



**NORTH CAROLINA**  
Department of Transportation



# Wrong Way Driving in NC

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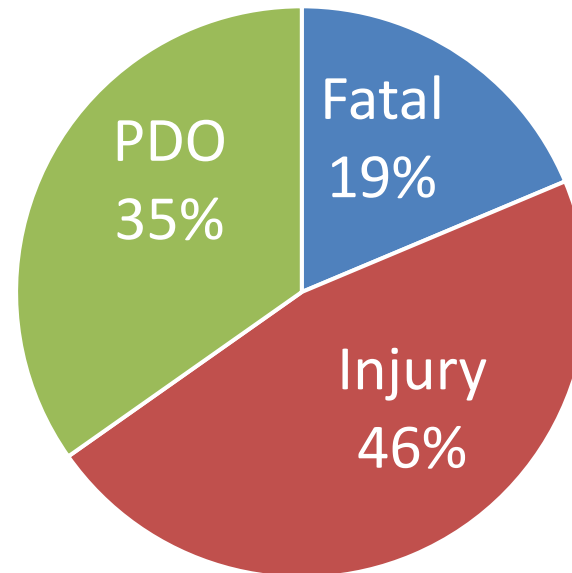
# Overview of Wrong Way Crashes

## Magnitude

- On average, 38 wrong way freeway crashes per year\*
- 0.01% of total crashes; 0.2% of total freeway crashes
- 0.40% of fatal crashes; 6.4% of freeway fatalities

## Severity

- Relatively high severity when they do occur



\* NC freeway crash data 2010-2019

# Overview of Wrong Way Crashes

## Characteristics of Freeway WW Crashes

- 50% occurred between 12:00am and 5:00 am
- 60% occurred on Friday, Saturday, and Sunday
- 48% were alcohol related
- 20% involved drivers 65 years of age and above (proportionally representative of driving population\*)

\*<https://www.fhwa.dot.gov/policyinformation/statistics/2018/dl22.cfm>

# How to address WW crashes?

- Many challenges in addressing
- Rare crashes
- Difficult to identify entry location
  - Driver can drive miles in the wrong direction before a crash
- Unknown number of crash-less wrong way driving incidents

# How to address WW crashes?

\* Unconventional approach



Trooper  
Jessica  
Schob



“...trooper was injured after stopping an impaired, wrong-way driver with her patrol car today on SR 3 at Newberry Hill.”

# Low Cost Engineering Strategies

Toolbox from “Strategies to Reduce Wrong Way Movements”(NCDOT Research Project 2017-12, Carter et al.)

– <https://connect.ncdot.gov/projects/research/Pages/ProjectDetails.aspx?ProjectID=2017-12>

- 8 signing strategies
- 5 marking strategies
- 5 geometric design strategies

# Signs

## Install WRONG WAY signs



*US-52 / Pilot Mountain Pkwy at S. Key St, Pilot Mountain, NC (Source: Google Streetview)*

Supplement to DO NOT ENTER signs but positioned farther away from the crossroad

# Signs

## Lower WRONG WAY signs



- Intended for older drivers and impaired drivers
- Consider potential visual obstructions

Source: Cooner et al., 2004



# Signs

## Install reflective strips



- Enhance visibility of WRONG WAY sign
- Red, 2" wide

*I-40 at New Hope Church Rd,  
Chapel Hill, NC (Source:  
Google Streetview)*

# Signs

## Install dynamic warning beacon



Sources: WSDOT via Moler, 2002 (above), Rhode Island DOT (right)

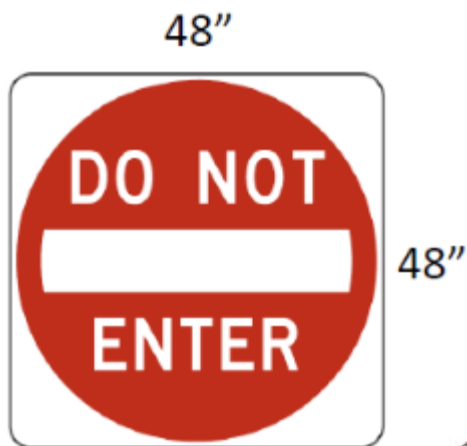


- Activated when wrong way driving is detected
- Used in TX, RI, WA

# Signs

Increase sign size

Increase conspicuity, especially for older drivers at night



R5-1



R5-1a

# Signs

Install Keep Right signs on medians at partial cloverleaf ramps

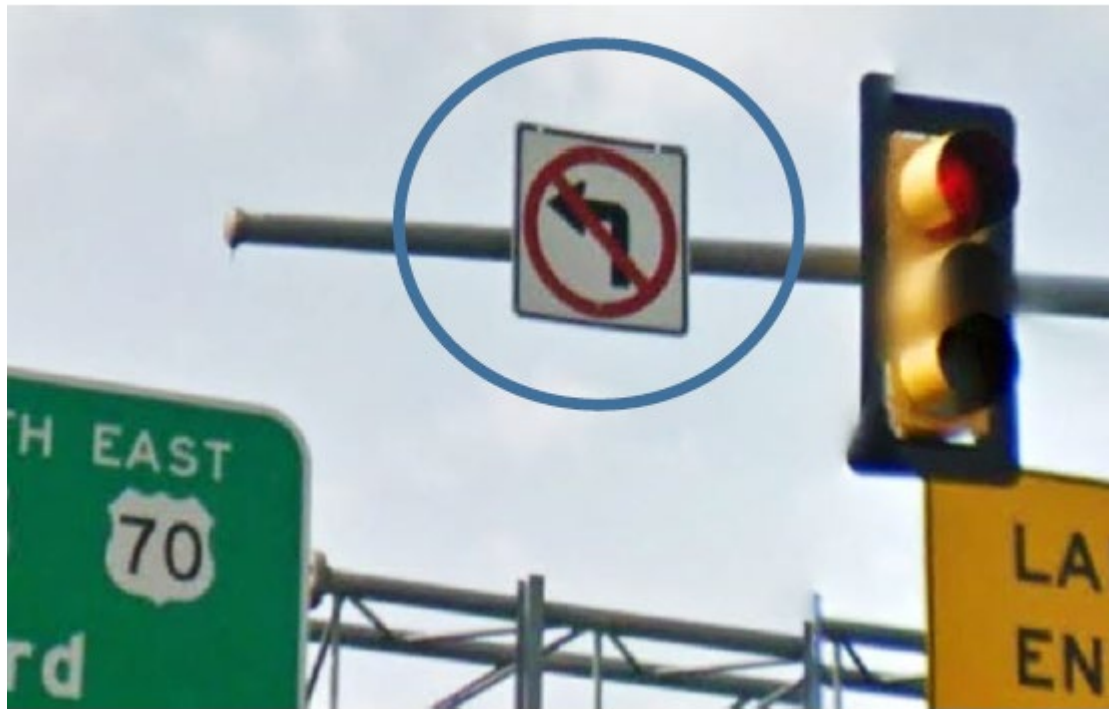


Guide drivers to avoid entering the exit ramp

*US-70 at US-117,  
Goldsboro, NC  
(Source: Google  
Streetview)*

# Signs

## Install turn prohibition signs



- Warn drivers away from entering exit ramps
- Placed on intersection corners, medians, or next to signal heads

*I-85 at Roxboro St, Durham, NC (Source: Google Streetview)*

# Signs

Install “Freeway Entrance” sign for on-ramp



- Inform road users of the freeway entrance
- Helpful when entrance ramp is directly adjacent to exit ramp

US-70 at US-117, Goldsboro, NC (Source: Google Streetview)

# Markings

## Install wrong way pavement marking arrows



Standard white pavement marking or raised pavement markers that show red to wrong-way road users and white to other road users

*Standard pavement marking wrong way arrow, US-421 at US-421 Business / Boone Trail Rd, Sanford, NC  
(Source: Google)*

# Markings

Install lane line extensions to guide turning traffic



©Google, Inc.

Intended to discourage wrong way movements when entrance ramp is directly adjacent to exit ramp

Source: Morena and Leix, 2012



# Markings

## Install stop line at exit ramp terminal



US-421 at Pittsboro Goldston Rd, Goldston, NC (Source: Google Streetview)

- Emphasizes the fact that the lane is from an exit ramp
- Intended to prevent wrong way movements when entrance ramp is directly adjacent to exit ramp

# Markings

Delineate median between ramp terminals

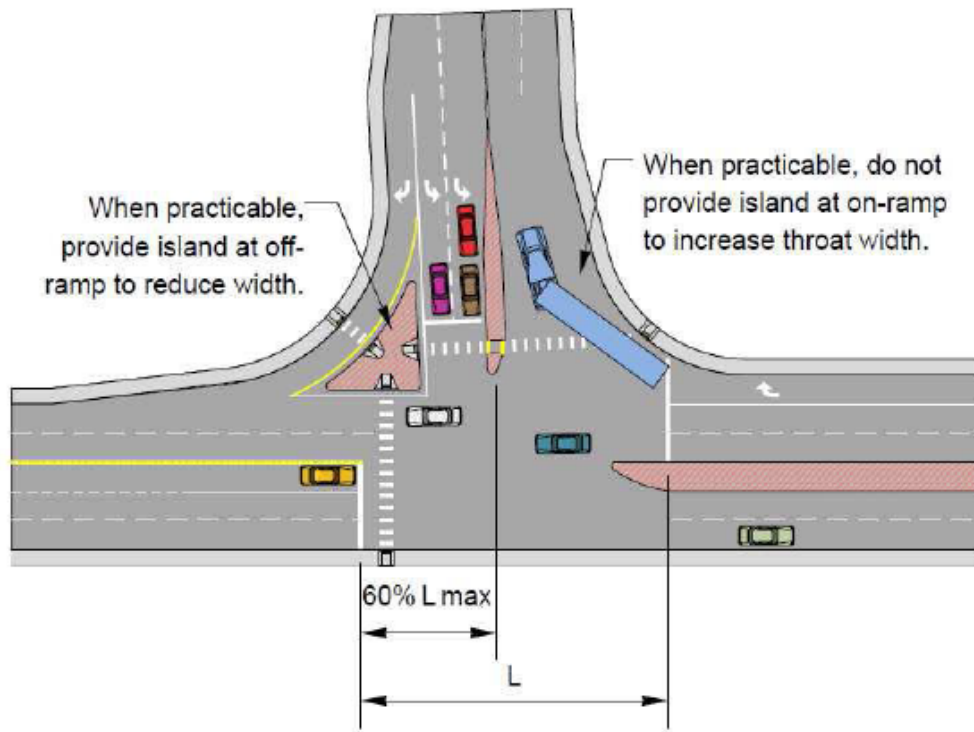


Intended to improve the conspicuity of the median and prevent drivers from entering the exit ramp

*I-40 Business at NC-66, Kernersville, NC (Source: Google Streetview)*

# Markings

## Move cross street left turn stop lines forward



Allow left-turning cross street drivers to have a better view of the entrance ramp

Source: Washington State DOT Design Manual 2013, as presented in Zhou and Rouholamin, 2014

# Geometric Design

Install channelizing island  
on exit ramp terminal



- Narrow the effective width of the exit ramp terminal
- Island needs to be sufficiently visible

# Geometric Design

Install median to discourage left-turn wrong way entry onto exit ramps



Deter drivers from making a left turn and entering an exit ramp

*I-77 at US-21 /  
Turnersburg Hwy,  
Troutman, NC  
(Source: Google  
Streetview)*

# Geometric Design

Reduce corner radius



Deter right  
turn wrong  
way  
movements  
onto the exit  
ramp

# Geometric Design

Retract median barrier between entrance and exit ramps



Allow clear view of the entrance ramp

# Geometric Design

Install roundabout at ramp terminal



Directional geometrics of roundabout discourages wrong way movements

*US-1 / US-501 at Hawkins Ave, Sanford, NC (Source: Google)*



# NCDOT Signing Pilot



I-40 WB/I-85 SB Ramp (Exit 132) and SR 3045 (Mt Hope Church Rd), Guilford County

# NC Turnpike Authority Initiatives

- Wrong way detection implemented as a pilot system on the Triangle Expressway (I-540/NC147) and Monroe Expressway (US 74 Bypass).
- Higher levels of technology and instrumentation on toll roads provides opportunity for wrong way detection.

# NC Turnpike Authority Initiatives

## Monroe Expressway Wrong Way Driver Detection and Notification System



# Wrong Way Driving Research

- NCDOT: “*Evaluation of the Monroe Expressway Wrong Way Vehicle Detection Program*” led by ITRE / NC State, scheduled for completion in early 2021
- NCHRP Report 881 – *Traffic Control Devices and Measures for Deterring Wrong Way Movements* (<http://www.trb.org/Main/Blurbs/178000.aspx>)
- NCHRP 3-135, *Wrong-Way Driving Solutions, Policy, and Guidance*, scheduled to be completed in 2022

# Contact Info

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