



AOTA Critically Appraised Topics and Papers Series

**Driving and Community Mobility
for Older Adults**

**A product of the American Occupational Therapy Association's
Evidence-Based Literature Review Project*

CRITICALLY APPRAISED PAPER (CAP)

Focused Question

What is the evidence for the effect of modifications of the infrastructure of the physical environment (e.g., roadways, signage, and lighting) on the driving ability, performance, and safety of the older adult?

Carlson, P. J. (2001). Evaluation of Clearview alphabet with microprismatic retroreflective sheetings (FHWA Report # FHWA/TX-02/4049-1). Springfield, VA: National Technical Information Service.

PROBLEM STATEMENT (JUSTIFICATION OF THE NEED FOR THE STUDY)

State the problem the authors are investigating in this study.

The traditional font that has been utilized on guide signs is problematic when the letters are fabricated from newer retroreflective sheetings. Because of the microprismatic nature of the materials, irradiation, or “blooming” can occur when these letters are illuminated by a vehicle’s headlamps. This results in decreased clarity of the individual letters, and therefore reduced legibility. Previous evaluations of the relatively new Clearview font used only 1 type of retroreflective sheeting. The study presented here assessed the effectiveness of several different kinds of retroreflective sheeting.

RESEARCH OBJECTIVE(S)

List study objectives.

The goal of this research study was to assess the nighttime legibility distance of the Clearview alphabet as used on overhead and shoulder-mounted guide signs.

Describe how the research objectives address the focused question.

NR

NR = Not reported.

DESIGN TYPE:

Mixed Factors Randomized

Level of Evidence:

Level I

Limitations (appropriateness of study design):

Was the study design type appropriate for the knowledge level about this topic? *If no, explain.*

Yes

No

SAMPLE SELECTION

How were subjects selected to participate? Please describe.

Convenience—as volunteers

Inclusion Criteria

Licensed drivers ages 18–65, Snellen visual acuity scores between 20/15 and 20/50

Exclusion Criteria

N/A

Sample Selection Biases: *If yes, explain.*

Volunteers/Referrals

Yes

No

Attention

Yes

No

Others (list and explain):

SAMPLE CHARACTERISTICS

N = 60

% Dropouts	<input type="text" value="NR"/>		
#/(%) Male	<input type="text" value="30"/>	#/(%) Female	<input type="text" value="60"/>
Ethnicity	<input type="text" value="NR"/>		
Disease/disability diagnosis	<input type="text"/>		

Check appropriate group:

<20/study group	20–50/study group	51–100/study group	101–149/study group	150–200/study group
✓				

Sample Characteristics Bias: If no, explain.

If there is more than one study group, was there a similarity between the groups?

Yes	<input type="text" value="✓ Because visual acuity and reaction times (influencing quickness of response) can degrade with age, participants were grouped into 1 of 3 age ranges: 18–34, 35–54, and 55+. For each gender and age group there were 10 participants."/>
No	<input type="text"/>

Were the reasons for the dropouts reported?

Yes	<input type="text"/>
No	<input type="text"/>
NR	<input type="text" value="✓"/>

INTERVENTION(S)—Included are only those interventions relevant to answering the evidence-based question.

Each participant drove 2 different vehicles over the course of the experiment—a 2001 Chevy Blazer SUV, and a 1991 Ford Crown Vic. The Crown Vic had the old style, sealed-beam headlamps that are most prevalent in the vehicle fleet at present, while the Blazer had newer style tungsten-halogen headlamps. These newer headlamps are designed to cast more light to the left and right on the road surface, but less upward projected light that would illuminate road signs, or could blind other drivers. Owing to this, the Blazer provided less illumination to the road signs.

The author also reports that the greater the vertical distance from the headlamp a driver’s head is, the less effective the retroreflective material will become. In the Crown Vic, the distance between the headlamp and average participant’s eye-height was 20.5 inches. In the Blazer the value was 23.5 inches. Combining this factor with the reduction in illumination from the

Blazer's newer headlamps meant that the luminance levels available to the participant when in the Blazer were less than those available to the participant when in the Crown Vic.

The study was conducted on a runway of an abandoned Air Force base that is now used by Texas Transportation Institute for on-road research studies. Data were collected under cover of darkness under clear and dry weather conditions. The runway was approximately 7,000 ft long, although participants drove on a shorter portion of the overall span. The first and second sign stations were placed 2,500 ft from the starting position. The sign stations faced opposite directions of travel on the roadway. While driving away from the starting position, participants could read 1 sign, and while driving back to the starting position participants could read the other sign. The third sign station was located another 2,500 ft past the first and second sign stations (moving away from the starting point).

Signs were positioned at shoulder height or mounted overhead, in accordance with current signing practices. The bottoms of the overhead signs were 18 ft above the road surface, and the bottoms of the shoulder-mounted signs were 9 ft above the road surface. The overhead signs were positioned directly above the roadway, while the left edge of the shoulder-mounted signs was 24 ft from the fog line.

A total of 21 test words were placed on the signs, 1 word per sign per trial. Ten of the words were neutral words that did not have ascending lowercase letters (f, l, d, b) or descending lowercase letters (g, p, q, y). The remaining 11 words had at least 1 of these letters. Each of the words consisted of 6 or 7 letters. The words were approximately 8 ft by 2 ft in size, and centered on the signs between a state highway number and a guide arrow aimed down. The presentation order of words and word position, sign position, and sign height were randomized. Participants drove both vehicles, and vehicle primacy was randomized as well. Each participant experienced 56 trials.

Add groups if necessary

Group 1

Brief Description	
Setting	
Who Delivered?	
Frequency?	
Duration?	

Intervention Biases: *Explain, if needed.*

Contamination

Yes

No

Co-intervention

Yes

No

Timing

Yes

No

Site

Yes

No

Use of different therapists to provide intervention

Yes

No

MEASURES AND OUTCOMES—Included are measures relevant to answering the focused question.

Name of measure:

Legibility Distance

Outcome(s) measured (what was measured?):

Distance from sign at which the participant was able to read the word on the sign.

Is the measure reliable (as reported in article)?

Yes

No

Is the measure valid (as reported in article)?

Yes

No

How frequently was the measure used for each group in the study?

Each participant had a total of 56 exposures to the signs.

Measurement Biases

Were the evaluators blinded to treatment status? *If no, explain.*

Yes

No

Recall or memory bias? *If yes, explain.*

Yes

No

Others (list and explain):

Limitations (appropriateness of outcomes and measures) *If no, explain.*

Did the measures adequately measure the outcome(s)?

Yes

No

RESULTS

List results of outcomes relevant to answering the focused question.

Include statistical significance where appropriate ($p < 0.05$).

Include effect size if reported.

For the shoulder-mounted signs, a 3-way repeated-measures ANOVA (alphabet, vehicle, sheeting) with a between-subjects factor (age) revealed a highly significant ($p = .0001$) main effect for subject age. In the older age group, the results showed an increase in legibility distance when using the Clearview alphabet. This increase was 9.3%, which the authors report as translating to a 0.45-second gain in available reading time assuming a 70-mph roadway. Overall, the Clearview alphabet was legible from a greater distance than the Series E (Modified) alphabet, and this difference was highly statistically significant ($p = .0001$). Unfortunately, this difference may not be meaningful in real world applications because the practical gain in legibility distance ranged between 18 and 58 feet.

There were also significant primary effects for vehicle type (the Crown Vic had much greater legibility distance than the Blazer) as well as sheeting material used (type VIII sheeting outperformed type IX sheeting), but these variables did not interact with any of the other variables.

For overhead-mounted signs, a similar ANOVA determined that the legibility distance was greater for the type IX than type III sheeting. The type III was included purely as a means by which to correlate the results of this study with work previously performed at TTI. Because type III sheeting is no longer used (for whatever reason), the trials performed using this sheeting were not included in the analysis used to compare the 2 alphabets.

An ANOVA was conducted to assess the impact of vehicle type, alphabet, and age on legibility distance. Alphabet and vehicle type were repeated measures variables, and subject age was again a between-subjects variable. Again, there was a highly significant main effect for alphabet type on legibility distance, but this improvement in score was modest, ranging between 26 and 54 ft.

Again, age was found to be a significant main effect, but this time the interaction between age and alphabet was significant as well ($p = 0.028$). For the older age group, the benefits of the Clearview alphabet were more pronounced, with a percentage gain in legibility distance of 6.8%. This translates to a 0.33-second increase in available reading time assuming a 70-mph roadway.

Was this study adequately powered (large enough to show a difference)? *If no, explain.*

Yes

No

Were appropriate analytic methods used? *If no, explain.*

Yes

No

Were statistics appropriately reported (in written or table format)? *If no, explain.*

Yes

No

CONCLUSIONS

State the authors' conclusions that are applicable to answering the evidence-based question.

There is a clear performance benefit for the Clearview font in nighttime driving when compared to the Series E (Modified) font—particularly for older age groups. The author points out that there is no increased cost of production in using the Clearview rather than the Series E (Modified), which perhaps means that when worn-down signs are replaced, the Clearview alphabet should be utilized.

Were the conclusions appropriate for the Study Design (Level of Evidence)? *If no, explain.*

Yes

No

Were the conclusions appropriate for the statistical results? *If no, explain.*

Yes

No

Were the conclusions appropriate given the study limitation and biases? *If no, explain.*

Yes

No

IMPLICATIONS FOR OCCUPATIONAL THERAPY

This section provides guidance about clinical practice, program development, and other implications of the study findings as they relate to the focused question.

The overall take-away message from this study is that the Clearview alphabet seems to improve guide sign legibility for older drivers. In some instances, these benefits are greater for older drivers than other age groups. However, these effects may not be meaningful in real world applications because they provide only marginal increases in available reading time and legibility distance.

This work is based on the evidence-based literature review completed by Paula C. Bohr, Ph.D., OTR/L, FAOTA and Kathleen A. Harder, PhD.

CAP Worksheet adapted from: Critical Review Form – Quantitative Studies ©Law, M., Stewart, D., Pollack, N., Letts, L., Bosch, J., & Westmorland, M., 1998, McMaster University. Used with permission.

For more information about the Evidence-Based Literature Review Project, contact the American Occupational Therapy Association, 301-652-6611, x 2052.



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