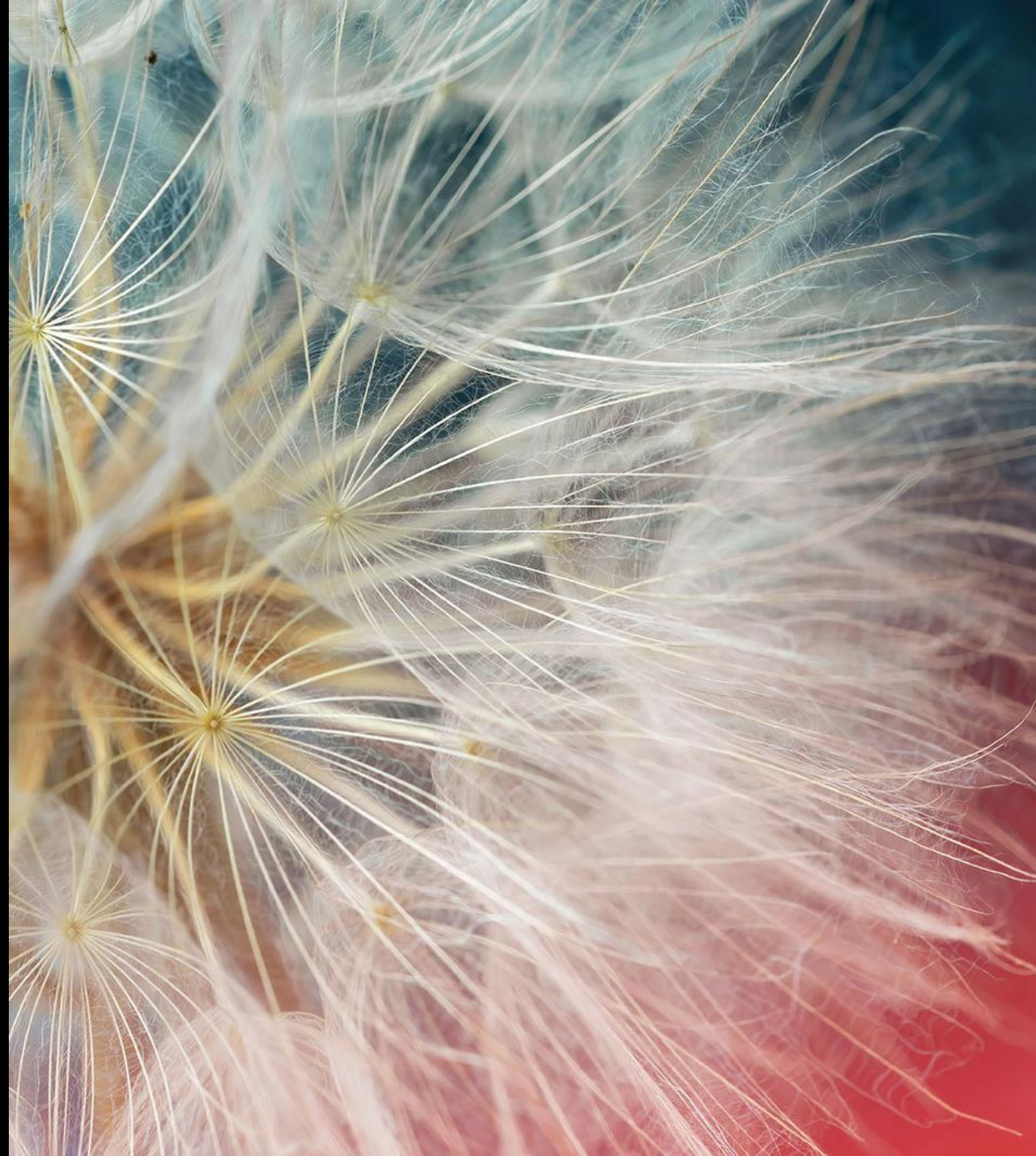
# INNOVATIVE SAFETY ASSESSMENT

**JOLIE TRAN, LING CHEN, MENGQING WANG**

ITE Western District Meeting | June 2026



# Presenter

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Traffic Operation/Planning/Safety

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Data Scientist

Planning/Safety/Data

**Ling Chen**

Data Scientist

Planning/Safety/Data

# How Technology Could Enhance Safety Analysis

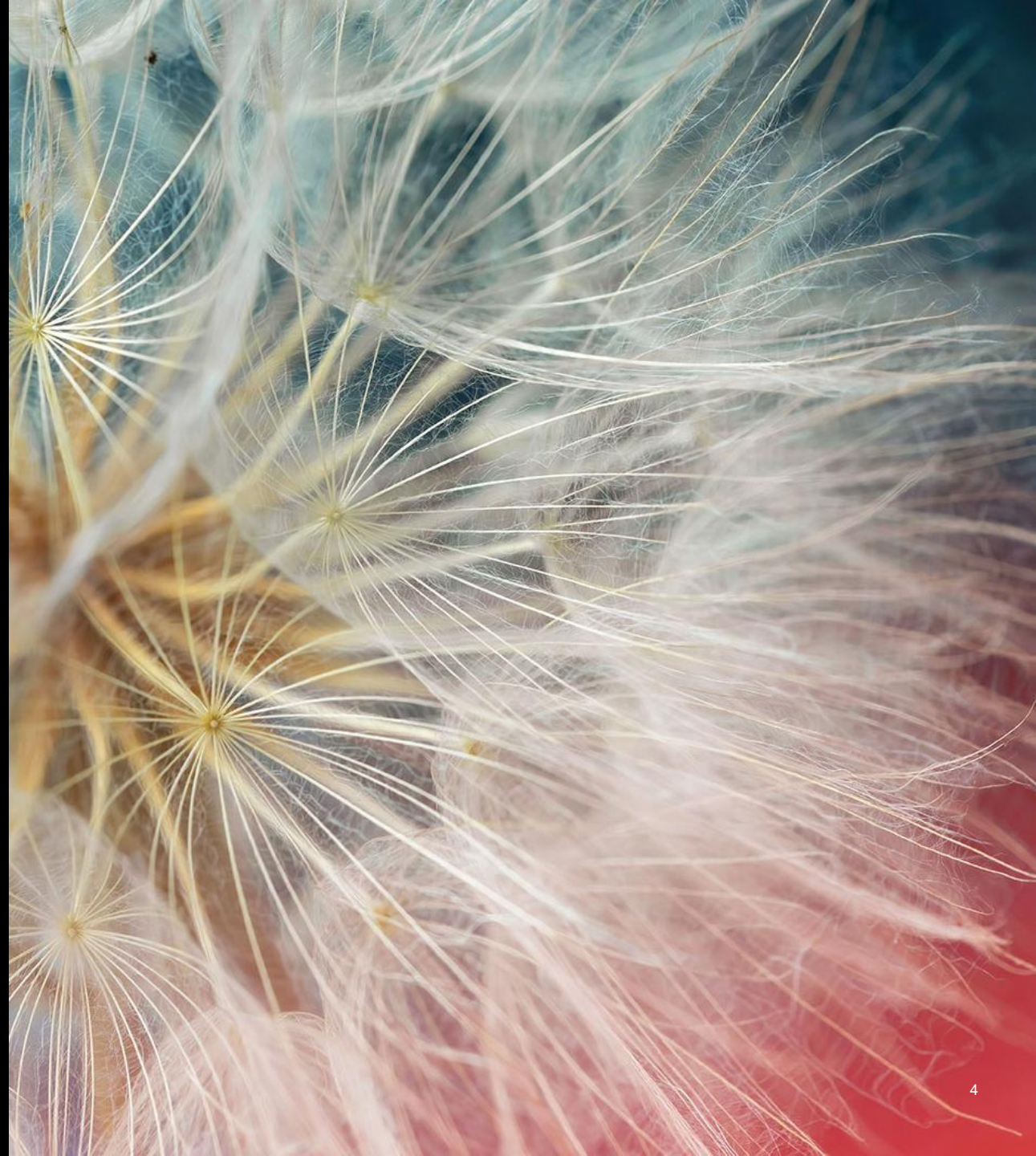
PUBLIC CONCERN FEEDBACK

NEAR MISS DATA

SAFETY DASHBOARD

DATA-DRIVEN ANALYSIS

# PUBLIC CONCERN FEEDBACK



# Public Feedback

Design Workshops & Charrettes

On-street Demonstrations/Pilots

Interviews & Focus Groups

Community Meetings & Open House

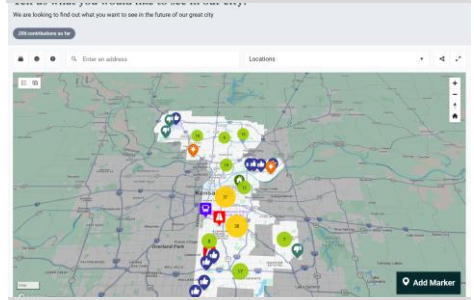
Community Advisory Committees


Project Information Websites

Pop-up Community Events Outreach

Media Monitoring & Engagement

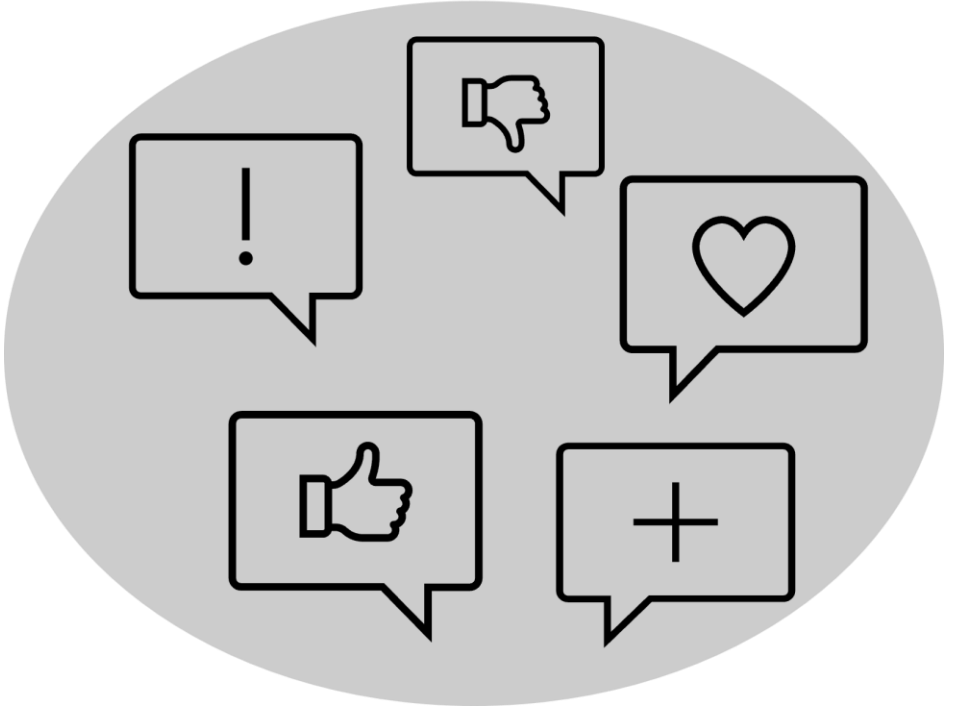
Formal Public Comment Periods




Interactive Map Pinning & Surveys

# Strengthening Public Feedback with Technology

- **What** people said
- **How** opinions evolved
- **Where** issues occurred geographically
- **How** feedback influenced decisions



**Use AI Tools to Categorize and Cluster**

**Coherent, Evidence-based Narrative**

# **From Scattered Feedback to an Insightful Narrative:** An AI-Integrated Pipeline

1. Collect feedback into Single Database
2. Use AI to Categorize and Cluster Feedback
3. Organize Feedback Chronologically
4. Geographic Storytelling Through Maps
5. Detect Stakeholder Perspectives
6. Track Public Reactions Over Time
7. Monitor Media and Social Discussions
8. Generate Summaries
9. Connect Feedback to Project Decision
10. Interactive Story Dashboard

# Example of Public Feedback Collection: Online Surveys

## Purposes

- Capture real-world safety concerns
- Enable proactive safety planning

## Innovative Safety Analysis

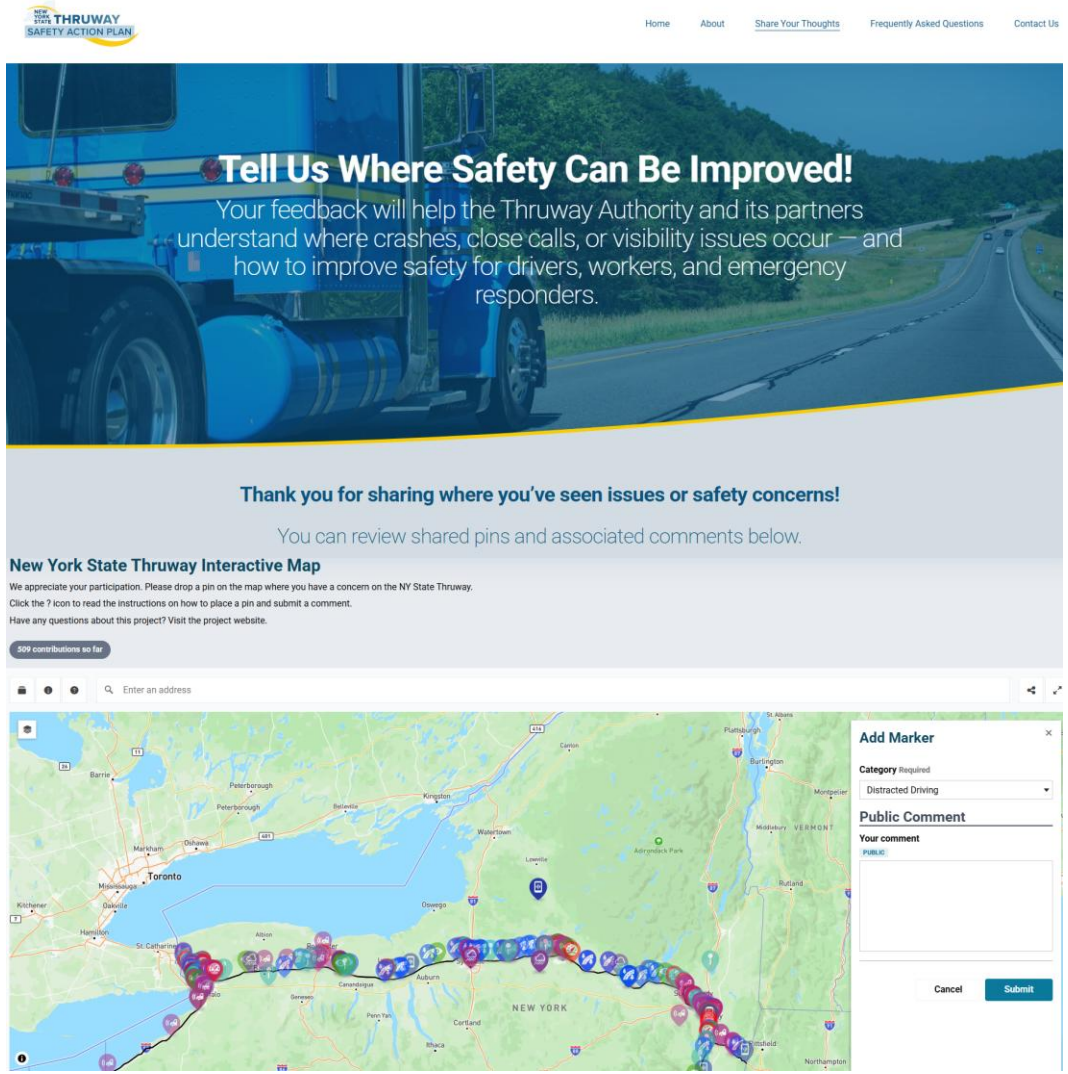
- Integrates perception-based data
- Supports predictive safety insights

## Why It Matters

- Crash data is reactive
- Early signals help prevent severe incidents

## Use Cases

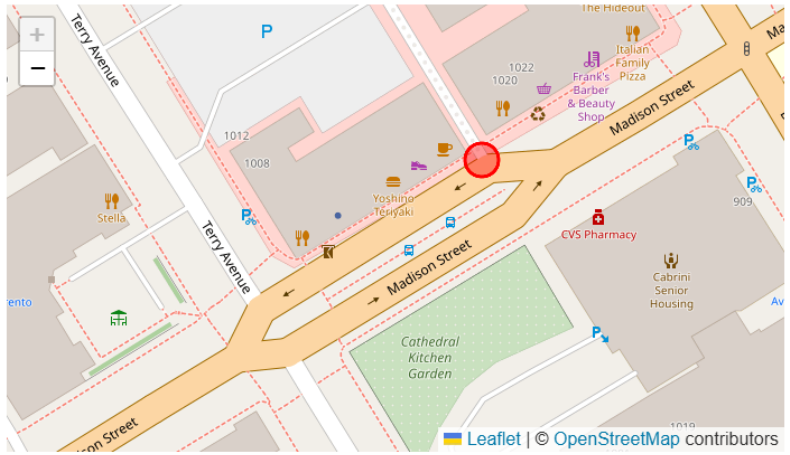
- Identify emerging risk locations
- Prioritize safety investments




***Source***: *Share Your Thoughts | Enhance Road Safety — Share Feedback Now — NYSTA Comprehensive Safety Action Plan*

# Example of Public Feedback Collection: Proposed Features for Online Surveys

## Location Info




Selected: 47.609160, -122.325760

Look up street

Location (lat, lon)

47.609160, -122.325760

Street

Madison Street

Location Type

Midblock

Zone Type

Transit stop

## Concern Info

### Concern 1

Concern Type

Near miss or safety concern

What happened?

Failure to yield

Additional details

Add another concern

Back

Next

## Contextual Info

Who is affected?

Choose options

Time of Day Affected

| AM peak | Midday | PM peak | Night | Varies |
|---|---|---|---|---|

Day(s) Affected

| Weekdays | Weekends | All days | Specific day |
|---|---|---|---|

How often does this occur?

| Once | Occasionally | Daily | Multiple times per day |
|---|---|---|---|

How severe do you think this issue was?

| Not at all | Minor Issue | Severe Issue | N/A |
|---|---|---|---|

How urgent does this issue need to be addressed?

| Not at all | Mildly Urgent | Very Urgent | N/A |
|---|---|---|---|

Please fix the following:

- At least one affected mode is required
- Time of day is required
- Day(s) affected is required
- Frequency is required
- Severity is required
- Urgency is required

Back

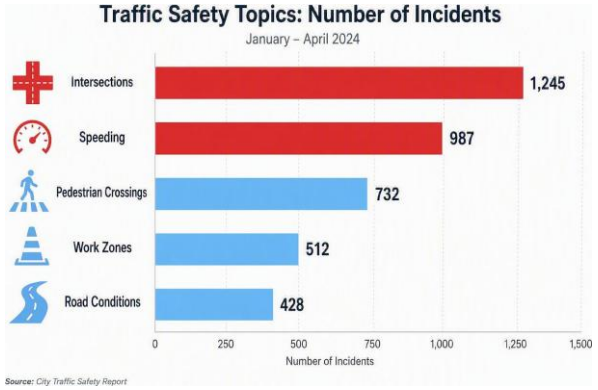
Submit

**Note:** Data shown in this slide is fictitious and intended solely for demonstration purposes.

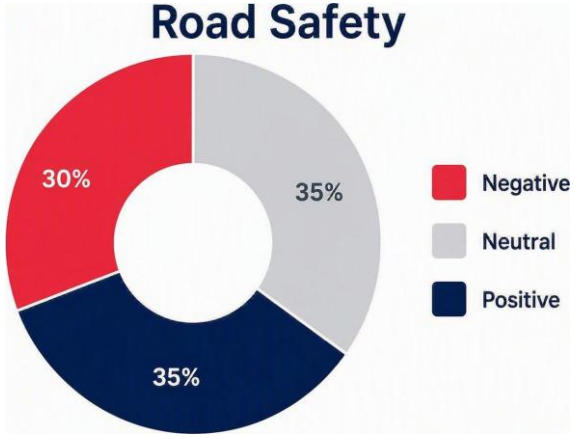
# **Example Application of AI**: Public Concern Feedback Collection and Classification

- Frequency-Based Safety Keyword Detection

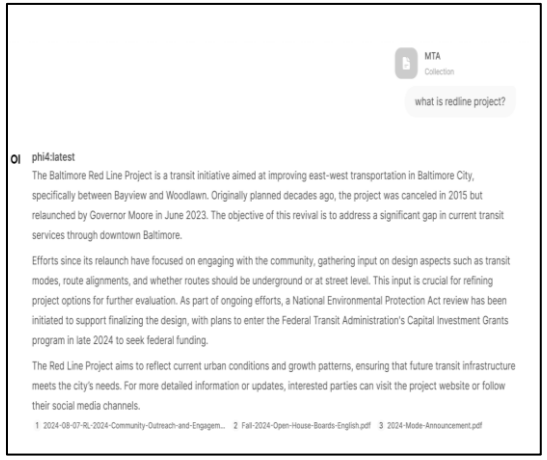

- Safety Topic Classification & Modeling




- Road Safety Sentiment Analysis




- Local LLM Enabled Interaction




**Note:** Data shown in this slide is fictitious and intended solely for demonstration purposes.

# Public Concern Dashboard

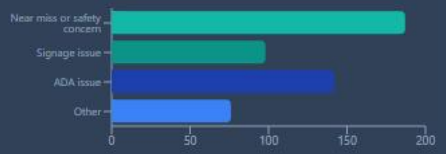
## Location Info

### Location Type


### Zone Type

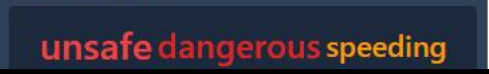

## Concern Info

### Concern Type



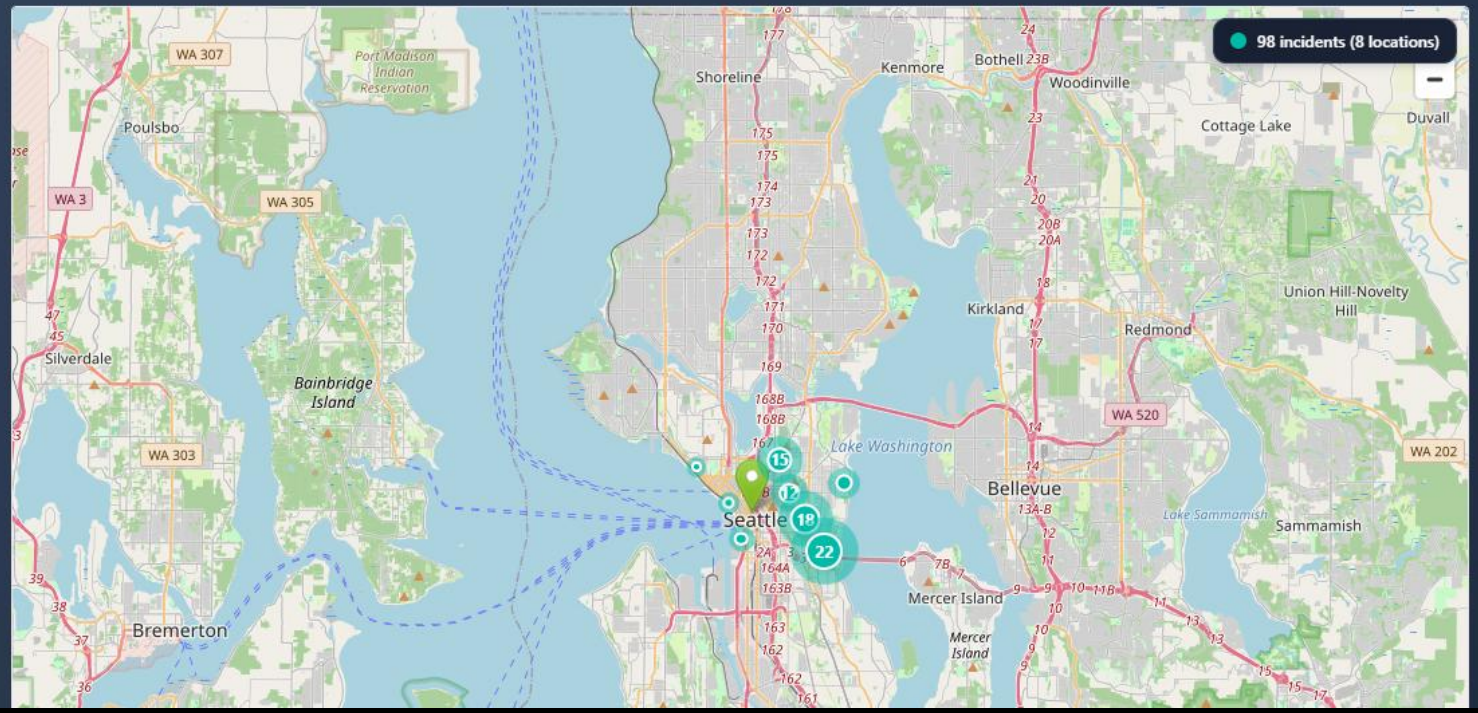

### What Happened?


### Sentiment Analysis




## Total Incidents/Complaints by Time in 2025

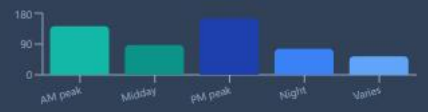

## Incident Locations



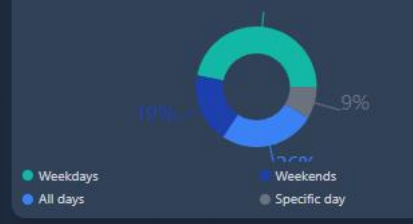

## Contextual Info

### Who is affected?


### Time of Day Affected




### Day(s) Affected



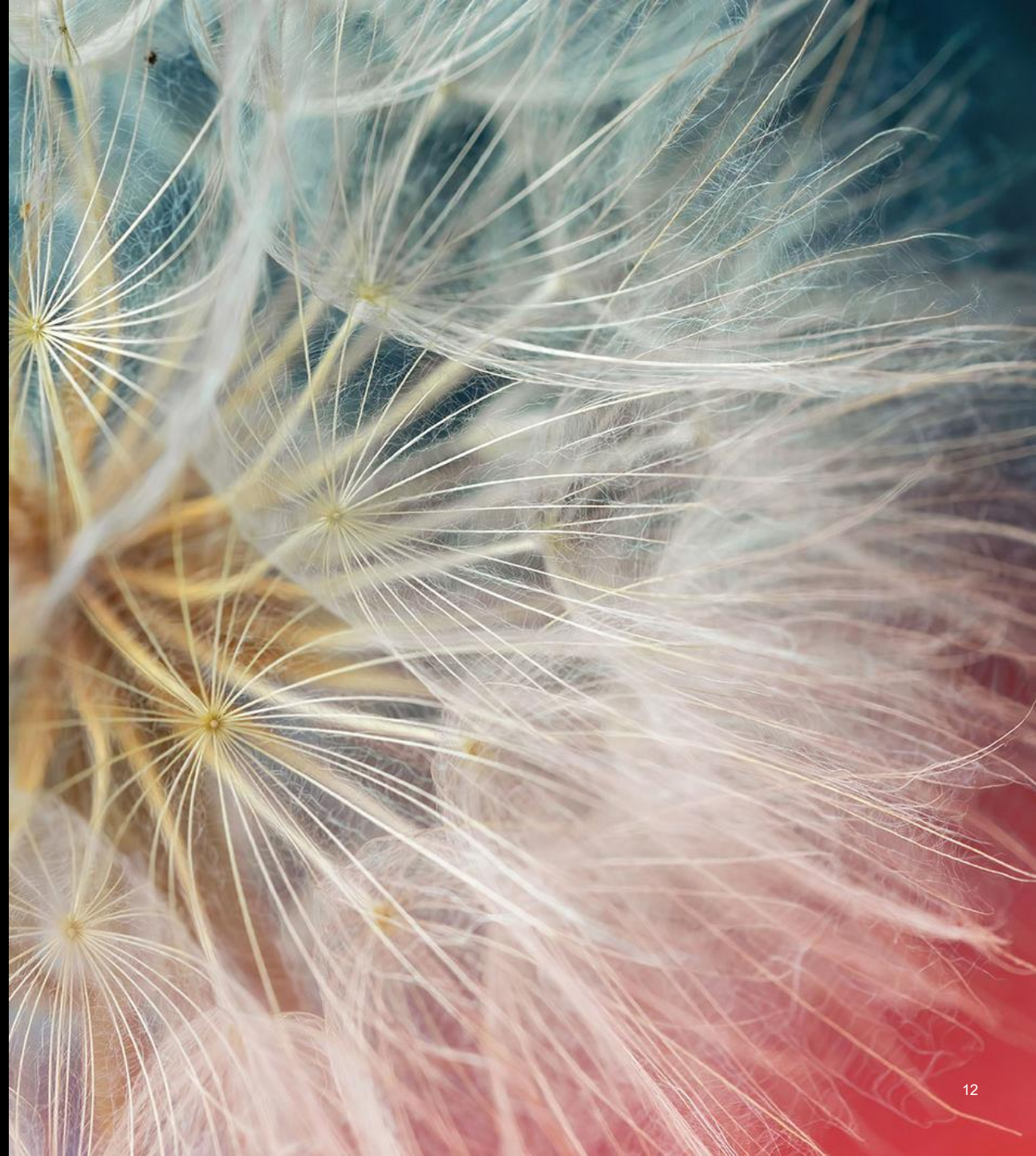

### How often does this occur?


### How severe do you think this issue was?

| | |
|---|---|
| Not at all | 23 |
| Minor Issue | 134 |
| Severe Issue | 245 |

**Note:** Data shown in this slide is fictitious and intended solely for demonstration purposes.

# NEAR-MISS DATA



# Near-miss Definition

The event can often be quantified using indicators such as

**TTC Time to Collision**

Time to Collision is the time left before two vehicles collide if they continue on the same course and speed.

**PET Post-Encroachment Time**

**Post-Encroachment Time** is the time gap between one road user leaving a conflict area and another entering it.

| Severity level | Approximate threshold |
|---|---|
| Severe risk | < 0.5 s |
| Near-miss / risk indicator range | 0.5 to 2 s |
| Low risk | > 2.0 s |

# Near-miss Data Collection

Video processing

3D Digital Lidar

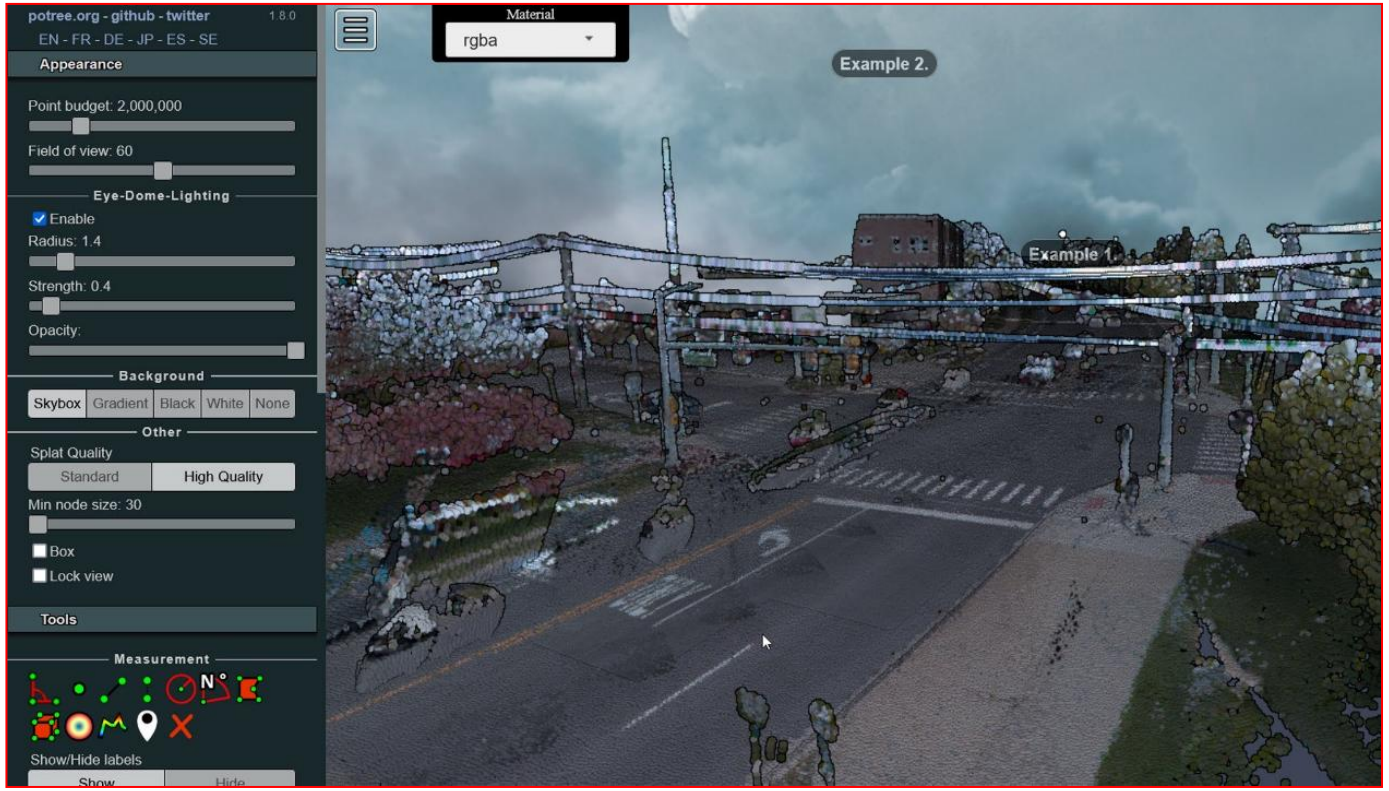
**Safety Analysis:**

- Validate public concerns
- Perform before and after analysis for safety improvement projects

# 3D Digital Lidar

:

- Mobile LiDAR or vehicle-mounted LiDAR can be used to create a 3D inventory of roadway assets and roadside conditions
- LiDAR can also be used in Smart intersection and connected vehicle applications by feeding real-time object detection data into infrastructure systems




**Source:** 3D image from Potree (Github)

# Video processing

:

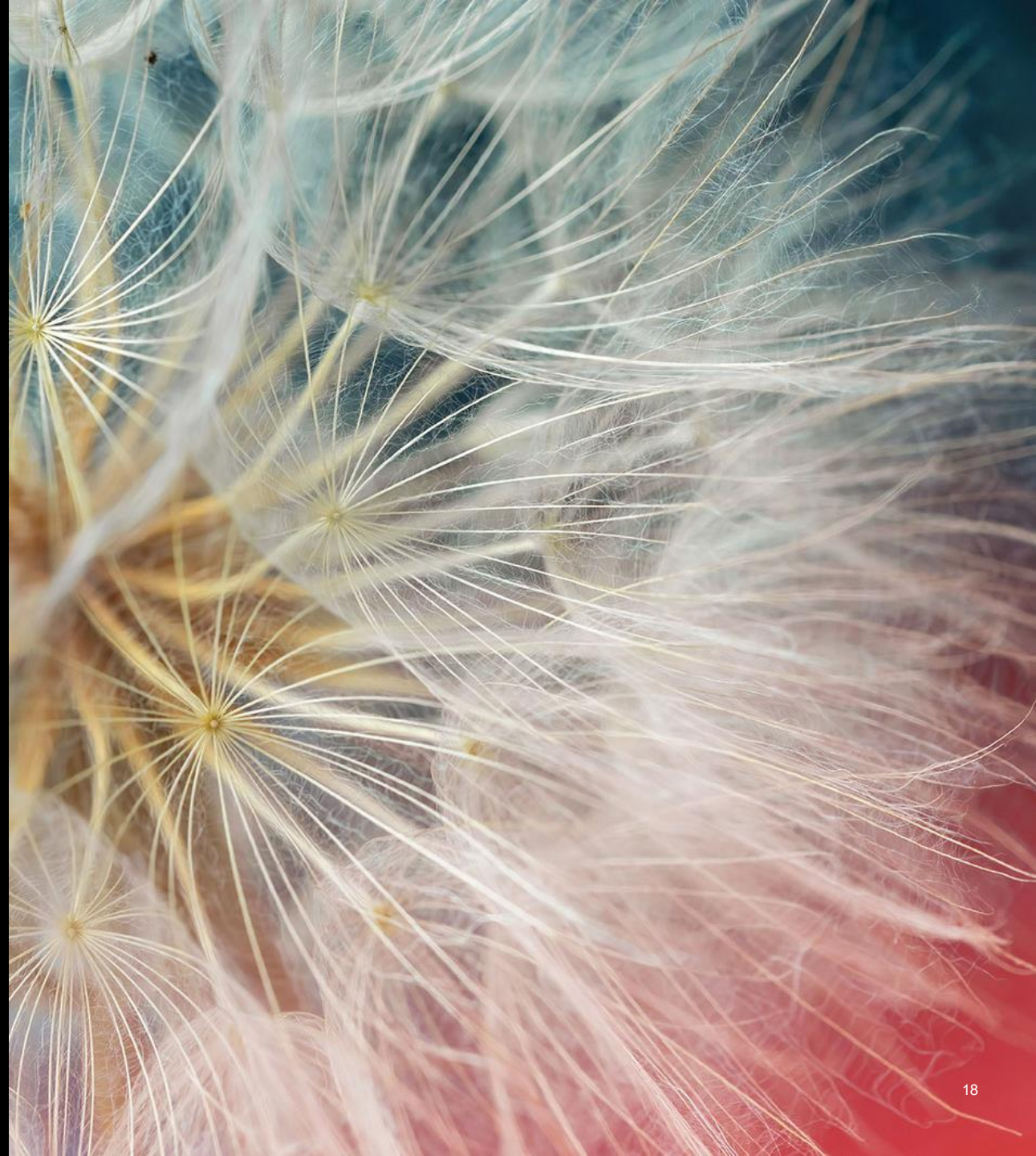
- Video-based object detection system to automatically identify and classify roadway users at intersections.
- Track vehicle trajectories through the intersection to identify major movement patterns and conflict zones.
- Identify potential near-miss events by analyzing how close vehicles come to each other in space and time.


***Source:*** *Example image from fisheye camera (VERALYTIX)*

# Incorporating Near-Miss into Analysis

- History of Crashes
- Data on Near-misses
- Ratio of Near-misses to Crashes
- Including Near-miss Data Safety Assessment Process
- Preventing Crashes Before They Occur

# SAFETY DASHBOARD



# Vision Zero Dashboard

## 1 Crash History Dashboard

- Basic information
  - Mode
  - Injury Level
  - Time
  - If near Transit
- Physical Environment
  - Weather condition
  - Lighting condition
- Crash Summaries
  - By time of the year
  - By road users type
  - Contributing factor
  - Collision type

## 2 Public Concern Dashboard

- Location Info
  - Location type
  - Zone type
- Concern Info
  - Concern type
  - What happened
  - Sentiment Analysis
- Contextual Info
  - Who is affected
  - Time of day affected
  - Days affected
  - Frequency
  - Severity and urgent level

## 3 Safety Project Planning Dashboard

- High safety risk area
  - High Crash Location
  - Incident Reports
- Project Status
  - Completed safety projects
  - On-going safety projects
  - Planned safety projects

# Crash History Dashboard

## Crash Summary Tab

**Time Selection by Year**

2020 — 2026

From 2020 to 2026

**Road Users:**

Ped | Bike | Car | All

**Injury Level**

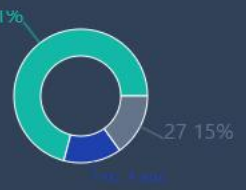
All | Property Damage Only | Minor Injuries | Serious Injuries | Fatalities

**If Near Transit**

- [ ] Light Rail
- [ ] Bus

**Physical Environment:**

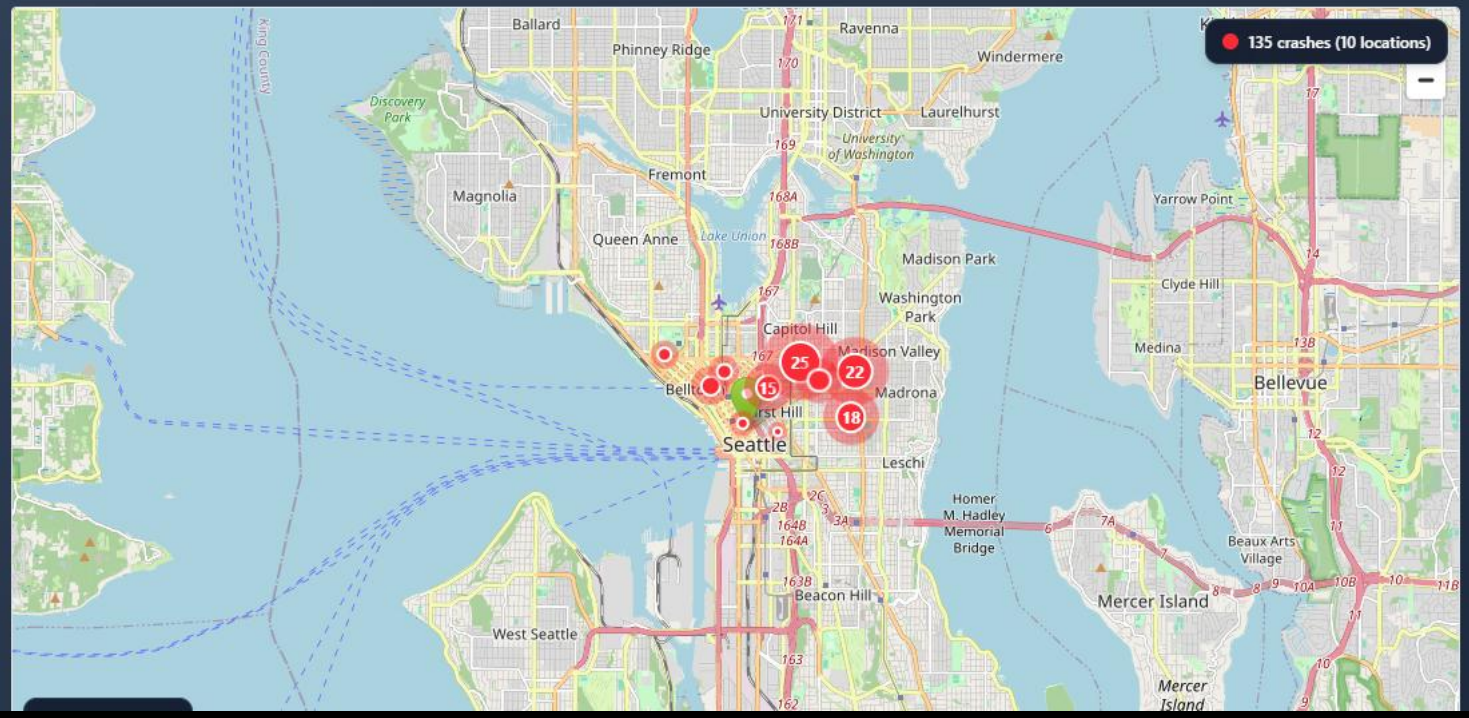
Weather Condition



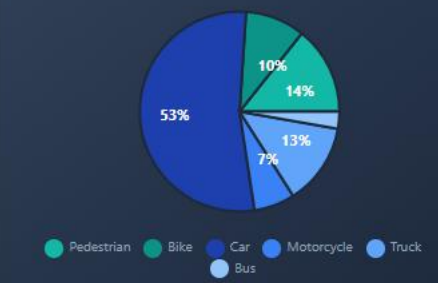

Lighting Condition

**Total Crashes by time within the year in 2025**

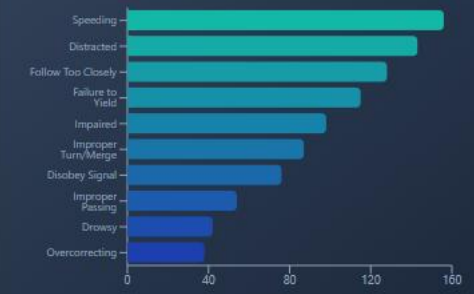

**High Crash Location**



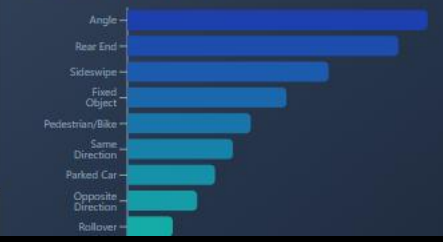

**Crash Summary by Road Users**




**Crashes by Contributing Factors**




**Crashes by Collision Types**




**Note:** Data shown in this slide is fictitious and intended solely for demonstration purposes.

# Public Concern Dashboard

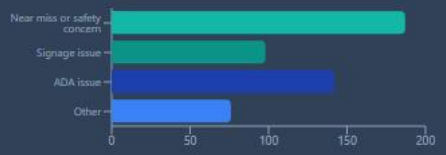
## Location Info

### Location Type


### Zone Type


## Concern Info

### Concern Type



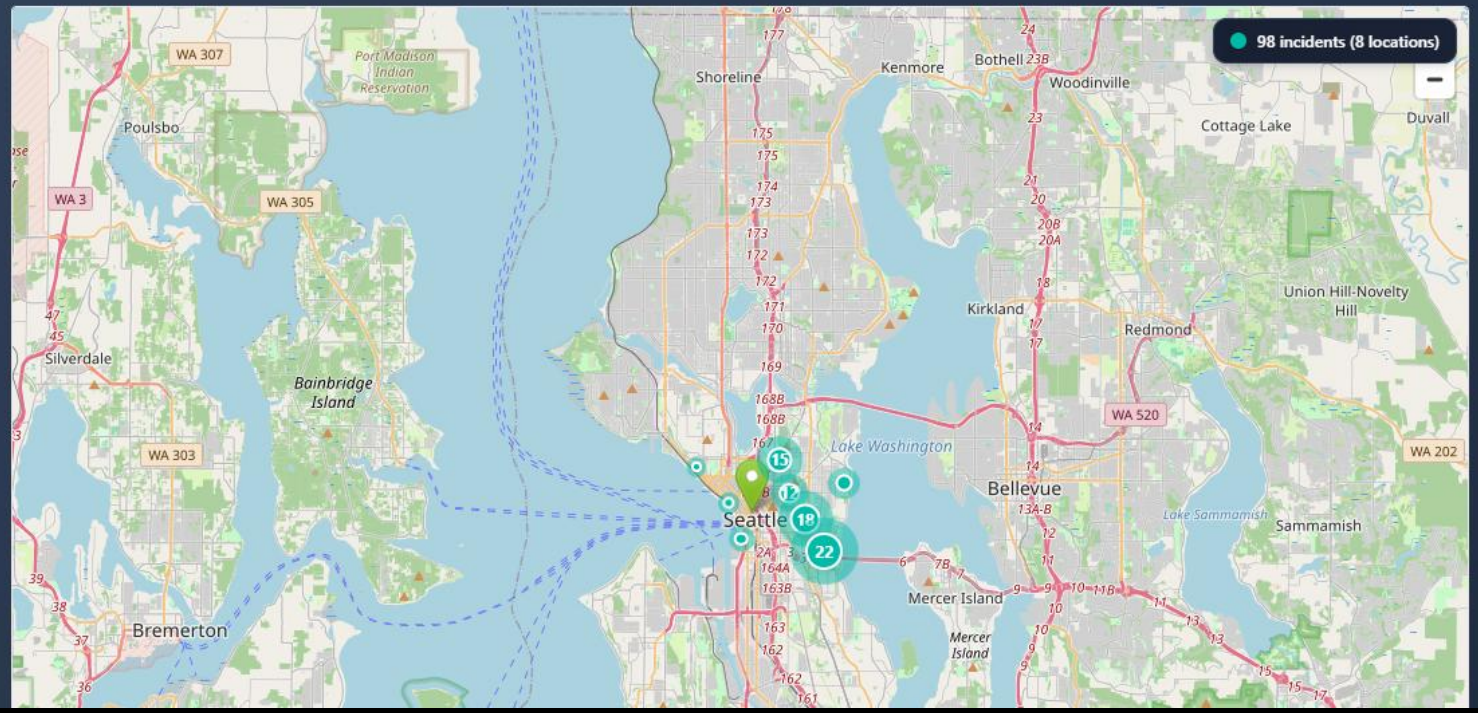

### What Happened?


### Sentiment Analysis

unsafe dangerous speeding

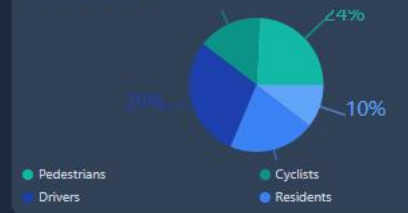
## Total Incidents/Complaints by Time in 2025


## Incident Locations

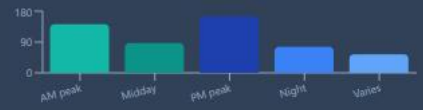



## Contextual Info

### Who is affected?




### Time of Day Affected




### Day(s) Affected


### How often does this occur?


### How severe do you think this issue was?

| | |
|---|---|
| Not at all | 23 |
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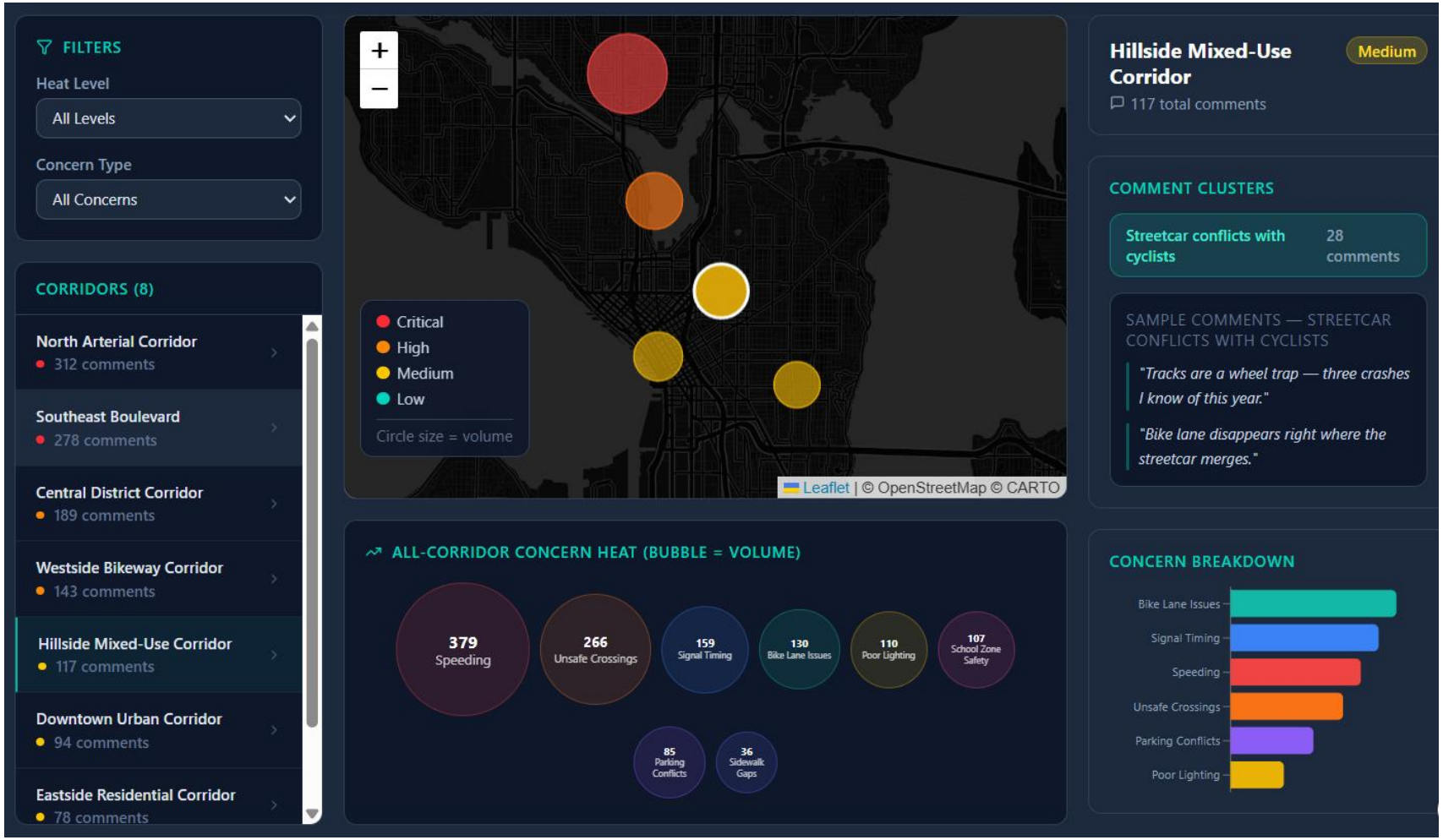
# Public Concern Dashboard

## Next Steps

- Heat maps of concerns
- +
- Comment Clusters
- +
- Location-specific themes




**Note:** Data shown in this slide is fictitious and intended solely for demonstration purposes.

# Safety Project Planning Dashboard

Crash Summary | Incident Reports | Vision Zero & Complaint Dashboard Overlay

## Roadway Safety Design Features

### Project Status

- [x] Completed safety projects — 5
- [x] On-going safety projects — 15
- [x] Planned safety projects — 10

### Map Layers

- [x] High Crash Location
- [x] Incident Reports

### Total Projects

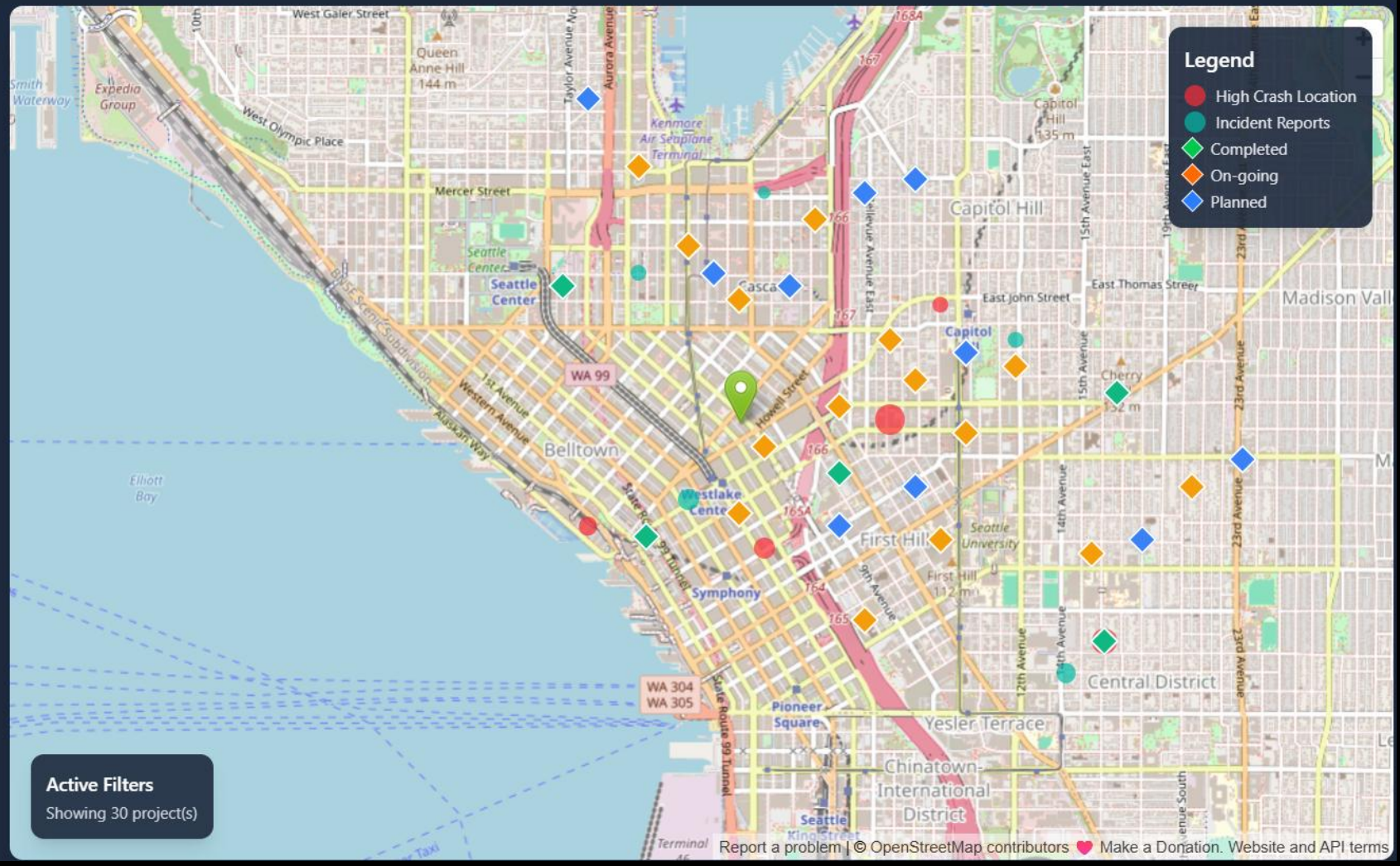
**30**

Safety improvement initiatives

### Impact Metrics

| | |
|---|---|
| Miles Improved | 58.3 |
| Intersections | 42 |
| Budget Allocated | $22.8M |

WSP | Footer goes here | Data




**Note:** Data shown in this slide is fictitious and intended solely for demonstration purposes.

# Interactive Story Dashboard

**Who participated**

**What they said**

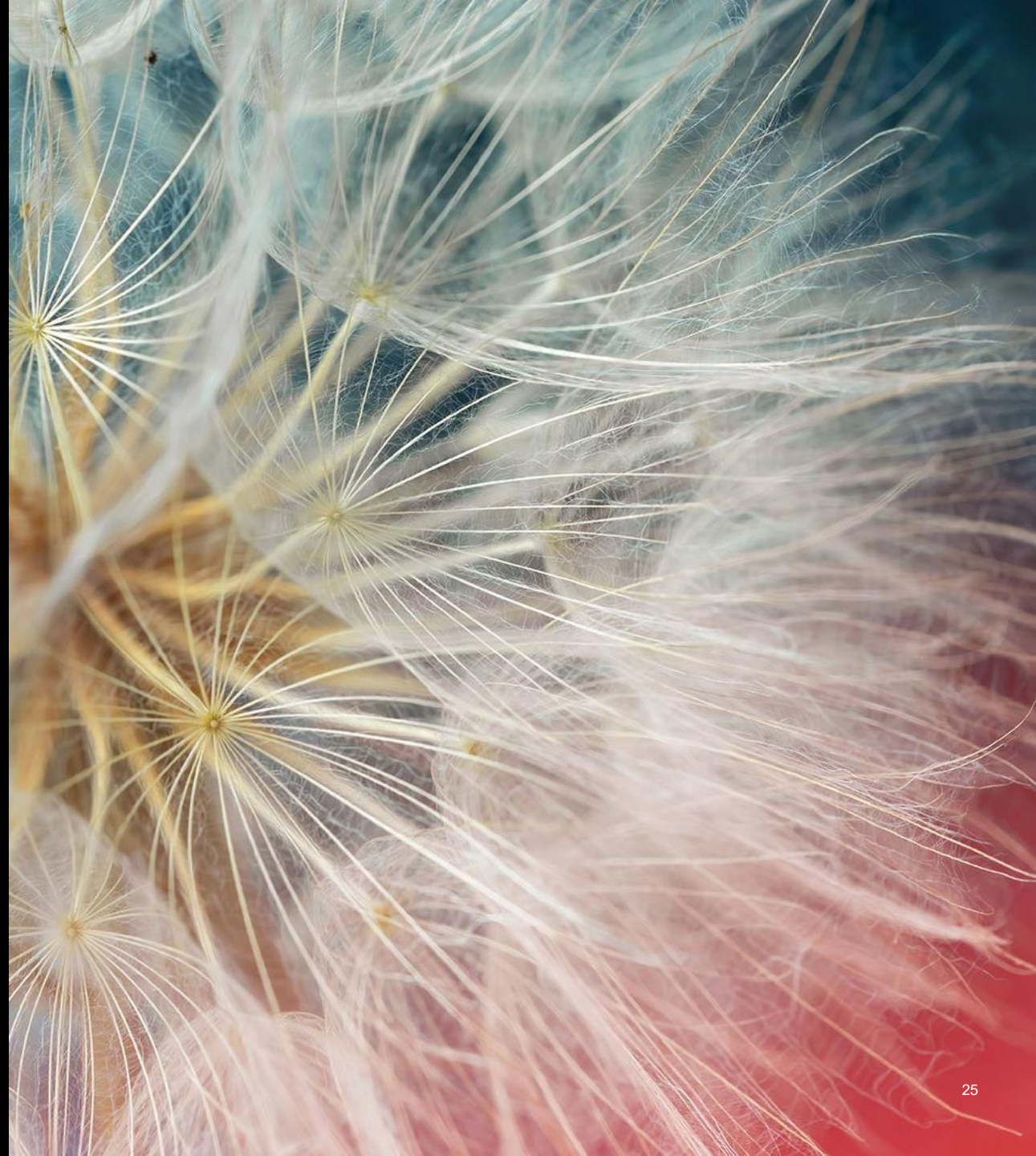
**Where concerns occurred**

**How opinions evolved**

**What decisions were influenced**

**What remains unresolved**

# DATA-DRIVEN ANALYSIS



# Data & Emerging Tools for Safety Decisions


**Note:** Data shown in image is for demonstration only

SAFETY CONCERN SCREENING

TRANSIT SAFETY IMPROVEMENT PROJECTS

GIS SPATIAL ANALYSIS

PREDICTIVE SAFETY ANALYSIS

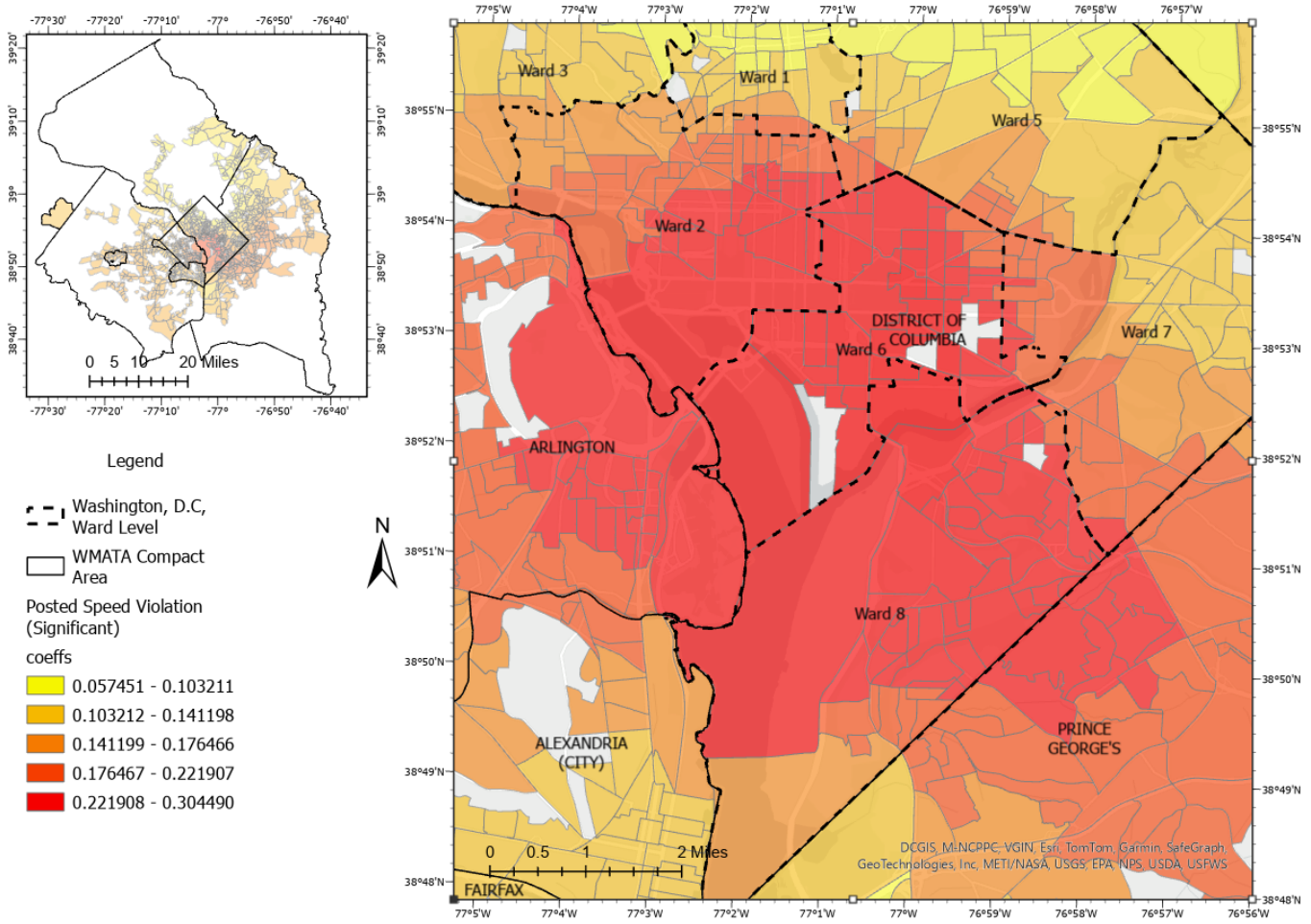
TIME SERRIES ANALYSIS

BUILT-ENVIRONMENT VARIABLES

MACHINE LEARNNING TO SUPPORT MORE TARGETED DECISIONS

# Example Application: Collisions vs Driving Behavior

- This research focuses on identifying **leading indicators** associated with **bus collisions rate** using transit safety data, driving behavior data, and spatial-temporal analytics.
- By linking driving behavior data with collision patterns, the study provides a proactive method for identifying where safety risks may be emerging.
- The findings can help agencies target safety improvements more effectively, support data-driven decision-making, and ultimately reduce the likelihood of future bus collisions.




***Source:*** *https://journals.sagepub.com/doi/abs/10.1177/03611981251404351*

# Example Application: Hot Spot Analysis

The **Safety Priority Index System (SPIS)** is a network screening tool developed by the Oregon Department of Transportation (ODOT) to evaluate both state and local roadways for segments with high crash histories.

SPIS is primarily used to:

- Identify high-risk road segments for further safety analysis.
- Support data-driven decisions for roadway safety improvements.
- Provide transparency and public access to crash data trends across Oregon

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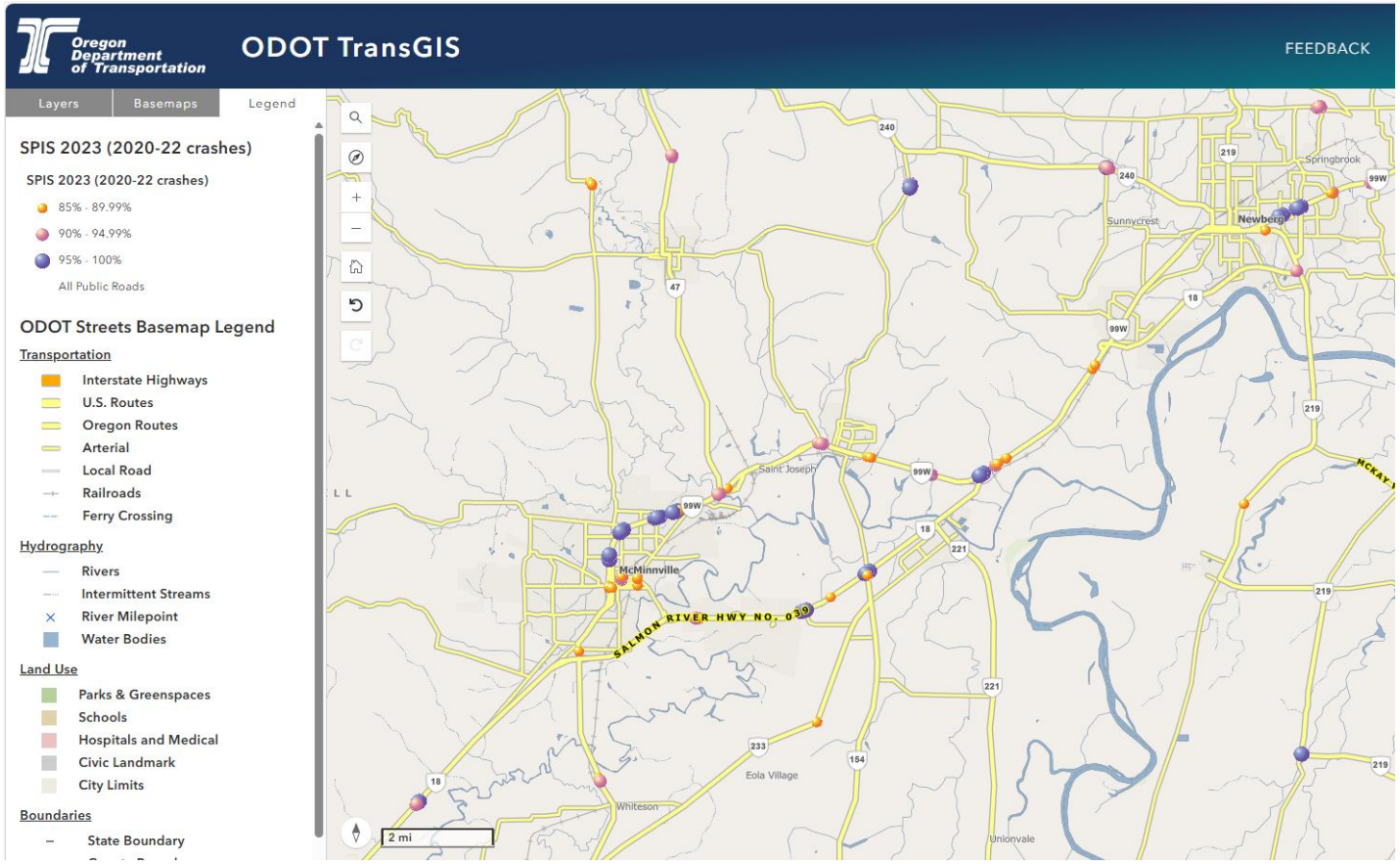
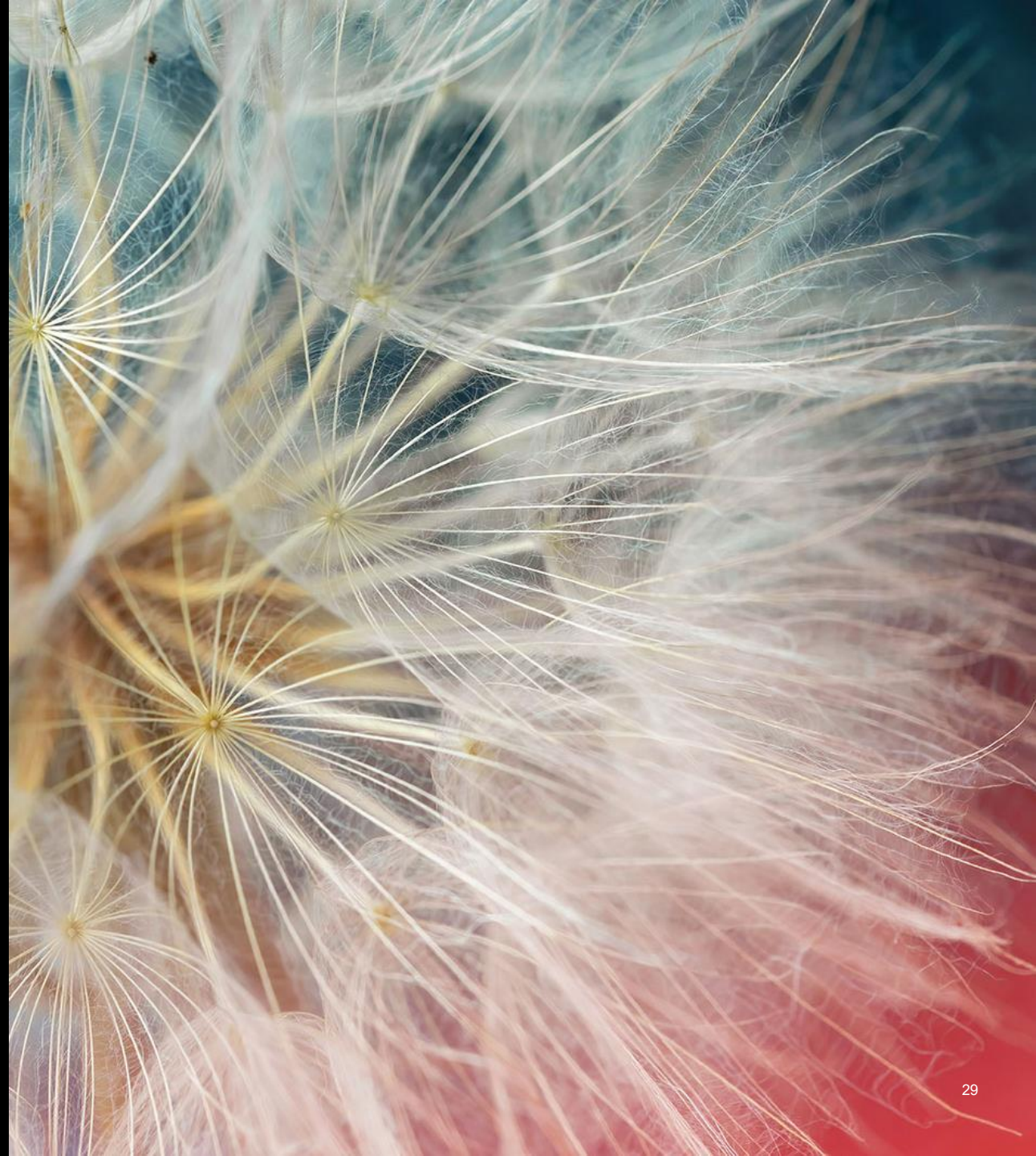



***Source:*** *ODOT GIS Database*

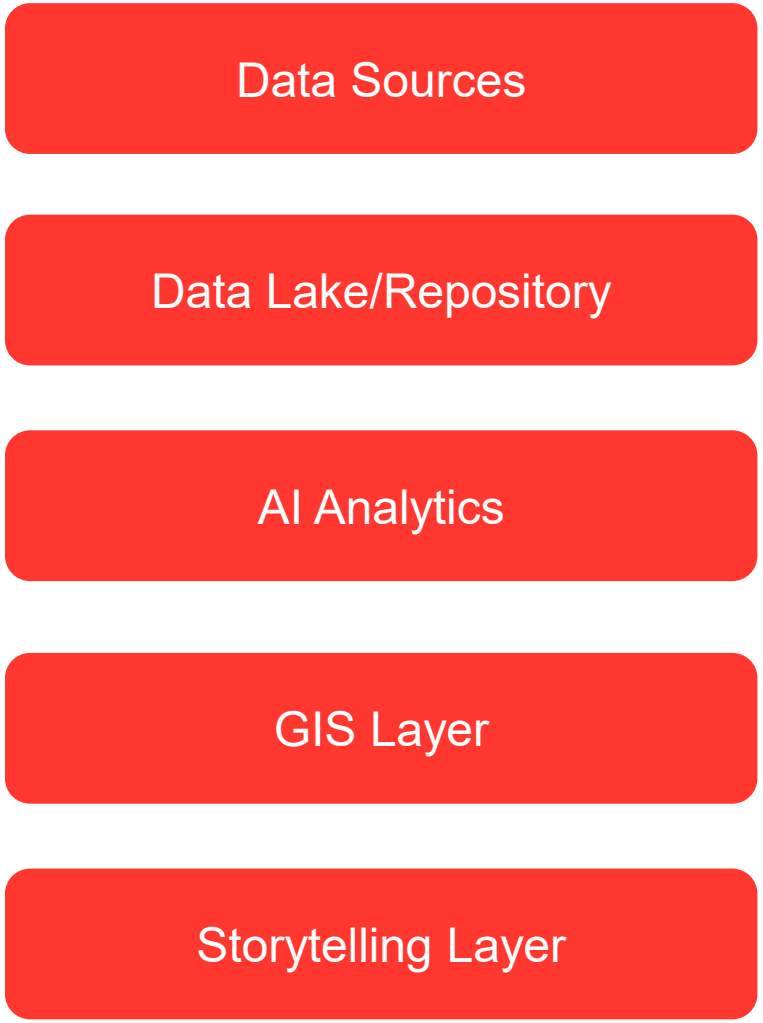
# SUMMARY



# Summary

The combination of **public feedback**, **emerging near-miss analytics**, **advanced data science**, and **modern communication technologies** is reshaping transportation safety practice.

By leveraging these tools, agencies can identify risks earlier, make more informed investment decisions, improve transparency, and ultimately create safer transportation systems for all users



# THANK YOU

Questions?
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## WSP TEAM

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Ling Chen--Data Scientist
Yuxuan Guo--Data SME
Robert Mayers--Public Outreach SME
Edith Lopez Victoria--Safety SME