Leveraging Esri Technology to Improve the Safety of State Roadways

Presented by
STEVE ANDERSON, GISP

July 7, 2019

Presentation Overview

- What is the issue we are trying to solve?
- What is safety management?
- How can Esri technology help?

Crash Fatalities

- Worldwide:
  - ≈ 1.35 million people die each year on roads
    - 3,700 people die on the roads every day
- United States:
  - ≈ 40,000 killed in crashes (2018)
  - ≈ 4.5 million seriously injured in crashes
  - Every 7 seconds someone is hurt in a car crash.

"Forty-thousand deaths is unacceptable," said **Nicholas Smith, interim president and CEO of NSC**. "We cannot afford to tread water any more. We know what works, but we need to demonstrate the commitment to implementing the solutions. **Roadway deaths are preventable by doubling down on what works, embracing technology advancements and creating a culture of safer driving."**

National Safety Council (NSC), June 5, 2019

What is safety management?

Overview of Safety Management

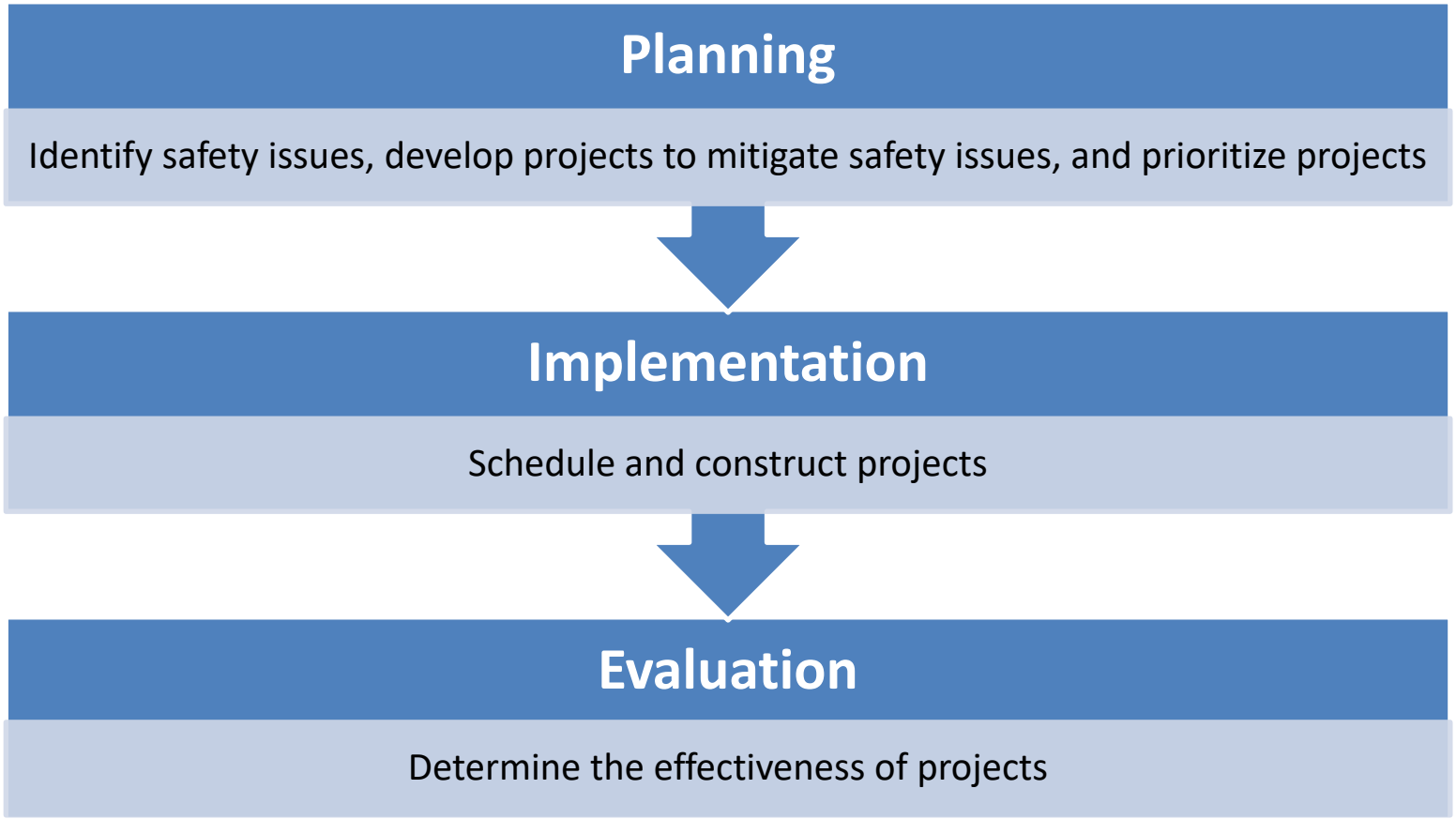
Purpose

"Achieve a **significant reduction** in traffic **fatalities and serious injuries** on **all public roads**, including non-State-owned roads and roads on tribal land."

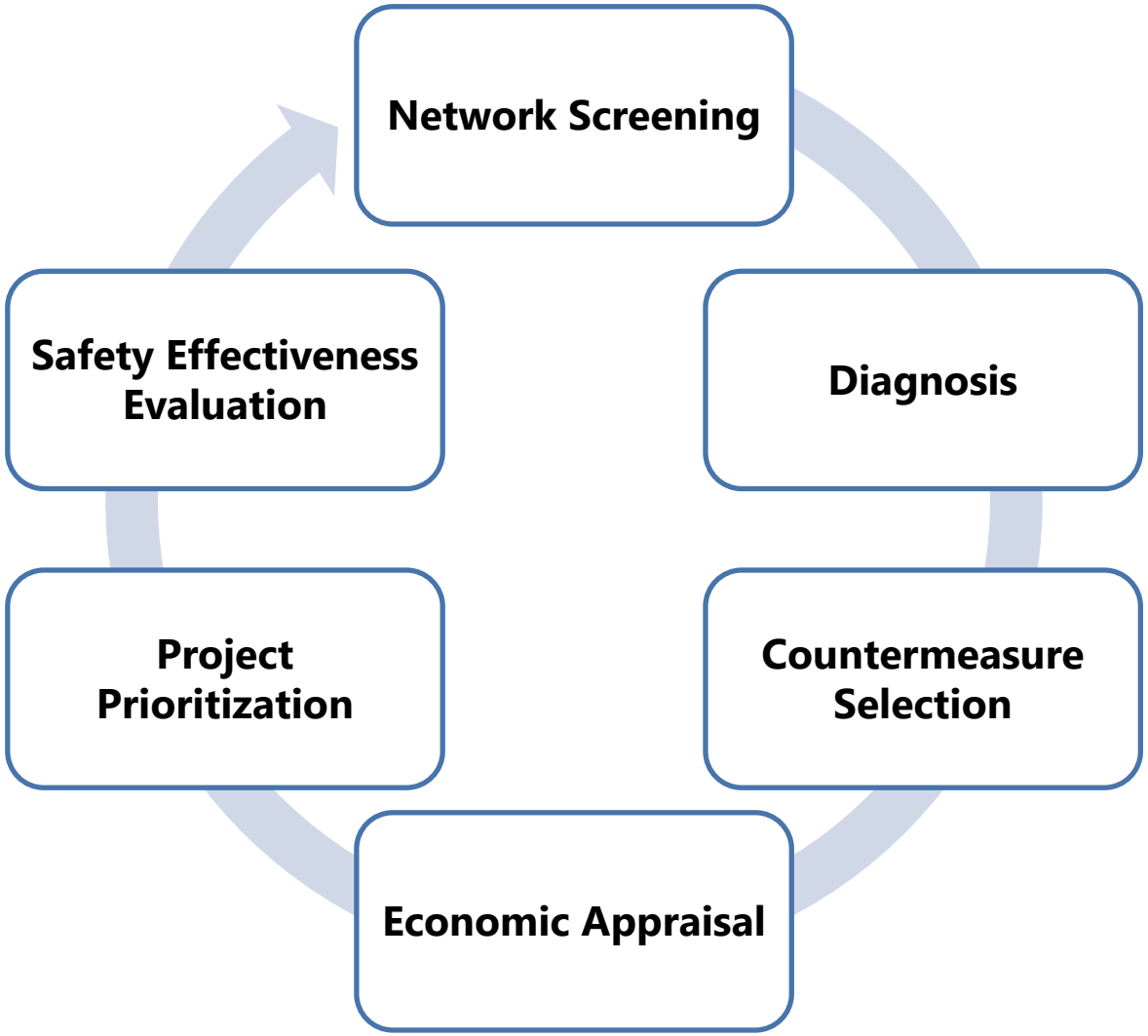
--FHWA Highway Safety Improvement Program (HSIP)

Overview of Safety Management

Process

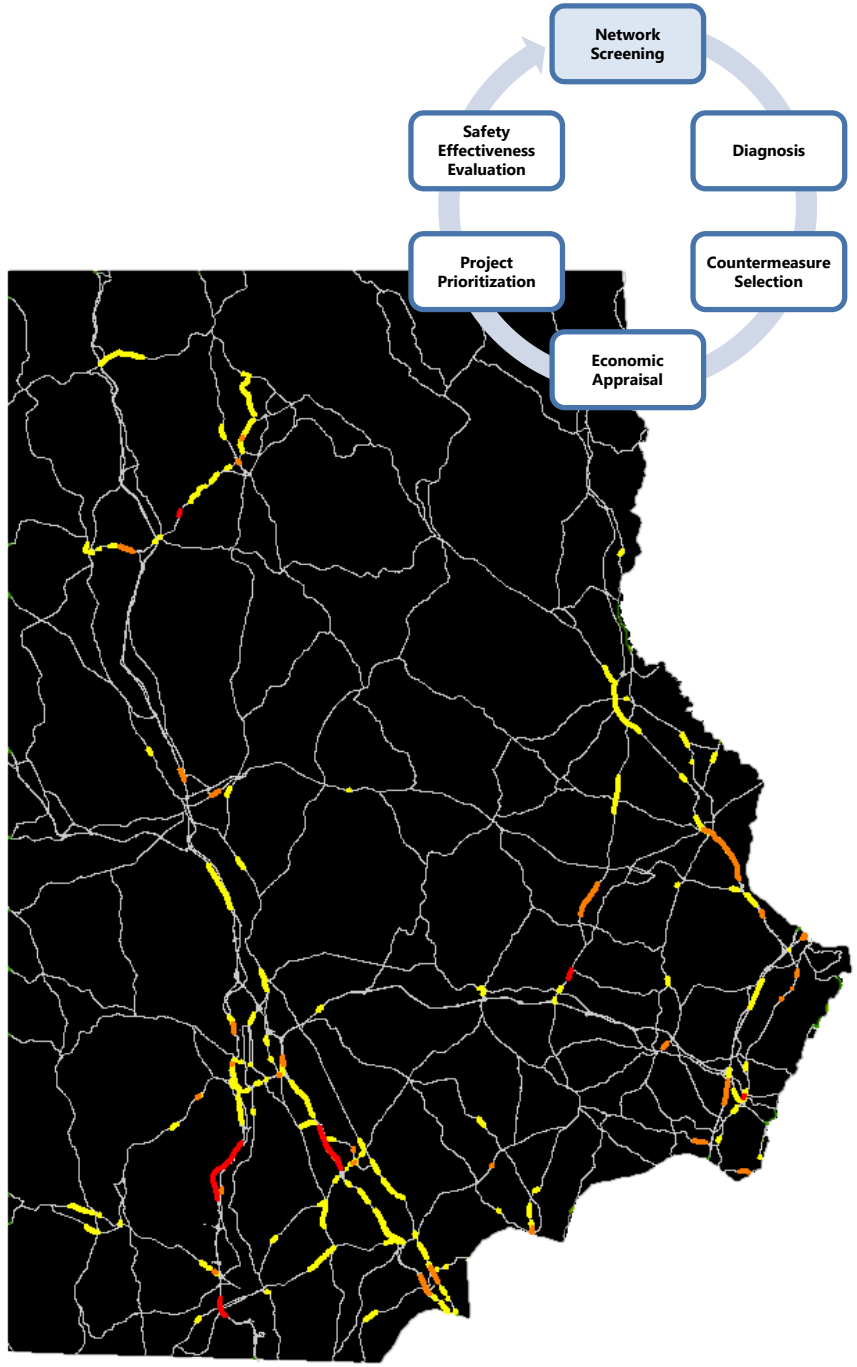


6-Step Safety Management Process

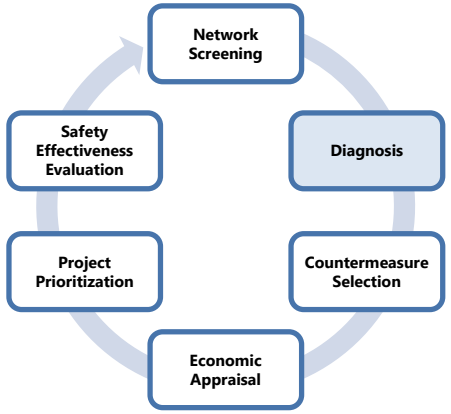


Network Screening

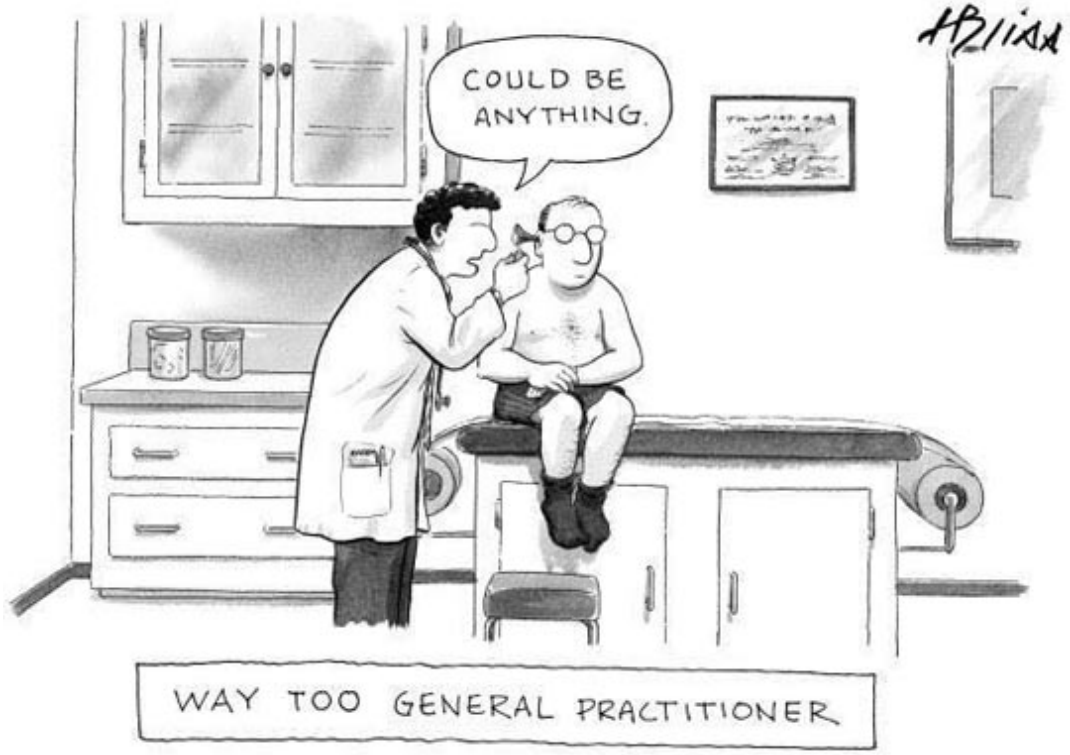
- **Objective:** Select sites for further investigation
  - Pare-down network to manageable list



Diagnosis

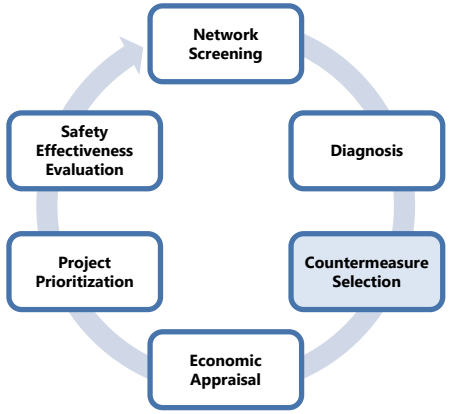


- **Objective:** investigate sites with promise
  - Understand crash patterns
  - Diagnose underlying factors

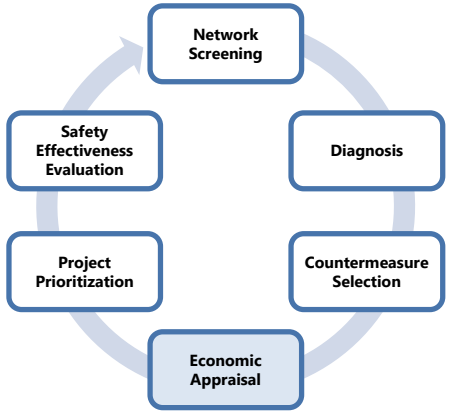


Countermeasure Selection

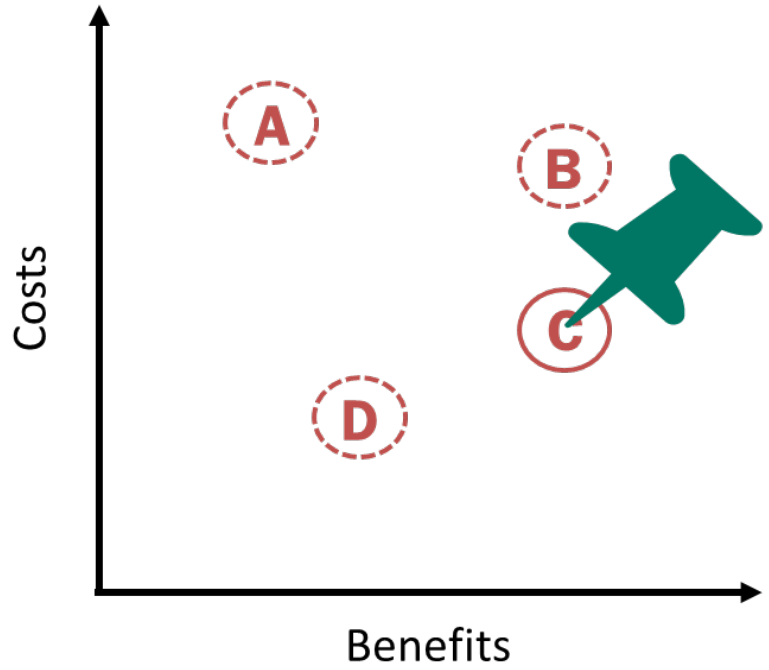
- **Objective:** identify potential treatments to target underlying safety issues
  - Consider 4E approach
    - Engineering
    - Education
    - Enforcement
    - Emergency Response



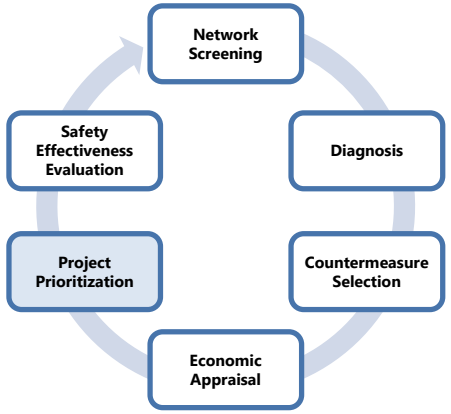
Economic Appraisal



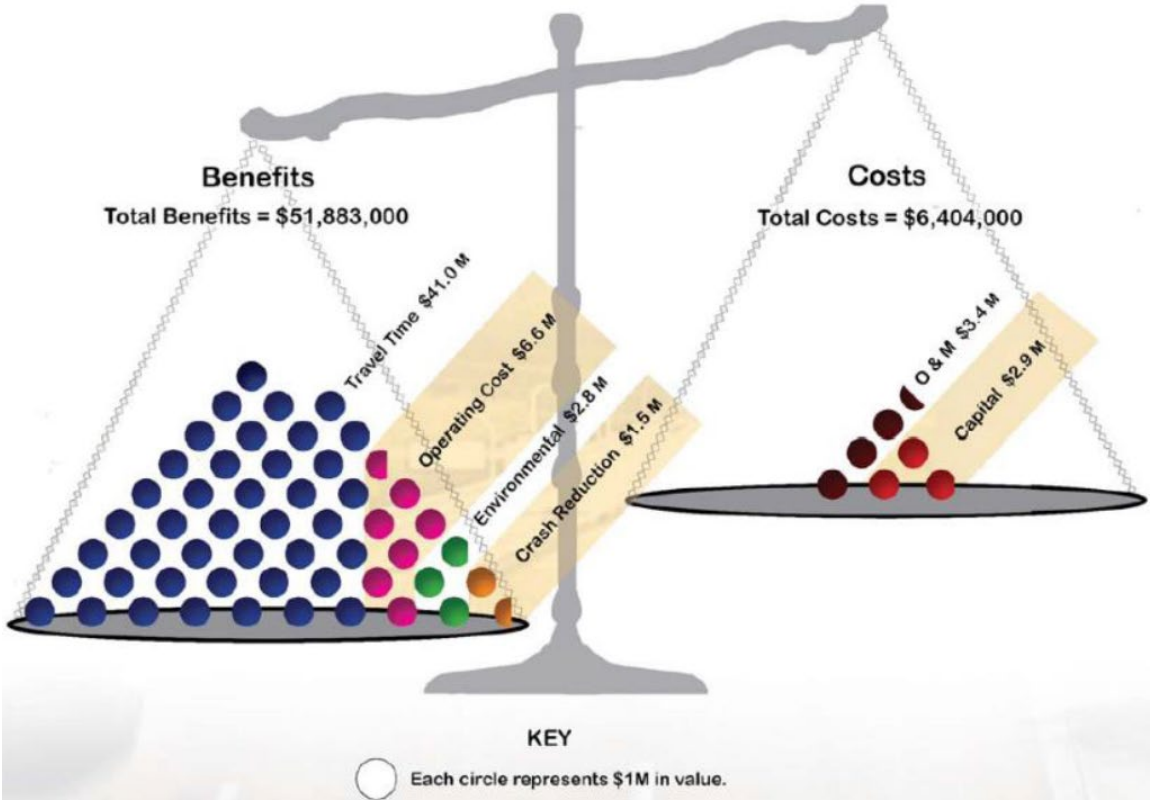
- **Objective:** Compare relative costs and benefits of alternatives
  - Perform benefit/cost analysis
  - Identify economically-efficient alternatives
  - Select final countermeasures



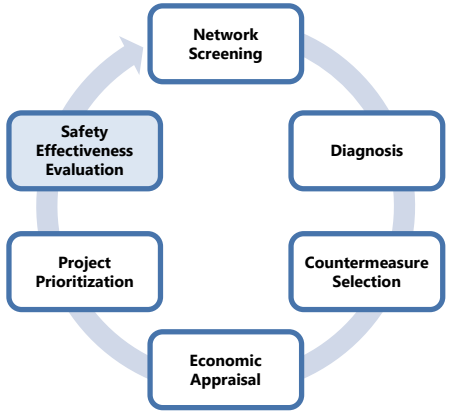
Project Prioritization



- **Objective:** Develop portfolio of projects for a given fiscal year that maximizes the return on investment

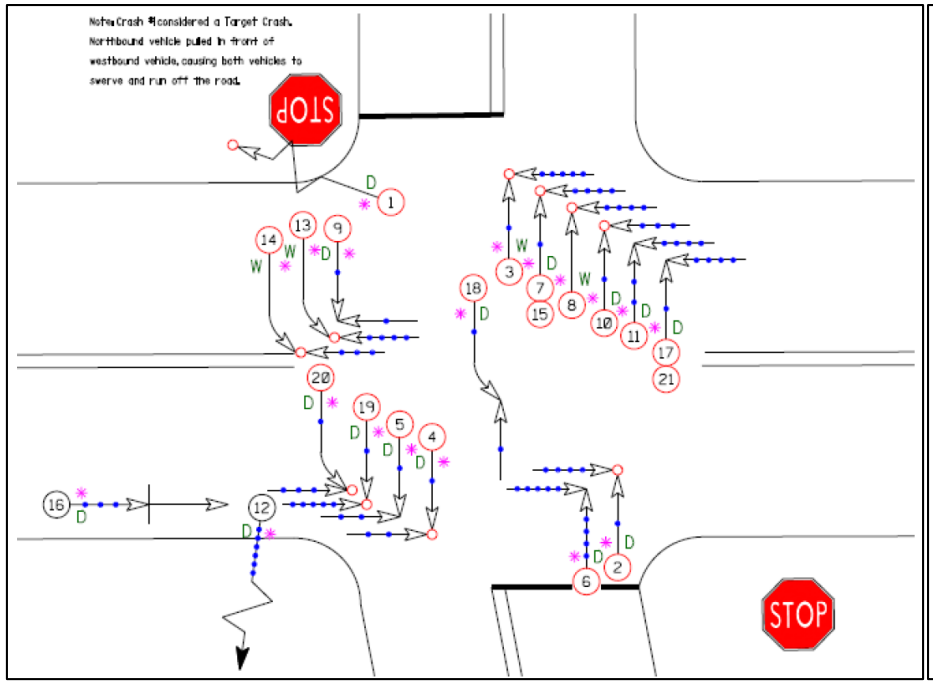


Safety Effectiveness Evaluation

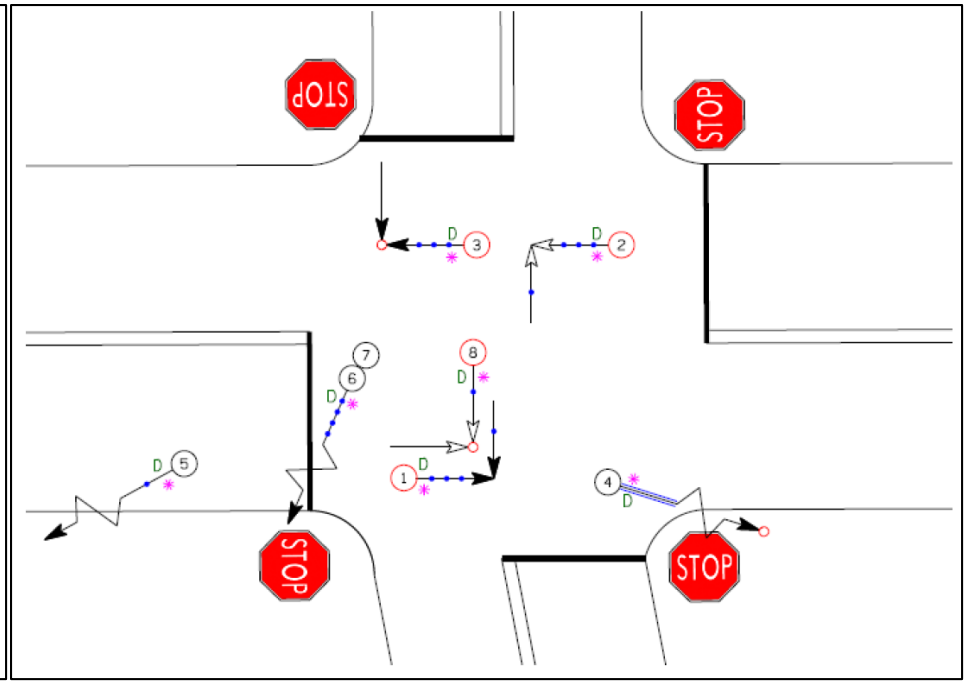


- **Objective:** Determine how projects have affected safety performance
  - Use results to make future decisions, allocate funds, and change policies

Before



After

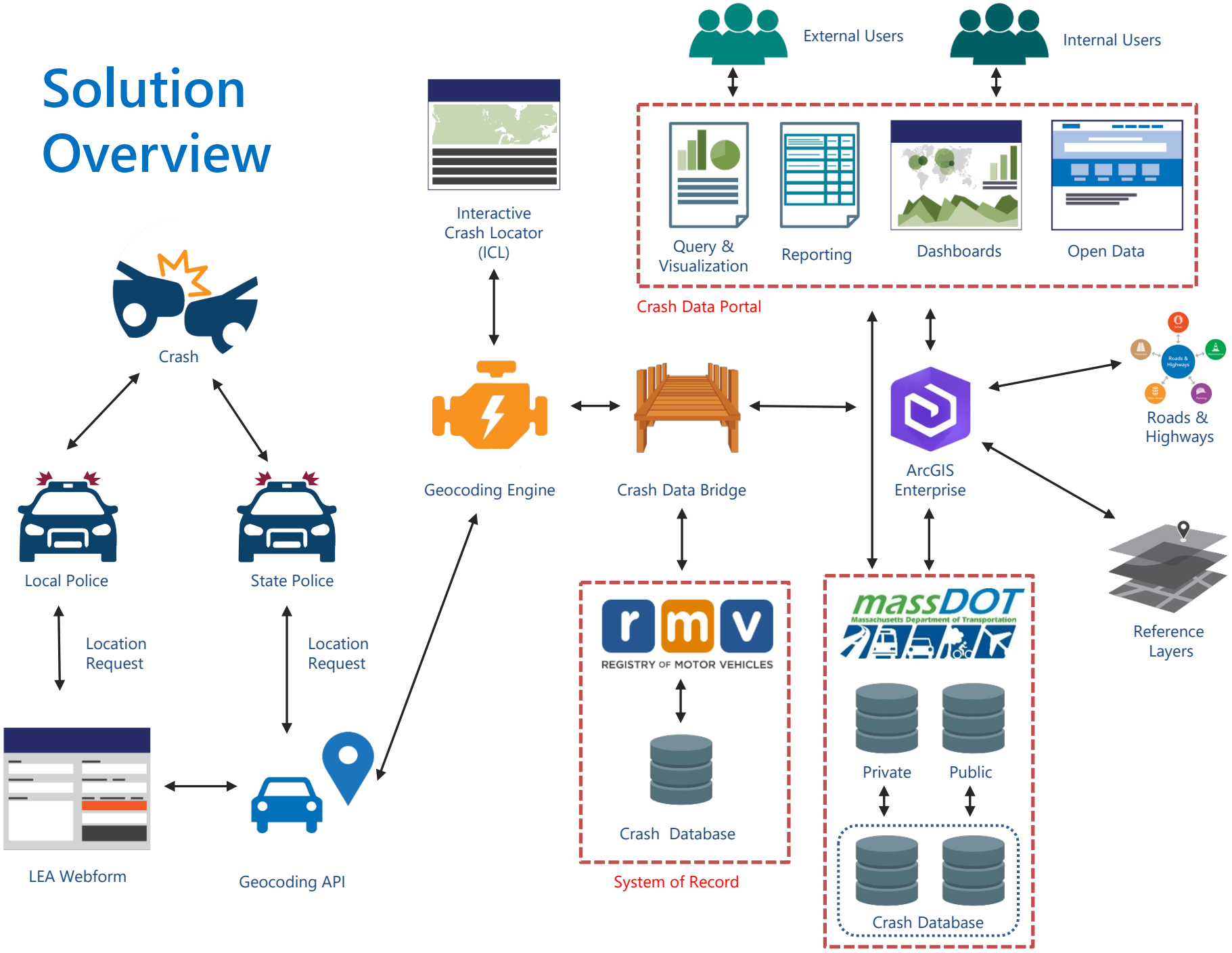


How are states improving their process with Esri technology?

MassDOT's Objectives

- **Replace** and enhance the **existing crash geocoder** system
- Leverage Esri **Roads and Highways**
- **Validate** and **geo-locate** crash data **in real time**
- Develop a **new crash database** that will:
  - interface with the **new geocoder** and validator system
  - be the **system of record** for crash locations
  - support a new, **public-facing crash data portal**
  - provide **real-time synchronization** with the RMV Crash Database
  - provide relevant **data redaction** within key workflows

Solution Overview



Interactive Crash Locator (ICL)

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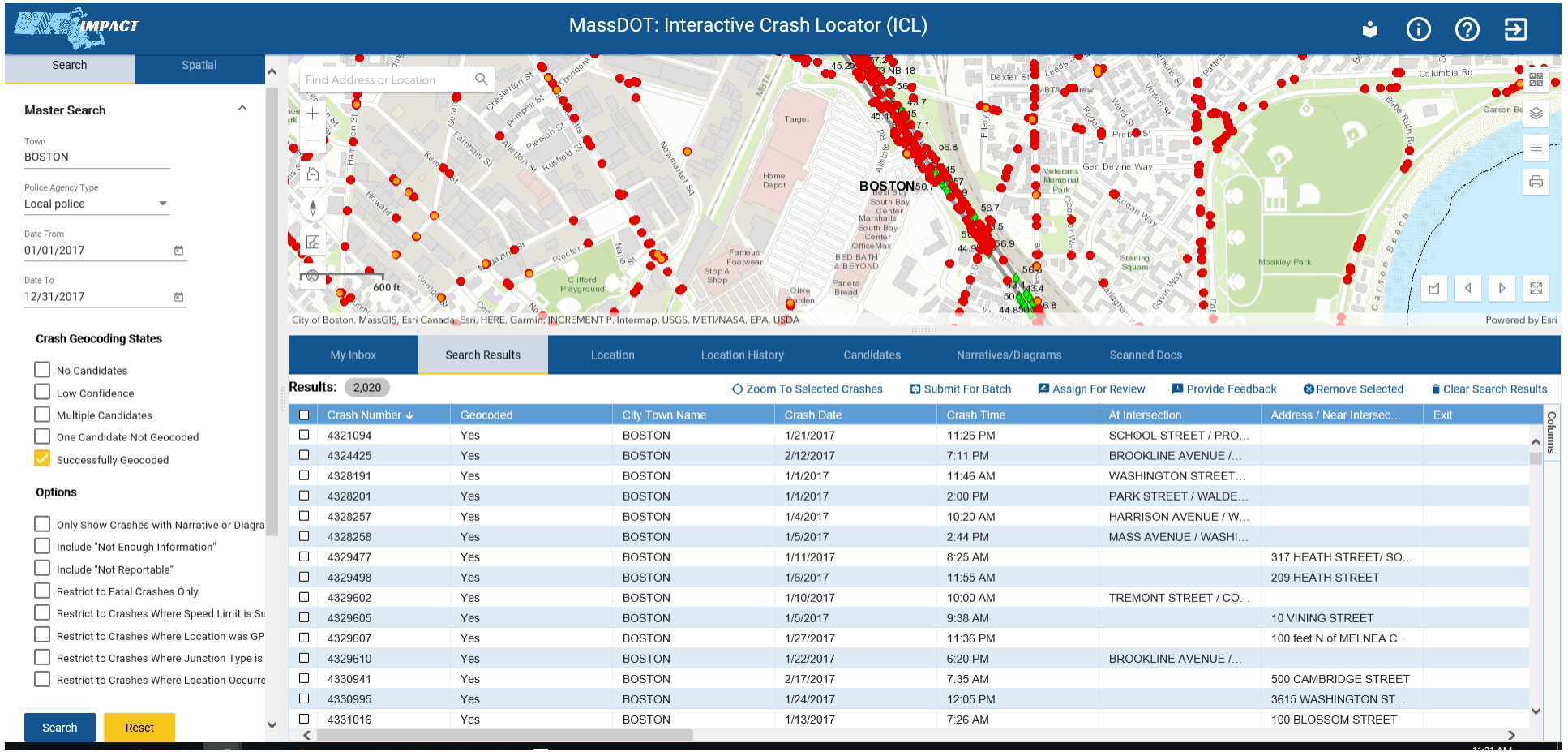
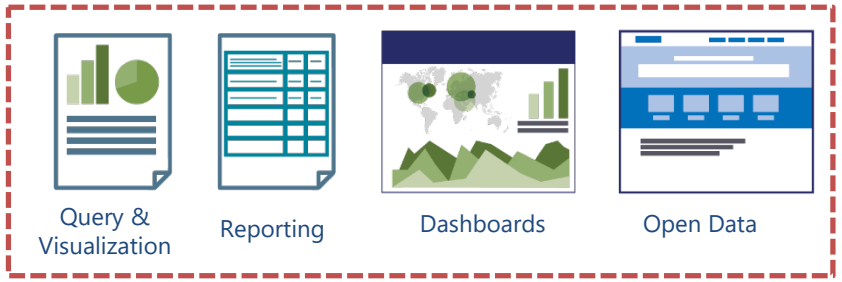


Crash Data Portal



Mass.gov LIVING WORKING LEARNING VISITING & EXPLORING YOUR GOVERNMENT

IMPACT IMPACT Home Welcome, Guest User Log In

IMPACT is designed to encourage public safety initiatives and awareness specific to crash information. Within IMPACT you can engage with crash related data through easy to understand pre-built reports or conduct your own self-driven analysis. Please take the time to explore the various options and find what is right for you.

Interactive Data Dashboards

IMPACT dashboards tell powerful data stories using maps, charts and tables based on complex analyses. These pre-built dashboards allow for interactive analysis and data exploration specific to a given data theme in a range of categories.

INTERACT

Data Query and Visualization

Using the Data Query and Visualization tool you can conduct simple to sophisticated data queries to generate subsets of the crash data. This may be done at the crash level, the vehicle level or the person level. Once generated you can then visualize the data in three core ways: on charts, on tables, or spatially on a map. Though noted separately, these elements all work in tandem providing the ability to switch between the visualization methods seamlessly.

EXPLORE

Data Extraction

Using the data extraction service, you can request publicly available data by municipality and date range in several formats. The standard data report request form should be used when trying to obtain datasets of town-wide crash data for specific years. In addition, a link is provided to MassDOT's Open Data Portal for more large-scale data download capabilities where the entire crash data file may be downloaded for each year.

EXTRACT

Reports

IMPACT provides a suite of pre-built reports for rapid access to cleanly organized information across a spectrum of categories. Some reports are configurable given desired date ranges and all are downloadable in several formats.

REPORTS

Crash Tabulation and Charting

IMPACT provides this tool to aggregate selected data in a matrix to display two or more variables. The crosstab provides summary data and can be used to summarize the full crash database as well as subsets of the data, based on the user selected variables.

EXPLORE

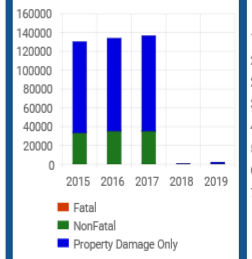
Reported Crashes YTD
2,118
As of: Mon Jun 24 2019

Reported Fatalities YTD (FARS)
159
As of: Wed Jun 19 2019

Reported Pedestrian Crashes YTD
34
As of: Mon Jun 24 2019

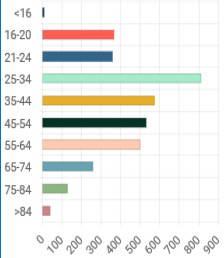
Reported Bicyclist Crashes YTD
33
As of: Mon Jun 24 2019

Reported Crash Severity By Year (CDS)



As of: Mon Jun 24 2019

Reported Ages of Drivers in Crashes Year to Date



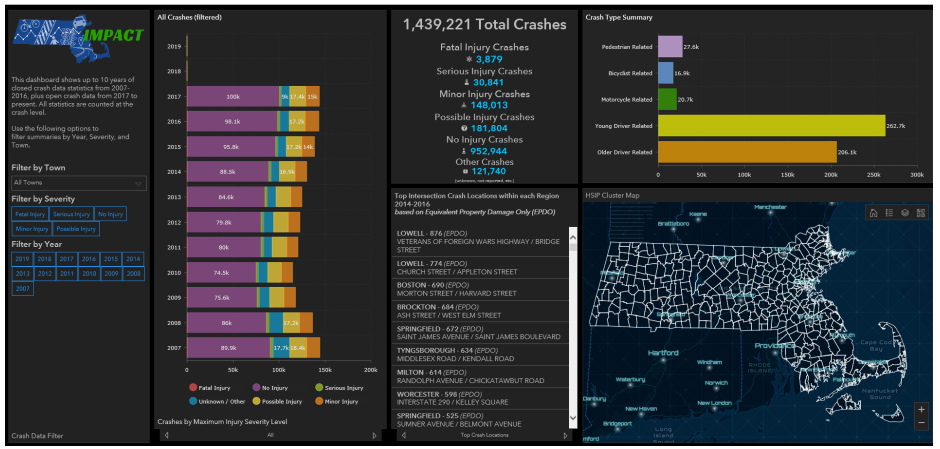
As of: Mon Jun 24 2019

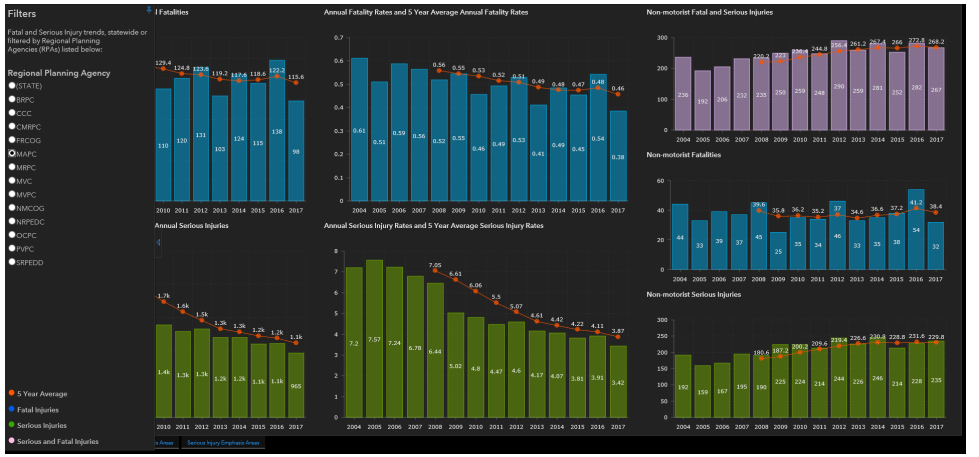
MassDOT makes no representation as to the accuracy, adequacy, reliability, availability or completeness of the crash records or the data collected from them and is not responsible for any errors or omissions in such records or data. Under no circumstance will MassDOT have any liability for any loss or damage incurred by any party as a result of the use of the crash records or the data collected from them. Furthermore, the data contained in the web-based crash report tool are not an official record of what transpired in a particular crash or for a particular crash type. If a user is interested in an official copy of a crash report, contact the Registry (http://www.mass.gov/rmv/). In addition, any crash records or data provided for the years 2018 and later are subject to change at any time and are not to be considered up-to-date or complete. The data posted on this website, including crash records and other reports, are collected for the purpose of identifying, evaluating or planning the safety enhancement of potential crash sites, hazardous roadway conditions or railway-highway crossings. Under federal law, this information is not subject to discovery and cannot be admitted into evidence in any federal or state court proceeding or considered for other purposes in any action for damages that involves the sites mentioned in these records (see 23 USC, Section 409).

Crash Analysis Dashboards

Dashboards

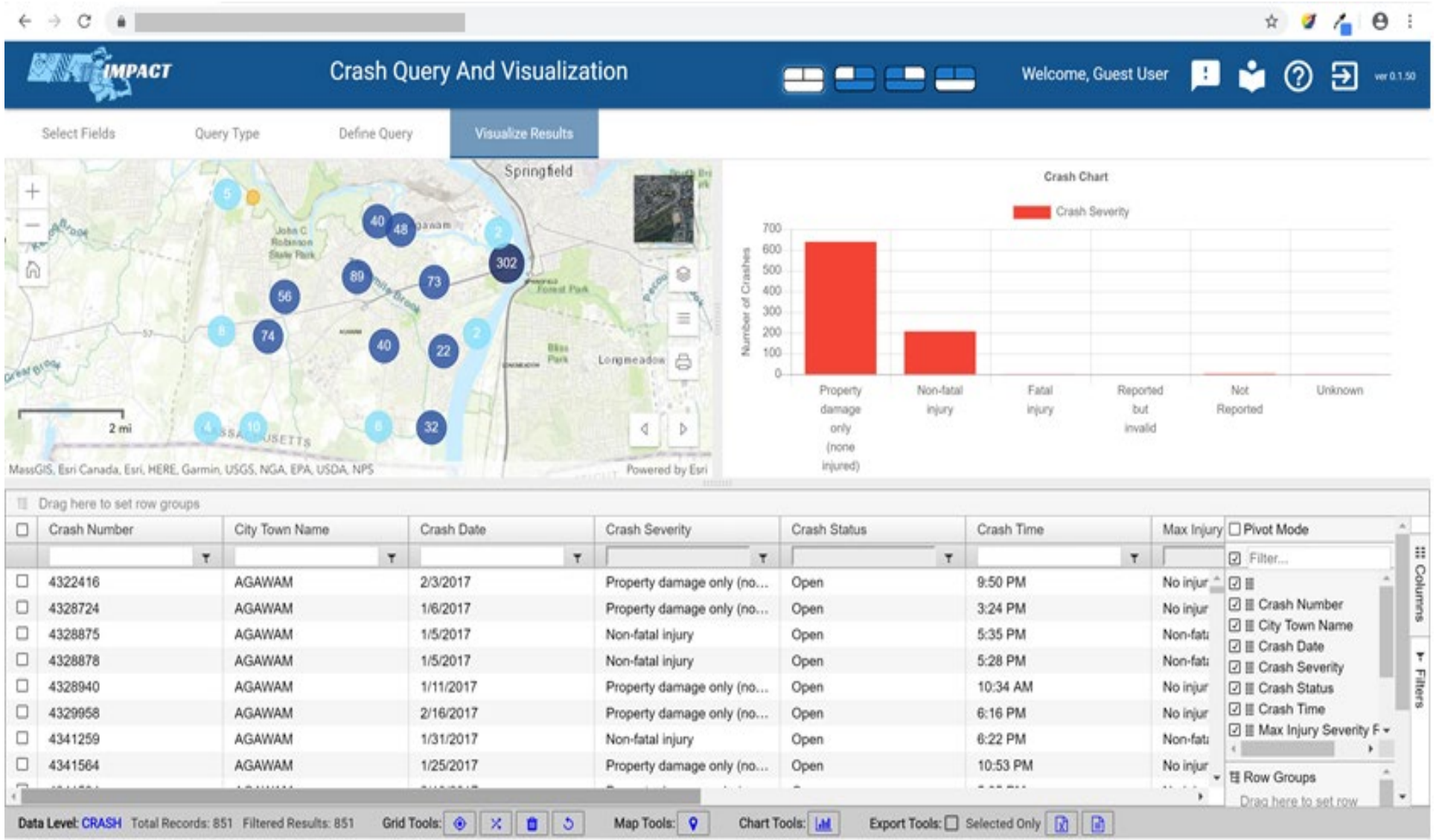
Operations Dashboard





Q&V – Visualize Results

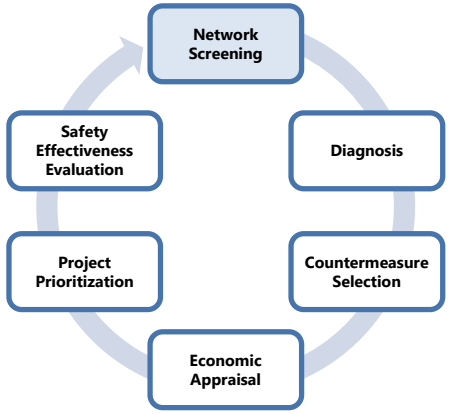
Query & Visualization

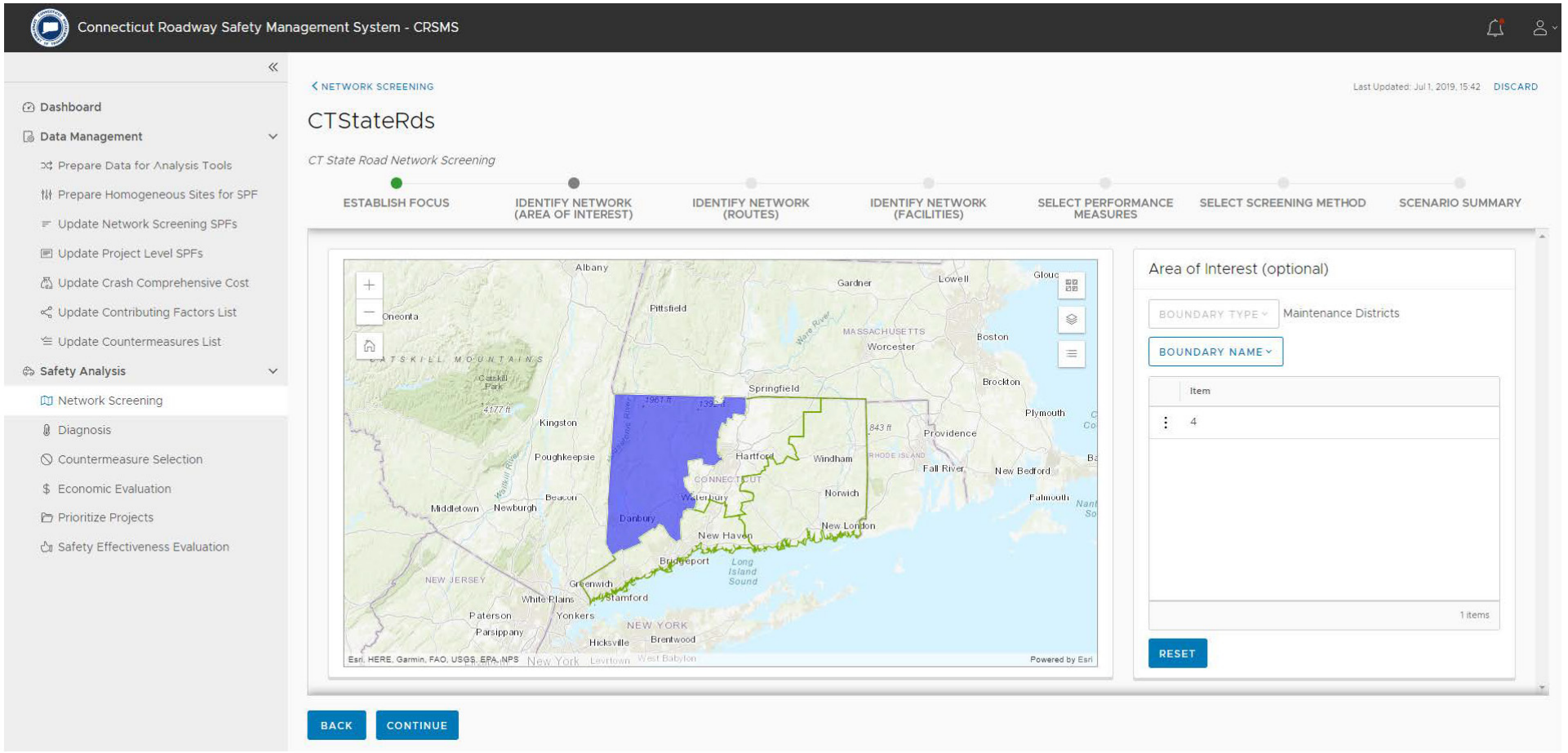


Crash Number	City Town Name	Crash Date	Crash Severity	Crash Status	Crash Time	Max Injury
4322416	AGAWAM	2/3/2017	Property damage only (no...	Open	9:50 PM	No injur
4328724	AGAWAM	1/6/2017	Property damage only (no...	Open	3:24 PM	No injur
4328875	AGAWAM	1/5/2017	Non-fatal injury	Open	5:35 PM	Non-fatu
4328878	AGAWAM	1/5/2017	Non-fatal injury	Open	5:28 PM	Non-fatu
4328940	AGAWAM	1/11/2017	Property damage only (no...	Open	10:34 AM	No injur
4329958	AGAWAM	2/16/2017	Property damage only (no...	Open	6:16 PM	No injur
4341259	AGAWAM	1/31/2017	Non-fatal injury	Open	6:22 PM	Non-fatu
4341564	AGAWAM	1/25/2017	Property damage only (no...	Open	10:53 PM	No injur

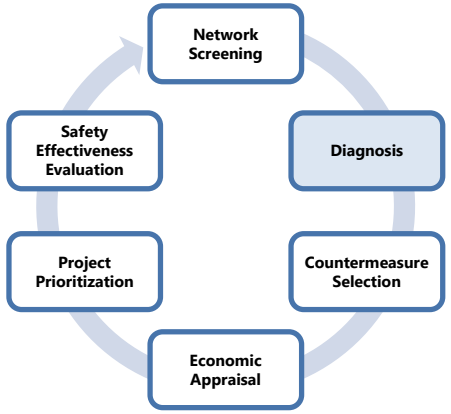
CTDOT – Improving Crash Analysis

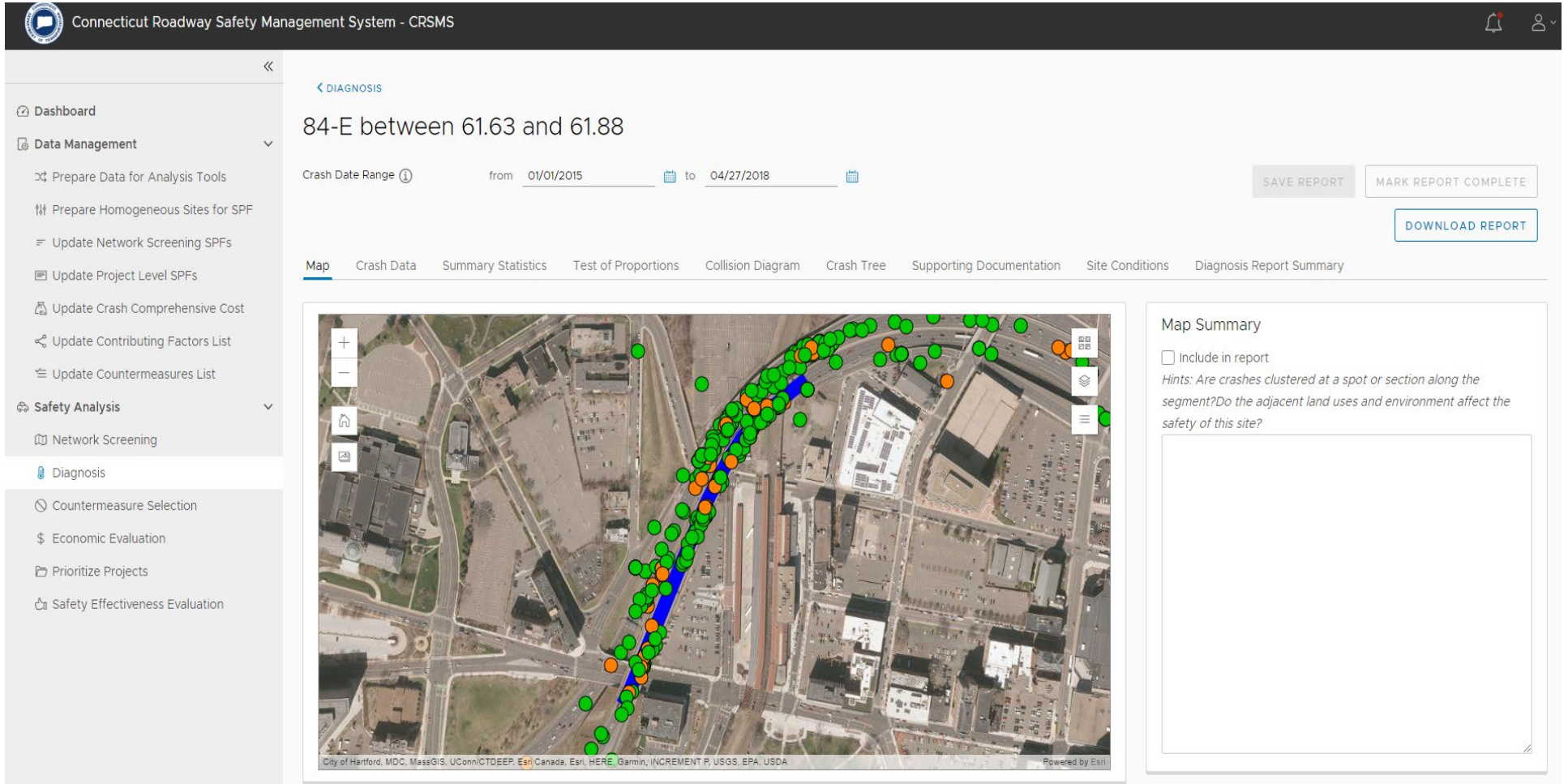
Network Screening



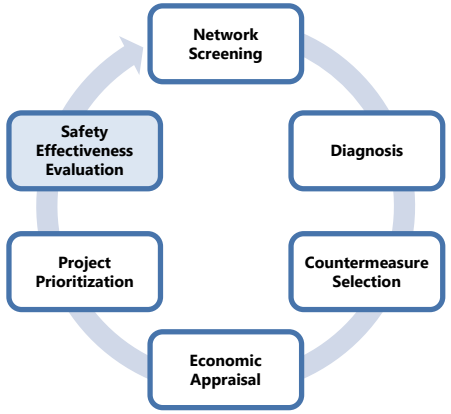


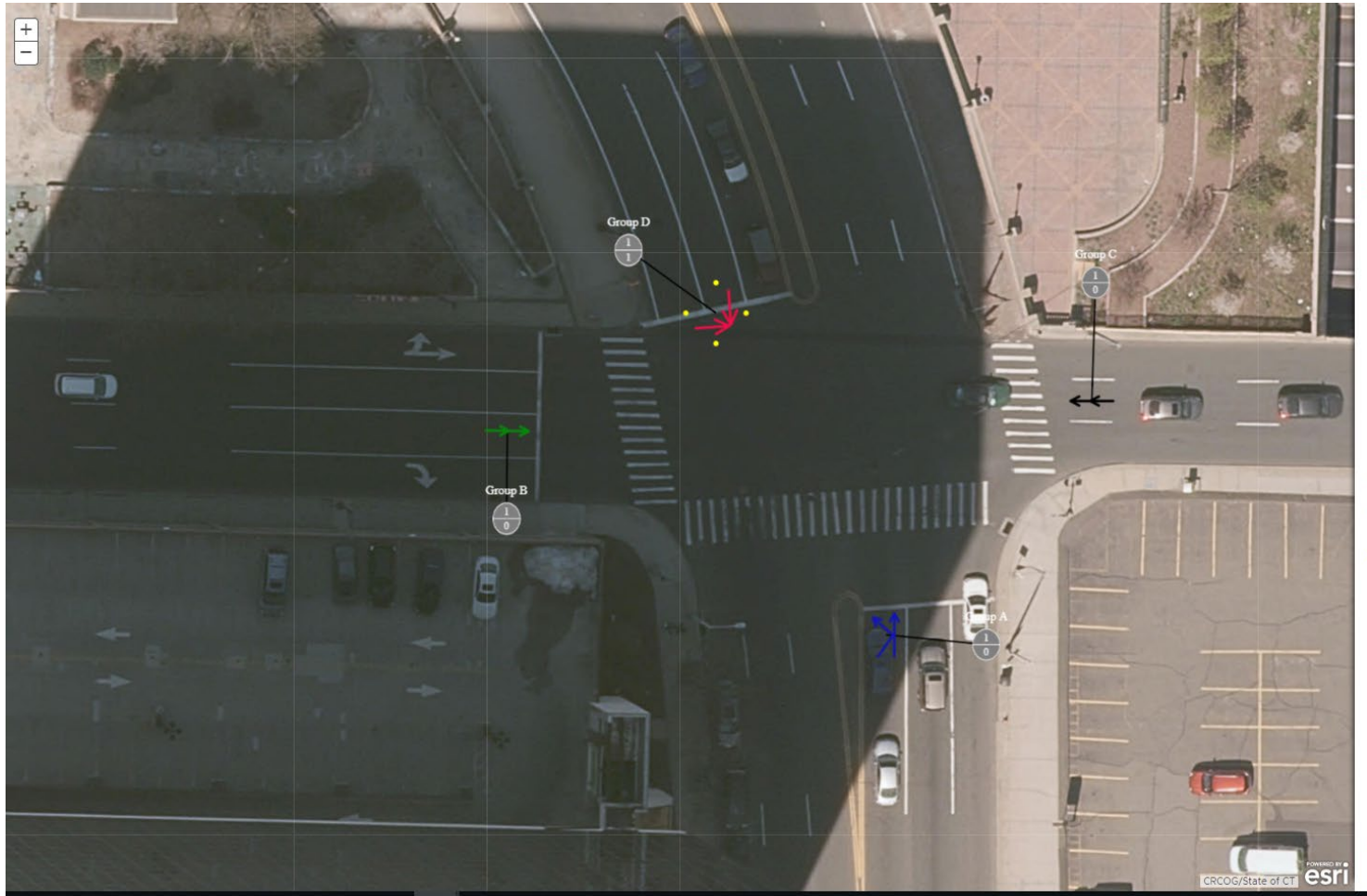
Diagnosis

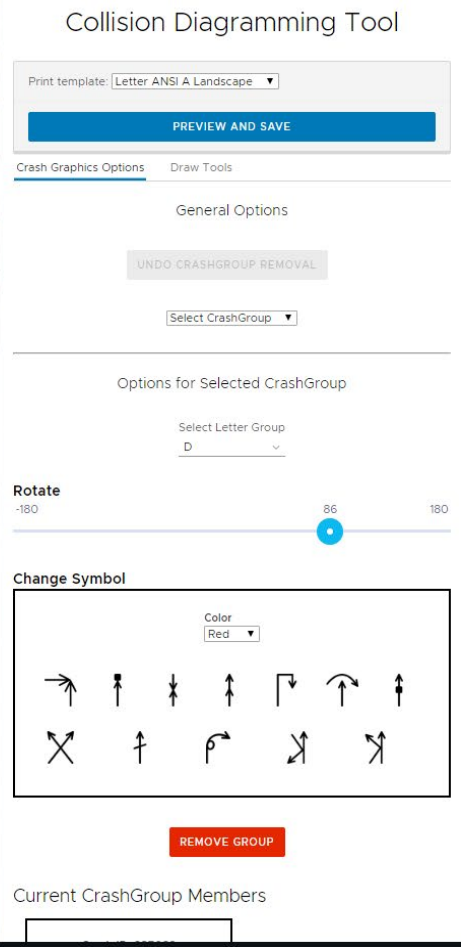

Network Screening
Diagnosis
Countermeasure Selection
Economic Appraisal
Project Prioritization
Safety Effectiveness Evaluation


Connecticut Roadway Safety Management System - CRSMS
Dashboard
Data Management
Prepare Data for Analysis Tools
Prepare Homogeneous Sites for SPF
Update Network Screening SPFs
Update Project Level SPFs
Update Crash Comprehensive Cost
Update Contributing Factors List
Update Countermeasures List
Safety Analysis
Network Screening
Diagnosis
Countermeasure Selection
Economic Evaluation
Prioritize Projects
Safety Effectiveness Evaluation
DIAGNOSIS
84-E between 61.63 and 61.88
Crash Date Range
from 01/01/2015
to 04/27/2018
SAVE REPORT
MARK REPORT COMPLETE
DOWNLOAD REPORT
Map
Crash Data
Summary Statistics
Test of Proportions
Collision Diagram
Crash Tree
Supporting Documentation
Site Conditions
Diagnosis Report Summary
City of Hartford, MDC, MassGIS, UConn/CTDEEP, Esri Canada, Esri, HERE, Garmin, INCREMENT P, USGS, EPA, USDA
Powered by Esri
Map Summary
Include in report
Hints: Are crashes clustered at a spot or section along the segment?Do the adjacent land uses and environment affect the safety of this site?

Safety Effectiveness Evaluation

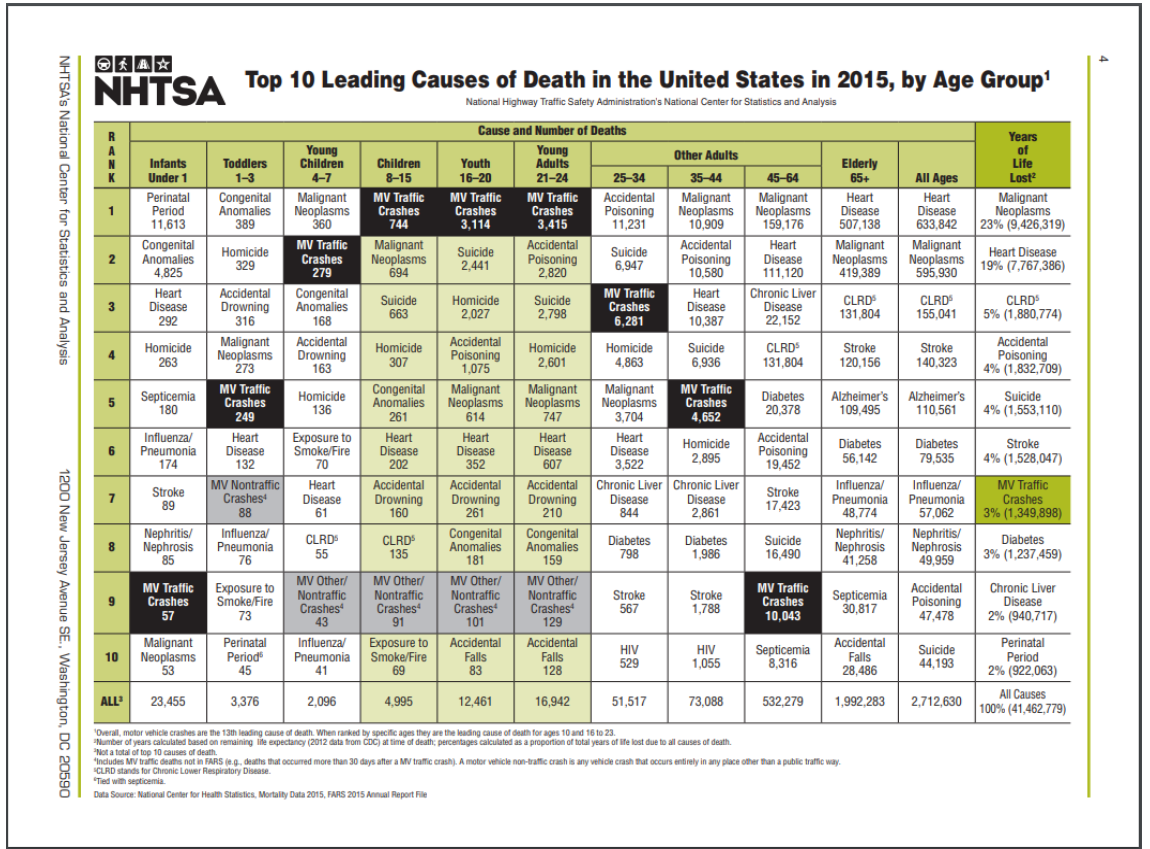






Summary

- Top 10 Leading Causes of Death
- Embracing and applying technology can save lives



NHTSA's National Center for Statistics and Analysis 1200 New Jersey Avenue SE., Washington, DC 20590

NHTSA

Top 10 Leading Causes of Death in the United States in 2015, by Age Group[1]

National Highway Traffic Safety Administration's National Center for Statistics and Analysis

RANK	Cause and Number of Deaths											Years of Life Lost[2]
	Infants Under 1	Toddlers 1–3	Young Children 4–7	Children 8–15	Youth 16–20	Young Adults 21–24	Other Adults 25–34	Other Adults 35–44	Other Adults 45–64	Elderly 65+	All Ages	
1	Perinatal Period 11,613	Congenital Anomalies 389	Malignant Neoplasms 360	**MV Traffic Crashes 744**	**MV Traffic Crashes 3,114**	**MV Traffic Crashes 3,415**	Accidental Poisoning 11,231	Malignant Neoplasms 10,909	Malignant Neoplasms 159,176	Heart Disease 507,138	Heart Disease 633,842	Malignant Neoplasms 23% (9,426,319)
2	Congenital Anomalies 4,825	Homicide 329	**MV Traffic Crashes 279**	Malignant Neoplasms 694	Suicide 2,441	Accidental Poisoning 2,820	Suicide 6,947	Accidental Poisoning 10,580	Heart Disease 111,120	Malignant Neoplasms 419,389	Malignant Neoplasms 595,930	Heart Disease 19% (7,767,386)
3	Heart Disease 292	Accidental Drowning 316	Congenital Anomalies 168	Suicide 663	Homicide 2,027	Suicide 2,798	**MV Traffic Crashes 6,281**	Heart Disease 10,387	Chronic Liver Disease 22,152	CLRD[5] 131,804	CLRD[5] 155,041	CLRD[5] 5% (1,880,774)
4	Homicide 263	Malignant Neoplasms 273	Accidental Drowning 163	Homicide 307	Accidental Poisoning 1,075	Homicide 2,601	Homicide 4,863	Suicide 6,936	CLRD[5] 131,804	Stroke 120,156	Stroke 140,323	Accidental Poisoning 4% (1,832,709)
5	Septicemia 180	**MV Traffic Crashes 249**	Homicide 136	Congenital Anomalies 261	Malignant Neoplasms 614	Malignant Neoplasms 747	Malignant Neoplasms 3,704	**MV Traffic Crashes 4,652**	Diabetes 20,378	Alzheimer's 109,495	Alzheimer's 110,561	Suicide 4% (1,553,110)
6	Influenza/ Pneumonia 174	Heart Disease 132	Exposure to Smoke/Fire 70	Heart Disease 202	Heart Disease 352	Heart Disease 607	Heart Disease 3,522	Homicide 2,895	Accidental Poisoning 19,452	Diabetes 56,142	Diabetes 79,535	Stroke 4% (1,528,047)
7	Stroke 89	MV Nontraffic Crashes[4] 88	Heart Disease 61	Accidental Drowning 160	Accidental Drowning 261	Accidental Drowning 210	Chronic Liver Disease 844	Chronic Liver Disease 2,861	Stroke 17,423	Influenza/ Pneumonia 48,774	Influenza/ Pneumonia 57,062	MV Traffic Crashes 3% (1,349,898)
8	Nephritis/ Nephrosis 85	Influenza/ Pneumonia 76	CLRD[5] 55	CLRD[5] 135	Congenital Anomalies 181	Congenital Anomalies 159	Diabetes 798	Diabetes 1,986	Suicide 16,490	Nephritis/ Nephrosis 41,258	Nephritis/ Nephrosis 49,959	Diabetes 3% (1,237,459)
9	**MV Traffic Crashes 57**	Exposure to Smoke/Fire 73	MV Other/ Nontraffic Crashes[4] 43	MV Other/ Nontraffic Crashes[4] 91	MV Other/ Nontraffic Crashes[4] 101	MV Other/ Nontraffic Crashes[4] 129	Stroke 567	Stroke 1,788	**MV Traffic Crashes 10,043**	Septicemia 30,817	Accidental Poisoning 47,478	Chronic Liver Disease 2% (940,717)
10	Malignant Neoplasms 53	Perinatal Period[6] 45	Influenza/ Pneumonia 41	Exposure to Smoke/Fire 69	Accidental Falls 83	Accidental Falls 128	HIV 529	HIV 1,055	Septicemia 8,316	Accidental Falls 28,486	Suicide 44,193	Perinatal Period 2% (922,063)
ALL[3]	23,455	3,376	2,096	4,995	12,461	16,942	51,517	73,088	532,279	1,992,283	2,712,630	All Causes 100% (41,462,779)

[1]Overall, motor vehicle crashes are the 13th leading cause of death. When ranked by specific ages they are the leading cause of death for ages 10 and 16 to 23.
[2]Number of years calculated based on remaining life expectancy (2012 data from CDC) at time of death; percentages calculated as a proportion of total years of life lost due to all causes of death.
[3]Not a total of top 10 causes of death.
[4]Includes MV traffic deaths not in FARS (e.g., deaths that occurred more than 30 days after a MV traffic crash). A motor vehicle non-traffic crash is any vehicle crash that occurs entirely in any place other than a public traffic way.
[5]CLRD stands for Chronic Lower Respiratory Disease.
[6]Tied with septicemia.

Data Source: National Center for Health Statistics, Mortality Data 2015, FARS 2015 Annual Report File

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