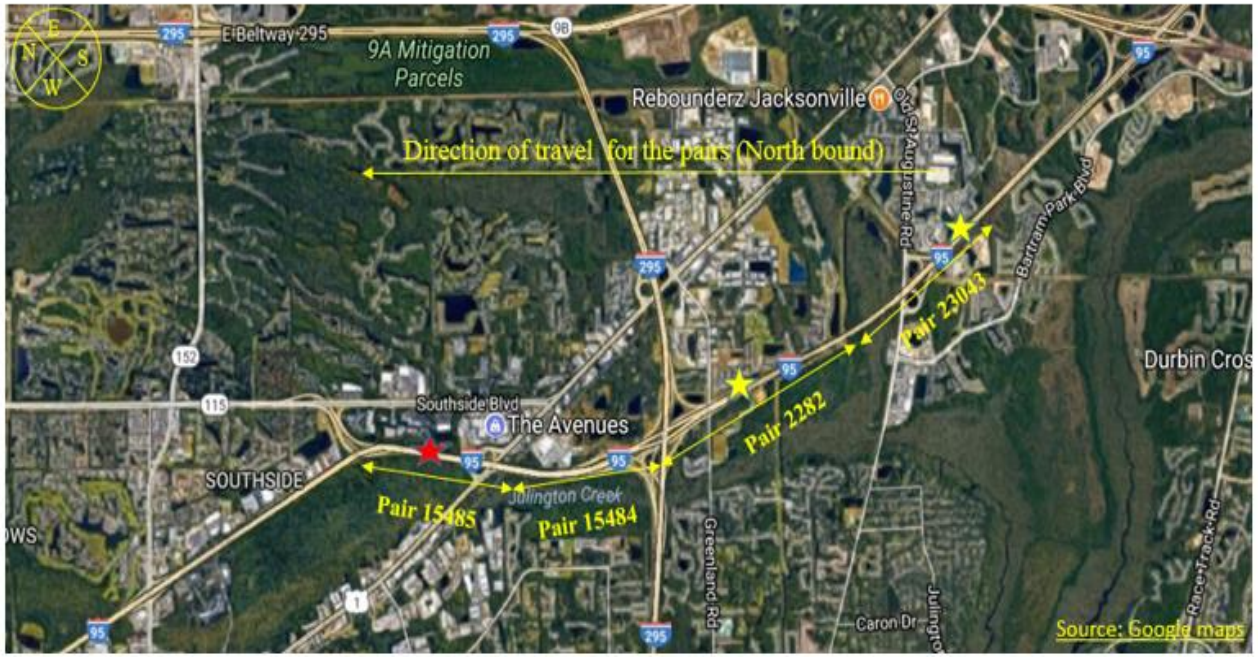




An Example

Time (hours)

Upstream Pair ID	1645	1700	1715	1730	1745	1800	1815	1830	1845	1900	1915	1930	1945	2000	2015	2030	2045
15485	4.5	4.1	2.81	0.68	-1.0	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
15484	2.4	4.3	2.82	0.90	-0.1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2282	12.3	29.7	31.2	17.9	6.1	12.8	9.8	6.9	8.5	7.6	10.7	4.8	-0.6	NA	NA	NA	NA
23043	16.9	38.7	33.6	33.6	11.5	13.4	7.6	3.4	3.5	4.8	10.9	4.8	4.7	5.6	5.18	5.09	6.92

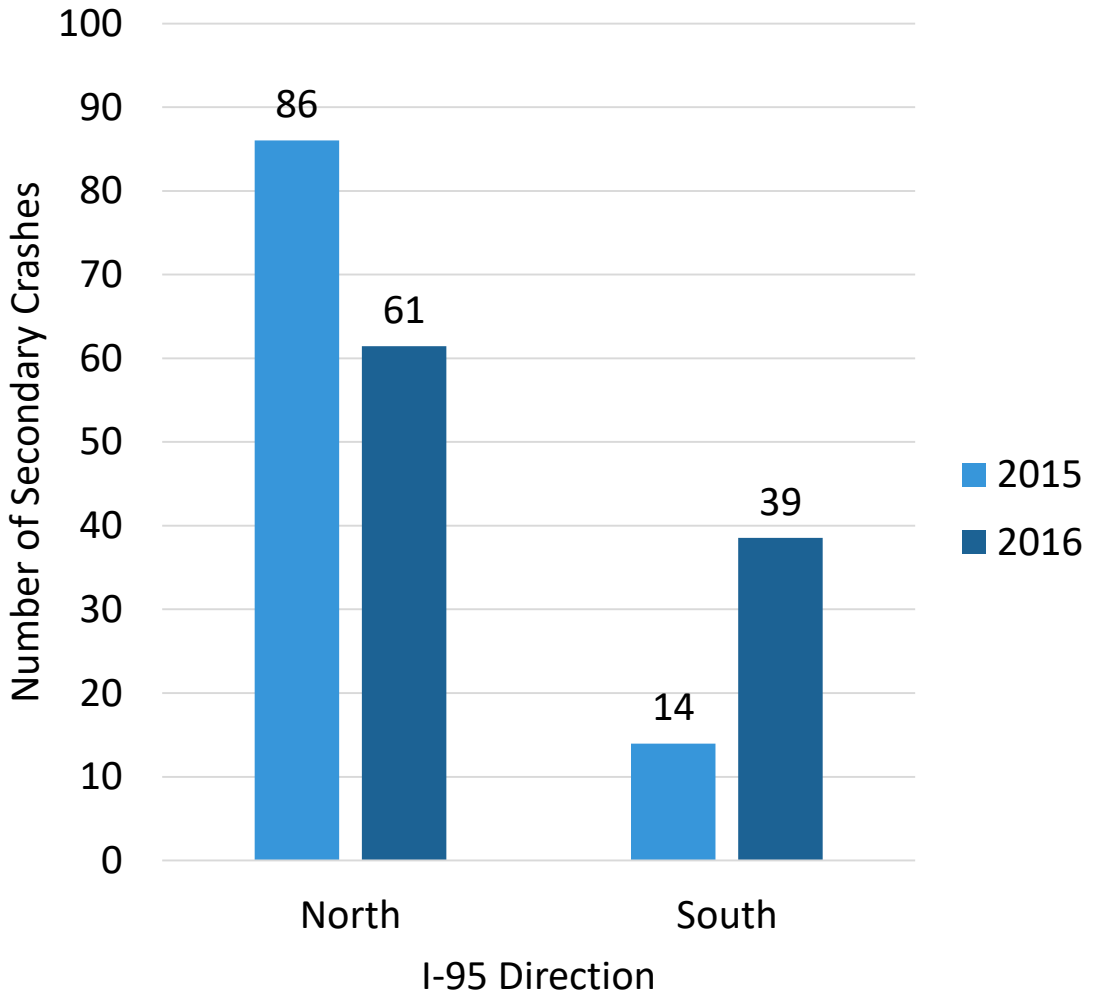


Legend

Symbol	
★	Primary incident
★	Secondary crash
Color	
■	Speeds below normal (mph)
□	Normal speeds (mph)

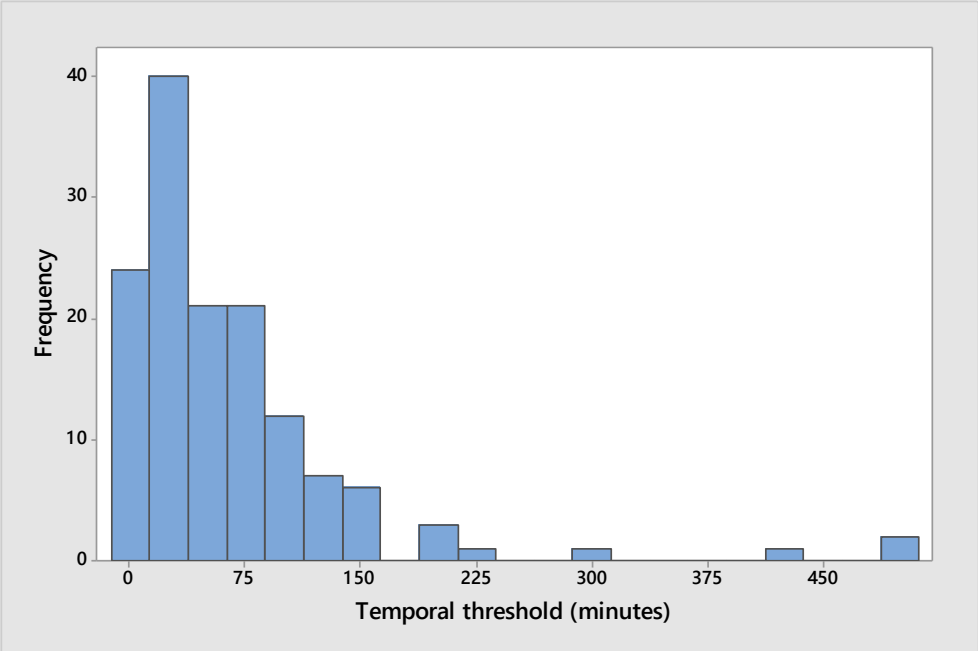
Preliminary Findings

- 2,019 traffic incidents were used to identify secondary crashes
- 8% of incidents that occurred along I-95, Jacksonville are secondary crashes
- 89% occurred in the upstream direction of the primary incident
- 11% occurred in the opposite direction



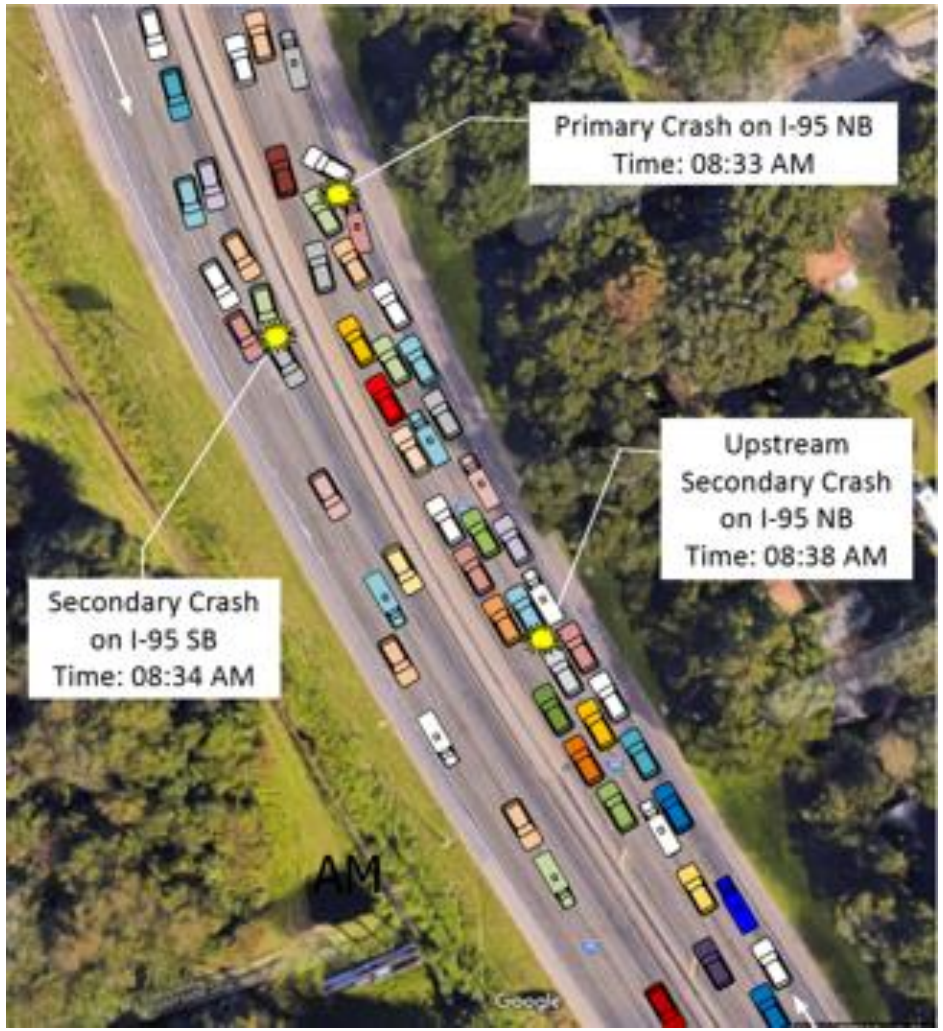
Temporal Thresholds & SCs Occurrence

Time (min)	Proportion (%)
<= 30	41
31-45	13
46-60	7
61-120	26
> 120	13

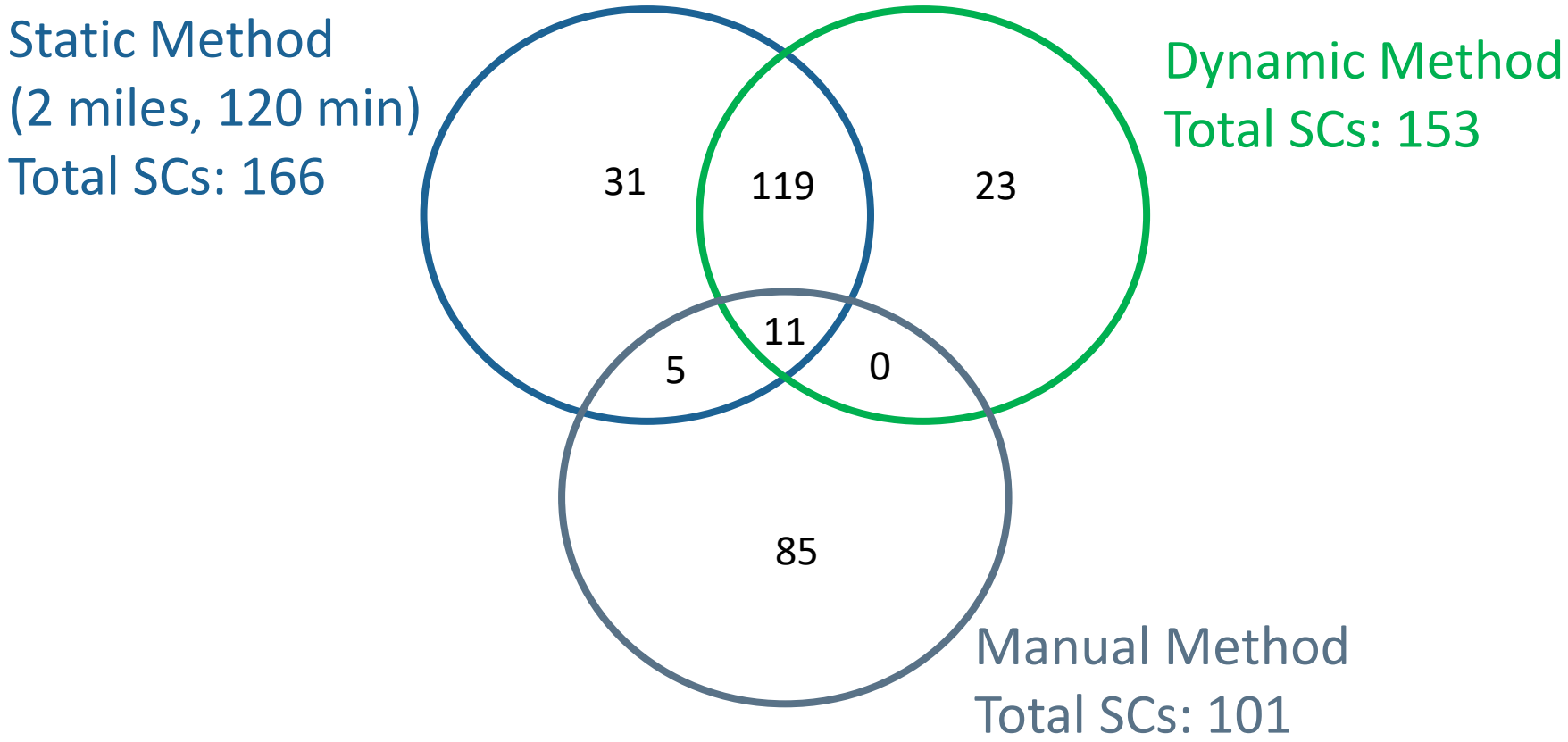


Limitations of Dynamic Method

- Resource intensive
- Data intensive
- Incidents with incorrect/missing location information are excluded
- Cannot capture incidents not reported in the database
- Not applicable to arterials



Static vs. Dynamic vs. Manual Methods



- Results for dynamic and static approach are comparable
- Manual method results differ from both the results of static & dynamic method

Concluding Remarks

- Proper identification of SCs is pivotal to accurate reporting of the effectiveness of the programs in reducing SCs.
- Manual method is unreliable and inefficient.
- Identifying SCs using static method with fixed spatio-temporal thresholds is not the most accurate approach.
- Dynamic method using real-time traffic information is recommended; however, it is resource intensive.
- A combination of static and dynamic approaches might be more feasible.

Thank You!

Angela Kitali
Florida International University
(904) 514-5980
akita002@fiu.edu

Priyanka Alluri, Ph.D., P.E.
Florida International University
(305) 348-3485
palluri@fiu.edu

Thobias Sando, Ph.D., P.E., P.T.O.E.,
University of North Florida
(904) 620-1142
t.sando@unf.edu