

An Evaluation of Using Portable Changeable Message Signs (PCMS) To Regulate Speed Limit in the I-95 Workzone Northampton County Project # I-4913



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Project Scope



The goal of this project is as follows:

Determine if temporary speed limits posted on a PCMS in workzones are effective in creating speed limit compliance.

Engineering Standard for Posting Speed Limits on Portable Changeable Message Signs:

"A changeable message sign that changes the speed limit for traffic and ambient conditions may be installed provided that the appropriate speed limit is shown at the proper times."

MUTCD 2003 Section 2B.13



Measures of Effectiveness



- **Vehicle Speeds**

speed chosen by the lead driver and collected using the Lidar Gun

- **Average Speed**

speeds collected per location and direction averaged

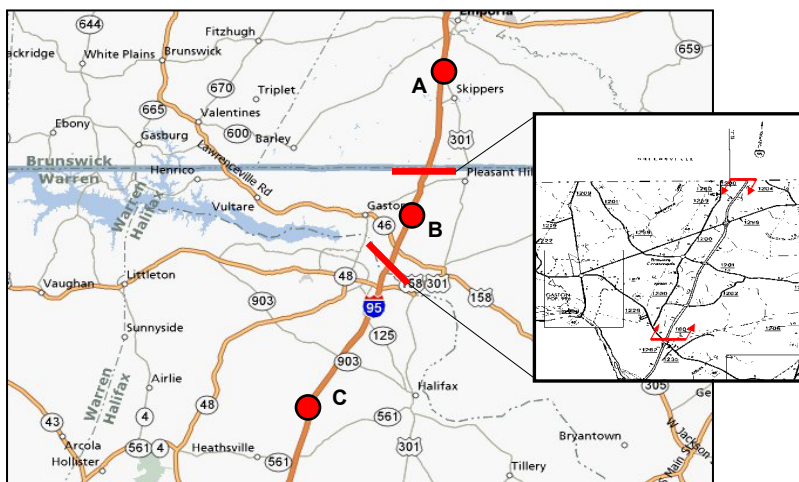
- **Percentage of Vehicles Exceeding Speed Limit**

calculated and graphed results showing “Number of Vehicles” vs. “Observed Speed minus Speed Limit”

- **Pace Speed**

set of 10 miles per hour where the largest percentage of speeds fall per data set

Data Points



- A. Upstream Location – Greenville County, Virginia: VA 639 (Rock Bridge Rd)
- B. Study Location – Northampton County, North Carolina: SR 1202 (Blythe Rd)
- C. Downstream Location – Halifax County, North Carolina: SR 1001 (Justice Branch Rd)

Data Collection



- i. Speeds collected with Lidar Gun – conducted accuracy test
- ii. Data was collected Monday – Saturday during daytime hours (9am – 3pm) @ 1 hr increments
- iii. Collect Before, After, Upstream During, and Downstream During from atop bridges with no access ramps to I-95 – inconspicuous spot (not to influence behavior)
- iv. Only targeted unimpeded vehicles for speed (free-flow conditions) – no platoon vehicle speeds
- v. Speeds collected under similar weather conditions – clear to overcast skies and dry roadway
- vi. In the Workzone – speeds collected from shoulder within lane closure



Southbound



Northbound



Workzone Approach Warning



Workzone: single lane closure, one direction, daytime hours 8am – 7pm

1. ROAD WORK AHEAD / BE PREPARED TO STOP (Virginia Exit 4)
2. WORKERS IN ROADWAY / REDUCE SPEED AHEAD (Virginia MM 2)
3. WORKERS IN ROADWAY / MERGE LEFT / BEGIN 55 4000 FEET (Virginia MM1)
4. \$250.00 SPEEDING PENALTY / **SPEED LIMIT 55** (Edge of WZ – Line)



Speed Results



| I-95 NB & SB Before Totals | | I-95 NB & SB Totals Workzone Data | | I-95 NB & SB After Totals | |
|----------------------------|-------|-----------------------------------|-------|---------------------------|-------|
| Total Obs | 6045 | Total Obs | 1957 | Total Obs | 4707 |
| Speed Limit | 70 | Speed Limit | 55 | Speed Limit | 70 |
| Average | 72.63 | Average | 54.65 | Average | 72.12 |
| 50th Percentile | 72.30 | 50th Percentile | 54.07 | 50th Percentile | 71.73 |
| 85th Percentile | 76.90 | 85th Percentile | 58.98 | 85th Percentile | 76.50 |
| Std Dev | 4.88 | Std Dev | 5.33 | Std Dev | 4.84 |
| Variance | 23.98 | Variance | 31.97 | Variance | 23.44 |

85th Percentile of Before and After nearly the same – expected after increase due to smoother roadway

Average and 50th Percentile of Workzone speed under speed limit means compliance achieved

| PACE Speed Calc | | PACE Speed Calc | | PACE Speed Calc | |
|-----------------|-------|-----------------|-------|-----------------|-------|
| Low Pace | 69 | Low Pace | 50 | Low Pace | 68 |
| High Pace | 78 | High Pace | 59 | High Pace | 77 |
| Vehicle % | 70.48 | Vehicle % | 73.94 | Vehicle % | 69.98 |

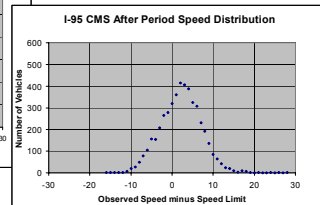
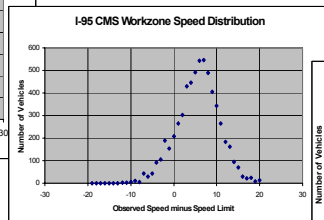
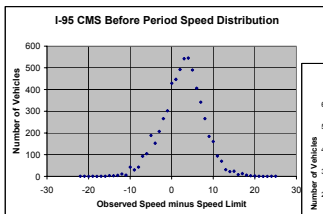
Pace Speeds contain 70% of vehicles = enhanced safety based on commonly accepted engineering practices

Percentage of Vehicles Exceeding Speed Limit



| | Before | During Downstream | During Workzone | During Upstream | After |
|-------------|--------|-------------------|-----------------|-----------------|--------|
| Speed Limit | 70 | 70 | 55 | 65 | 70 |
| Total Obs | 6045 | 1842 | 1957 | 2260 | 4707 |
| Above Limit | 4580 | 1277 | 817 | 1812 | 3033 |
| % Exceeding | 75.77% | 69.33% | 41.74% | 80.18% | 64.44% |

- Highest speed compliance in workzone
- Similar speed distribution, peak from 0 to +10



Progression Analysis



SB During Progression Analysis

| | Upstream | Workzone | Downstream |
|-------------|----------|----------|------------|
| Speed Limit | 65 | 55 | 70 |
| Total Obs | 1524 | 1226 | 1042 |
| Average | 69.92 | 55.11 | 72.9 |
| 85th | 73.98 | 59.31 | 76.78 |
| % Exceeding | 82.61% | 43.47% | 71.11% |

SB Progression: A-B-C

% reduced by nearly half coming into the workzone

NB During Progression Analysis

| | Downstream | Workzone | Upstream |
|-------------|------------|----------|----------|
| Speed Limit | 70 | 55 | 65 |
| Total Obs | 800 | 731 | 736 |
| Average | 72.42 | 53.71 | 68.73 |
| 85th | 76.60 | 58.34 | 73.03 |
| % Exceeding | 66.75% | 38.85% | 75.00% |

NB Progression: C-B-A

Significant reduction into workzone, reduced % upstream compared to SB analysis

Discussion / Other Factors



•Construction vehicle lead platoons



- Squeezing of traffic onto shoulder
- Crossing rumble strips getting onto and using the shoulder

Conclusions



1. Speed Compliance obtained – successful workzone traffic control
2. 55-mph CMS Posted Speed was **NOT SOLEY RESPONSIBLE** for compliant speed reduction within the workzone
3. Other commonly used workzone techniques to include – construction lead vehicles, “squeezing” of traffic onto shoulder, effective use of pre-existing rumble strips, and significant advance warning of approaching roadwork

Any Questions?

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