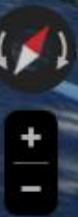


# All-way stop vs. 2-way stop for rural intersections

Discussion of all-way  
stop control as a  
safety  
countermeasure

May 21, 2024



# Overview/Agenda

- NHDOT intersection control hierarchy
- Intersections recently converted from 2-way to all-way stop control
- FHWA/Roadway Safety Foundation recognition of 10 “Life-saving projects”
  - Overview of North Carolina and Delaware experience
- Opportunities and Challenges in New Hampshire
- Discussion/Questions



# NHDOT intersection control hierarchy

- Prior to January, 2024:
  - Federal Guidelines (MUTCD)
    - Traffic volume based
    - Other criteria considered for rare exceptions
  - Emphasis on minimal impact to highway capacity/traffic operations
  - Safety concerns addressed with intersection “enhancements”
    - Larger STOP signs
    - “Cross Traffic Does Not Stop” plaques
    - Overhead intersection control beacon
    - Flashing beacons on STOP signs (or embedded LED STOP signs)
    - Flanking STOP signs
    - Intersection sight line improvements
    - Intersection Conflict Warning Systems (ICWS)



# Federal guidance (MUTCD)

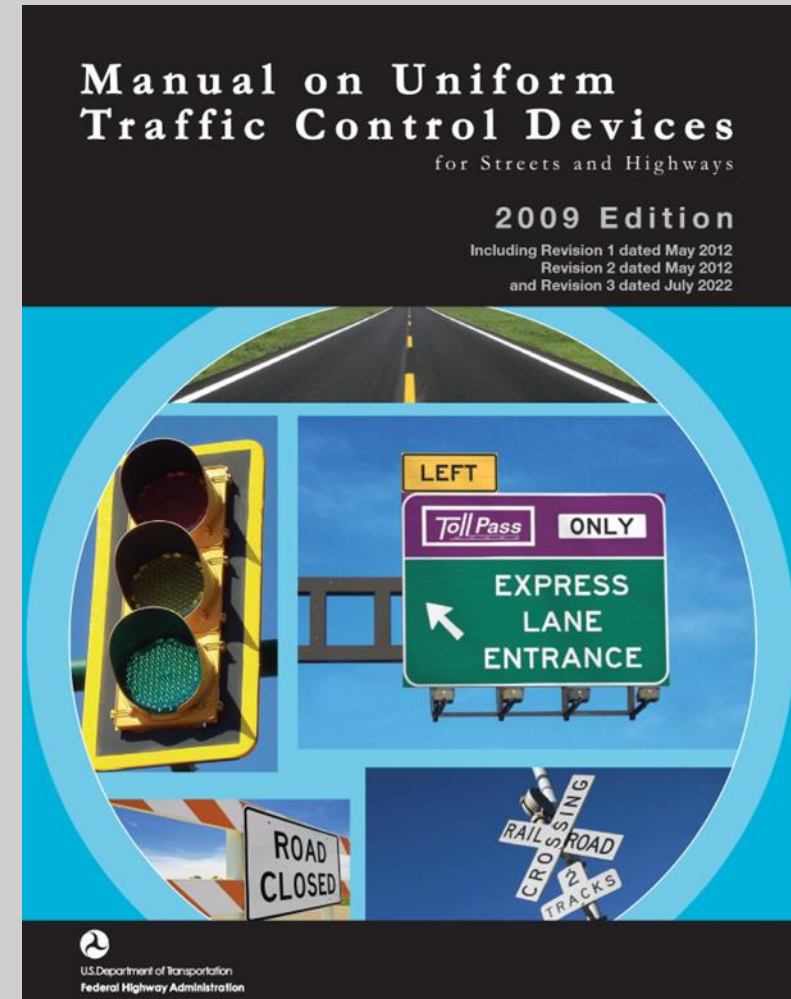
## *Guidance:*

*The decision to install multi-way stop control should be based on an engineering study.*

*The following criteria should be considered in the engineering study for a multi-way STOP sign installation:*

*A. Where traffic control signals are justified, the multi-way stop is an interim measure that can be installed quickly to control traffic while arrangements are being made for the installation of the traffic control signal.*

*B. Five or more reported crashes in a 12-month period that are susceptible to correction by a multi-way stop installation. Such crashes include right-turn and left-turn collisions as well as right-angle collisions.*



# Federal guidance (MUTCD)

Guidance:

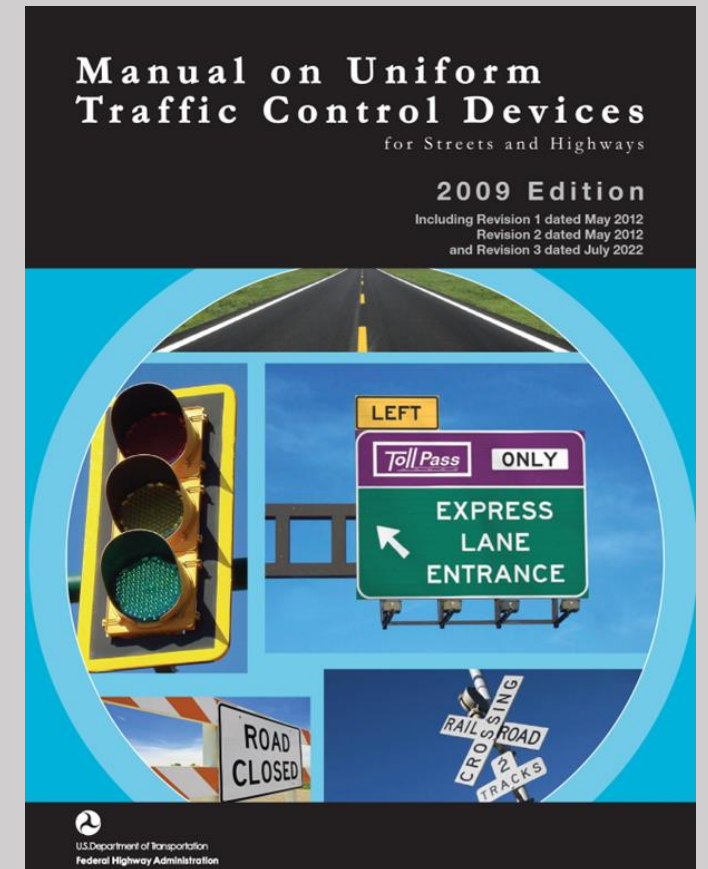
*C. Minimum volumes:*

*1. The vehicular volume entering the intersection from the major street approaches (total of both approaches) averages at least 300 vehicles per hour for any 8 hours of an average day; and*

*2. The combined vehicular, pedestrian, and bicycle volume entering the intersection from the minor street approaches (total of both approaches) averages at least 200 units per hour for the same 8 hours, with an average delay to minor-street vehicular traffic of at least 30 seconds per vehicle during the highest hour; but*

*3. If the 85th-percentile approach speed of the major-street traffic exceeds 40 mph, the minimum vehicular volume warrants are 70 percent of the values provided in Items 1 and 2.*

*D. Where no single criterion is satisfied, but where Criteria B, C.1, and C.2 are all satisfied to 80 percent of the minimum values. Criterion C.3 is excluded from this condition.*



# Federal Guidance (MUTCD)

Option:

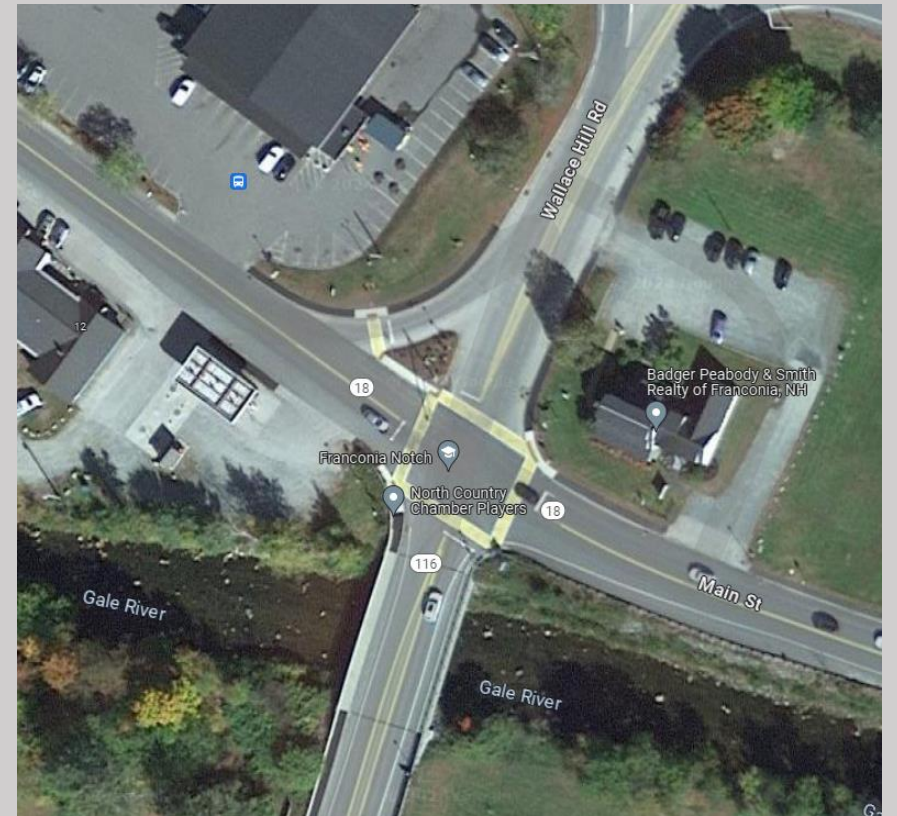
Other criteria that may be considered in an engineering study include:

- A. The need to control left-turn conflicts;
- B. The need to control vehicle/pedestrian conflicts near locations that generate high pedestrian volumes;
- C. Locations where a road user, after stopping, cannot see conflicting traffic and is not able to negotiate the intersection unless conflicting cross traffic is also required to stop; and
- D. An intersection of two residential neighborhood collector (through) streets of similar design and operating characteristics where multi-way stop control would improve traffic operational characteristics of the intersection.



# NHDOT intersection control hierarchy

- All-way stop control as a last resort
  - Speed along uncontrolled approaches is a concern
  - Continued crashes despite intersection enhancements
    - High-profile crashes elevate interest and urgency, even if unrelated to intersection control
  - Crash severity due to angle and speed
  - Complaints of “near-misses” and/or “only a matter of time before someone is hurt...or worse”





# Paradigm shift

Insanity: Doing the same thing over and over again and expecting different results.

*Albert Einstein*



# Recent New Hampshire examples of all-way stop control

Franconia, NH 18 at NH 116

3,049 vpd (NH 18) vs. 2,272 vpd (NH 116)

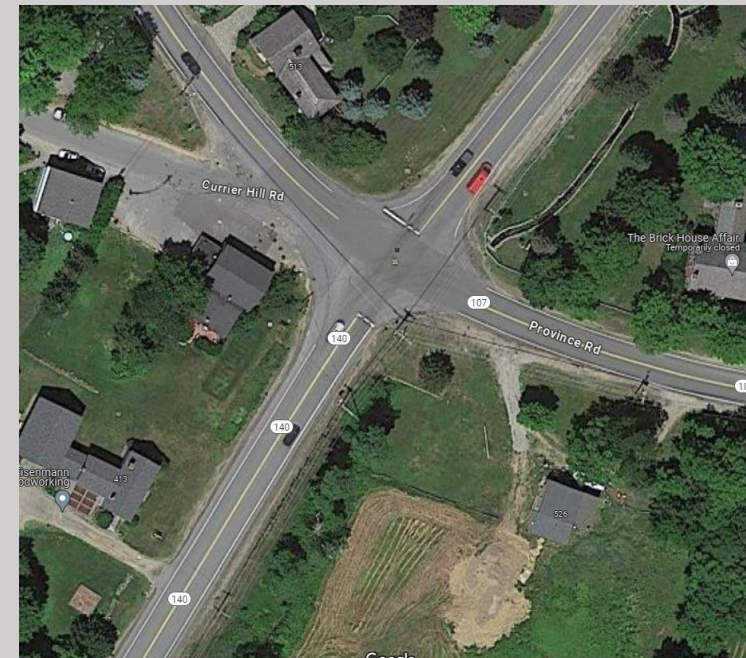
Converted in 2021



Gilmanton, NH 107 at NH 140

2,861 vpd (NH 107) vs. 3,978 vpd (NH 140)

Converted in 2020



# FHWA/Roadway Safety Foundation recognition of 10 “Life-saving projects”

- Two states recognized for converting 2-way stops to all-way stops, Delaware and North Carolina
  - “2023 National Roadway Safety Awards recognize innovations to protect pedestrians, cyclists, and motorists as pandemic spike in road fatalities continues mostly unabated”
  - “Ten innovative highway safety projects, representing the very best of the nation’s roadway safety practices,...honored with National Roadway Safety Awards...”
  - Delaware Department of Transportation (DelDOT) for converting 20 low-volume intersections from two-way to all-way stops.
  - North Carolina Department of Transportation (NCDOT) for significantly reducing the number of fatal and serious crashes at rural intersections



# Delaware

- Systemic project initiated in 2021 with 15 intersections
  - 5 intersections added in 2022 (2-years of “after” crash data available)
  - 5 intersections added in 2023 (1-years of “after” crash data available)
- On average, all types of crashes (angle, rear-end, single vehicle, and “others”) decreased
- On average, frequency of all severities of crashes (PDO, injury, and fatal) also decreased
- Local roads and collector roads saw reductions in annual crashes
- 12/25 locations did not meet MUTCD crash criteria

# Delaware

#	Major Road	Intersecting Road	Rural/ Urban	Major Road 2019 AADT	Minor Road 2019 AADT	Major Road Speed Limit	Functional Class	Crash Warrants Met	Met Reduced Crash Thresholds	Years of Before Crash Data	Years of After Crash Data
1	Delaware Ave	Woodland Beach Rd / Beach Ave	Rural	572	513	25	Minor Collector	No	No	3	3
2	K241 (Peach Basket Rd)	K240 (Turkey Point Rd)	Rural	3183	2485	50	Local	Yes	Yes	3	3
3	K371 (Barratts Chapel Rd)	K381 (Fox Chase Rd)	Rural	1765	990	35	Major Collector	Yes	Yes	3	3
4	N53 (Thompson Station Rd)	N301 (Pleasant Hill Rd) / N302 (Hopkins Rd)	Rural	4260	3464	35	Local	Yes	Yes	3	3
5	S326 (Bethesda Rd)	S86 (Avenue of Honor)	Rural	1353	2035	50	Local	No	Yes	3	3
6	S326 (Bethesda Rd)	S432 (Governor Stockley Rd)	Rural	887	1542	50	Local	No	Yes	3	3
7	S38 (Clendaniel Pond Rd)	S224 (Fleatown Rd)	Rural	1189	1714	50	Local	Yes	Yes	3	3
8	S46 (Old Furnace Rd)	S535 (Middleford Rd)	Rural	5208	7483	35	Major Collector	Yes	No	3	3
9	S47 (Johnson Rd)	S290 (Hurdle Ditch Rd)	Rural	1384	1268	45	Local	Yes	Yes	3	3
10	S62 (East Trap Pond Rd)	S329 (W. Piney Grove Rd / Whaleys Corner Rd)	Rural	978	630	50	Local	Yes	Yes	3	3
11	S750 (Shockley Town Rd)	S920 (Gum Rd)	Rural	849	1507	50	Local	No	Yes	3	3
12	SR 30 (Gravel Hill Rd)	S47 (Springfield Rd / Johnson Rd)	Rural	4546	1384	50	Major Collector	No	Yes	3	3
13	SR 30 (Whitesville Rd)	S66 (Pepperbox Rd)	Rural	1141	1485	50	Major Collector	No	Yes	3	3
14	SR 30 (Whitesville Rd)	S68 (Old Stage Rd)	Rural	1881	2206	50	Major Collector	No	No	3	3
15	SR 5 (Harbeson Rd)	S292 (Forest Rd) / Anderson Corner Rd	Rural	4549	1106	50	Major Collector	Yes	Yes	3	3
16	K103 (Hourglass Rd)	K182 (Slaughter Station Rd)	Rural	1175	1016	50	Local	Yes	Yes	3	2
17	N216 (Rockwood Rd)	N217 (Miller Rd)	Urban	4057	2822	35	Minor Collector	No	No	3	2
18	N243 (Old Kennett Rd)	N246 (Center Mill Rd)	Rural	3299	539	40	Major Collector	Yes	Yes	3	2
19	Munchy Branch Rd	Field Lane / Shady Ridge Dr	Urban	5230	Unknown	35	Local	No	No	3	2
20	S48 (Zoar Rd)	S317 (Peterkins Rd)	Urban	7586	801	45	Major Collector	Yes	Yes	3	2
21	SR 5 (Indian Mission Rd)	S302 (Harmons Hill Rd / Phillips Branch Rd)	Rural	6738	1360	50	Major Collector	No	No	3	1
22	SR 30 (Cedar Creek Rd)	S38 (Jefferson Rd / Sylvan Acres Rd)	Rural	6938	519	50	Major Collector	No	Yes	3	1
23	K388 (Canterbury Rd)	K404 (Church Hill Rd)	Rural	6578	829	50	Minor Arterial	Yes	Yes	3	1
24	SR 30 (Cedar Creek Rd)	S207 (Johnson Rd)	Rural	4848	1674	40	Major Collector	Yes	Yes	3	1
25	S410 (Godwin School Rd)	S433 (Country Living Rd)	Rural	404	794	45	Local	No	No	3	1



# Delaware

**Table 2. Annual Crashes at 25 Newly Converted AWSC Intersections**

Total Annual Crashes from All Study Intersections	Crash Type					Severity		
	Total	Angle	Rear End	Single Vehicle	All Others	PDO	Injury	Fatal
Before	120.67	67.33	17.00	19.33	17.00	70.33	48.67	1.67
After	52.33	22.67	12.17	11.33	6.17	43.67	8.67	0.00
% Change	-57%	-66%	-28%	-41%	-64%	-38%	-82%	-100%

# North Carolina

- Safety study evaluated 50 intersections (four-leg, 2-way stop control to all-way stop control)
  - 68% reduction in total crashes
  - 77% reduction in fatal and injury crashes
  - 75% reduction in frontal impact crashes
  - Benefit to cost ratio of 83:1 (at estimated \$20,000 per location)
    - Based on 36 locations where there were 26 fatal and serious injury crashes before, zero after
- “Where there is a demonstrated safety problem and a pattern of crashes at an intersection, AWSC should be considered.



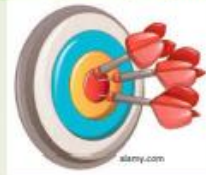
# North Carolina

## Safety Treatments – 2-Ln Minor Road Stop



All Way Stop

*Most Confident in Big Safety Improvement*



Roundabouts



Vehicle Entering When Flashing

*Middling and Scattered Safety Results*



Enhanced Intersection Signing



Stop Ahead Pavement Markings

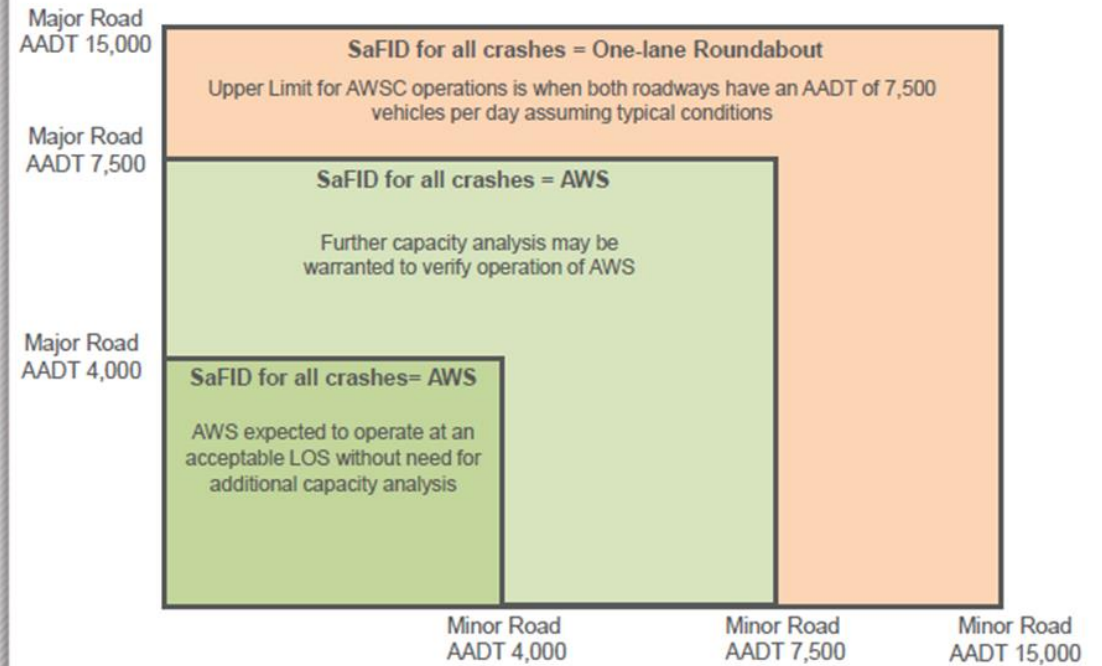
*Most Likely Missing the Safety Target*



Overhead Flashing Beacon

## Volume Thresholds

General Rules of Thumb Regarding Volumes (2 lane at 2 lane intersections):



# North Carolina

- Volume thresholds
  - Injury crashes: AWSC is “safest feasible intersection design” where Major street AADT < 5,000 vpd, Minor street AADT < 5,000 vpd
  - All crashes: AWSC is “safest feasible intersection design” where Major street AADT < 7,500 vpd, Minor street AADT > 7,500 vpd
- Unbalanced volumes
  - 2009 MUTCD reference to “approximately equal” volumes is relatively unchanged since 1971 and does not reflect more recent research
  - 2023 MUTCD has removed “approximately equal” language
- Primary Route performance
  - All-way stop control can be installed on primary routes without violating driver expectations or creating safety concerns.

# All-way stop control

- Opportunities

- Promotes safer speeds on major route
- Requires all drivers to stop, reduces odds of two drivers entering intersection at the same time
- Slower/stopped traffic provides a safer environment for pedestrians
- Does not require long-term commitment to flashing beacons or other STOP sign enhancements
- Can be implemented almost immediately

- Challenges

- Requires short-term re-education of familiar drivers (enhanced conspicuity for new STOP signs and short-term deployment of changeable message signs)
- Introduces new delay for Major street traffic
  - May need to conduct intersection analysis to determine scope
- Cultural and institutional resistance to change and/or inconvenience



# Implementation

- With local support?
  - NHDOT may conduct more detailed evaluation of all-way stop control
  - If all-way stop is feasible, NHDOT will notify local officials and implement as resources are available.
  - All-way stop control can be implemented by NHDOT personnel, with advance warning of new traffic pattern and enhance conspicuity
    - Location may be included in systemic, highway safety funded, capital project
- Without local support?
  - NHDOT would not pursue all-way stop control
  - NHDOT may be reluctant to implement other, less (or in-) effective countermeasures short of capital improvement project through TYP

# Questions?

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