iteris®

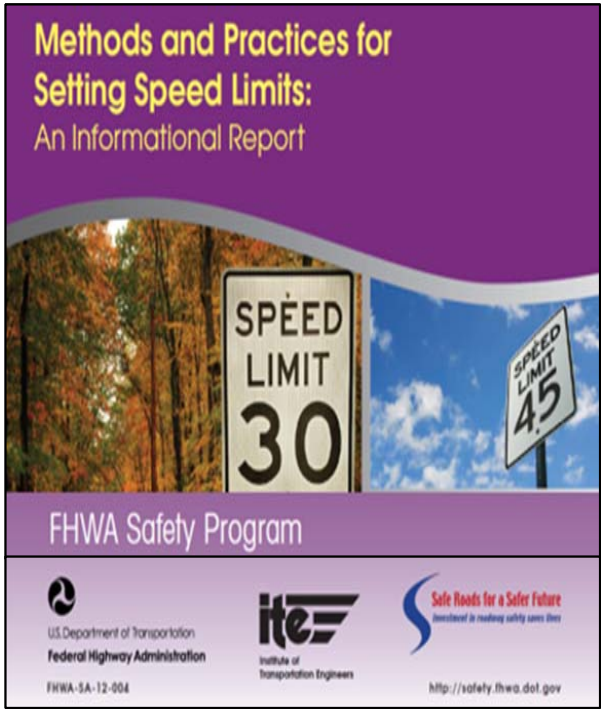
ARIZONA
ITE-IMSA
Annual Spring Conference

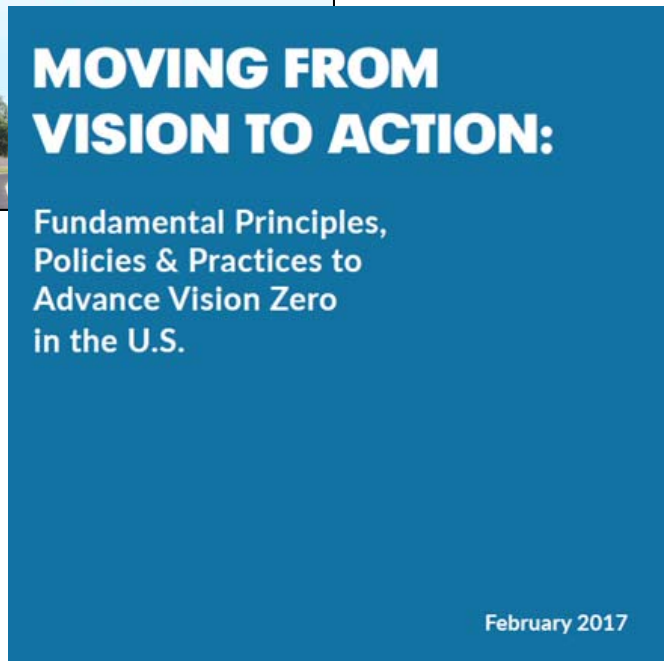
Speeding Towards Zero Deaths: Smart Communities & USLIMITS

March 10, 2017

Workshop: ITE San Diego, Riverside/San Bernardino, & Southern California Sections

References





Smart Cities – by Region

Pacific NW
Anchorage, AK
Portland, OR
Seattle, WA
Spokane, WA

Northern CA
Fremont, CA
Fresno, CA
Oakland, CA
Sacramento, CA
San Francisco, CA
San Jose, CA

Southern CA
Chula Vista, CA
Long Beach, CA
Moreno Valley, CA
Oceanside, CA
Riverside, CA

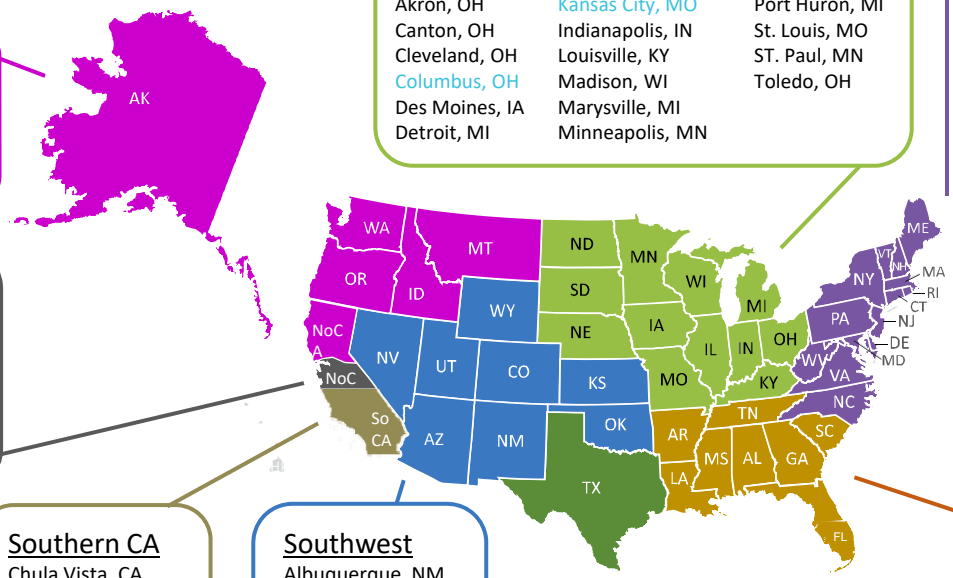
Southwest
Albuquerque, NM
Denver, CO
Las Vegas, NV
Oklahoma City, OK
Reno, NV
Scottsdale, AZ
Tucson, AZ
Tulsa, OK

Texas
Austin, TX
Lubbock, TX

Midwest
Akron, OH
Canton, OH
Cleveland, OH
Columbus, OH
Des Moines, IA
Detroit, MI
Kansas City, MO
Indianapolis, IN
Louisville, KY
Madison, WI
Marysville, MI
Minneapolis, MN
Port Huron, MI
St. Louis, MO
ST. Paul, MN
Toledo, OH

Southeast
Atlanta, GA
Baton Rouge, LA
Birmingham, AL
Brookhaven, GA
Chattanooga, TN
Columbus, GA
Greenville, SC
Jacksonville, FL
Memphis, TN
Miami, FL
Montgomery, AL
Nashville, TN
New Orleans, LA
Orlando, FL
Shreveport, LA
St. Petersburg, FL
Tallahassee, FL
Tampa, FL

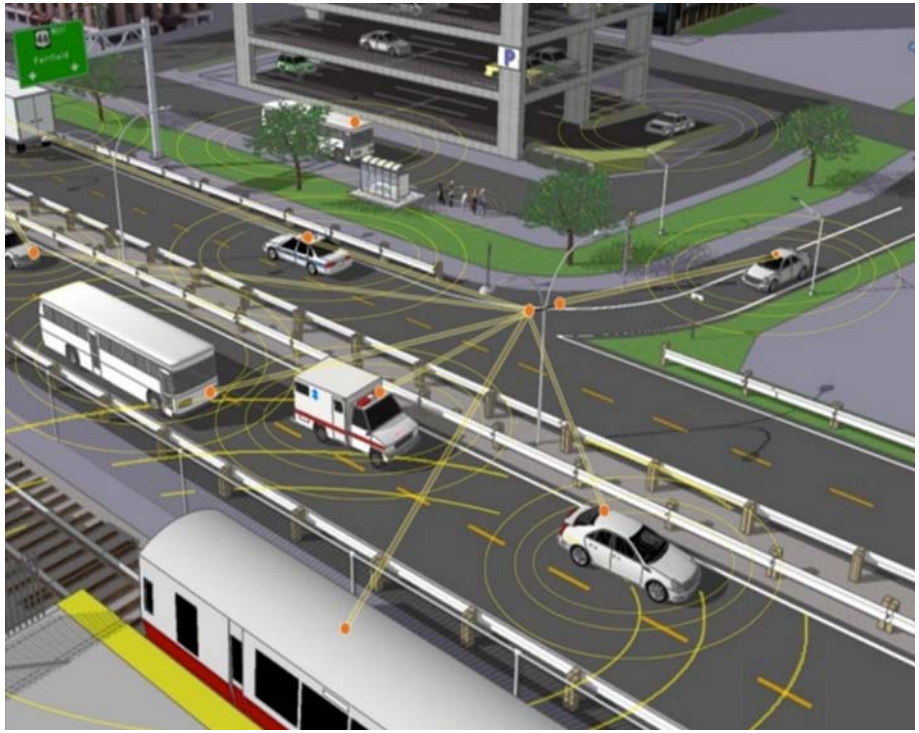
Northeast
Albany, NY
Baltimore, MD
Boston, MA
Buffalo, NY
Charlotte, NC
Greensboro, NC
Jersey City, NJ
Mt. Vernon, NY
New Haven, CT
New Rochelle, NY
Newark, NJ
Newport News, VA
Norfolk, VA
Pittsburgh, PA
Providence, RI
Raleigh, NC
Richmond, VA
Rochester, NY
Saratoga Springs, NY
Schenectady, NY
Troy, NY
Virginia Beach, VA
Washington, DC
Yonkers, NY



iteris

Smart Communities

- Use technology to identify and solve problems
- Improve safety, mobility and environmental outcomes.
- Prioritize safety and operate their streets in the best interest of their known users, across all modes.



iteris

Beyond Traffic: The Smart City Challenge

Technology Elements *(Highest Priority)*

Vision Element #1
Urban Automation

Vision Element #2
Connected Vehicles

Vision Element #3
Intelligent, Sensor-Based Infrastructure

Innovative Approaches to Urban Transportation Elements *(High Priority)*

Vision Element #4
User-Focused Mobility Services and Choices

Vision Element #5
Urban Analytics

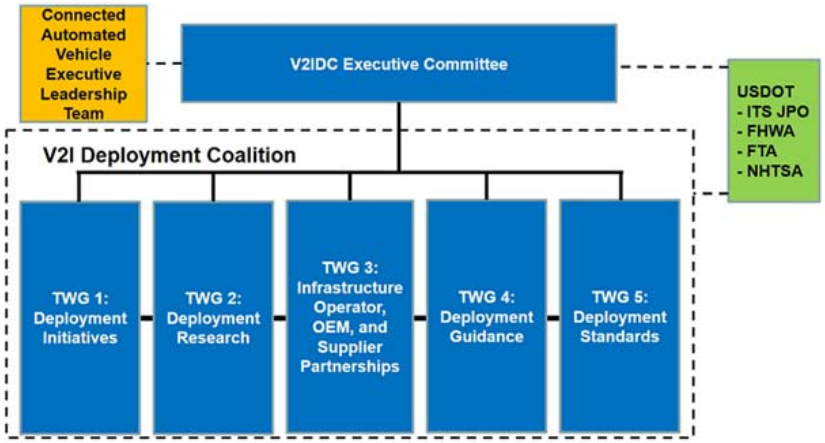
Vision Element #6
Urban Delivery and Logistics

Vision Element #7
Strategic Business Models & Partnering

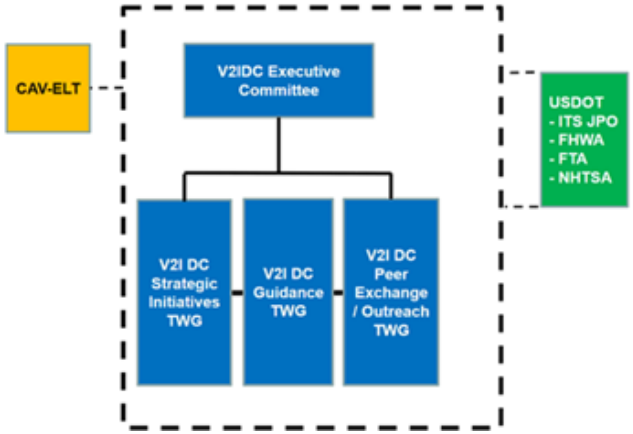
Vision Element #8
Smart Grid, Roadway Electrification, & EVs

Vision Element #9
Connected, Involved Citizens

V2I DC Structure



Proposed V2I DC Structure – Phase 2



Initial Goal of V2I DC

To help accelerate V2I deployments that support passenger vehicles, freight and transit in both urban and rural areas, with initial focus on:

1. Intersections (signalized/unsignalized)
2. Queue warnings
3. Work zone management
4. Curve warning systems

Fine-tuned Goal of V2I DC

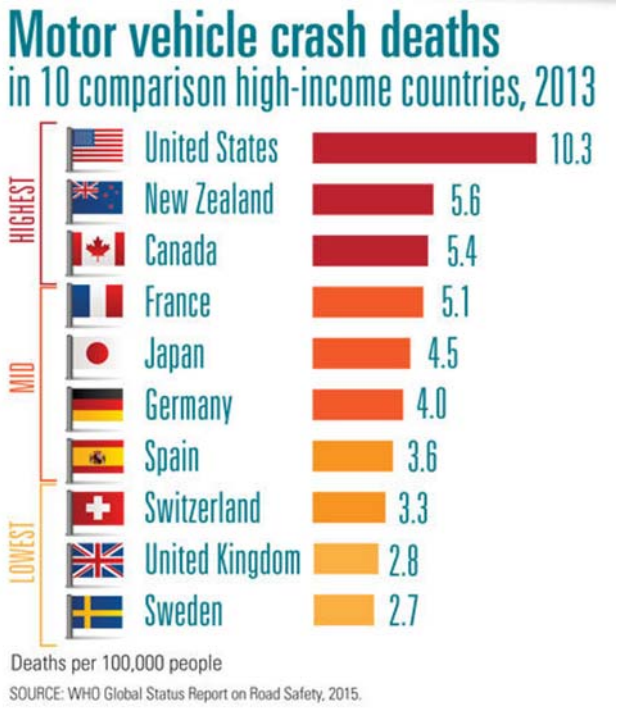
Approach for next 12 months

- Continue the Key Focus Areas:
  - SPaT/RLVW
  - Reduced Speed Zone Warning (RSZW)
  - Eco-Drive
  - Data Exchanges

iteris

What is Toward Zero Deaths?
2014 National Strategy on Highway Safety (Not Vision Zero)

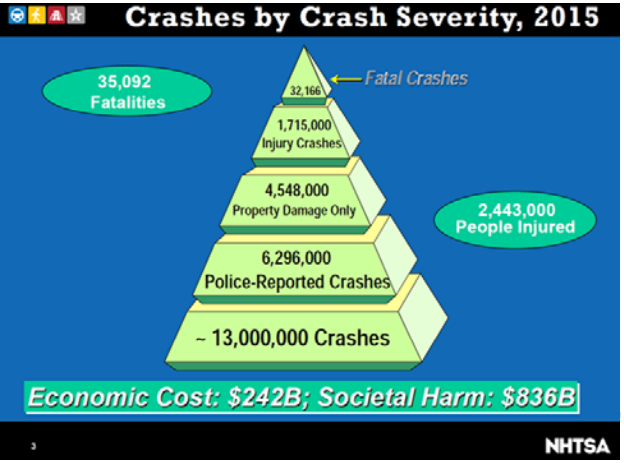
The Toward Zero Deaths Steering Committee:



Only Together Can We Move Toward Zero Deaths

September 26, 2016 / Getting Started, Learn More, Partnering

Thank you for joining the Toward Zero Deaths (TZD) initiative. Every year, traffic crashes claim the lives of more than 32,000 people in the United States–that's 32,000 people taken from their family and friends.



U.S. DOT, National Safety Council Launch 'Road to Zero' Coalition to End Roadway Fatalities

New partnership aims to end traffic fatalities within the next 30 years.

Share:

October 3, 2016 | Washington, DC

NACTO MENU

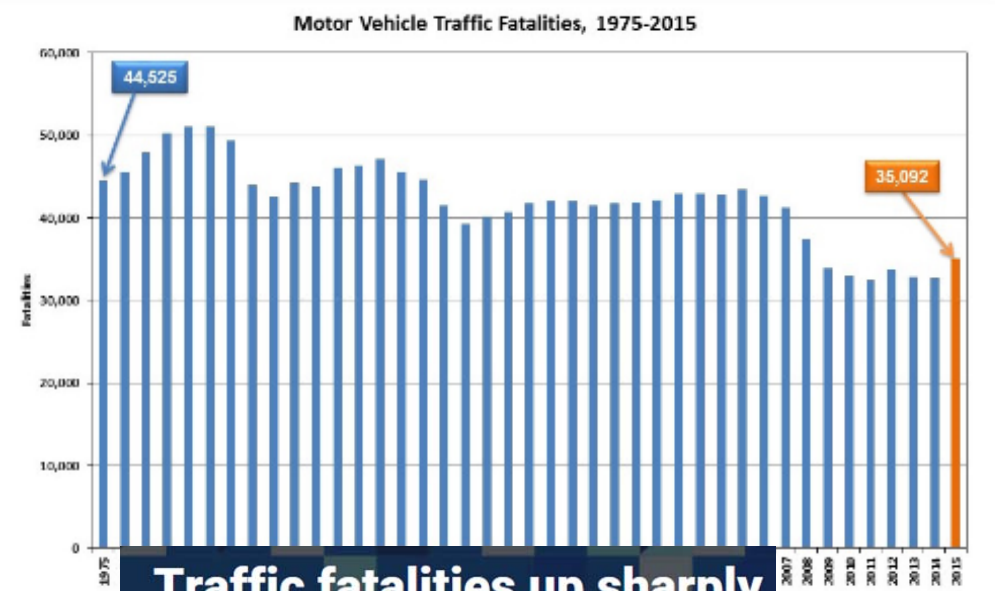
National Association of City Transportation Officials

40,200 needless deaths on U.S. streets

Re: Motor vehicle deaths in 2016 estimated to be highest in nine years

As reported by the National Safety Council today, an estimated 40,200 people died on U.S. streets and highways in 2016, an alarming statistic that underscores the disproportionately high numbers of people who have died on U.S. streets every year for decades. In cities, we know where these crashes are more likely to occur: on arterial streets designed to allow cars to go fast. Speed turns crashes into fatalities. Someone hit by a car going 50 mph has a 75% chance of being killed. At 20 mph, that same person would have a 93% chance of surviving.

iteris



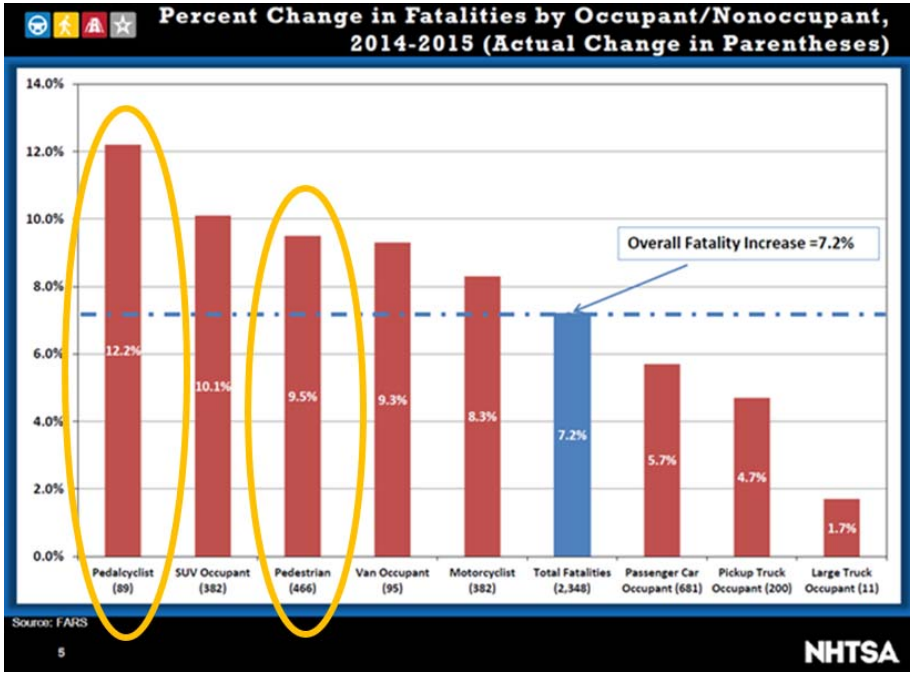
Traffic fatalities up sharply

Share:

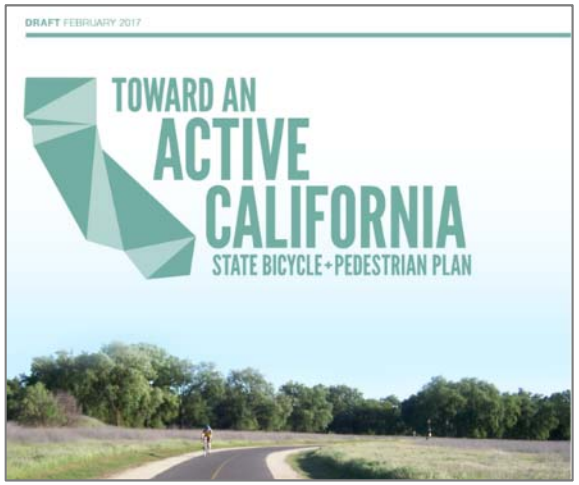
August 29, 2016 | Washington, DC

NHTSA 20-16

White House and DOT issue call to action to data scientists and public health experts as 2,348 more people died in traffic crashes compared to previous year

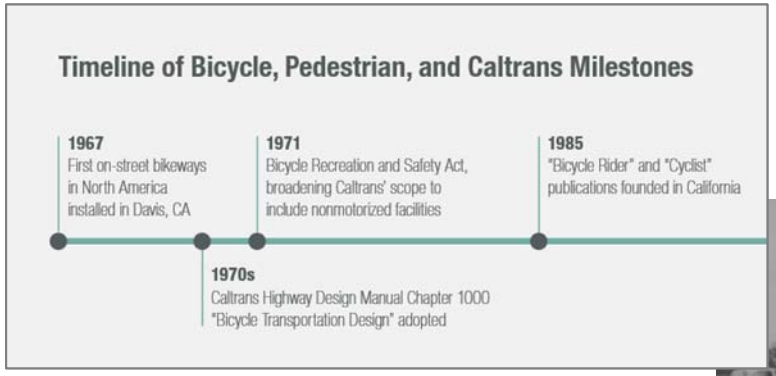


iteris



S4.4: Explore alternate methods to the 85th percentile approach to setting and enforcing speed limits

Like most states, the speed limit in California is typically set such that 85 percent of the vehicles on a particular stretch of road travel at or below the limit, though lower speed limits are allowed in certain circumstances (such as in school zones), as identified by the *California Manual for Setting Speed Limits*. This limits the ability of local municipalities to respond to local conditions and to set and enforce lower speed limits. Evaluate policy changes that would allow municipalities to establish reduced maximum speeds on certain roadways (such as bike boulevards and pedestrian-oriented streets) and to enforce these limits without conducting engineering and traffic studies. This action will be led by the Division of Research, Innovation and System Information with support from the Division of Traffic Operations and the Division of Transportation Planning.



Vision Zero Cities

FUNDAMENTAL PRINCIPLES OF A MEANINGFUL VISION ZERO COMMITMENT

These principles can and should be applied anywhere, regardless of a community's size or political structure. While certain strategies and timing will differ from place to place, these principles are core to successful Vision Zero efforts.

1. **Traffic deaths and severe injuries are acknowledged to be preventable.**
2. **Human life and health are prioritized within all aspects of transportation systems.**
3. **Acknowledgement that human error is inevitable, and transportation systems should be forgiving.**
4. **Safety work should focus on systems-level changes above influencing individual behavior.**
5. **Speed is recognized and prioritized as the fundamental factor in crash severity.**

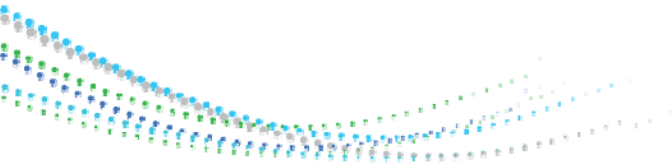
iteris

Vision Zero Action Plan

MOVING FROM VISION TO ACTION:

Fundamental Principles, Policies & Practices to Advance Vision Zero in the U.S.

February 2017



5. SPEED IS RECOGNIZED AND PRIORITIZED AS THE FUNDAMENTAL FACTOR IN CRASH SEVERITY

THE TRANSPORTATION SYSTEM SHOULD BE DESIGNED FOR SPEEDS THAT PROTECT HUMAN LIFE.

Vision Zero starts with the basic premise that the level of severity of a traffic injury is directly related to the force of the crash and the resulting impact on the human body.

Insisting on travel speeds that are appropriate to the context and designed to be safe, first and foremost, is not only an effective strategy, but a critical foundation of Vision Zero.

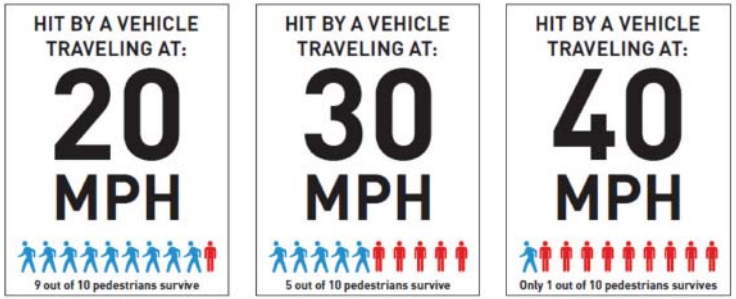


Image: Seattle Department of Transportation

VISION ZERO EFFORTS SHOULD PRIORITIZE THE FOLLOWING POLICIES AND PRACTICES:

1. **Build and sustain leadership, collaboration and accountability.**
2. **Collect, analyze and use data.**
3. **Prioritize equity and engagement.**
4. **Lead with roadway design that prioritizes safety.**
5. **Manage speed to safe levels.**
6. **Maximize technology advances, but don't overlook low-tech solutions.**

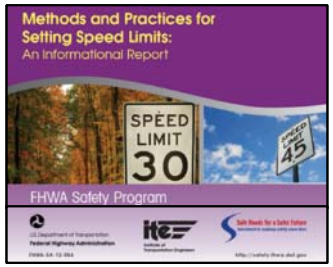
Simply put, communities will not significantly advance their Vision Zero goals if they do not directly and assertively manage speeds on their roadways. Vision Zero work that ignores speed management is merely playing in the margins of effectiveness.

Collecting, analyzing and using the right data will require a high level of coordination between different city agencies and partners. Data should impact not only initial priorities and resource decisions, but also the ongoing evolution and reporting of a Vision Zero program. How do we know if we're successful? What works best? How do various strategies rank? A Vision Zero effort will not be static, and its development will depend on using data to gauge impact over time.

Undoubtedly, various technology advances have greatly benefitted safety on our streets, and the pace of technology promises even more improvements.

iteris

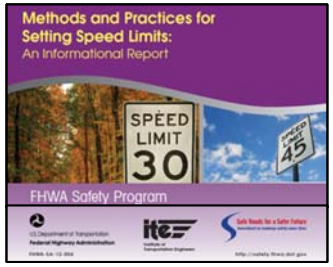
Approaches for Setting Speed Limits



1. Engineering (Widely Used in USA)
2. Expert System
3. Optimization
   - Not known to have been adopted, but considered in New Jersey
4. Injury Minimization
   - Gaining wide-spread use in countries at the forefront of global road safety

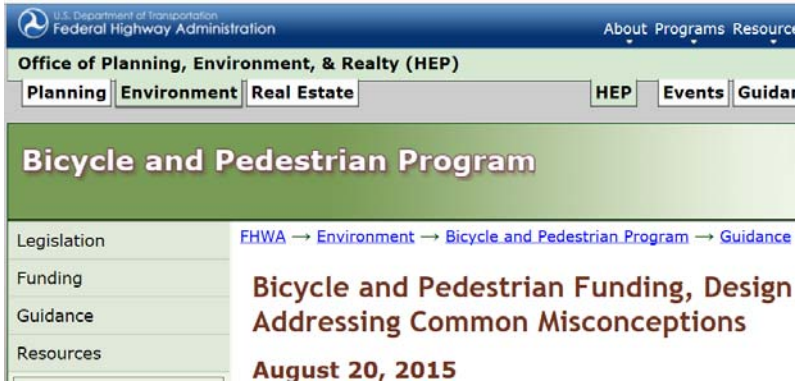
iteris

Engineering 85th Percentile Method



- Data collection tends to be costly and time-consuming
- Original research between speed and safety which purported that the safest travel speed is the 85th percentile speed is dated research and may not be valid under scrutiny

iteris

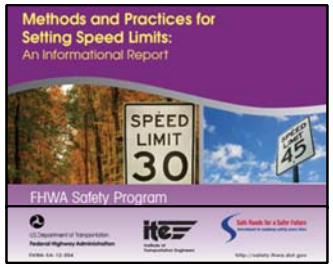


9. Speed limits must be set using the 85th percentile methodology.

This is false. The MUTCD Section 2B.13 contains the following mandatory (Standard) statement: "Speed zones (other than statutory speed limits) shall only be established on the basis of an engineering study that has been performed in accordance with traffic engineering practices." According to the 2012 FHWA Document *Methods and Practices for Setting Speed Limits*, there are basic ways of setting speed limits. Use of the 85th percentile methodology is just one part of what FHWA calls the Engineering Approach. This is described as "A two-step process where a base speed limit is set according to the 85th percentile speed, the design speed for the road, or other criterion. This base speed limit is adjusted according to traffic and infrastructure conditions such as pedestrian use, median presence, etc." The 2012 document goes on to say that the engineering approach requires the use of judgment. This is different than simply setting a speed limit based on the measured 85th percentile.

The FHWA developed a model called USLIMITS2, which is a web-based tool using an expert system with a fact-based set of decision rules to determine an appropriate speed limit for all roadway users. For roadway segments that experience high pedestrian and bicyclist activities, USLIMITS2 recommends speed limits close to 50th percentile instead of 85th percentile speed. For more information, visit http://safety.fhwa.dot.gov/uslimits/

Expert System Method



- A knowledge-based expert system for recommending speed limits
- USLIMITS2 was developed from previous research, expert input, and lessons learned from FHWAs first generation expert system

Safety

USLIMITS2

A TOOL TO AID PRACTITIONERS IN DETERMINING APPROPRIATE SPEED LIMIT RECOMMENDATIONS

USLIMITS is a web based tool designed to help practitioners set reasonable, safe, and consistent speed limits for specific segments of roads. USLIMITS is applicable to all types of roads ranging from rural local roads and residential streets to urban freeways.

User-friendly, logical, and objective, USLIMITS2 is of particular benefit to local communities and agencies without ready access to engineers experienced in conducting speed studies for setting appropriate speed limits. For experienced engineers, USLIMITS2 can provide an objective second opinion and increase confidence in speed limit setting decisions.

Extent of Ped/Bike Activity

Users are asked to select between 'High' and 'Not High'.

Vantage Live!™

Vehicles

Top 5 Intersections By Volume

Intersection	Volume
Imperial and La Mirada	95323
Imperial and Valley View	66582
Telegraph and Valley View	47072
Imperial and Telegraph	43836
Telegraph and Victoria	39619

Top 5 Approaches By Volume

Intersection	Dir	Volume
Imperial and La Mirada	SB	33779
Imperial and La Mirada	WB	23877
Imperial and La Mirada	EB	20865
Telegraph and Victoria	WB	19261
Imperial and Valley View	EB	18332

Top 5 Movements By Volume

Intersection	Dir	Move	Volume
Imperial and La Mirada	SB	T	22212
Telegraph and Valley View	WB	T	16236
Imperial and La Mirada	EB	T	16148
Telegraph and Victoria	EB	T	16026
Imperial and Valley View	EB	T	15703

Total System Volume

Yesterday

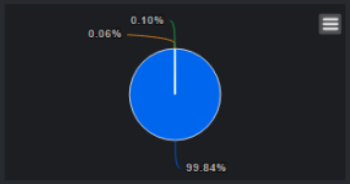
Vehicles	Bicycles	Pedestrians
361444	204	344

2. Collect, analyze and use data.

5. Manage speed to safe levels.

6. Maximize technology advances,

Mode Share - Yesterday



Bicycles

Top 5 Intersections By Volume

Intersection	Volume
Telegraph and Valley View	188
Imperial and Valley View	16

Pedestrians

Top 5 Intersections By Volume

Intersection	Volume
Telegraph and Valley View	344

USLIMITS2

Roadway Data - Fields marked with an asterisk * are required

85th Percentile Speed *	39	(maximum of 99 mph) More Info
50th Percentile Speed *	36	More Info
Section Length in Miles *	1.25	
Annual Average Daily Traffic *	14489	
Adverse Alignment *	No	More Info
Statutory Speed Limit for this Type of Road *	55 mph	More Info
Is this a one-way street? *	No	
Divided/Undivided *	TWLTL	
Number of Through Lanes *	2	More Info
Area Type *	Residential-Collector	More Info
Total number of driveways and unsignalized access points in the section (approximate) *	99	
Total number of signals in the section *	4	
On Street Parking and Usage *	High	More Info
Pedestrian/Bicyclist Activity *	High	More Info

ROAD SECTION IN DEVELOPED AREA

Project Name - Co County
Route Name -
From - La
To - Te

Extent of Ped/Bike Activity

Users are asked to select between 'High' and 'Not High'. Examples of areas with 'High' pedestrian and bicycle activity include:
(1) Residential developments with four or more housing units per acre interspersed with multifamily dwellings,
(2) Hotels located with 1/2 mile of other attractions such as retail stores, recreation areas, or senior centers,
(3) Downtown or CBD areas, and
(4) the presence of paved sidewalks, marked crosswalks, and pedestrian signals.

iteris

USLIMITS2

Crash Rate For This Section

The crash rate for the section is 473 per 100 million vehicle miles.

Average Crash Rate Per 100 Million Vehicle Miles

If you have data on crash rates for similar sections in your jurisdiction during the same time period please enter the rate below. Otherwise, an average taken from HSIS will be used. The HSIS average for this type of road and traffic volume is 247 per 100 million vehicle miles.

115 More Info

CRASH MODULE

Project Name - 1
Route Name - ad
From - La M
To - Telegr

*** are required**

Years * 3

Months 0 months

Enter the Average Daily Traffic (ADT) for this period (veh/day) * 14489

Enter the Total Number of Crashes for this period 63 More Info

Total Number of Injury and Fatal Crashes for this period 13 More Info

Submit

iteris

The crash rate for this section is 318 per 100 million vehicle miles.

The crash rate in this section is 176% higher than the average of similar sections.
The critical crash rate is 180 per 100 million vehicle miles.

USLIMITS2

Crash Rate Computations

The crash rate for this section is 318 per 100 million vehicle miles.

The Crash Rate in this section is 176% Higher than the average of similar sections.
The Critical Crash Rate is 180 per 100 million vehicle miles.

Injury Rate Computations

The rate of injury crashes for this section is 91 per 100 million vehicle miles.

The Rate of Injury and Fatal Crashes for this section is 24% Higher than the average rate of similar sections.

The Critical Injury Rate is 125 per 100 million vehicle miles.

The section crash rate of 318 per 100 MVM is above the critical rate (180). A comprehensive crash study should be undertaken to identify engineering and traffic control deficiencies and appropriate corrective actions. The speed limit should only be reduced as a last measure after all other treatments have either been tried or ruled out.

Can traffic control and/or geometric treatments reduce the crash/injury rate in this section? *

Unknown

CRASH MODULE 3 - RESULTS

Project Name - co
Route Name -
From - La
To - Tel

ROAD SECTION IN DEVELOPED AREA

User Name - John Lower
Project N
Project N
State - C
County -
City - La
Route Na
Termini F
Termini T
Descripti

Recommended Speed Limit is:

Note: The section crash rate of 318 per 100 MVM is above the critical rate (180). A comprehensive crash study should be undertaken to identify engineering and traffic control deficiencies and appropriate corrective actions. The speed limit should only be reduced as a last measure after all other treatments have either been tried or ruled out.

iteris

HSM Highway Safety Manual AASHTO

CMF CRASH MODIFICATION FACTORS CLEARINGHOUSE

What is a crash modification factor (CMF)?

A CMF is an estimate of the change in crashes expected after implementation of a countermeasure. For example, an intersection is experiencing 100 angle crashes and 500 rear-end crashes per year. If you apply a countermeasure that has a CMF of 0.80 for angle crashes, then you can expect to see 80 angle crashes per year following the implementation of the countermeasure (100 x 0.80 = 80). If the same countermeasure also has a CMF of 1.10 for rear-end crashes, then you would also expect to also see 550 rear-end crashes per year following the countermeasure (500 x 1.10 = 550).

iteris

CRASH MODIFICATION FACTORS CLEARINGHOUSE

Category: Speed management (29)

Countermeasure: 10% reduction in mean speed

Compare	CMF	CRF (%)	Quality	Crash Type	Crash Severity
☑	0.85	15	★★★★★	All	Serious injury,Minor injury
☑	0.68	32	★★★★☆	All	Fatal
☑	0.9	10	★★★☆☆	All	Property Damage Only (PDO)

Countermeasure: 15% reduction in mean speed

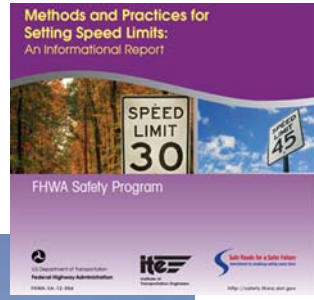
Compare	CMF	CRF (%)	Quality	Crash Type	Crash Severity
☑	0.56	44	★★★★☆	All	Fatal
☑	0.78	22	★★★★☆	All	Serious injury,Minor injury
☑	0.85	15	★★★☆☆	All	Property Damage Only (PDO)

iteris

Injury Minimization Method

(Slide 1 of 2)

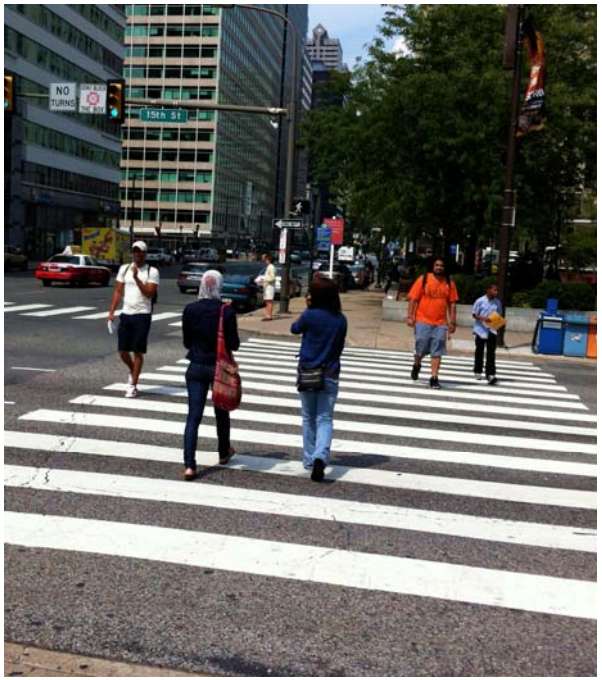
- The cornerstone of the injury minimization approach to setting speed limits is the tolerance of the human body to injury during a crash.
- It is based solely on a road safety platform and takes the position that it is unethical to create a situation where fatalities are a likely outcome of a crash in order to reduce delay, fuel consumption, or other societal objectives.



Injury Minimization Method

(Slide 1 of 2)

- The principal challenge in an injury minimization approach to speed limits is to manage crash energy so that no user is exposed to impact forces capable of causing death or serious injury.
- Thus vehicles cannot legally travel at speeds where, in the event of a crash, the release of kinetic energy can produce a serious or fatal injury.
- This would limit speeds on roads with peds and bikes to 20 MPH.



Is now the time for the Injury Minimization Method?

- The injury minimization approach to speed limit setting results in speed limits that are lower than those traditionally used in North America.
- Implementing an injury minimization approach to speed limits would be problematic.
- The road authority cannot simply lower the speed limit and expect immediate or substantial compliance. Drivers are unlikely to fully respond except in the face of almost constant enforcement.
- We need to build a case over time for a new paradigm as to what regarded and legislated as a safe speed limit on our road network, by starting where VRU activity is high.

iteris

How Are Peds & Bikes Considered?

- Few jurisdictions have quantitative criteria for adjustments to the 85th percentile speed.
  - e.g., How much should a speed limit be reduced if there is a “high volume” of pedestrian traffic on the street?

iteris

Vantage Live!™ + USLIMITS2

Multimodal (Vehicle, Peds, Bikes) Data Aggregator for Smart City Urban Analytics

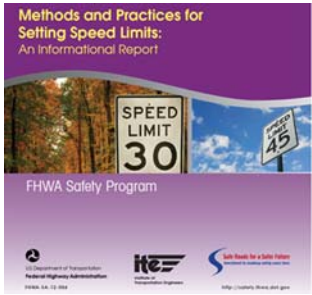
- **Automatic** Data Collection and Presentation System
- **Easy** to use
- **Charts** and Graphs
- **Reports** and Exports
- **Historical** analysis

iteris

Thank You!

Questions?

Optimal Speed Limit Process for Roadways with Shared Use



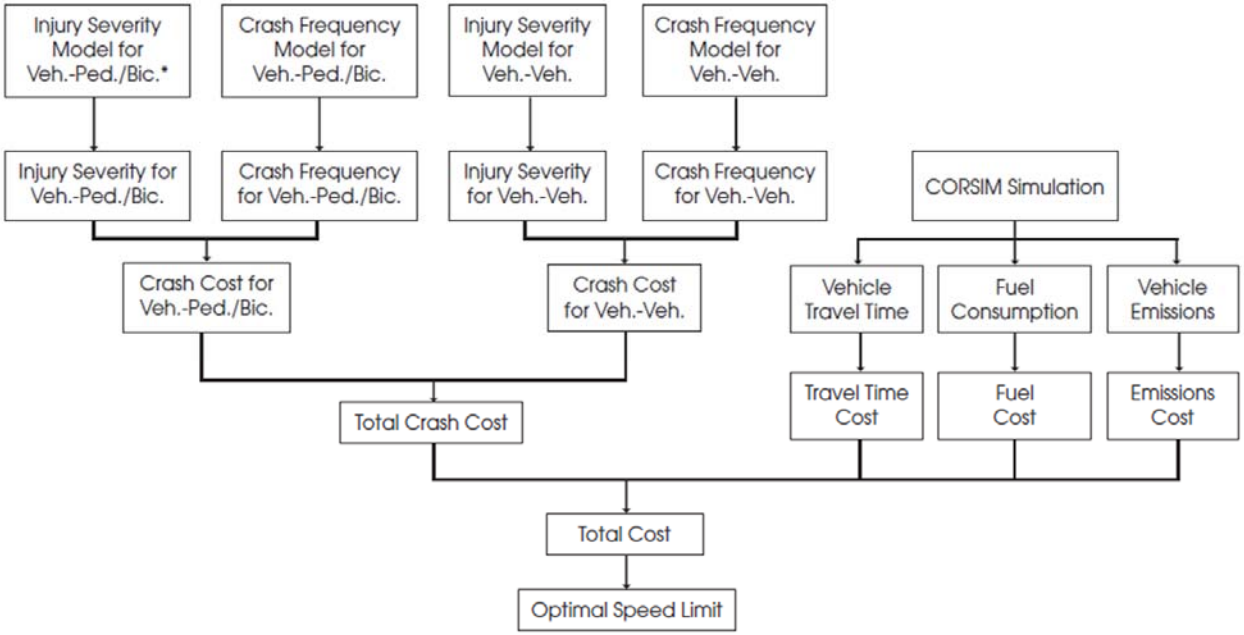


Figure 2. Optimal Speed Limit Process.[13]
*Vehicle-Pedestrian/Bicycle

iteris