Introduction

Nearly half of all traffic-related fatalities and serious injuries occur at or near intersections and crashes in which a left-turning vehicle is struck by oncoming traffic (left-turn crashes) are common and severe. These turns are particularly challenging because the opposing left-turn lane may contain vehicles blocking the view of oncoming traffic. Older adults are particularly at risk for this type of crash due to age-related declines in visual and spatial processing. Positive offset left-turn lanes are one countermeasure intended to reduce left-turn crashes by providing drivers with an unobstructed view of oncoming traffic. While positive lane offsets tend to reduce crash risk, space requirements for positive offset turn lanes make them impractical to install at some intersection locations. An alternative to positive offset lanes is to reduce the degree of negative offset, but evidence for the efficacy of less dramatic lane offsets is mixed. We examined how large (11.8 ft) and small (3.2 ft) negative lane offset influenced the turning behavior (gap acceptance) of younger, middle-age, and older drivers in a series of driving simulator studies.

Method

Participants

35 younger adults, aged 31 to 35 (M = 33 years)
23 middle-aged adults, aged 50 to 64 (M = 58 years)
25 older adults, aged 65+ (M = 72 years)

Tasks 1 and 2 were completed during a single 1 hour session

Task 1: Left Turn Judgments

Viewed scenes from the perspective of a driver in either a large negative offset (11.8 ft) or minimal negative offset (3.2 ft) left-turn lane

Presented with a continuous stream of traffic with varying gaps between cars

Speed of oncoming traffic varied between subjects, either 35 mph or 45 mph

Prompted every 2.5 or 5.5 seconds to indicate whether or not it was safe to turn

Made a total total of 147 turn judgments

Dependent measure was the distance between the participant’s vehicle and the nearest oncoming vehicle

Task 2: Simulated Driving Task

Participants completed a simulated driving task where they executed four left turns at signal-controlled intersections

Two turns were made from negative offset left turn lanes and two were made from minimal offset left turn lanes

Speed of oncoming traffic varied between subjects, either 35 mph or 45 mph

Dependent measure was the distance between the participant’s vehicle and the nearest oncoming vehicle

Eye movements were also recorded during the task

Task 1: Results

Participants accepted smaller gaps when oncoming traffic was moving at 35 mph than at 45 mph, $F(1,58) = 13.81, p < .001, d = .94$

Task 2: Results

Younger adults made riskier turn decisions than did middle-aged, $d = .79$, or older adults, $d = .73, p = .01$

Summary

A safety advantage was observed for all age groups for the small negative lane offset condition

Participants executing turns from left turn lanes with a smaller negative offset made safer turns, leaving a larger gap between their vehicles and oncoming traffic in a simulated driving task

Results suggest even less dramatic increases in the visibility of oncoming traffic can aid in the decision making process of the turning drivers of all ages, leading to safer left turn decisions

An implication of current findings is that when possible, and when relevant (e.g., offset probably has a minimal impact on protected turns), minimal negative offset or positive offset lanes should be implemented

Results presented in FDOT Technical Report BDK83 977-09

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