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

SunGuide

Mainline Traffic Incidents

Date & Time

Location

Type

2015 = 827
2016 = 1,192
Total = 2,019
Data Source for Real-time Traffic Information

BlueTOAD

Speed Data at 15-min Intervals

Device Location

Date & Time
Step 1: Create Incident Subset

Start

All Incident Data

Get Incident From All Incident Data

Get All Incidents that Share Similar BlueTOAD Pair IDs

Associate The Primary Incident with the Corresponding BlueTOAD Pair at the Incident Location

Primary Incident Event

Primary Event
Step 2: Identify Secondary Crashes

1. Get Incident from Incident Subset
2. Check if Incident occurs During Primary Incident Event’s Duration
3. Potential Secondary Incident
4. Check if Secondary Incident Event Type is a “Crash”
5. Store Secondary Incident ID as SC

Flowchart:
- Start
- Get Incident From All Incident Data
- Primary Incident Event
- Get All Incidents that Share Similar BlueToad Pair IDs
- Remove Incidents Already Marked as a Secondary Crash
- Incident Subset
- Check for New Incident in Incident Subset
- Check if New Incident in Incident Subset
- Check if New Incident Event Type is a “Crash”
- Store Secondary Incident ID as Secondary Crash for Incident Event
- STOP
An Example

<table>
<thead>
<tr>
<th>Traffic Pair ID</th>
<th>Time (hours)</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>1645</td>
</tr>
<tr>
<td>15A85</td>
<td>4.5</td>
</tr>
<tr>
<td>05A84</td>
<td>2.4</td>
</tr>
<tr>
<td>12A42</td>
<td>12.3</td>
</tr>
<tr>
<td>23043</td>
<td>16.9</td>
</tr>
</tbody>
</table>

Legend
- 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

<table>
<thead>
<tr>
<th>Time (min)</th>
<th>Proportion (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;= 30</td>
<td>41</td>
</tr>
<tr>
<td>31-45</td>
<td>13</td>
</tr>
<tr>
<td>46-60</td>
<td>7</td>
</tr>
<tr>
<td>61-120</td>
<td>26</td>
</tr>
<tr>
<td>&gt; 120</td>
<td>13</td>
</tr>
</tbody>
</table>

![Histogram of Temporal Thresholds]
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

- **Static Method**
  - (2 miles, 120 min)
  - Total SCs: 166

- **Dynamic Method**
  - Total SCs: 153

- **Manual Method**
  - Total SCs: 101

- 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!

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