Traffic Safety Engineering Analysis

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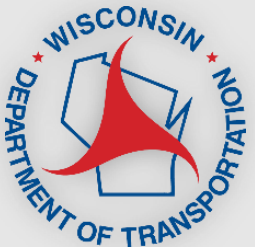
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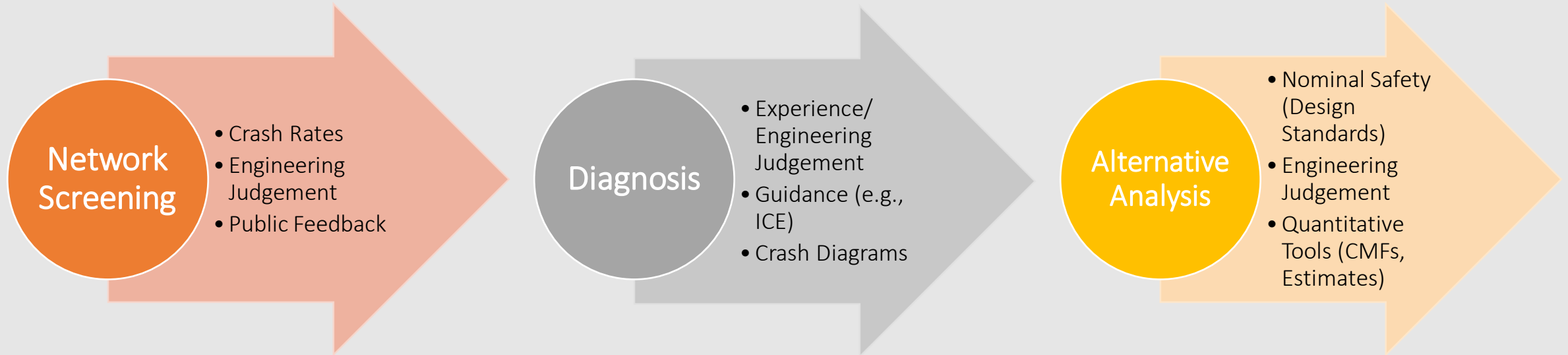
Traffic Tech Talk

September 18, 2024

Overview

- Background on the Safety Certification Process (SCP)
- Where does safety fit into the Improvement Program process?
- Network Screening
- Alternative Analysis
- AASHTOWare Safety

WisDOT's background

- Historically, relied heavily on experience and qualitative approaches to address safety
  - Focused on Nominal Safety (i.e., design standards) vs Substantive Safety (data-driven analyses)

Network Screening
- Crash Rates
- Engineering Judgement
- Public Feedback

Diagnosis
- Experience/ Engineering Judgement
- Guidance (e.g., ICE)
- Crash Diagrams

Alternative Analysis
- Nominal Safety (Design Standards)
- Engineering Judgement
- Quantitative Tools (CMFs, Estimates)

Background

- Safety Certification Process (SCP)
  - Created in 2018 - Defined in [FDM 11-38](FDM 11-38)
  - Uses performance-based practical design philosophy to quantify safety benefits of improvements
  - Aligns with the Highway Safety Manual (HSM) 1st Edition
    - HSM Part B – Network Screening
    - HSM Part C – Alternative Analysis (IHSDM)

Where does safety fit within the Improvement Program process?

Where does safety fit into the Improvement Program process?

- Completed within the Scoping Phase
- Required to complete the Safety Certification Process on all improvement projects with some exceptions:
  - Maintenance projects (e.g., culvert replacements)
  - Preservation/restoration projects
  - Expansion/modernization projects
- FDM 11-1 Attachment 10.1

Safety Certification Process Overview

Safety Certification Process

- Aligns with the Highway Safety Manual's (HSM) Roadway Safety Management Process

  1. Network Screening for Safety Sites of Promise
  2. Diagnosis of Safety Sites of Promise
  3. Countermeasure Identification
  4. Safety Evaluation & Economic Appraisal of Alternatives
 5. Documentation
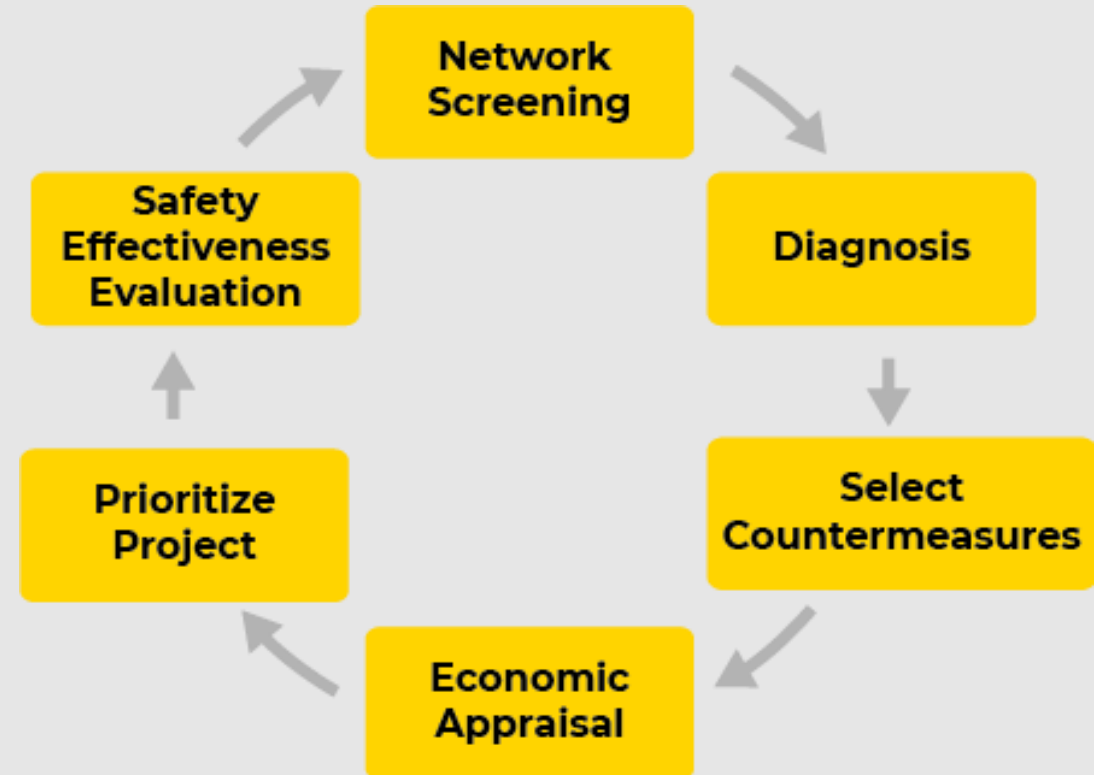
Network Screening (HSM Part B)

- Identifies needs on the State Highway System (Target 10-20%)
  - Segments use **critical crash rates** (statewide averages)
    - Total & Serious Injury Crashes (K, A, B) & Pedestrian/Bicycle Crashes
    - Future update will use SPFs for segments
  - Intersections use **safety performance functions** (SPFs) to generate Level of Service of Safety (LOSS)
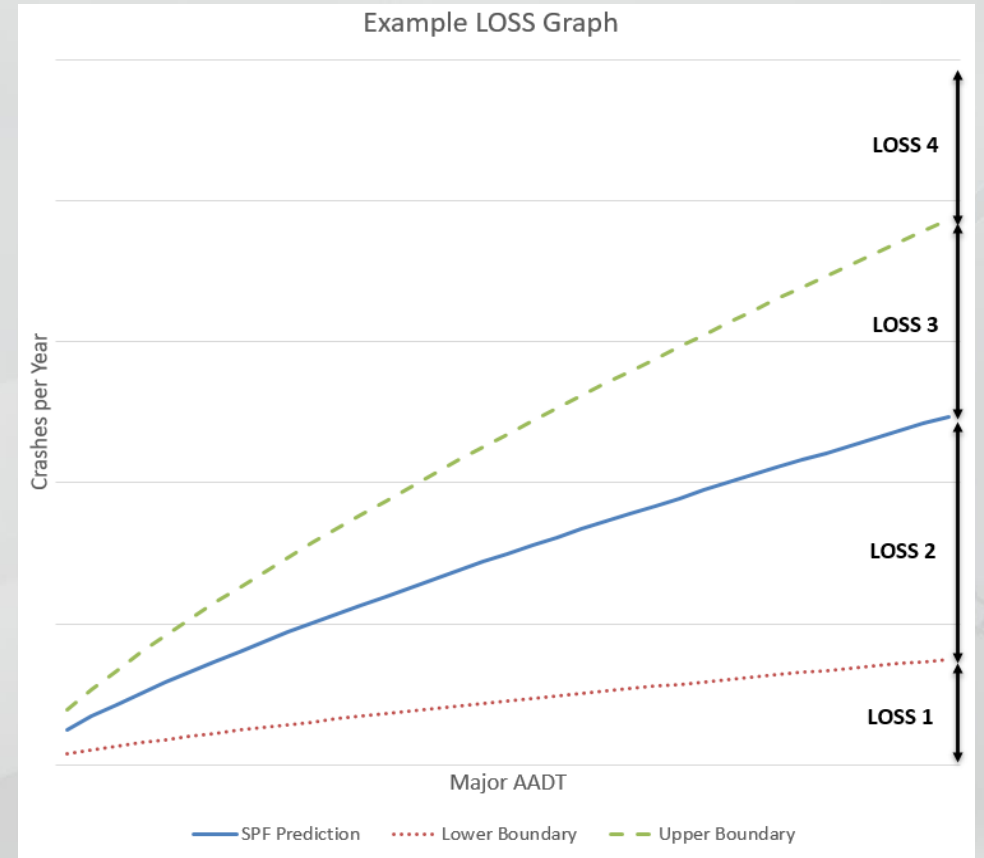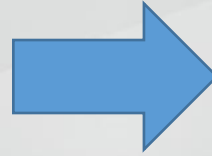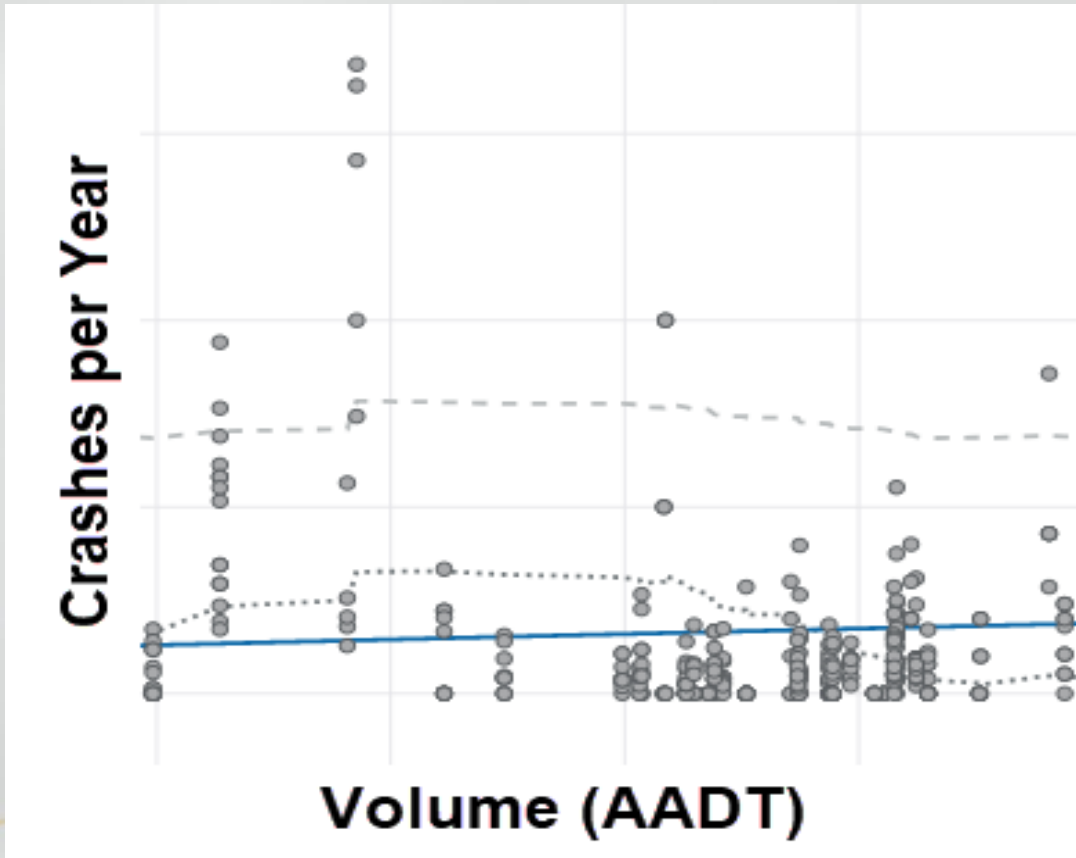   - Total & Injury Crashes (K, A, B, C Injuries)

Network Screening (HSM Part B)

- WisDOT developed network screening SPFs
    - Based on network-level, site-specific info (e.g., volume, control, etc.)
    - SPFs produce "Predicted Crashes" for "an average" location
   - Observed Crashes are used to estimate "Expected Crashes"
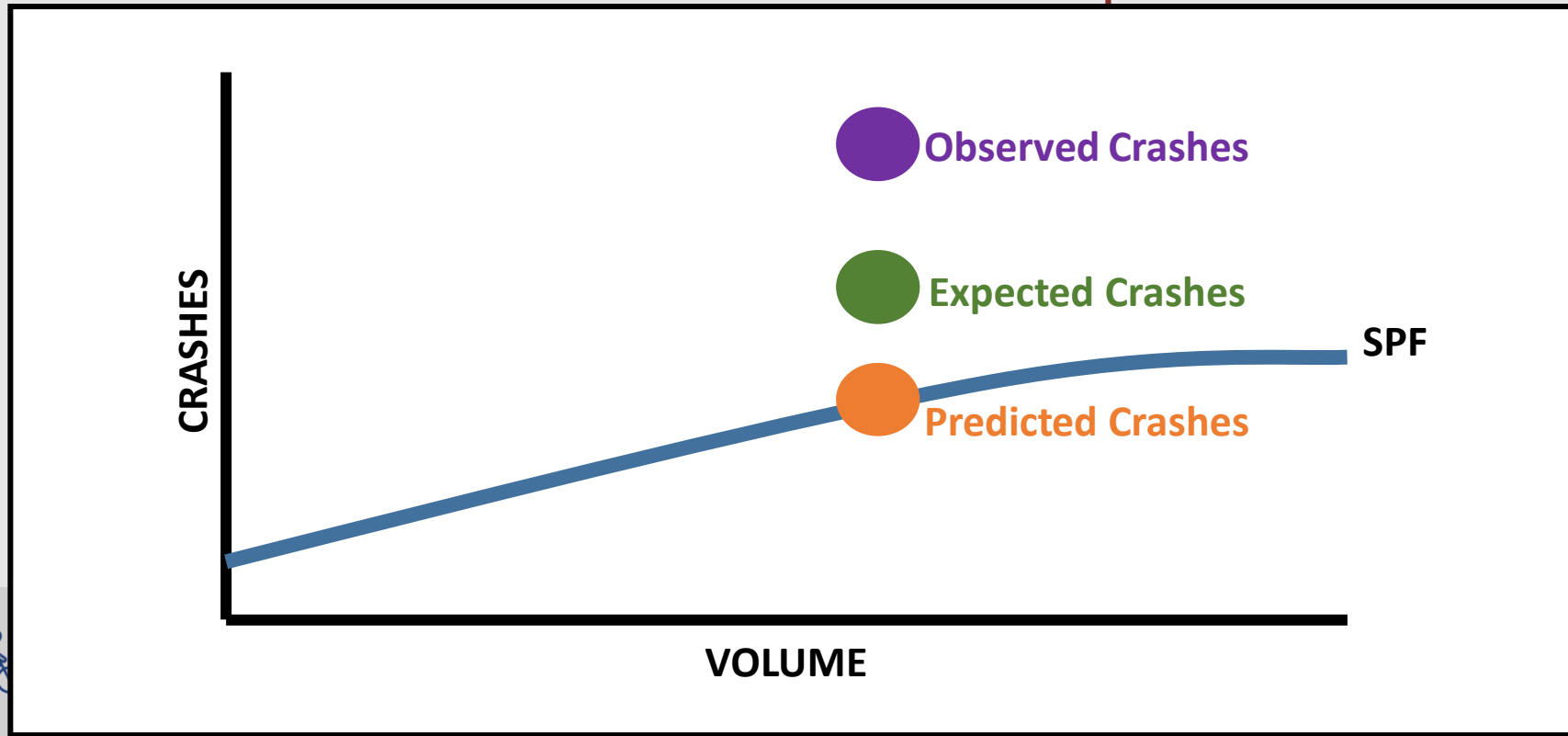
# Network Screening

- Expected crashes are categorize into four LOSS groups
  - WisDOT focuses on the highest potential for safety improvement (LOSS 4)

Diagnosis & Countermeasure Selection

- Understand the location conditions

- Understand the *why*

- Leads to identifying contributing factors

- Engineering judgement used to select appropriate countermeasures

Source: r/memes
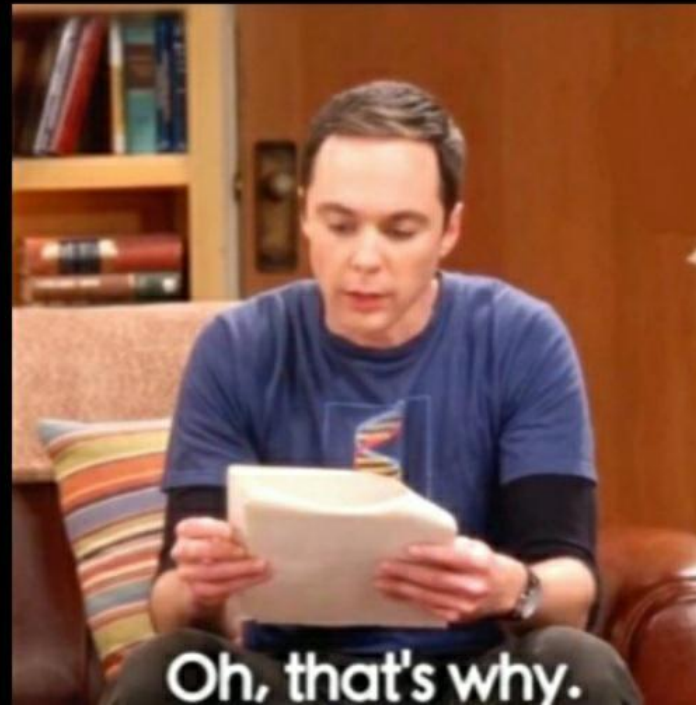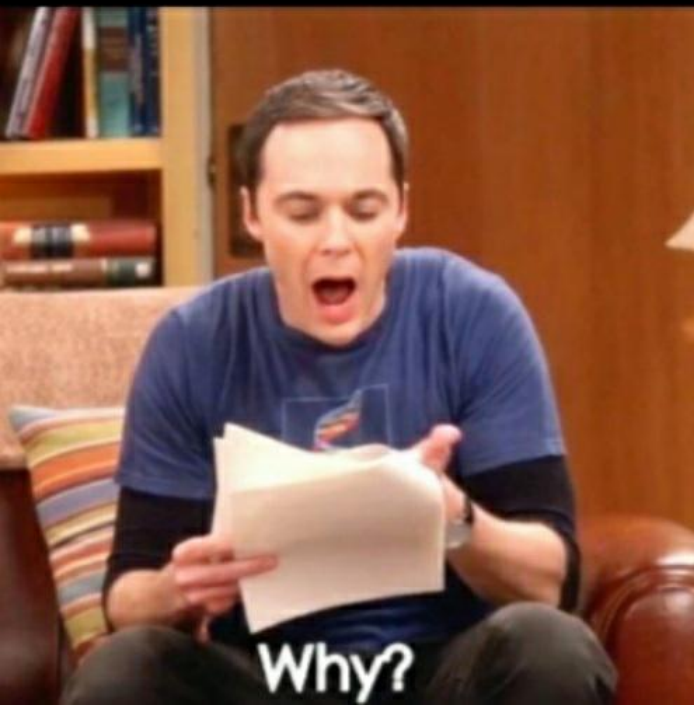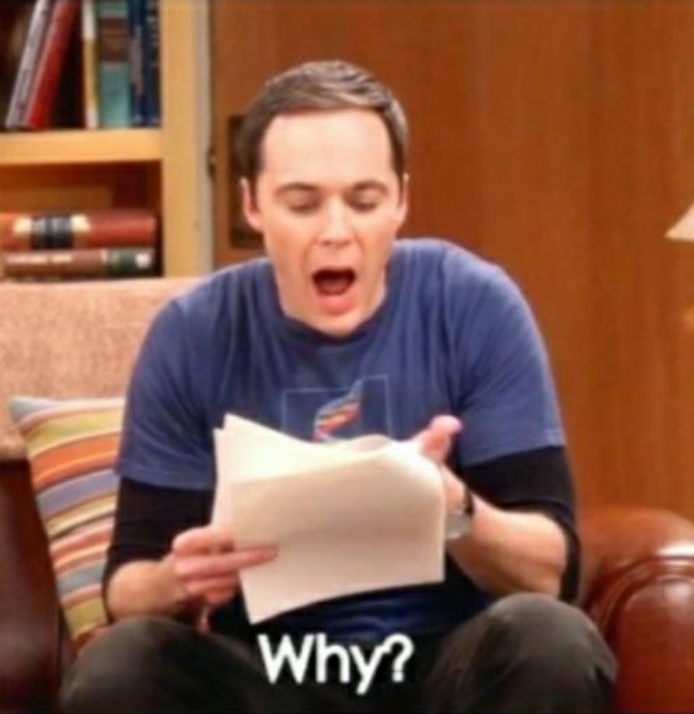
Alternative Analysis

- Safety Evaluation of alternatives (HSM Part C)
  - Use statistical models to predict the number of crashes of each alternative
    - Total number of crashes
    - Number of fatal and injury crashes
    - Number of property damage crashes
  - Determines the _safety_ benefit of each alternative

Alternative Analysis

- Data Requirements
  - Required = AADT, facility type, area type, roadway geometrics, control type, cost
  - Model Dependent = Signal timing, pedestrian volumes, right turn permissions, lighting, …, etc., …, even more data elements, …
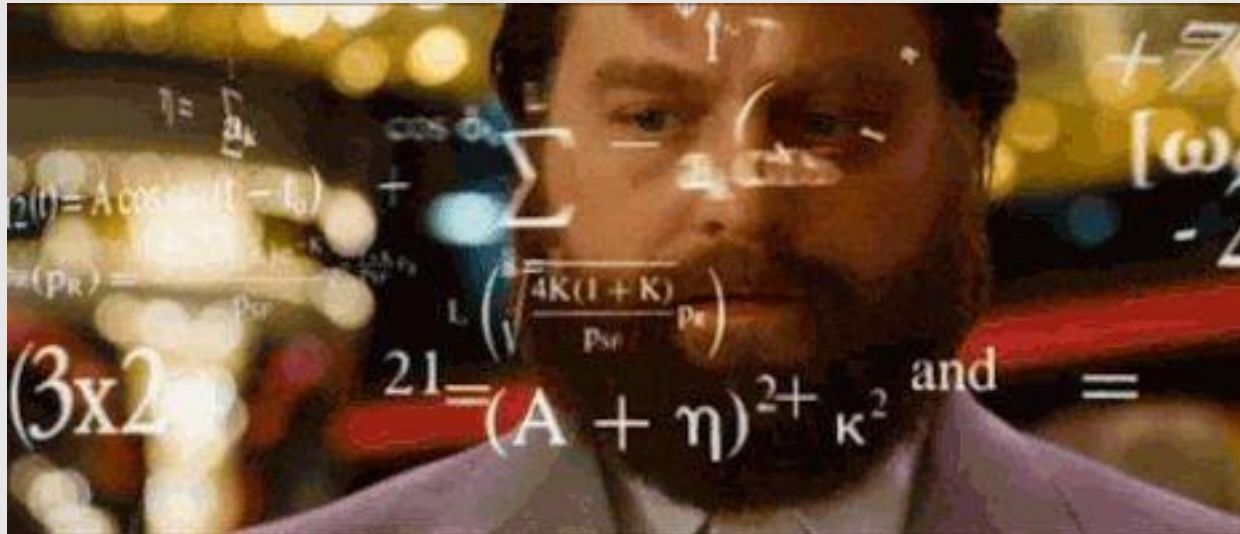
Alternative Analysis

- Economic Appraisal of alternatives
  - Assigns crash costs to monetize findings
  - Compares the *safety* benefits and cost of constructing the alternative
  - Produces an economic analysis result (Benefit-Cost (B/C) ratio) for each alternative

Source: Shutterstock

Alternative Analysis

Do what we can and learn from our investments.

- We utilize the tools available to use to make the best decisions.
- Our tools are imperfect and can only do so much.
- Also, humans make mistakes, and we can't engineer everything.

Next Steps

Next Steps

- Safety Certification Process (SCP) status
  - Existing tools are reaching their limitations
    - Highway Safety Manual 2nd Edition will not be supported
  - Tool requirements
    - Support screening processes
    - Alternative analysis
    - Data trend analysis
    - Availability for local agencies / consultants
    - Improve user experience

AASHTOWare Safety

Vision: Support the entirety of the Highway Safety Manual (HSM)

- Purchased in June 2024

- Supported by AASHTO

- Designed to meet the unique needs of state and local transportation agencies

- Integrates agencies roadway, crash and volume data to support safety analyses

- Adaptive to future editions of the HSM

AASHTOWare Safety

- Supports
  - Crash queries
  - Crash dashboards / statistics reporting
  - Network screening
  - Sliding window analyses
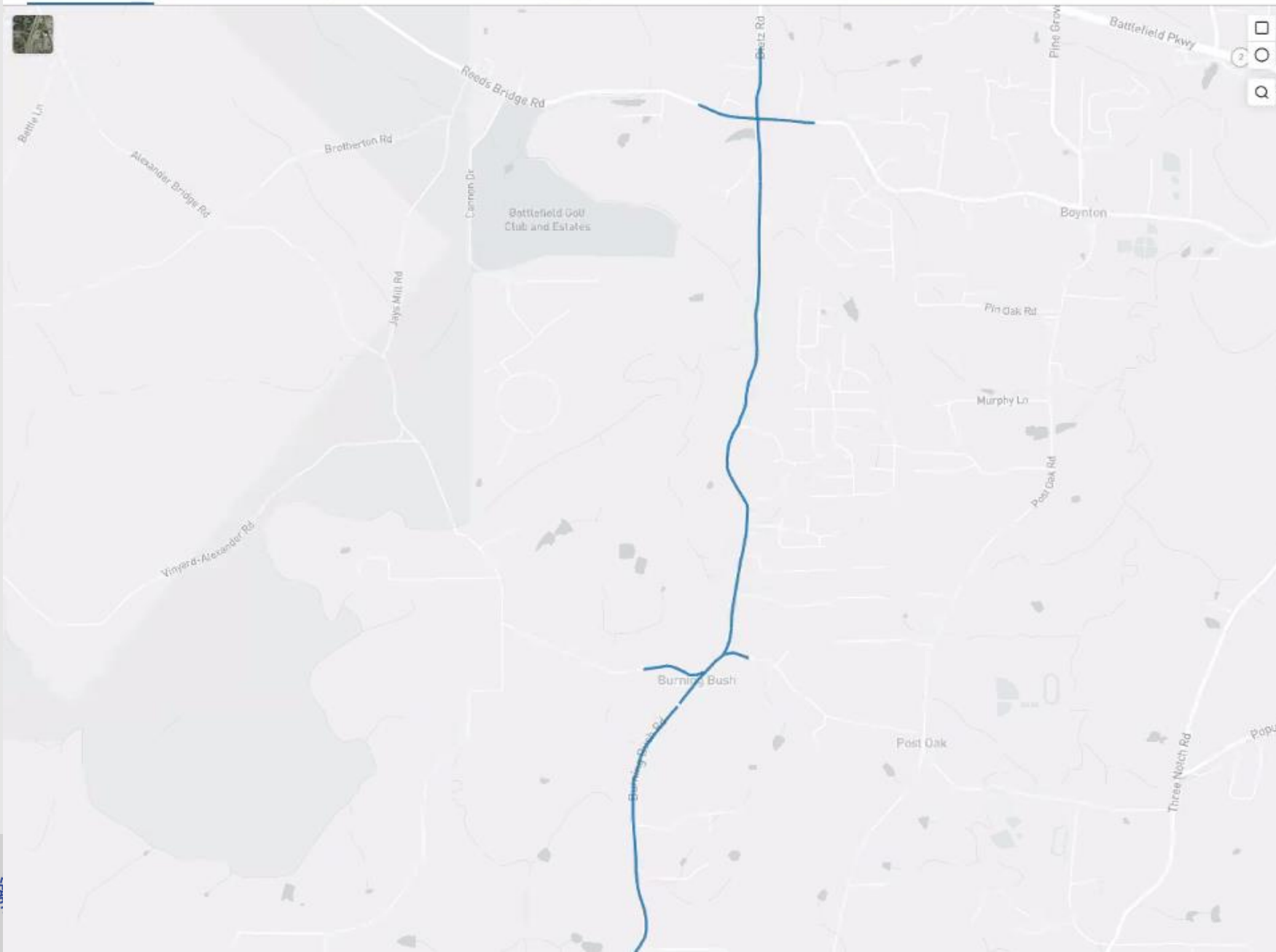 - Countermeasure evaluation/Economic Appraisal

- In Development
  - Incorporation of HSM's Safety Performance Functions (SPFs) for alternative analysis (i.e., IHSDM)
    - Expected September 2024
    - Numetric's Goal is to make tool understandable and useful to designers

Preview

Project Selection Current Condition Lighting Paved Shoulders Lighting and Lane Wi... Comparison Summary Reference Table

Wisconsin Call Intersection

| Route ID | = | 04720382001 | MP: 0.7 - 1.11 | × |

| Route ID | = | 04720384001 | MP: 5.27 - 5.75 | × |

+ Add Intersection Leg

Upper Burning Bush Road

| Route ID | = | 04720384001 | MP: 3.6 - 5.26 | × |

Burning Bush - Popular Springs Road

| Route ID | = | 04720384001 | MP: 3.26 - 3.59 | × |

| Route ID | = | 04720138001 | MP: 0.96 - 1.18 | × |

| Route ID | = | 04720333001 | MP: 0.01 - 0.09 | × |

+ Add Intersection Leg

Lower Burning Brush

| Route ID | = | 04720384001 | MP: 1.22 - 3.24 | × |

+ Add Segment   + Add Intersection

Continue

Information
Wisconsin Call Intersection
Upper Burning Bush Road
Burning Bush - Popular Springs Road
Lower Burning Brush
Cost
Summary

Upper Burning Bush Road: Roadway Details

Route ID	=	0472038400I	MP: 3.6 - 5.26

Lane Width

LANE WIDTH (FT)

`12` ▼

Base Condition: 12

CURRENT AF ⓘ
1.17 ⓘ
PROPOSED AF ⓘ
1.00

Current   `10`
Proposed   `12`

Shoulder Width and Type

RIGHT SHOULDER WIDTH (FT)

`4` ▼

Base Condition: 6

RIGHT SHOULDER TYPE

`Paved` ▼

Base Condition: Paved

CURRENT AF ⓘ
1.05 ⓘ
PROPOSED AF ⓘ
1.09 ⓘ

Current   `6, Turf`   `6, Turf`
Proposed   `4, Paved`   `4, Paved`

LEFT SHOULDER WIDTH (FT)

`4` ▼

Base Condition: 6

LEFT SHOULDER TYPE

`Paved` ▼

Base Condition: Paved

Horizontal Curves

LENGTH OF HORIZONTAL CURVE (MI)

`.215`

Base Condition: 0

RADIUS OF CURVATURE (FT)

`163`

Base Condition: 0

CURRENT AF ⓘ
2.48 ⓘ
PROPOSED AF ⓘ
2.48 ⓘ

Current   `.215, 163`
Proposed   `.215, 163`

SPIRAL TRANSITION CURVE

🔘 Not Present (Base Condition)
⚪ One End Only
⚪ Present

AASHTOWare Safety Implementation

- Target completion date: Mid-2025

- Plan to implement in phases
  - Network Screening (Summer 2025)
  - Alternative Analysis (Late 2025/2026)
    - Training
    - Replace IHSDM

Questions?

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