Reviewed By:

R.F.Cauley, P.E.
Materials & Research
Engineer

Prepared By :

R.E. Brunelle
January 24, 1994

RESEARCH UPDATE

Number U94-2

"SWAREFLEX" WILDLIFE WARNING REFLECTORS

REFERENCE: Work Plan 86-R-9, Updates U87-3 and U87-10

BACKGROUND:

Noting a nationwide trend toward increasing deer/vehicle accidents on our highways, the Vermont Agency of Transportation (VAOT) and the Vermont Department of Fish and Wildlife (VDFW) share an interest in systems designed to curtail these collisions.

The "SWAREFLEX" system is based on the placement of a line of reflectors which are especially designed to reflect headlights from oncoming vehicles and redirect their beam as a red light at a 90 degree angle to the side of the highway. The intensity and location of the red lights vary as the vehicle approaches. The result is a "visual fence" which is supposed to create a mesmerizing effect on the deer, lasting long enough to prevent them from crossing while vehicles are present. This system has been tried in several states in this country as well as in Europe with mixed results. VT Route 64, the chosen evaluation site, connects I89 Interchange #5 in Williamstown with VT Route 12A in South Northfield. When Route 64 was reconstructed in 1986, the VAOT and the VDFW agreed to cooperate in an evaluation of the "SWAREFLEX" system (manufactured by Strieter Corporation of Rock Island, IL) which was to be installed on the reconstructed highway. Relocated Route 64 passes through a deer wintering area, and for this reason was considered to be a good test site.

EXPERIMENTAL CONTROLS:

The evaluation compared the number of deer/vehicle collisions in protected areas (i.e., areas where the reflectors had been installed) vs. unprotected areas. Confidence in the validity of these comparisons was further enhanced by determining the comparative levels of crossing activity within the protected vs. the unprotected areas. Crossing activity was validated through on-site counts of numbers of deer tracks at crossing points during seven observation periods which occurred between 12/11/86 and 1/22/87. The results of those counts indicated 153 crossings within protected areas and 197 crossings in unprotected areas. Protected areas were selected on the basis of concentrated crossing activity, but it should be pointed out at this point that the total numbers of crossings are somewhat higher in the unprotected areas because the lengths of these areas exceed the protected areas by a ratio of nearly four to one. Since motorists are legally accountable for disclosure of automobile/deer collisions to the VDFW, these events were reported to the

VAOT indirectly via that Department. Although a multiplicity of variables could have been considered, only these two (i.e., numbers of deer/vehicle collisions and levels of crossing activity) were utilized. It was thus assumed that the numbers of (night time) deer/automobile collisions within any area along Route 64 was directly proportional to the volume of deer crossing activity in that area. The relationship described above could be more specifically defined with the following mathematical expression:

$$R = \frac{K_p * DX_u}{K_u * DX_p}$$

Where K_p = No. of deer kills in the protected areas

K_u = No. of deer kills in the unprotected areas

DX_p = No. of deer crossings in protected areas

DX_u = No. of deer crossings in unprotected areas

And R = Kill ratio, protected to unprotected areas, based on crossing activity

In the relationship shown above, as R approaches or exceeds unity, the effectiveness of the reflectors is cast further into doubt.

PERFORMANCE:

The Vermont Department of Fish and Wildlife reported all deer kills on VT Route 64 for nearly seven years, beginning in November, 1986 and continuing through August, 1993. When VAOT personnel tallied the reports, daytime collisions were eliminated and on the basis of the time of year, only those events which would have occurred between twilight and dawn hours were included. The seven year counts yielded a total of thirteen (13) kills in protected areas and twelve (12) kills in unprotected areas. When these values are applied in the mathematical expression shown above, the result is 1.39, which strongly suggests that the reflectors were not effective.

Furthermore, inasmuch as the level of crossing activity is nearly 29% higher within the unprotected areas than in the protected areas, the number of auto/deer collisions would be expected to be somewhat higher there, but this was not the case. This outcome is compatible with most research done to date. Although several studies suggest that reductions in deer mortality are effected by reflectors during the first year, long term benefits have nearly always been reported as negligible.(1)

DISCUSSION:

The higher incidence of collisions in the protected areas could be interpreted to mean that the SWAREFLEX reflectors are contributing to the

(1)Beauchamp, D.E. 1970 Deer mirror evaluation. Calif. Dep. Fish and Game Proj. W-51-R-15. 8pp.

Queal, L.M. 1967. Effectiveness of roadside mirrors in controlling deer-car accidents. Mich. Dep. Conserv., Res. Dev. Rep. 103. Proj. W-40-R. 7pp.

problem rather than easing it. Such a conclusion is not warranted, however, since there are too many relevant variables (i.e., effects of snowplow operations, horizontal and vertical alignments, weather variability, poor terrain conditions, etc.) which were not included in the evaluation.

It might be suggested that the evaluation of the SWAREFLEX reflectors as an auto/deer collision deterrent on VT Route 64 is not a reasonable test. Indeed, conditions on this recently relocated secondary highway tend toward extremes and would not be conducive to efficient operation of the SWAREFLEX system. The so called "Mill Hill" road was constructed on steep side-hill terrain with gradients that require a climbing lane for most of its length. It was also built with a constantly weaving horizontal alignment. These conditions would ostensibly reduce the amount of time that the headlight beams were directed at the reflectors. Also, rugged terrain (i.e., steep and sometimes rocky slopes adjacent to the highway) is typical. Prevailing conditions would in many cases reduce the opportunity for direct crossings and require the deer to stay in the more hazardous areas near or within the roadway while they searched for an acceptable exit point. These surroundings have probably had a nullifying impact on the effectiveness of the reflectors. The key point here is that this evaluation site was chosen because it was environmentally suited as deer habitat, not because alignment characteristics of the highway were ideal for effective functioning of the reflectors.

CONCLUSIONS AND RECOMMENDATIONS:

1. Data collected during this evaluation indicates that the SWAREFLEX reflectors are ineffective within the context of the VT 64 environment.

2. The sharply curving horizontal alignments and mountainous terrain that characterize the Northfield "Mill Hill" road are quite typical of many of Vermont's highways; therefore any decision to install reflectors as a deer crossing deterrent should include careful consideration of the alignment, grade and overall terrain characteristics of the highway, and the impacts these features would have on the effectiveness of the reflectors.

3. Data collection is complete and no further evaluation of the Swareflex system is planned. Based on past performance, no further maintenance of the existing Swareflex system on VT Route 64 is recommended.

Dist. A,B,C,D,F,G