Welcome!
Advisory Council on Traffic Safety

June 12, 2024

Note: Today's meeting will be recorded for record keeping purposes only

Welcome and Introductions

- Chairs' Welcome and Introductions

- Approve Today's Agenda

- Approve Minutes from April 10 Meeting

- Membership Updates

Crash Data Analysis Systems in Minnesota

- Introduction and Background

  - *Mike Hanson, Minnesota Department of Public Safety*

- MnDOT

  - *Derek Leuer*

- DPS

  - *Mike Hanson, Rachel Horne, and Brandon Walters*

- MDH

  - *Erik Zabel*

Crash Data Analysis Systems in Minnesota

MnDOT Crash Mapping, Analysis, and Reporting Tool: CrashMART
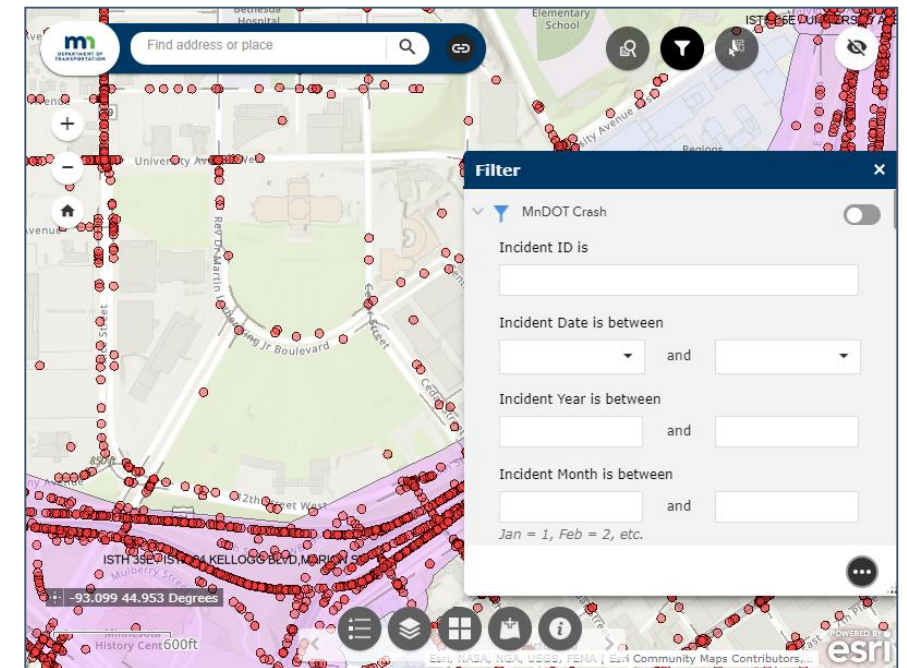
Tool Owner:
MnDOT Office of Traffic Engineering

Users:
CrashMART is available to MnDOT staff conducting traffic safety analyses.

Features:
- 10 calendar years of crash data plus the current year.
- Nightly crash data updates.
- Ability to overlay additional spatial layers including jurisdictional boundaries, intersections, interchanges, and traffic volumes.
- Ability to upload spatial data for custom spatial queries
- Import spatial data from ArcGIS Online cloud
- Detailed crash filtering
- Spatial selection tool
- Export results to spreadsheet for further analysis
- Crash Data Toolkits
- All data accessible in desktop applications like ArcGIS Pro

Crash Data Analysis Systems in Minnesota

Minnesota Crash Mapping Analysis Tool: MnCMAT2
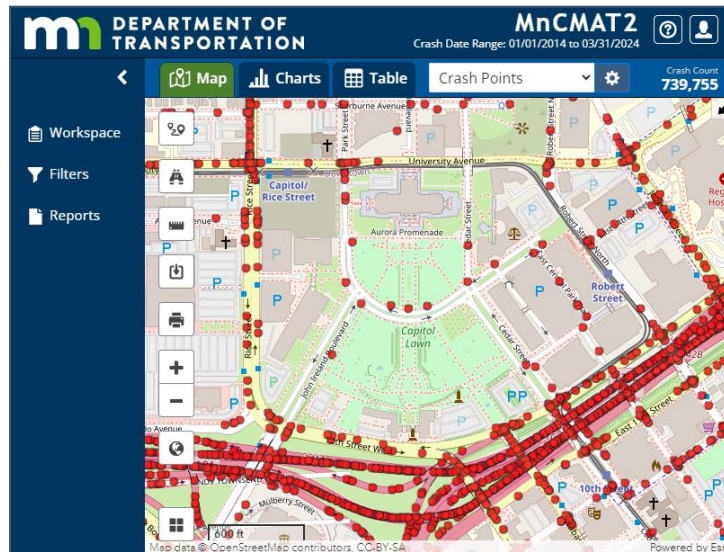
Tool Owner:
MnDOT State Aid Office

Users:
MnCMAT2 is available to MnDOT, county, city, and consultant staff conducting traffic safety analyses.

Features:
- 10 calendar years of crash data plus the current year.
- Quarterly crash data updates.
- Built in charts and reports
- Crash filtering
- Spatial selection tool
- Export results to spreadsheet for further analysis

ArcGIS Pro

Tool Owner:
ESRI

Users:
MnDOT staff with access to the MnDOT copy of DPS crash data and ArcGIS Pro.

Features:
- Crash data back to 1984.
- Ability to do any type of spatial analysis with no limit to the other data sources available to be linked or added to the software.
- Heavy analytics and used by those with significant training and consistent use.
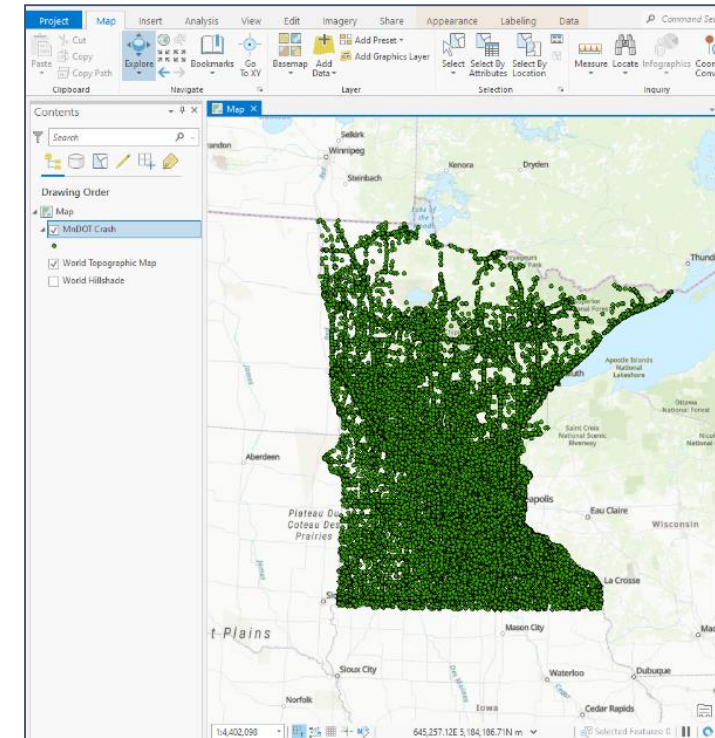
Crash Data Analysis Systems in Minnesota

Safety Analysis Software as a Service: *COMING IN 2024*
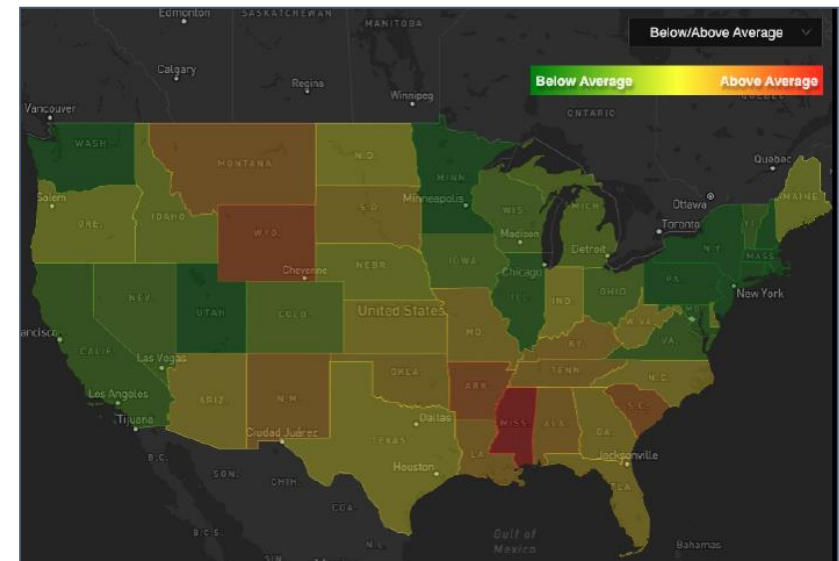
Tool Owner:
MnDOT Office of Traffic Engineering. The process to obtain this tool has been in conjunction with MNIT and DPS OTS.

Users:
This tool will be available to state, county, city, MPO, research, and consultant staff conducting traffic safety analyses.

Features:
- All features of CrashMART. This tool will replace CrashMART.
- Network screening of intersections and segments based upon any filtered attribute or metric
- Benefit-cost reports for intersections and segments treatments
- Rigorous countermeasure analyses of intersections and segments
- Complete integration of separate data sets such as crashes, roadway network, hazards, POIs, and assets
- Standardized crash reduction/modification factors (linkages to CMF Clearinghouse) or custom CMFs
- Safety Performance Function (SPF) validation via Crash Prediction/EB module for intersections and segments
- Custom per-agency filters and dashboards for collaboration of targeted crash reductions and outreach
- Public-facing reports and dashboards
- Simple and fast editing interface for crash locations and attributes to correct errors
- Machine Learning (AI/ML) for automated auditing and analysis functions

Crash Data Analysis Systems in Minnesota

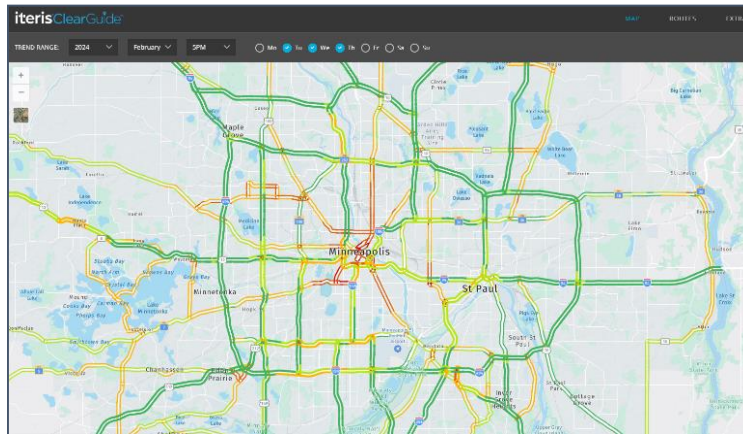## Other MnDOT Non-Crash Mapping Tools

ClearGuide (Traffic Flow and Speeds)

Tool Owner: Iteris

Users: MnDOT staff and consultants

Features:
- Route-specific travel time data
- Real-time and historical traffic flow, speeds, and bottleneck locations
- Incident and congestion analytics
- Weather-related traffic impacts
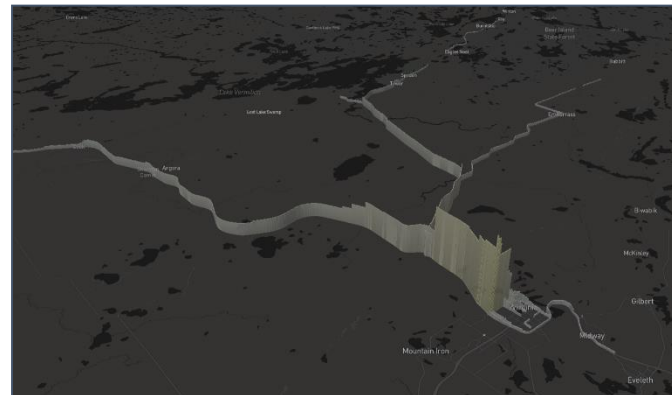- Travel time reliability metrics

StreetLight Insight

Tool Owner: StreetLight

Users: MnDOT staff and consultants

Features:
- Traffic patterns (e.g., origin-destination patterns, trip route statistics, estimate turning movements)
- Traffic volume variations over time
- Trip characteristics such as travel time, trip length, speed, and traveler demographics.

Traffic Mapping Application

Tool Owner: MnDOT Traffic Forecasting & Analysis Office

Users: Publicly available
https://www.dot.state.mn.us/traffic/data/tma.html

Features:
- Current and historical AADT and Heavy Commercial Annual Average Daily Traffic (HCAADT) volumes
- Weigh-in-Motion (WIM), Automatic Traffic Recorder (ATR), traffic detector locations
- Vehicle class and traffic count locations
- Reference post numbers and locations
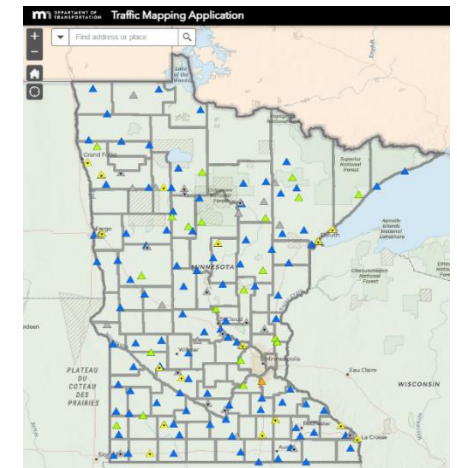
Many more mapping applications are also in use.

The Road Safety Information Center (RSIC) is the cornerstone of the Data Analytics Information Center. Features and benefits include:

- Data initiative + visualization
- Integration of multiple data sources
- Better data and expanded analytic capabilities

- Improved preventative safety measures
- More readily available data with public and mobile platforms
- Identification of more and better ways to serve over-represented communities in crash data

GOAL: Equitable levels of service to all communities in Minnesota

Road Safety Information Center Project Partnerships

Technical

- Minnesota IT Services (MNIT)
- Google
- Nerdery
- CARTO

Testing

- OTS researchers
- Minnesota Department of Health (MDH)
- Minnesota Department of Transportation (MnDOT)
- Transparent Artificial Intelligence Governance Alliance (TAIGA)
- Law Enforcement Liaisons

Stakeholders

- University of Minnesota
- Mayo Clinic
- Toward Zero Deaths (TZD) coalitions
- Advisory Council on Traffic Safety (ACTS)

OFFICE OF TRAFFIC SAFETY

RSIC as a Public Resource

- Deliberate in development, recognizing different data needs
- Complements other tools and research avenues to solve problems

MnDOT Tools
- CRASHMART
- Minnesota Crash Mapping Analysis Tool (MnCMAT2)

Medical Research Community
- U of M: Translational Center for Resuscitative Trauma Care
- Mayo Clinic
- U of M: Advanced Trauma Care Services

Closing the Loop on Feedback

Content

- Better explanation on export re: map display & multiple files
- Consistent naming for null data across fields
- Revision of Data Definitions based on UI changes
- Removal of Waze's Irregularity data

Closing the Loop on Feedback

Usability

- Increased sensitivity for crash dots on map display
- Updated tabbing features to be more accessible for keyboard users
- Increased dot sizing when zooming on map display

Captured Feedback

What's Next?

- EMS mapping model
- Active engagement with traffic safety stakeholders to identify collaborative opportunities
- Continuous interface and user experience improvements on internal and external sites
- Identify and obtain additional data sets to address traffic safety issues and inform intervention strategies
- Continuous improvement of data models

OFFICE OF TRAFFIC SAFETY
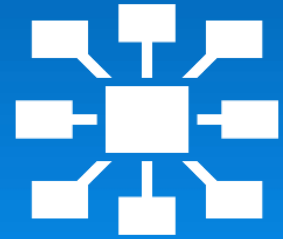
How Can You Help?

Share the platform with colleagues and partners: **https://roadsafetyinfocenter.mn.gov/**

Give us your feedback: **OTSRoadSafety.public@state.mn.us**

Crash Model Preview

Crash #1137960

Prediction: True

Probability: 0.3045635541358975

^ Prediction Factors
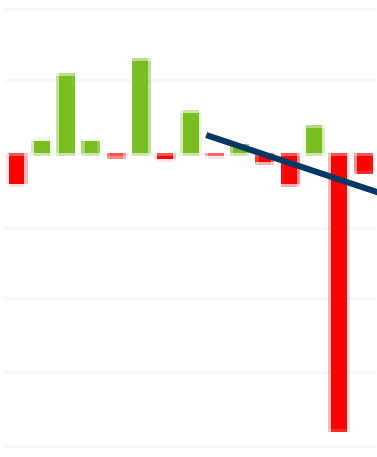
Each crash provides the output of the model – showing the positive or negative correlation for each predictive factor (using ML algorithm) identified based on data fields in a crash report.

As an example, for this crash we know:

- This crash did lead to a fatality (i.e., the prediction is true).
- ~30% chance that if the crash were to occur under similar conditions it would lead to a fatality.
- Below shows one of the factors; the driver was exceeding the speed limit.

^ Prediction Factors

ExceedingSpeedLimitInd- Exceeding Speed Limit
● 1.1599489611024643
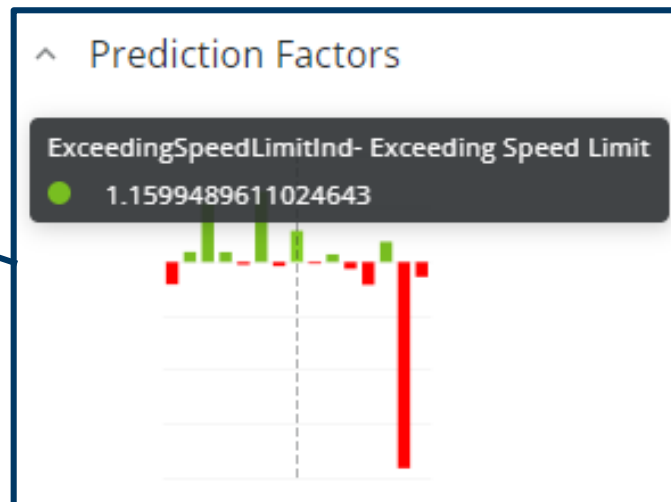
Description of the Crash Model Applied:

3 years training data: 2021-2023, severe injury and fatality as dependent variable, Model created 03/17/24
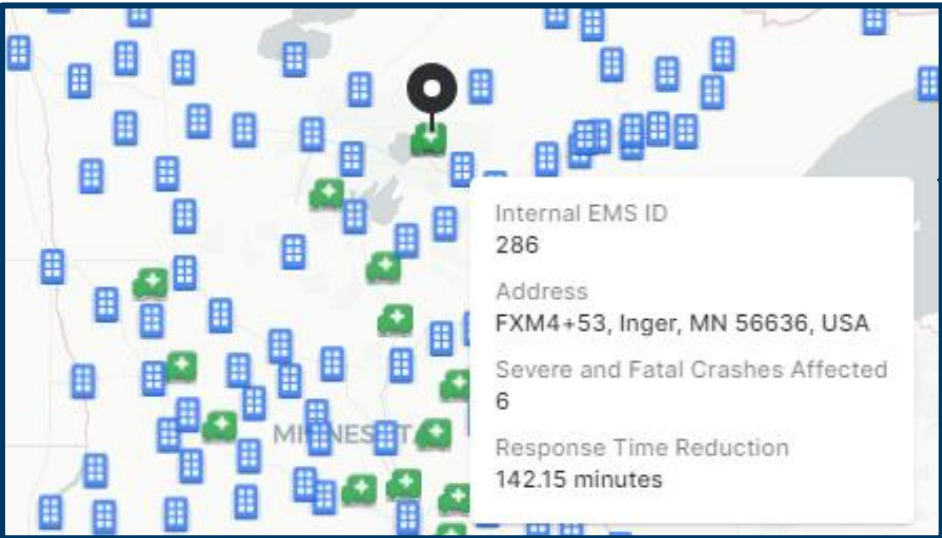
Severity Index: 5

Goal of the Model: Identify where additional dispatch locations could be to reduce response times for fatal and severe crashes.

Blue icons show *current* EMS provider locations.
Green icons show *proposed* EMS dispatch locations.

Adding this location could reduce the response time for 6 crashes by 142 minutes.
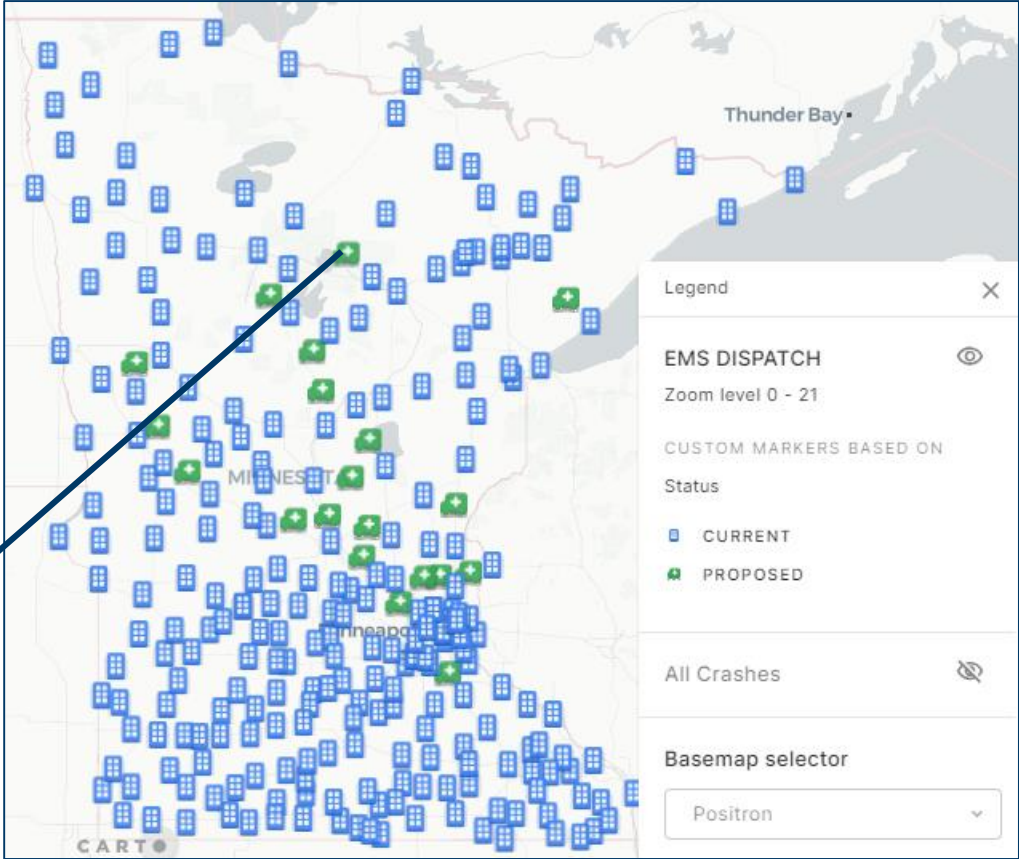
Internal EMS ID
286

Address
FXM4+53, Inger, MN 56636, USA

Severe and Fatal Crashes Affected
6

Response Time Reduction
142.15 minutes

Legend ✕

EMS DISPATCH 👁

Zoom level 0 - 21

CUSTOM MARKERS BASED ON

Status

▣ CURRENT
🟢 PROPOSED

All Crashes 🚫

Basemap selector

Positron ▼

20

Crash Data Analysis Systems at MDH

Erik Zabel, PhD, MPH – Anna Gaichas, MS – Nadav Cassuto, PhD
Advisory Council on Traffic Safety
June 12, 2024

PROTECTING, MAINTAINING AND IMPROVING THE HEALTH OF ALL MINNESOTANS

- MDH Data - what it adds to crash analysis

- Linking MDH data to crash data (CODES)

- Example data analysis results

MDH Injury & Violence Prevention

- Traffic Safety Data Linkage & Analysis

- Traumatic Brain and Spinal Cord Injury Registry

- Center for Occupational Health & Safety

- Alcohol/Drug Abuse Epidemiology & Prevention

- Suicide Epidemiology & Prevention

- & more

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Data linkage

Crash Outcome Data Evaluation System

- A System that links

- Crash to Hospital, Ambulance, and other Data

- To Evaluate Cost and Health Outcomes

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OF HEALTH

Data Sources to Link to Crash by Status

Data Sources	Linked	Processing	Planned
Hospital & emergency department discharge	2016-2021, 2006-2012	2022-2023	2024+
Trauma registry	2006-2012	2016-2023	2024+
Traumatic brain & spinal cord injury registry	2006-2012	2016-2023	2024+
Death certificates	2006-2012	2016-2023	2024+
EMS		2016-2023	2024+
All payer claims data			TBD
Syndromic surveillance			TBD

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Hospital Data Additional Components

- Hospital-determined injury severity

- Other medical information
  - Injury type (e.g., brain injury)
  - Outcome
  - Payer
  - Resources used (emergency department vs. inpatient, length of stay, cost estimates)

- Trauma Registry (alcohol/drug use , vital signs, narrative, etc.)

- Non-traffic transportation injury

  - Pedestrians & bikes not on roadway

- Intentional injury

  - Road rage (assault), self-inflicted injury

- Unreported crashes

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Results: Analysis Examples

Pedestrians are injured more severely than bicyclists.

Severity (All) ▾

Bicyclist	No Injury	
	Minor	547 (39%)
	Moderate	409 (29%)
	Serious	203 (15%)
	Severe	50 (4%)
	Critical	
	Expired	
Pedestrian	No Injury	
	Minor	371 (30%)
	Moderate	
	Serious	206 (17%)
	Severe	87 (7%)
	Critical	
	Expired	
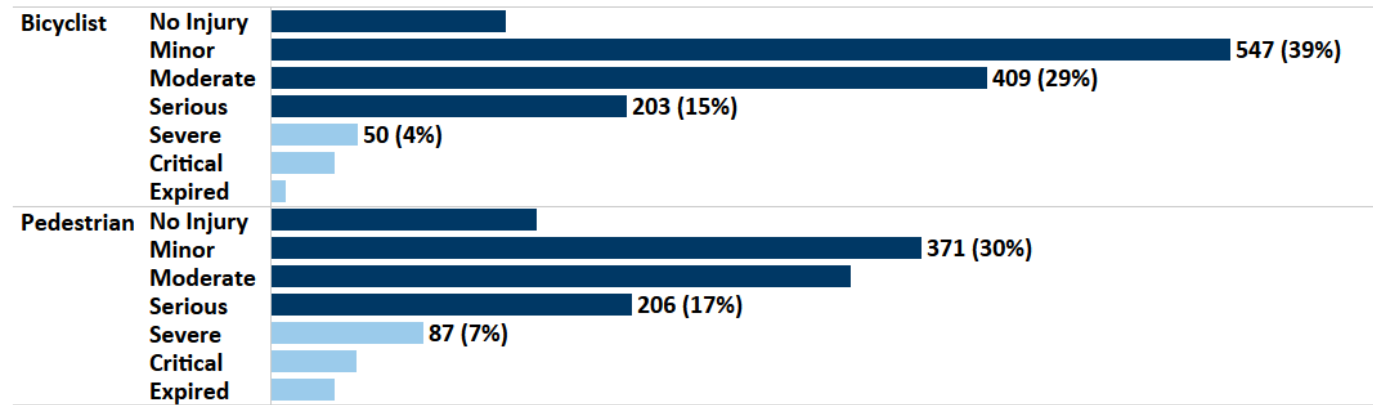
Pedestrians struck by Pickups, SUVs and Vans are injured more severely than those struck by cars.

Bicyclist — Car: No Injury 20, Possible 71, Minor 77, Moderate 37, Severe 10, Critical 7, Expired 1

Bicyclist — Pickup, Van, SUV: No Injury 11, Possible 47, Minor 58, Moderate 29, Severe 10, Critical 7, Expired 4

Pedestrian — Car: No Injury 45, Possible 146, Minor 111, Moderate 67, Severe 39, Critical 24, Expired 15

Pedestrian — Pickup, Van, SUV: No Injury 25, Possible 89, Minor 104, Moderate 70, Severe 26, Critical 15, Expired 17

Average

Speed Limit	Cost
5-15 mph	$15,618 (65 people)
20-30 mph	$26,019 (1,896 people)
35-50 mph	$28,500 (1,770 people)
55-65 mph	$32,734 (4,248 people)
70 mph	$26,921 (380 people)

- # Total Cost

Mean = 6195.59
Std. Dev. = 21069.221
N = 33,468

		TotalCost
N Valid		33468
Mean	$	6,195.59
Std. Deviation	$	21,069.22
Range	$	690,856.69
Minimum	$	31.29
Maximum	$	690,887.98
Sum		$207,354,063.26

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- **Inpatient**

- **Emergency Department**

Type of Bill

	ED	Inpatient
	28958	4510

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- **Inpatient**

- **Emergency Department**

	TotalCost-Mean	TotalCost - N	TotalCost-Sum	TotalCost Minimum	TotalCost-Maximum
Emergency.Department	$ 1,868.34	28,958.00	$ 54,103,346.36	$ 31.29	$ 51,584.51
Inpatient	$33,980.20	4,510.00	$153,250,716.90	$1,176.83	$690,887.98
Total	$ 6,195.59	33,468.00	$207,354,063.26	$ 31.29	$690,887.98

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Median Hospital Inpatient Costs by Position and Year
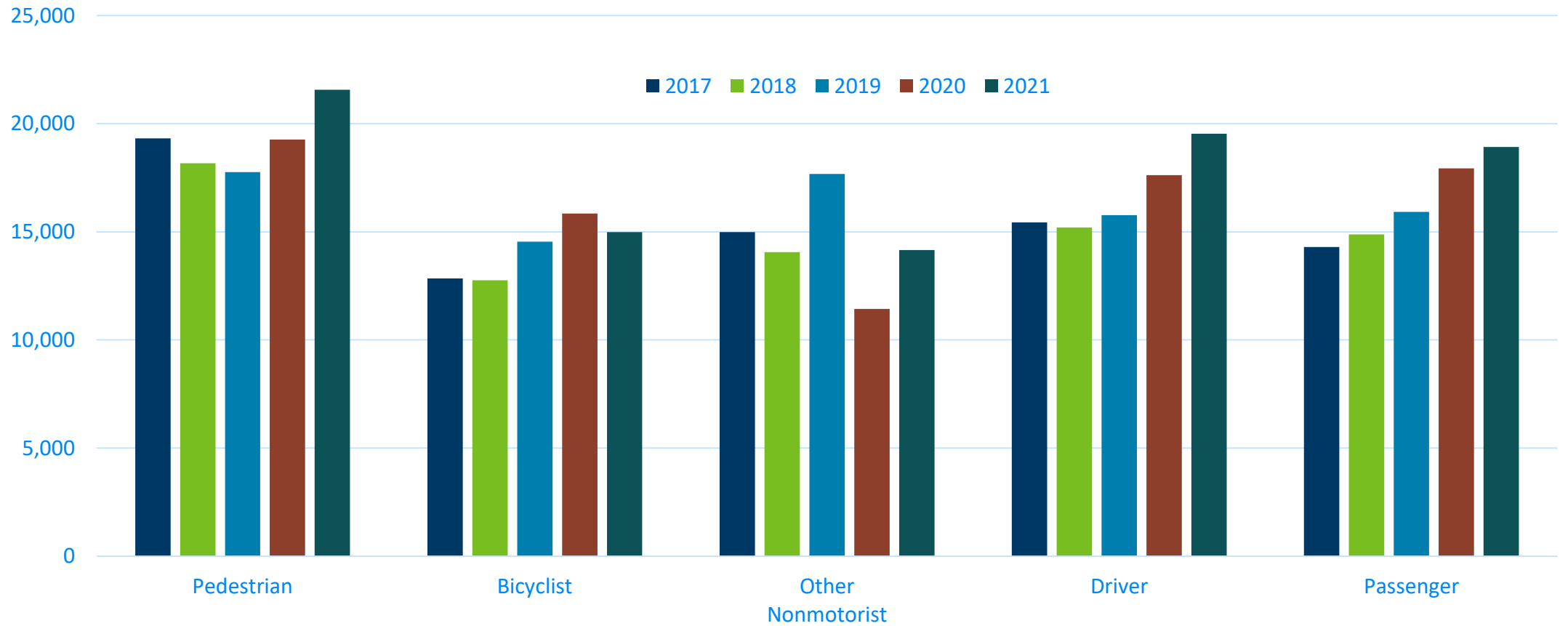
Median Emergency Department Costs by Position and Year
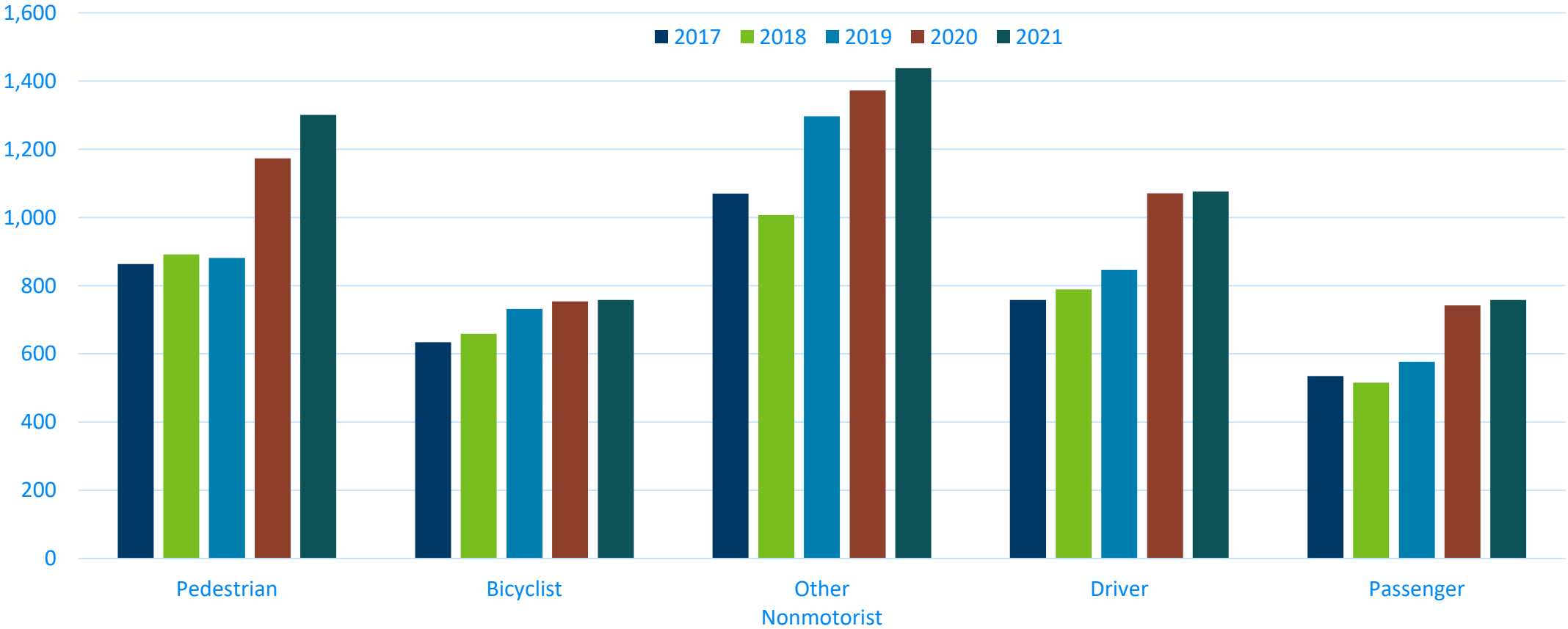
2021 Linked Hospital Data – Injury Severity Score

- **ISS 15+ – Serious Injury**

ISS	Frequency	Percent
Not Severe Injury	33546	91.7
Severe Injury	3054	8.3
Total	36600	100.0

Iss

N	33490
Mean	5.05
Median	1.00
Mode	1
Std. Deviation	8.176
Range	75
Minimum	0
Maximum	75
Sum	169119

- **Logistic Regression**

- Running the LR to get the best combination of variables predicting the probability for TBI.

1.929
1.555894223
0.449147974

Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)	Z	
Step 12ʲ	vehtypestdall.snow.01	1.830	0.428	18.290	1	0.000	6.236	9.5899	9
	SafetyEquipmentUseCde.None_Used_Motor_Vehicle_Occupant.01	0.991	0.058	291.299	1	0.000	2.693	1.7030	7
	vehtypestdall.atv.01	0.940	0.187	25.195	1	0.000	2.560	1.4054	7
	vehtypestdall.motorcycle.01	0.931	0.080	134.373	1	0.000	2.537	1.3551	7
	VehicleModel	0.501	0.163	9.500	1	0.002	1.651	-0.6181	3
	SafetyEquipmentUseCde.No_Helmet.01	0.468	0.129	13.051	1	0.000	1.596	-0.7399	3
	SafetyEquipmentUseCde.None.01	0.467	0.105	19.619	1	0.000	1.595	-0.7433	3
	CarAge.X.PersonAge	0.154	0.020	57.343	1	0.000	1.167	-1.6955	1
	Road.Obstacle	0.125	0.021	35.046	1	0.000	1.133	-1.7719	1
	driver.driver.seat	-0.086	0.019	19.510	1	0.000	0.918	-2.2501	1
	SUV.LIKE_Vehicle	-0.112	0.026	17.888	1	0.000	0.894	-2.3023	1
	SafetyEquipmentUseCde.Child_Restraint_System_Rear_Facing.01	-1.818	0.452	16.204	1	0.000	0.162	-3.9322	1

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Crash 3 Variables Sample Generated From Narrative Data

Narrative Derived Variables (mlelinks18-20)	N	Sum	%
NarrativeTxt.Distracted.01_max	240796	4724.00	1.96%
NarrativeTxt.Alcohol.01_max	240796	4053.00	1.68%
NarrativeTxt.Rage.01_max	240796	3483.00	1.45%

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Minnesota Injury Data Access System (MIDAS)

https://www.health.state.mn.us/communities/injury/midas/index.html

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Thank you.

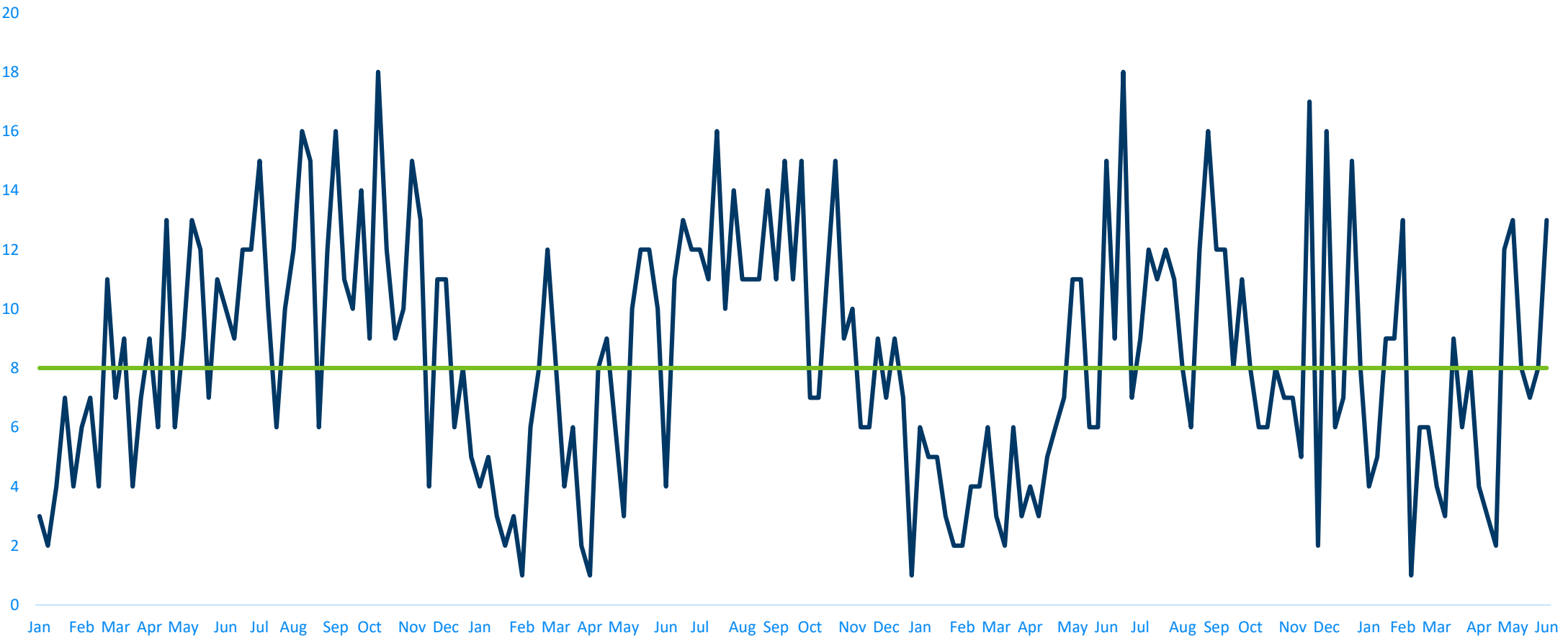Erik.Zabel@state.mn.us

Anna.Gaichas@state.mn.us

Nadav.Cassuto@state.mn.us

Council Member Group Photo

Break

- Impacts of Winter Weather on Crash Data

    - *Brian Harmon, Minnesota Department of Public Safety*

    - *Ian Saari, Minnesota Department of Transportation*

Traffic Fatalities by Week: December 28, 2020-June 2, 2024

Are Mild Winters More Dangerous on Minnesota Roadways?

- Short Answer? Probably So…

- Review Winter Fatality & Serious Injury Crash Data from the TZD Era (2004-05 through 2023-24)

  - Crash Counts in Mild vs. Normal Winters

  - Correlations of Fatalities & Serious Injuries with Broad Weather Measures (Snowfall, Average Temperatures, etc.)   {*Metro Area Only*}

Mild Minnesota Winters Since Start of TZD

- 2004-05

- 2006-07

- 2015-16

- 2023-24

Fatal & Serious Injury Crashes for Each Winter (Dec-Mar)
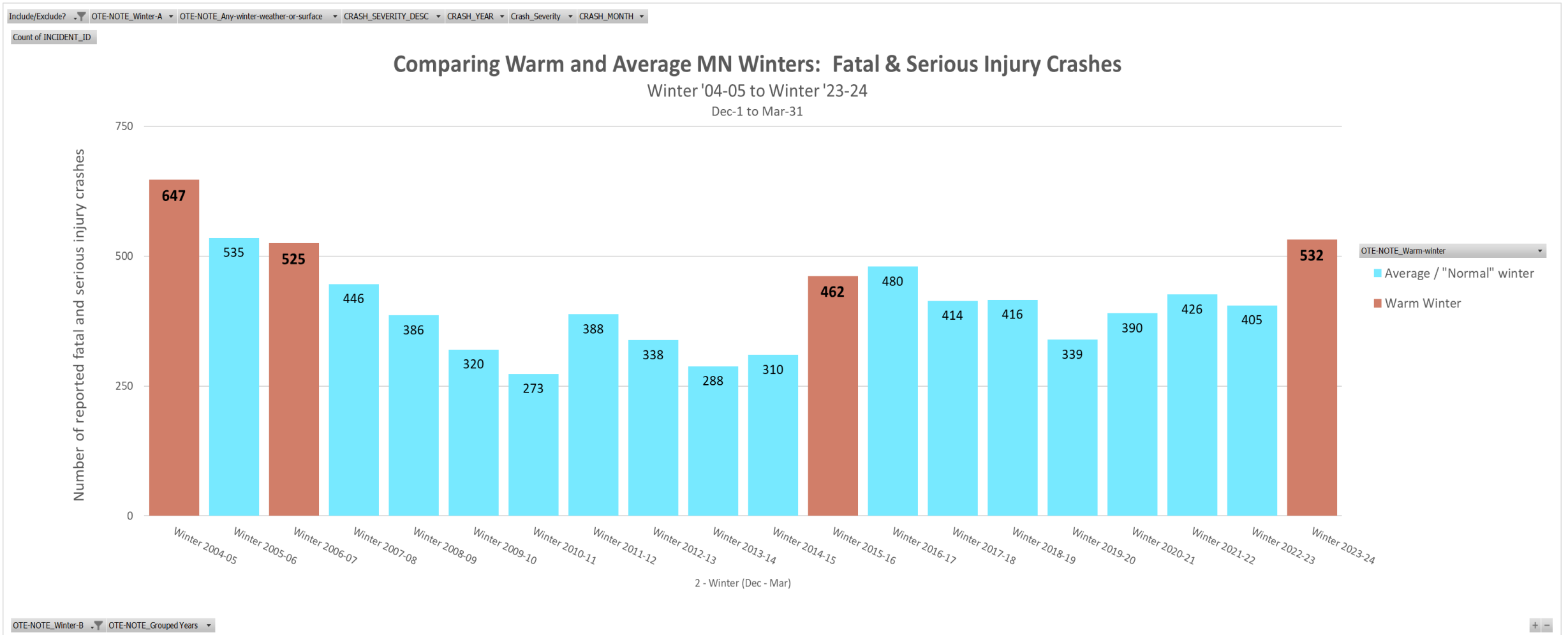
Non-Motorist Fatal & Serious Injury Crashes for Each Winter

Comparing Warm and Average MN Winters: Fatal & Serious Injury Crashes
Winter '04-05 to Winter '23-24
Dec-1 to Mar-31
Other criteria: Crash involved at least 1 non-motorist
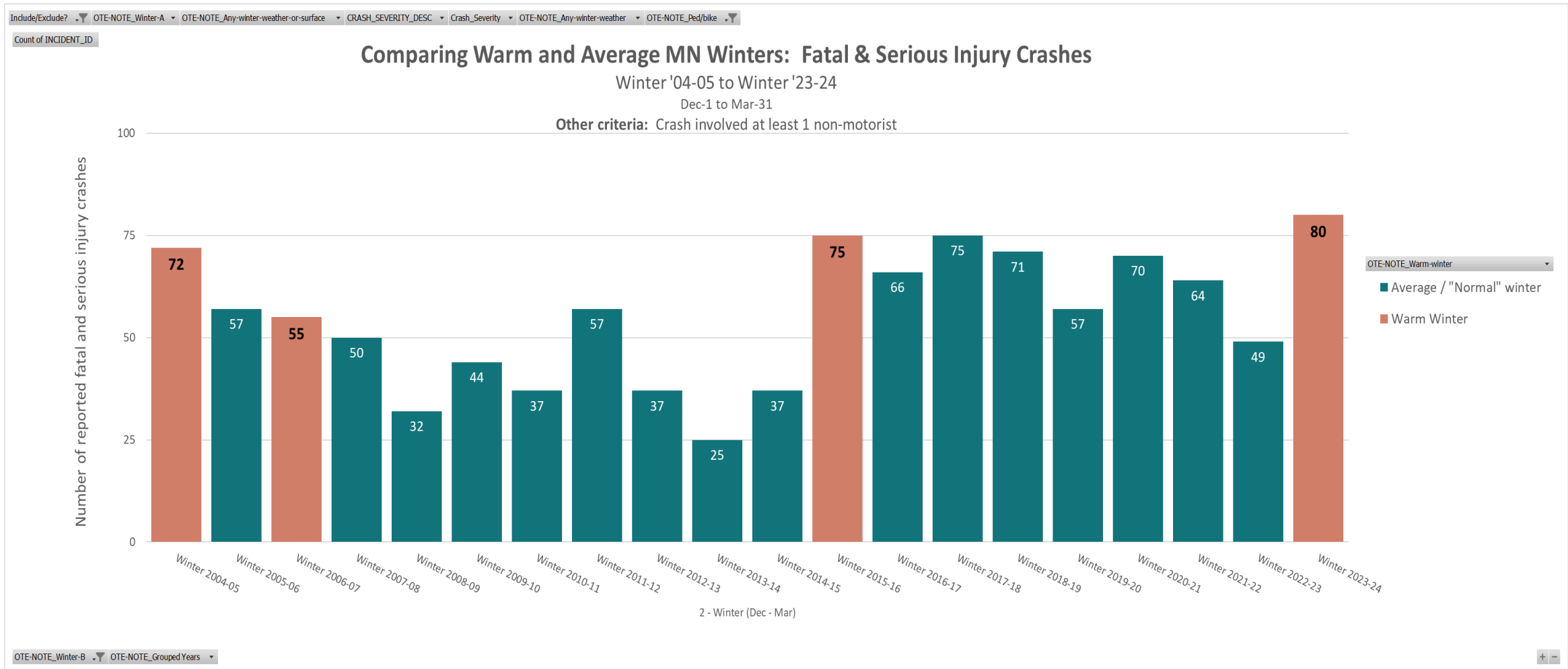
Mild Winters Accounted for Higher Fatal & Serious Injury Crash Counts in :

- Single Vehicle Run-Off-Road Crashes (4 of top 7 were mild winters)

- Motorcycle Crashes (3 of top 5)

- Crashes With At Least One Driver Under 21 Years of Age (3 of top 5)

Correlation between Fatalities/Serious Injuries and Weather Measures for Metro Area

- Total Snowfall (Inches)

- Number of Days with Measurable Snowfall (> 0.1 Inches)

- Average Temperature (Fahrenheit)

- Number of Days Minimum Temperature was Below Zero

- Each Season Nov-Mar

- 2005-06 through 2023-24 (19 seasons)

Data Sample

Season	Total Snow	Days with Snow	Average Temp	Days Below Zero	Fatalities & Serious Injuries
2023-24	29.5	22	33.12	6	349
2022-23	90.3	48	24.66	17	294
2021-22	50.2	36	23.70	28	325
2020-21	48.7	33	27.64	15	245
2019-20	51.5	36	26.68	18	246

Correlations of All Winter Fatalities & Serious Injuries With Winter Measures

	Fatalities & Serious Injuries	Fatalities Only	Serious Injuries Only
Total Snow	-0.21	-0.20	-0.19
Days With Snow	**-0.54**	-0.30	**-0.54**
Average Temp	0.44	0.10	**0.46**
Days Below Zero	-0.37	-0.14	-0.37

The More Snow, the Fewer Fatalities and Serious Injuries

- Over the course of an entire season, the number of days with measurable snow tends to be a better indicator than the total amount of snow fallen.

- This difference dissipates when reviewed on a month-by-month basis.

- The trend might shift with a days indicator more sensitive to greater amounts of snow (i.e., number of days with snowfall greater than 4 inches, etc.)

What is This Saying?

The Higher the Average Temperature, the More Fatalities and Serious Injuries

The More Days of Bitter Cold, the Fewer Fatalities and Serious Injuries

- While neither of these were statistically significant, the trend was still notable.

What is This Saying?

When Taken Separately, These Patterns are More Robust for Serious Injuries Than They Are For Fatalities

- The smaller number of fatalities each winter makes correlational analysis less effective.

- There may be a greater number of factors (some of them random) that differentiate a fatality from a serious injury.

Risk Factors (Speed, Alcohol, Distraction, Seat Belts)

- The correlation analysis did not reveal anything new when fatalities & serious injuries were isolated by the four major risk factors.

- In some instances, the correlation structure remained roughly the same as the overall, but more often than not, it fell apart.

- For example, we might have expected speed-related serious crashes to have been more strongly related to weather measures than for overall counts. Instead, the relationships were much weaker.

Risk Factors (Speed, Alcohol, Distraction, Seat Belts)
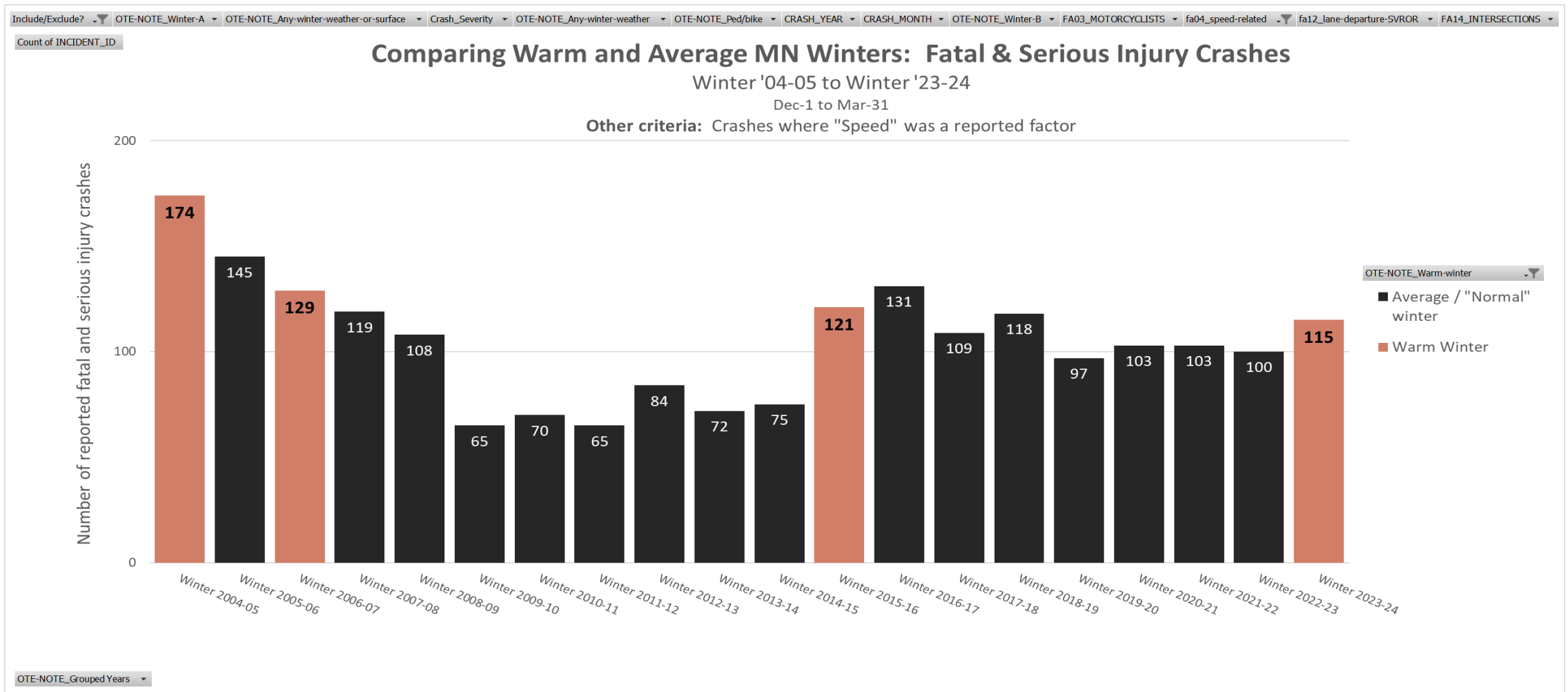
Risk Factors (Speed, Alcohol, Distraction, Seat Belts)

- There were a few isolated exceptions to this pattern drop-off within the risk factor isolation correlation analyses, but small Ns and other problems make them more likely to be statistical oddities than genuine trends.

Correlations of All Winter Fatalities & Injuries with Weather Measures by Month

	Nov	Dec	Jan	Feb	Mar
Total Snow	-0.08	-0.41	-0.26	-0.32	0.15
Days with Snow	0.02	-0.41	-0.25	-0.32	-0.07
Avg Temp	0.09	0.39	0.28	0.14	0.37
Days Below Zero	-0.20	-0.21	-0.14	-0.13	-0.43

In Summary…

- While the data are murky and loaded with confounding factors, there is reason to assume that in general, milder winters are a contributing factor to higher numbers of severe traffic crashes in Minnesota.

- This exercise has revealed a number of subtle distinctions that we may not have previously considered that can improve our research into this question in the future.

- In the future, when milder winters are forecast, does it make sense to plan some limited deployment of countermeasures that are typically reserved for warmer months?

Questions?

2024 MN Legislative Session: Traffic Safety Recap

- 2024 Legislative Highlights

- 2025 (Pre) Thinking

Council Business: Subcommittees and Working Groups

- Project Idea Solicitation Process Subcommittee

  - *Stephanie Malinoff, Center for Transportation Studies*

- Strategic Highway Safety Plan Working Group

  - *Derek Leuer, Minnesota Department of Transportation*

- Rural High Risk Roads/Safe Road Zones Working Group

  - *Derek Leuer, Minnesota Department of Transportation*

Project Idea Solicitation Subcommittee

- Volunteers

  - *Becky Putzke, Brian Sorenson, Catherine Diamond, Derek Leuer, Heidi Schallberg, Jeff Tate, Kristine Hernandez, Kerry Meyer, Mike Hanson*

- Application Timeline

  - *Applications due: June 17 at 8:00am*

  - *Review and scoring meeting: June 28*

  - *Decisions announced: around July 1*

- **Strategic Highway Safety Plan**

  - Currently 11 Members Volunteered

  - Paul Aasen, Luis Flores, Chris Hartzell, Kristine Hernandez, Pete Hosmer, Lisa Kons, Annette Larson, Judge Kerry Meyer, Cheryl Quinn, Michael Wojcik, Heidi Schallberg

  - Support: Whitney Mason, Michelle Pooler, Tim Burkhart, Major Joe Dwyer, Major Jeff Huettl, Mike Hanson

- **Strategic Highway Safety Plan**

- Met on May 10th

- Discussed the following:

  - Went thru the engagement materials used at TZD

  - Provided feedback into the SHSP Process

  - Provided feedback on the tools used to collect engagement

- Next Meeting: June 12, 2024

Working Group Updates

- **Strategic Highway Safety Plan Status**

- Crash Data Analysis finalizing

- Engagement!
  - TZD Workshops (Completed)
  - Online Survey
  - Online Map
  - More to Come!
  - Work Groups
  - Equity Meetings

- Next ACTS: Crash Data Presentation? Engagement Results (Preliminary)?

talk.dot.state.mn.us/shsp

- Strategic Highway Safety Plan

  - *Derek Leuer, Minnesota Department of Transportation*

- **Safe Road Zone and Rural High Risk Roadways**

  - *Derek Leuer, Minnesota Department of Transportation*

Safe Road Zone and Rural High Risk Roadways

- Group has met six times

- Developed the Rural High Risk Roadways Program and Solicitation

    - $10M ready for safety projects on Minnesota Trunk Highways

    - Goal to "Reduce Speeds and Conflicts on Rural Highways"

- Solicitation has been out and completed!

- MnDOT is converting funds and sending to recipients

- All money spoken for!

Rural High Risk Roadways Timeline

- Reviewed/Sent to the Team completed

- Now-April 30: Team is reviewing applications

- May 1st: Team meets to review/finalize scores

- May 2nd: Sent out notifications

- Working with recipients

Safe Road Zones

- Solicitation Closed May 3rd

- Local Agencies applied for funding

- $1M for establishment of zone and $1M for added enforcement

- Can be used for studies, infrastructure, education, social media campaigns, etc

- 24 agencies applied for funding

Safe Road Zones

- All 24 funded to the full amount (some more then requested!)

- DPS is processing Enforcement Grants

- MnDOT is processing education/awareness grants

- Funds awarded/distributed July 1 (new State Fiscal Year)

ASK: Can we disband this work-group at this time?

- Meeting Attendance Expectations

  - *Brian Sorenson, Minnesota Department of Transportation*

- Toward Zero Deaths Statewide Conference

  - *Brian Sorenson, Minnesota Department of Transportation*

Public comment is limited. The number of commenters and length of time permitted is at the discretion of the chair, and is subject to change.