Abridgment

Effect of Dotted Extended Lane Lines on Single Deceleration Lanes

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In the Manual on Uniform Traffic Control Devices (MUTCD) there is a provision for an optional dotted extension of the right edge line for parallel and tapered deceleration lanes. According to MUTCD, the dotted extension is usually made up of short segments 0.6 m (2 ft) long and longer gaps 1.2 m (4 ft) or more.

The purpose of this study was to determine the effectiveness of the optional dotted extension of the right edge line for deceleration lanes.

Tapered and parallel deceleration lanes are currently used with various interchange geometries in New Jersey. Different exit ramp and approach geometries and extended dotted lane lines may interact to cause variations in driver performance. In the summer of 1975, a study was made of the effect of dotted lines at both tapered and parallel right, single deceleration lane exits with varying approach and exit ramp geometries on New Jersey's Interstate system.

The data collection procedures included the following tasks: performing before studies, installing extended dotted lane lines, and performing after studies.

SITE LOCATIONS

Traffic was observed at two different locations in the state: Rt-440 and I-287 in the northeast, and in the south I-295 in Camden County, which served as the location of many sites. Sixteen sites were selected in all, and 12 were used for actual study. The remaining 4 were upstream sites where extended dotted lane lines were installed to help eliminate any possible uniqueness effect at the other 12 sites. Of these 12, 7 were categorized as tapered deceleration types and 5 as parallel deceleration types. Because other characteristics were similar, tapered and parallel lanes were differentiated by length, tapered lanes being those shorter than 122 m (400 ft). Two sites were selected as controls, where no dotted lane lines were applied.

PREPARATION OF SITES

The deceleration lanes were standardized according to MUTCD guidelines prior to the before study. Extended dotted lane lines were installed from the gore point on tapered lanes and from the ends of skip-lines on parallel lanes, and upstream to the point where the edge line begins to taper at the beginning of the exit lane (see Figure 1). The dotted lane lines were made up of 0.6-m (2-ft) strips placed every 8 m (27 ft) on center. The best spacing was determined subjectively by observing several gap lengths on deceleration lanes.

At each study site, a reference point was painted to help define the zones for observers, who classified each vehicle entering the deceleration lane according to zone. The reference point separated zones 1 and 2 where there was an even chance of exiting maneuvers from each, as determined by prior observation of traffic. It was felt that an equal distribution of zone 1 and zone 2 exiting maneuvers would provide the most sensitive measure of a change in exiting behavior. We counted another type of maneuver, labeled 4, which entailed crossing back from the deceleration lane into the through lanes.

DATA COLLECTION

Data were collected at the 12 sites by two teams of three hidden observers. One observer counted two-axle exiting traffic and all through traffic. The other two observers independently counted two-axle exiting vehicles by maneuver type.

Observations were conducted between 10:00 a.m. and 12:10 p.m. and between 1:00 and 3:10 p.m., with a 10-min break at 11:00 a.m. and 2:00 p.m. A total of 4 h of traffic data were recorded Monday through Friday, and for each day these before data were matched with data collected three weeks later for the same time and day of week.

The two control sites, 7 and 12, are both tapered, and each is located at one of the two locations near the experimental sites. Traffic was observed at each control site for the first 3 d of before studies, for 3 d between the before and the after studies, and for the last 3 d of after studies.

We divided each study week into high-volume sites on Monday and Tuesday and low-volume sites on Wednesday, Thursday, and Friday. This gave the lower volume sites more matched data periods than the higher volume sites, but the latter had larger samples in each data period.

METHOD OF ANALYSIS

Before and after rates of exit maneuvers in 10-min periods were matched by time of day and day of the week in order to see if the rates changed with statistical significance at the 95 percent confidence level. A standard deviation 1.64 or more is a significant difference at the 95 percent level, using a one-tailed test.

Changes between rates before and after were tested by using the conservative, nonparametric, Wilcoxon matched-pairs, signed-ranks test.

RESULTS AND CONCLUSIONS

The comparison of total exit maneuver rates by lane type for each study site in Table 1 shows a significant increase in zone 1 exit maneuvers (except for site 1) after dotted lane lines were installed; zone 2 exits decreased proportionately. This is a beneficial effect for orienting exiting traffic into the deceleration lane. No significant change was noted in before and after rates for zone 3 exit maneuvers on parallel deceleration lanes. Type 4 maneuvers, less than 1 percent of the total volume, are not shown.

Site 8 experienced a high increase in through volume (40 percent), but exit volume decreased by 22 percent for the period between the before and the after studies. This large change may be indicative of a bias effect on exit maneuver rates. The rest of the sites experienced less than a 15 percent change of volume.

Table 1 also presents a summary of exit maneuver rates for the two control sites. Significant changes in

Figure 1. Deceleration lanes and zones.

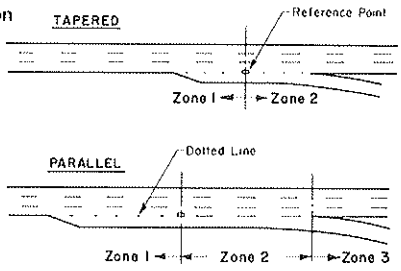


Table 1. Comparison of exit rates in zone 1 before, between, and after dotted line marking.

Lane Type	Site No.	Before	Between	After	Statistical Significance (Z value)
Tapered	1	48	—	47	0.207, n = 41[a]
	2	45	—	69	7.07, n = 69
	5	41	—	64	5.78, n = 44
	8	58	—	60	2.33, n = 41
	9	60	—	77	4.99, n = 33
Parallel	3	54	—	66	5.85, n = 67
	4	31	—	50	5.36, n = 38
	10	24	—	37	6.14, n = 65
	11	70	—	75	3.59, n = 67
	13	45	—	51	2.34, n = 39
Control	7	55	52	60	—[b]
	12	50	58	56	—[b]

[a]Not significant. [b]Significant.

these rates in zone 1 occurred for each combination of data collection periods.

The graphic comparison of experimental and control site results in Figures 2 and 3 of zone 1 shows the negligible effect that control site percentages have. The control sites were not identical to the experimental sites they represent, so we do not know what the precise corrections should be. Correction accuracy is also limited by our assuming linear relationships between the percentage of exit maneuvers in zone 1 and the passage of time as determined by only three points representing control site variation.

The following major conclusions were drawn from the results of the Wilcoxon test of matched pairs and the subsequent analysis:

1. The dotted extension of a right edge line was more effective in orienting exiting traffic sooner into the deceleration lane, single tapered and parallel deceleration lanes and
2. No significant change was noted in zone 3 exits (crossing the painted gore regions) at parallel deceleration lanes.

It was also observed that exiting vehicles use the shorter deceleration lanes with less variation, because

Figure 2. Percentages of exit maneuvers at I-295 sites.

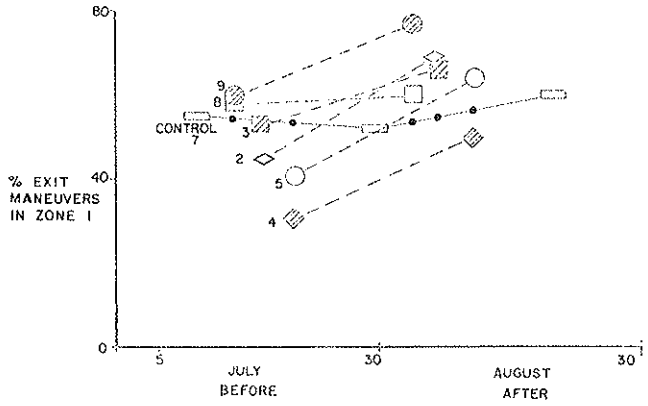
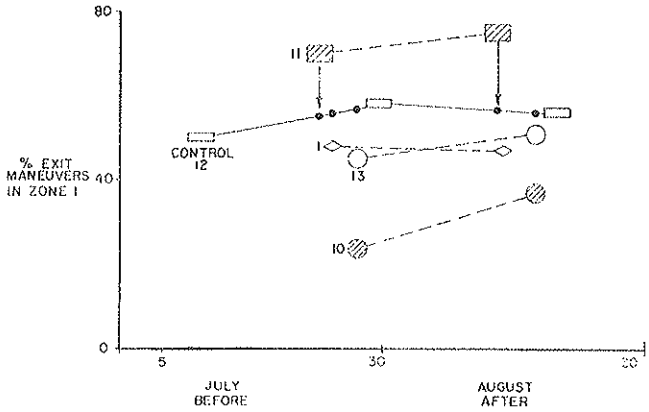


Figure 3. Percentages of exit maneuvers at I-287 and Rt-440 sites.



there is less room to maneuver. As a result, the use of dotted lane lines did not have as marked an effect on orienting vehicles into these shorter lanes.

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