Assessing Value of Waze Data for TIM Applications

Performance Measures

Planning

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Communications

Archive

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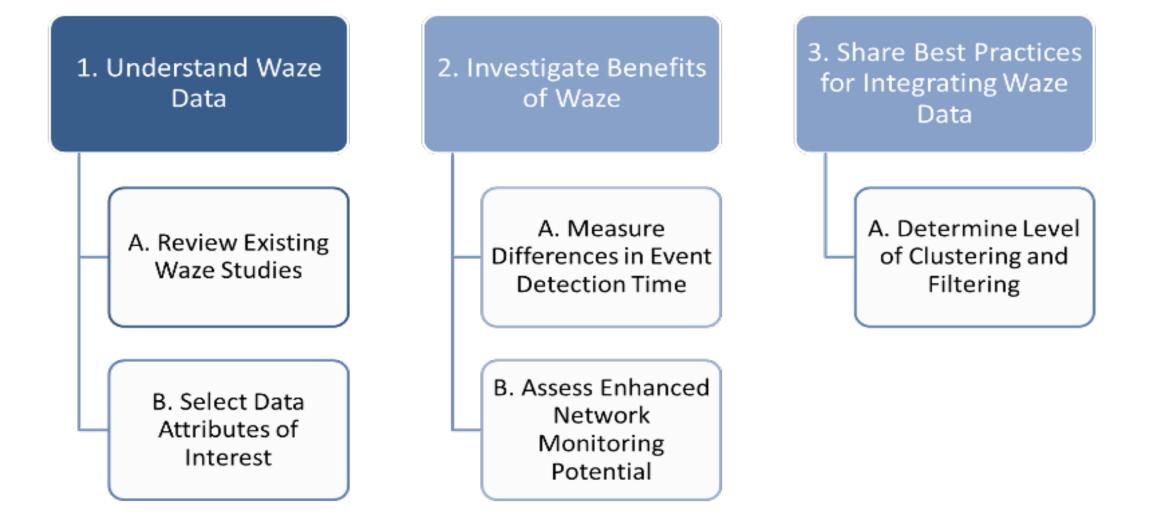
Agenda

- Motivation and Objectives
- Waze Data Background
- Waze Data Challenges
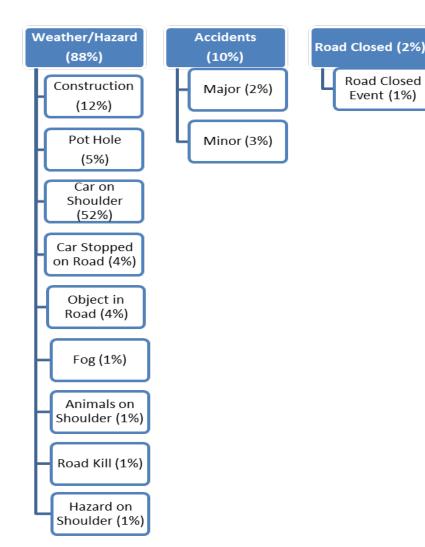- Waze Data Assessment
- Recommendations

Motivation

- Crowd-sourced data has potential to improve situational awareness
- Limited studies on utilizing this emerging data
  - Most DOTs filter out the following:
    - Police activities, cars stopped on shoulders, road closure reports and reports with reliability <5
  - Most DOTs consolidate duplicates – no specific rules discussed
  - Some states allow preference to reports done by DOT employees– helps establish immediate credibility of reports

Objectives

1. Understand Waze Data

- A. Review Existing Waze Studies
- B. Select Data Attributes of Interest

2. Investigate Benefits of Waze

- A. Measure Differences in Event Detection Time
- B. Assess Enhanced Network Monitoring Potential

3. Share Best Practices for Integrating Waze Data

- A. Determine Level of Clustering and Filtering

Waze Data Background

Weather/Hazard (88%)
- Construction (12%)
- Pot Hole (5%)
- Car on Shoulder (52%)
- Car Stopped on Road (4%)
- Object in Road (4%)
- Fog (1%)
- Animals on Shoulder (1%)
- Road Kill (1%)
- Hazard on Shoulder (1%)

Accidents (10%)
- Major (2%)
- Minor (3%)

Road Closed (2%)
- Road Closed Event (1%)

Waze Events by Road Type

Road Type	Value	Percent
Primary	~1,100,000	14%
Streets	~225,000	3%
Ramps	~475,000	6%
Freeways	~4,700,000	60%
Secondary	~600,000	8%
Primary Streets	~275,000	4%
Parking lot road	~0	0%
Private road	0	0%
4X4 Trails	0	0%
Ferry Crossing	0	0%

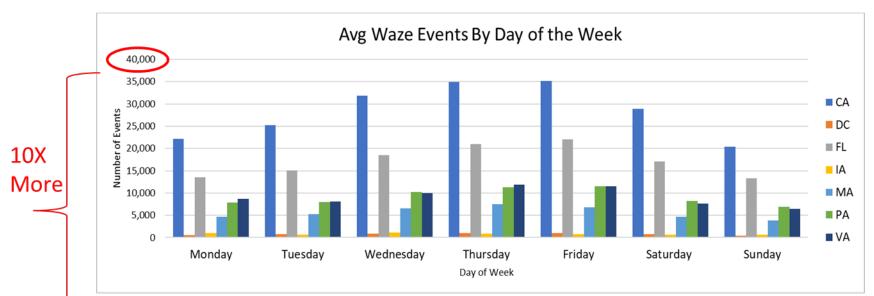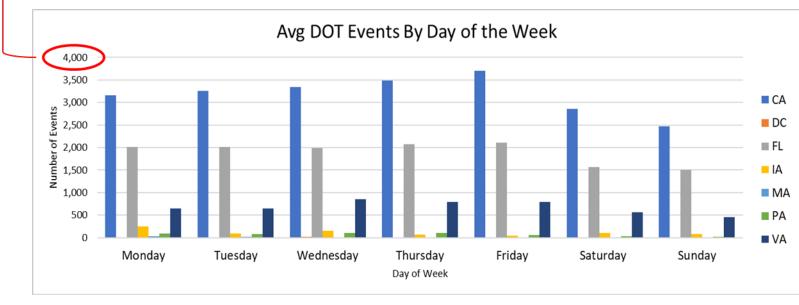**Note:**
- Waze data excludes jams event type
- 3 Month Period of 3/17 – 5/17 displayed

Waze Data Background

Avg Waze Events By Day of the Week

Avg DOT Events By Day of the Week

State	Avg Waze Events Per Day	Avg DOT Events Per Day
CA	28,389	3,184
DC	777	16
FL	17,210	1,895
IA	810	114
MA	5,613	14
PA	9,171	70
VA	9,168	681

Note:
- Waze data excludes jams event type
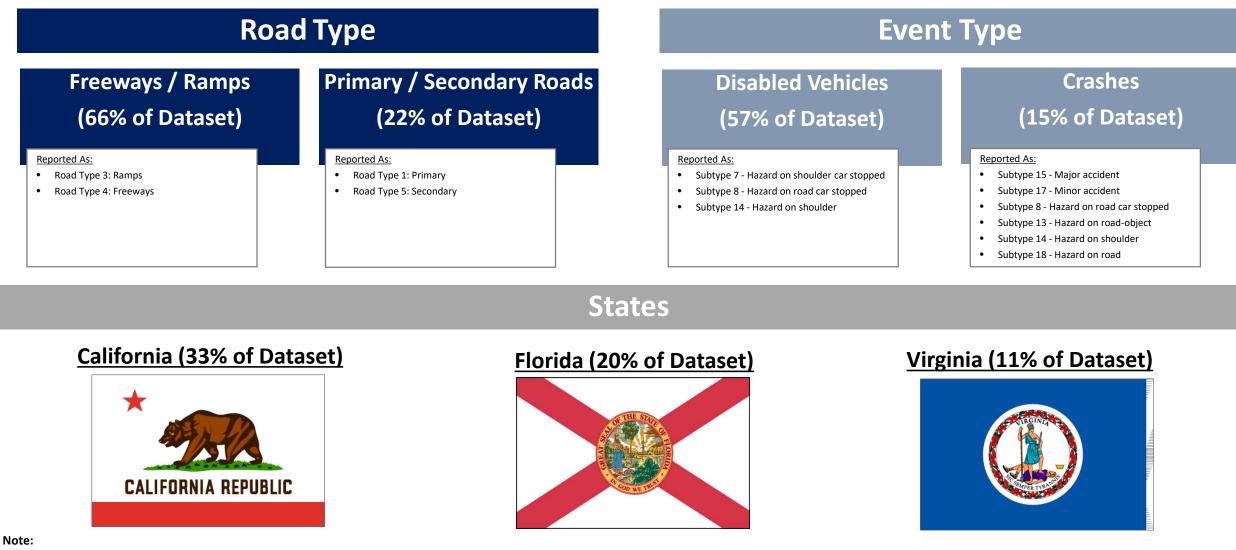- 3 Month Period of 3/17 – 5/17 displayed

Waze Data Challenges

- Data Size

State	Avg Waze Events Per Day	Avg DOT Events Per Day
CA	28,389	3,184
DC	777	16
FL	17,210	1,895
IA	810	114
MA	5,613	14
PA	9,171	70
VA	9,168	681

Table 1: Waze vs DOT Events Per Day (excluding jams)

- Data Quality:
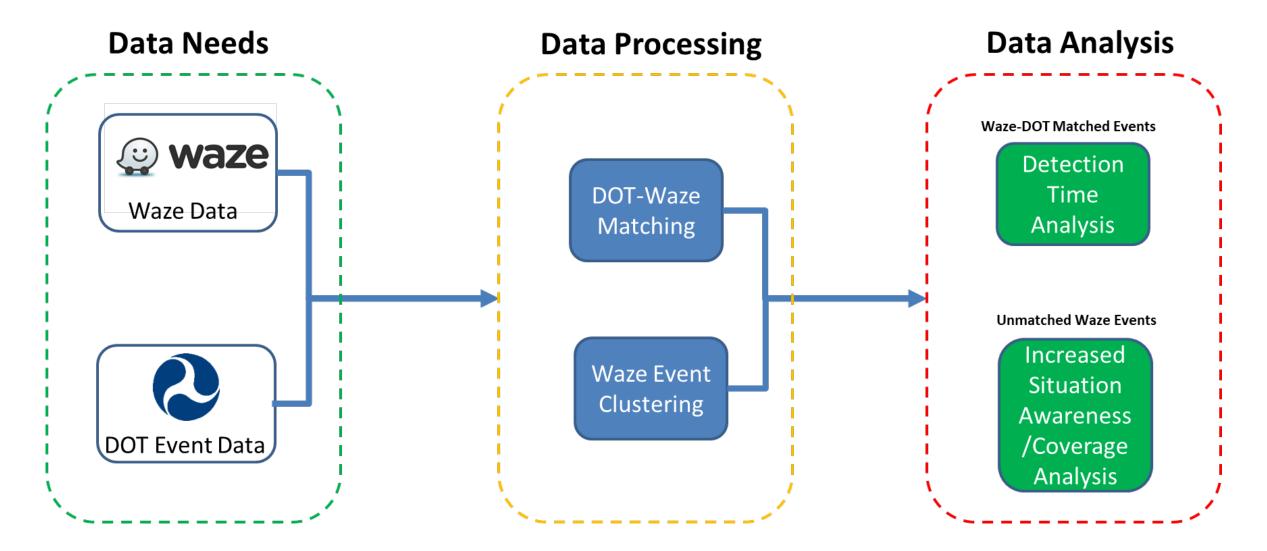 - Redundancy
  - Reliability

Waze Data Assessment: Data Focus

- <u>Two event types:</u> Crashes and disabled vehicle events.
- <u>Two road types:</u> Freeways/ramps and primary/secondary roads.

Road Type

Freeways / Ramps (66% of Dataset)

Reported As:
- Road Type 3: Ramps
- Road Type 4: Freeways

Primary / Secondary Roads (22% of Dataset)

Reported As:
- Road Type 1: Primary
- Road Type 5: Secondary

Event Type

Disabled Vehicles (57% of Dataset)

Reported As:
- Subtype 7 - Hazard on shoulder car stopped
- Subtype 8 - Hazard on road car stopped
- Subtype 14 - Hazard on shoulder

Crashes (15% of Dataset)

Reported As:
- Subtype 15 - Major accident
- Subtype 17 - Minor accident
- Subtype 8 - Hazard on road car stopped
- Subtype 13 - Hazard on road-object
- Subtype 14 - Hazard on shoulder
- Subtype 18 - Hazard on road

States

California (33% of Dataset)

Florida (20% of Dataset)

Virginia (11% of Dataset)

Note:
- Waze data excludes jams event type
- 3 Month Period of 3/17 – 5/17 displayed
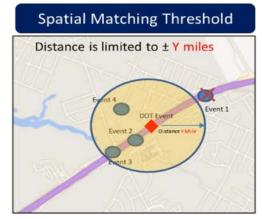- CA did not have disabled vehicle event data

Waze Data Assessment: Methodology

Waze Data Assessment: Methodology

Matched DOT events to Waze events	Clustered redundant Waze events
Step 1: Established initial search parameters	**Step 1:** Established initial search parameters
Step 2: Created rules to match DOT events to Waze events	**Step 2:** Created rules to cluster Waze events
Step 3: Analyzed matching distributions to refine thresholds	**Step 3:** Analyzed clustering distributions to refine thresholds

Temporal Matching Threshold

Time is limited ± X minutes

Event 4
Event 1
DOT Event
Event 2
Event 3

Identified 4 Waze events within ± X minutes of the DOT event

Spatial Matching Threshold

Distance is limited to ± Y miles

Event 4
Event 1
DOT Event
Event 2
Distance Y Mile
Event 3

Determined that 3 of the Waze events were within ± Y miles of the DOT event

Road Matching Rules

Apply Final Road Matching Criteria

Event 4
Incorrect Road
DOT Event
Event 2
Event 3
Incorrect Direction

Determined that 1 of the Waze events was on the correct road and direction of travel

Analysis Scenario	Matching Refined Thresholds		Clustering Refined Thresholds	
	X (Minutes)	Y (Miles)	X (Minutes)	Y (Miles)
Freeway/Ramps Crashes	10	0.37	10	0.37
Freeway/Ramps DV	30	0.44	15	0.44
Primary/Secondary Crashes	10	0.19	10	0.19
Primary/Secondary DV	30	0.37	10	0.37

Waze Data Assessment: Matching Results

Crash Results on Freeways/Ramps

State	% DOT Matched to Waze (# of crashes)	% Waze Matched to DOT (# of crashes)	Unmatched Waze Crash Events
VA	55.7% (3,333)	7.6% (4,825)	58,883
FL	45.7% (8,341)	9.5% (17,612)	168,534
CA	37.9% (51,546)	21.8% (73,382)	263,199

Type of Event	Total Number of DOT Events During This Period	Total Number of Waze Events During this Period	Percentage of Events that were Reported By Waze First	Average Time that a Waze Event was Reported Before a DOT Event
VA Crashes	5,989	63,708	57.6%	3 Minutes Earlier
FL Crashes	18,242	186,146	80.4%	3 Minutes Earlier
CA Crashes	*135,865	336,581	39.1%	4 Minutes Earlier

Waze Data Assessment: Clustering Results

Crash Results on Freeways/Ramps

Type of Event	Total Number of Waze Events During this Period	Total Number of Waze Events During this Period After Clustering	Percent Reduction in Events Due to Clustering	Percent Reduction Attributable to Duplication in DOT Sharing Data with Waze	Percent Reduction in Events Due to Clustering (including adjustments)
VA Crashes	63,708	58,224	8.6%	0.8%	7.8%
FL Crashes	186,146	155,231	16.6%	7.4%	9.2%
CA Crashes	336,581	269,861	19.8%	7.8%	12.0%

- <u>VA</u>: 53,819 additional unique events in 3 months / 585 additional unique events per day
- <u>FL</u>: 140,557 additional unique events in 3 months / 1,528 additional unique events per day
- <u>CA</u>: 211,085 additional unique events in 3 months / 2,294 additional unique events per day

The additional unique Waze events are events that have been clustered and were not matched to DOT events.

Analysis Summary: Matching & Detection Time

Type of Event	Matching	
	% DOT Matched to Waze	Average Time that a Waze Event was Reported Before a DOT Event
Freeways/Ramps Crashes	40%	3 Minutes
Primary/Secondary Crashes	12%	3 Minutes
Freeways/Ramps Disabled Vehicles	37%	14 Minutes
Primary/Secondary Disabled Vehicles	4%	16 Minutes

Analysis Summary: Enhanced Network Monitoring

	Existing VDOT Crash / Disabled Vehicle Events	Additional Unique VA Waze Crash / Disabled Vehicle Events	Existing FDOT Crash / Disabled Vehicle Events	Additional Unique FL Waze Crash / Disabled Vehicle Events	Existing CALTRANS Crash Events	Additional Unique CA Waze Crash Events
3-month Period Number of Events						
Freeways/Ramps	16,330	400,087	37,552	860,966	135,865	211,085
Primary/Secondary	4,048	129,390	-	254,167		108,701
Combined Total	**20,378**	**529,477**	**37,552**	**1,115,133**	**135,865**	**319,786**
Daily Number of Events						
Freeways/Ramps	178	4,349	408	9,358	1,477	2,294
Primary/Secondary	44	1,406	-	2,763		1,182
Combined Total	**222**	**5,755**	**408**	**12,121**	**1,477**	**3,476**

Thank you!

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