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Research Bulletin

TILTED SIGNS RESEARCH PROGRESSES

Motorists traveling northbound on US 395 through Washoe valley that notice groups of regulatory signs with a strange message along the eastside frontage road may become confused. Sign messages like "WEST 3", "NORTH 0" and "SOUTH 12" are indeed unique. Of course, the sign messages have no regulatory meaning but are used in an experiment to discover whether a 'tilted' sign will accumulate less snow.

Snow accretion and snow cover on signs can decrease or obliterate the message of traffic signs thereby causing a variety of problems for the motorist. Motorists could miss a sign message altogether or could become so distracted trying to read a partially obscured message that they neglect the safe navigation of their vehicles. A completely missed sign message could be mere inconvenience such as missing a destination or street name. In contrast, if motorists miss a sign message such as "Wrong Way," "Stop", or "Do Not Enter", serious undesirable safety consequences can occur.The mechanics of snow accretion is complex because there are a number of factors that affect snow accretion on traffic signs. These factors include wind direction and speed, snow moisture content, air temperature, sign surface temperature, and sign backing material.

From a tour of some sites in Japan where signs, tilted forward vertically several degrees, have been installed, Rick Nelson, Assistant Director, Operations, learned that the sign installation method can be effective in reducing the snow accretion on sign surfaces. Consequently, an in-house research project was developed to evaluate the effectiveness of the vertically tilted sign in reducing the snow accretion and, if effective under Nevada conditions, develop guidelines for installing such signs. Debra Starnes, District II (Chair); Tom Lumpkin, District II; Scott Thorson, Traffic; Maria Ardila-Coulson, T2 Center; Sharon Hansen, FHWA and Reed Gibby, Research, are on the research panel to direct the research efforts.

Field Installation

Washoe Valley is located approximately 20 miles south of the Reno-Sparks area and 5 miles north of Carson City as shown in Figure 1. US 395 traverses the western portion of Washoe Valley that is commonly subjected to significant wind action. The wind speeds are frequently, in excess of 50 mph. The major wind directions include 1) from the south, 2) from the north, and 3) from the west. At the southern end of the valley, there is a frontage road along the east side of US 395 for approximately ½ mile north of the US 395 Interchange with East Lake Boulevard (SR 428). It is on this frontage road where the tilted signs were installed. Each sign was identified by black lettering on a white background indicating the direction of the wind origin and the angle of vertical tilt in degrees.

Orientation of Signs

In Washoe Valley there are major winter storms from generally three directions: south, west and north; consequently, three sets of signs were installed facing each of these major directions. Each of the three sets consisted of five signs that were 36"x48" in width and height with black letters on a white background. The sign messages contained the direction the sign faced and

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the degrees of vertical tilt. Each of the five sign sets was vertically tilted at 0, 3, 6, 9 or 12 degrees. For example, the sign message "WEST 6" was on the sign facing west with a vertical tilt of 6°. Similarly, "NORTH 0" was on a sign facing north with no tilt and "SOUTH 12" was on a sign facing south with a 12° vertical tilt. The signs in each group were installed randomly. The signs were placed with adequate spacing so that there would not be any interference with regards to snow accretion among the signs. The top of the sign face was tilted vertically away from the signpost.

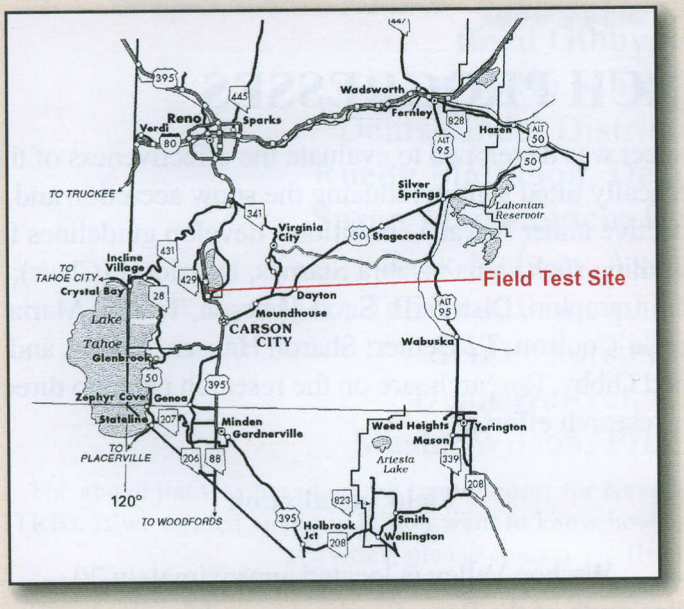

Figure 1. Vicinity of Experimental Study on Tilted Signs.

Figure 2 contains an illustration of one of the signs showing the sign face and a side view. Of particular note is the side view illustrating the mounting bracket at the top of the sign, which District II Maintenance personnel needed to fabricate in order to provide a rigid sign mounting system.

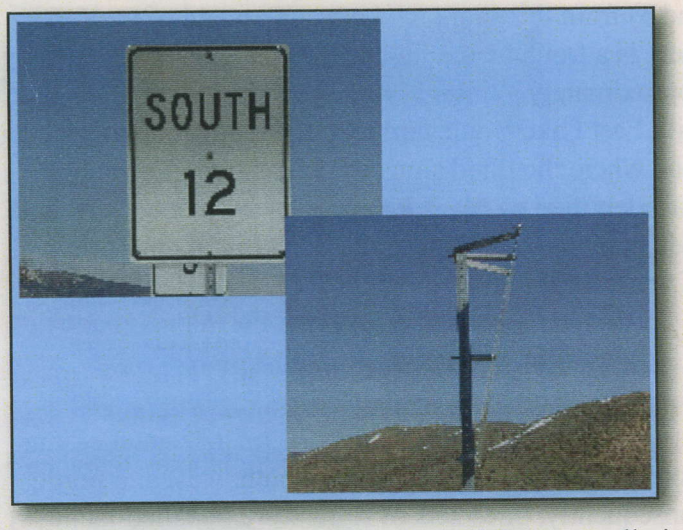

Figure 2. Illustration of Vertically Tilted Sign Installation

During the past two winters, 2003-2004 and 2004-2005, digital photographs were obtained from eight snowstorms. While there were cases when virtually no difference in the snow accretion as a function of tilt, most of the photographs revealed a definite pattern that signs with more tilt had less snow accretion. The set of photographs in Figure 3 is representative of the majority of the photographs. There were storms which were strong enough they covered or nearly covered the tilted sign message as illustrated by Figure 4.

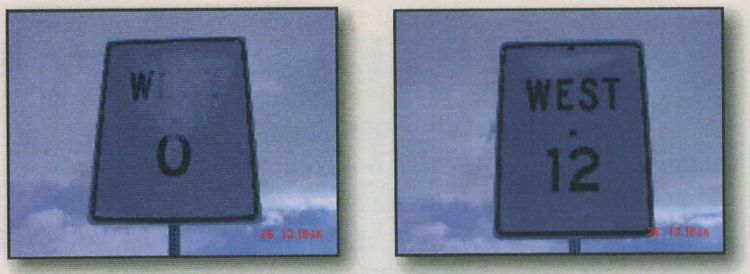

Figure 3. Illustrates the Progression of the Snow Accretion Reduction as the degree of Sign Tilt Increases. (Storm date 2-26-2004.)

Figure 4. In Some Storms Even the Message of 12-Degree Tilted Sign Cannot be Read. (Storm date 3-20-2005)

Major Findings

From an examination of the photographs, a clear pattern was observed. The degree of snow accretion decreased as the angle of tilt increased from 0° to 12°. However, there were conditions when there was little or no advantage of tilting the signs. The research panel has extended the project through one more winter.

Product Evaluation Committee (PEC) Meeting Recap

REJECTED

Thin Epoxy Bridge Deck Overlays

At its June meeting, the PEC rejected two epoxy overlays based on the results of the field test and recommendation by the Bridge and Materials Divisions. The members agreed that the department would continue to look into epoxy bridge overlays since these products appear to be cost-effective when compared to polyester overlay products.

The Bridge and Materials Divisions have completed a field test of thin epoxy bridge overlay systems - one from Transpo Industries and the other product - from Poly-Carb in District II. The PEC approved this test in 2000 providing that a successful test outcome would result in the two systems becoming eligible for listing in the QPL as alternative pre-qualified products.

The T-48 epoxy polymer overlay from Transpo Industries and Mark l63 Flexigrid from Poly-Carb were installed on contract 3112 on the Mill Street interchange structure on I-580 in Reno during August 2002. The Materials Division staff monitored installations for skid resistance according to ASTM E274 and bond strength testing per ACI 503R test procedures. The test data demonstrated that both systems performed well in the field for bridge deck waterproofing; however, both products exhibited poor skid resistance values.

INFORMATIONAL ITEMS

Annual NTPEP Meeting

Masha Wilson informed the committee that she and Scott Thorson attended the annual AASHTO National Transportation Product Evaluation Program (NTPEP) meeting in Mystic, CT. Various aspects of product evaluations tested through NTPEP test decks were discussed at the meeting. NTPEP test data for 13 product categories (maintenance, construction and traffic control devices) could be used when they are submitted for evaluation and approval by the department. FHWA recently published: "Quality Assurance Stewardship Review Summary Report for Fiscal Years 2003 and 2004" that contains discussion of the use of NTPEP data to increase assurance of product quality. Scott Thorson reported on current testing of snowplowable pavement markings in Georgia and Ohio.

Dri-Water Test On I-580 Project

Reed Gibby informed the committee that the Dri-Water - alternative irrigation system has been installed along the west side of the Kelly Canyon Road in the vicinity of Granite Ridge Road as part of the I-580 Extension Project through Pleasant Valley south of Reno. Plots of Ponderosa Pine, Mountain Top Sagebrush and Rabbitbrush have been planted. Bitterbrush and Mormon Tea were not available in sufficient quantities from nurseries and were deleted from the work plan, thus, reducing the quantity of tested plants from 576 to 252 plants. The planting was completed about six weeks ago and field inspections are being conducted about every two weeks. Another status report is expected at the next PEC meeting.

Reporting System On Product Failures

Dennis Coyle informed the committee that the Maintenance and Operations Division and the Specification Section will work together to develop a manual for the department's maintenance supervisors showing how to identify a typical product failure in the field. In addition, a reporting system will be established so that when a product's poor performance is identified it can be reported to the Product Evaluation Coordinator. A poorly performing product can be removed from the QPL according to product evaluation procedures.

Product Evaluation Continued on Next Page

Studies of Traffic Control Devices

Scott Thorson gave a presentation regarding the Traffic Control Devices Consortium Pooled Fund Study. The completed pooled fund study projects include the following: (1) Pavement Marking for Speed Reduction, (2) Colors for Transponder-controlled Tollbooth Lanes, (3) Navigation Signing for Roundabouts; and (4) Countdown Pedestrian Signals: a Comparison of Alternative Pedestrian Displays.

NDOT EMPLOYEES SERVE ON NATIONAL RESEARCH COMMITTEES AND PANELS

Sohila Bemanian, Assistant Materials Engineer
Reed Gibby, Research Coordinator
Tie He, Chief of Research Division
Denise Inda, District Traffic Engineer, District II
Ruedy Malfabon, Deputy Director Southern Nevada
Susan Martinovich, Deputy Director/Chief Engineer
Rick Nelson, Assistant Director, Operations
Darin Tedford, Principal Materials Engineer – Bituminous
Scott Thorson, Chief Traffic Engineer
Dean Weitzel, Chief Materials Engineer
Masha Wilson, Product Evaluation Coordinator

The above list was based on the "state report for Nevada" dated August 09, 2005 from the Transportation Research Board (TRB). If we missed anybody or you want to know how to get on TRB's panels/committees or participate in national research activities, please contact Tie He, Research Division Chief, at (775) 888-7220.

Nevada Department of Transportation
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The Nevada Department of Transportation
1263 S. Stewart Street
Carson City, Nevada 89712

Kenny C. Guinn, Governor
Jeff Fontaine, P.E., Director

If you have comments or need additional information regarding any of the topics discussed in this issue please contact the Research Division at (775) 888-7803.

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