



By Susan Barton
Contributing Author

Guards lose cover

Study finds most effective way to treat guardrails

For the past 50 years or more, mowing and herbicides have been the predominant methods used to manage nationwide roadside vegetation.

New environmental laws, reduced budgets and increased public interests necessitate finding more environmentally sensitive methods, incorporating new technologies, incurring lower maintenance costs and finding cost-effective alternatives to today's methods of management of roadside vegetation. The Delaware Department of Transportation (DelDOT) is committed to reducing pesticide use in their transportation rights-of-way and therefore funded a study to look at various options for controlling vegetation under guardrails while maintaining functionality.

A variety of ways

The area adjacent to the guardrail must be kept clear of vegetation to allow clear visibility of the barrier. Robert Moosmann of Maine DOT explained that control of vegetation under and behind guardrails would restrict the buildup of debris, which includes sand and sediment that prevent proper sheet flow of water off the road surface. With unmanaged vegetation, rills develop behind the guardrail as water channels to points of least resistance and results in erosion. But low-growing grasses planted under guardrails can increase biofiltration of storm-water runoff.

Some states use mowing and hand trimming (mechanical control) as their primary management tool. Mowing, while evaluated as the most cost efficient currently available option in a California study, is often not



Left to right: U-Teck WeedEnder standard cut, U-Teck WeedEnder custom cut, Universal Weed Cover, Traffix. All are guardrail treatments studied in Delaware.

feasible because of mower size and the inability to maneuver the mowing head around and under the guardrails. Hand trimming is time consuming and labor intensive as well as dangerous because of operator exposure working between traffic and the barriers.

With cultural control, a plant species is established that will compete with and suppress growth of the unwanted brush. A dense stand of low-growing plants is referred to as living mulch. White clover was tested as living mulch but did not establish successfully enough to compete with weeds. Where maintenance with residual herbicides has been practiced over a number of years, the lingering presence of residual herbicides may limit desirable plant growth, favoring the most aggressive and often undesirable species. Creating and encouraging stable, low-maintenance vegetation is a more permanent vegetation-management strategy and should be the goal for all rights-of-way. Weed-control mats (fiber and rubber)

have been tested in some states, and concerns about joint sealing and molding around guardrail posts providing an opportunity for weed growth have been identified. Washington state tested several weed barriers and found a need for annual cleaning to remove accumulation of organic and inorganic debris. Without this debris removal, the organic buildup starts to grow grass and weeds. Although prohibitively expensive for normal guardrail locations, on sites where herbicide use is restricted, weed barriers may provide a viable option.

Herbicides are considered to be the cheapest and most efficient method of vegetation control. Two applications of herbicide are often sufficient to effectively treat weeds for a season. There also are many environmental, health and logistical problems with herbicide use. Herbicide spray trucks hamper traffic flow, often requiring a lane closure and causing traffic delays. Herbicide application is sensitive to weather conditions—herbicides cannot be applied on rainy or windy days. Human health risk is a concern, and protective equipment must be used



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Table 1. DeIDOT Treatments Under Guardrails

Three herbicide formulations
<i>Formulation 1</i> - standard DeIDOT New Castle County formulation comprised of DuPont Karmex DF Herbicide (diuron), BASF Plateau (imazapic ammonium salt), Dow AgroSciences Accord XRT (glyphosate), BASF Pendulum (pendimethalin)
<i>Formulation 2</i> - sensitive areas formulation comprised of BASF Plateau (imazapic ammonium salt), Dow AgroSciences Accord XRT (glyphosate), BASF Pendulum (pendimethalin)
<i>Formulation 3</i> - Dow AgroSciences Accord XRT (glyphosate)
Four weed-control barriers
<i>U-Teck WeedEnder standard installation</i> (a permeable recycled fiber material)
<i>U-Teck WeedEnder custom installation</i> (a product designed to reach the road edge and accommodate variances in post width)
<i>Universal Weed Cover</i> (a semi-rigid panel made of 100% recycled plastic)
<i>TraFFix</i> (a rubber mat with three punched guardrail cutouts for flexible installation)
Competitive vegetation
Low fescue
Zoysia seed
Zoysia sod
Hand trimming
Pavement under guardrail



Irregular edge between herbicide-treated guardrail zone and median vegetation.

Table 2. DeIDOT Suitability Rating and Weeds Rating Summarized by Treatments for 2011

Treatment	DeIDOT suitability	Weeds
U-Teck WeedEnder standard cut	3.38	2.75
U-Teck WeedEnder custom cut	4.87	4.58
TraFFix	4.20	3.93
Low fescue	4.20	3.45
Zoysiagrass sod	4.93	4.47
Zoysiagrass seed	4.00	2.27
Hand trim	3.73	2.78

by applicators. Dead vegetation after the use of herbicides can be unsightly. Bare-ground herbicides can increase the risk of erosion and usually results in an uneven line between bare ground and living vegetation, which is unsightly. Herbicides are a tool in integrated vegetation management, but high ecological costs, high sociological costs and short-term, temporary benefits are prompting vegetation managers to look for alternatives.

Plotting for improvement

Most states use a mixture of vegetation-control methodologies. Site-specific procedures are selected rather than policy that applies to the entire state. The department of transportation can then utilize a geographic information system (GIS) to map populations and preserve desirable roadsides while managing undesirable vegetation. The first step is to decide if vegetation control is required based on surface-drainage issues; subsurface drainage issues; storm-water management; pavement breakup; visibility for safety; worker safety; fire starts; landscape design; wildlife road kill; and structural deterioration of guardrails. If control is required, feasibility of alternatives (mechanical, cultural, biological and chemical) is considered. Finally, criteria can be developed to identify highly sensitive areas that warrant finding workable alternatives to conventional maintenance even if costs increase.

In April 2008, 24 guardrail plots were selected on Delaware roadsides based on the presence of guardrail with low-growing existing vegetation, as well as accessibility for treatment and data collection. Treatments included three formulations of herbicide, four weed barriers, hand trimming, pavement, low fescue turf, zoysiagrass and a control (Table 1). There were three replications of each treatment located at different sections of guardrail and split between the two sites.

Low fescue plots were established using a low fescue blend (Silverlawn Creeping Red Fescue [34.46%]), Discovery Hard Fescue (27.34%), Rescue 911 Hard Fescue (27.32%) and Annual Ryegrass (9.98%), and were

hand trimmed as needed to meet DeDOT's safety requirements. Low fescue plots were spot-treated with herbicides as needed in order to reduce competition during the establishment period. Zoysiagrass plots were seeded with Compadre zoysiagrass. Zoysiagrass sod plots were prepped by raking out debris and digging out the soil so the sod could be installed level with the road surface and surrounding median turf. Hand-trimmed plots were trimmed as needed to maintain vegetation below the top of the guardrail. Hand trimming varied from year to year based primarily on rainfall. There was no vegetation-management strategy employed on the control treatment.

Plots were observed monthly during the growing season, and were assessed for compliance with DeDOT guardrail standards and the weed level present. A DeDOT acceptability rating was taken as an assessment of how well the plot conformed to DeDOT's requirement of a clear guardrail on a scale of 1-5 (1 = guardrail completely obscured; 2 = vegetation covering most of guardrail; 3 = vegetation taller than guardrail in spots; 4 = vegetation starting to grow taller than guardrail in spots; 5 = no



When you consider amortization over a 10-year lifespan, weed-control barriers are still the most expensive vegetation-control option under guardrail.

vegetation near guardrail). A weeds rating was assigned on a scale of 1-5 (1 = completely overgrown with weeds; 2 = a high level of weeds present; 3 = moderate weeds present; 4 = a few weeds present; 5 = no weeds present).

Optimal options

Vegetation management of some kind is necessary to keep guardrails from being obstructed. Guardrails were still visible for the first year with no treatment, but early in the growing season of the second year they were obstructed.

Herbicides have been the traditional method of vegetation control in Delaware. The standard DeDOT guardrail formulation (DuPont Karmex DF Herbicide [diuron]), BASF Plateau (imazapic ammonium salt), Dow AgroSciences Accord XRT (glyphosate) and BASF Pendulum (pendimethalin) is used in most places, and an alternative formulation of BASF Plateau

(imazapic ammonium salt), Dow AgroSciences Accord XRT (glyphosate) and BASF Pendulum (pendimethalin) is used in sensitive areas. Both provided adequate vegetation control when applied once a year. A third formulation (Dow AgroSciences Accord XRT [glyphosate]) did not adequately control vegetation. Herbicide treatments result in bare ground for most of the year. Erosion can be a problem when bare ground is maintained. After treatment, a brown zone of vegetation exists below the guardrail and can be unsightly, especially when spray drift or misapplication results in an uneven treatment edge.

We know that herbicides will prevent roadside vegetation from interfering with the guardrail and provide an inexpensive control option (Table 3). The goal of this project was to find a more environmentally satisfactory alternative to herbicide

Table 3. Cost Comparison of Guardrail Treatments in Delaware (per 100 linear ft of guardrail)

Treatment	Installation cost	Yearly maintenance cost	Installation cost (amortized over 10 years)	Total yearly cost (incl. amortized installation cost)
Standard herbicide formulation (1)	0	\$44.92	0	\$44.92
Sensitive site herbicide formulation (2)	0	\$44.20	0	\$44.20
Accord (glyphosate)-only formulation (3)	0	\$38.58	0	\$38.58
U-Teck WeedEnder standard cut	\$1789.52	\$24.00 ¹	\$178.95	\$202.95
U-Teck WeedEnder custom cut	\$2197.54	\$8.00 ²	\$219.75	\$227.75
Universal Weed Cover	\$2607.00	0	\$260.70	\$260.70
TrafFix	\$2537.17	\$24.00 ¹	\$253.72	\$277.72
Low fescue	\$444.33	\$47.02 ³	\$44.43	\$75.34
Hand trimming	0	\$24.00 ¹	0	\$24.00
Zoysia sod	\$1,582.28	0	\$158.23	\$158.23
Zoysia seed	\$345.28	\$16.00 ⁴	\$34.53	\$50.53
FlightTurf	\$541.93	TBD	\$54.19	\$54.19
Control	0	0	0	0

¹ Includes 1.5 hand trims/100 linear ft, no herbicide treatment.

² Includes .5 hand trims/100 linear ft, no herbicide treatment.

³ Includes 1.5 hand trims/100 linear ft, and 1.25 herbicide treatments/100 linear ft. (The herbicide treatment for low fescue is assumed to be required for three years until the low fescue stand becomes thick enough to outcompete other vegetation.)

⁴ Includes 1 hand trim/100 linear ft. (This is based on only one year of data and assumed to be at least 1.5x in future years.)



Strip between weed barrier and pavement allowing weed growth.

use, so alternative control measures must compare favorably with herbicide use in terms of effectiveness, cost, environmental impact and aesthetics.

Weed-control barriers are difficult to retrofit in existing sites where the weed barrier cannot be laid true to the side of the road and on a perfectly flat surface. They are more appropriate in new road situations where grading and consistent distance between guardrail and road surface can be controlled. Vegetation growing over the surface of the barrier is not a problem, since the plants that grow over the surface are

low. Deposition of organic material on the barrier surface that supports weed growth may result in taller weed growth and is more likely to happen the longer the barrier stays in place on the road-side. Caulk is the weakest portion of the barrier and may degrade faster than the barrier fabric, resulting in breakthrough vegetation. Installation error also is a cause of barrier breakthrough. Expertise (possibly by vendors themselves) is required for installation.

Vegetation grows in open soil between the road surface and barrier when the barrier cannot abut the road

surface. The U-Teck WeedEnder custom cut product was designed to address this issue. In some guardrail situations this product can abut or overlap the road surface, but in some cases the guardrail is located too far away from the road surface to make this feasible.

Low fescue turf is used under guardrail to provide a solid low-growing ground cover that competes with other weedy plants that will grow taller and disturb the integrity of the guardrail. In 2009 and 2011, selective herbicides were used to reduce the broadleaved weed and annual grass competition. Low fescue did not establish a dense enough cover to outcompete weeds during the course of this study. Plots required hand trimming, but the low fescue plots were superior in appearance to the hand-trimmed plots, because they contained a larger percentage of desirable turf.

Zoysiagrass did not establish from seed in 2012, but zoysiagrass sod established within one month and provided a competitive cover under the guardrail. Zoysiagrass sod was competitive enough to prevent significant weed incursion during the first year after planting. It did not require mowing during the first year. Since zoysiagrass is a warm-season grass, it went dormant and turned brown in Delaware after the first frost.

Hand-trimmed plots required trimming twice a year for the first two years



The picture above shows Bermuda grass growing around guardrail beam where caulk malfunctioned.



The study revealed that zoysiagrass sod provided a competitive, low maintenance vegetative cover under guardrail.

of the study, when they were trimmed in May and September. By waiting until mid-June for the first trimming, most plots were maintained at an appropriate height for guardrail function with one hand trimming per year. On average over the four years of data collection these plots were trimmed 1.5 times a year. Hand trimming results in relatively solid vegetation under the guardrail, which reduces erosion potential and is more attractive than bare-ground treatment.

When you consider amortization over a 10-year life span, weed-control barriers are still the most expensive vegetation-control option under guardrail. They may be warranted in highly sensitive areas where herbicide use is unacceptable or other conditions warrant the complete lack of vegetation under guardrail.

Low fescue, if it is established within three years, provided a competitive enough mat of vegetation such that selective herbicides were no longer needed and competes favorably in cost per 100 linear ft with herbicide treatments. Herbicide use has not been eliminated for the first three years, but the herbicide use is selective rather than a nonselective burn-back of all existing vegetation. So, erosion is not a problem and the guardrail treatment is more aesthetically pleasing than bare ground, especially compared with an uneven treatment edge that often exists between the guardrail zone and the median vegetation with bare-ground herbicide treatment.

Hand trimming is the least expensive control method employed in this study (other than the control). This was true when DelDOT crews performed the hand trimming. If outside contractors were hired to hand trim, the cost per year would be approximately double the herbicide and low fescue treatments.

Since zoysiagrass did not establish from seed during the first year, this does not appear to be a viable establishment protocol on the roadside. Zoysiagrass sod appears to be an effective vegetative cover. North Carolina has reported that centipedegrass and zoysiagrass can

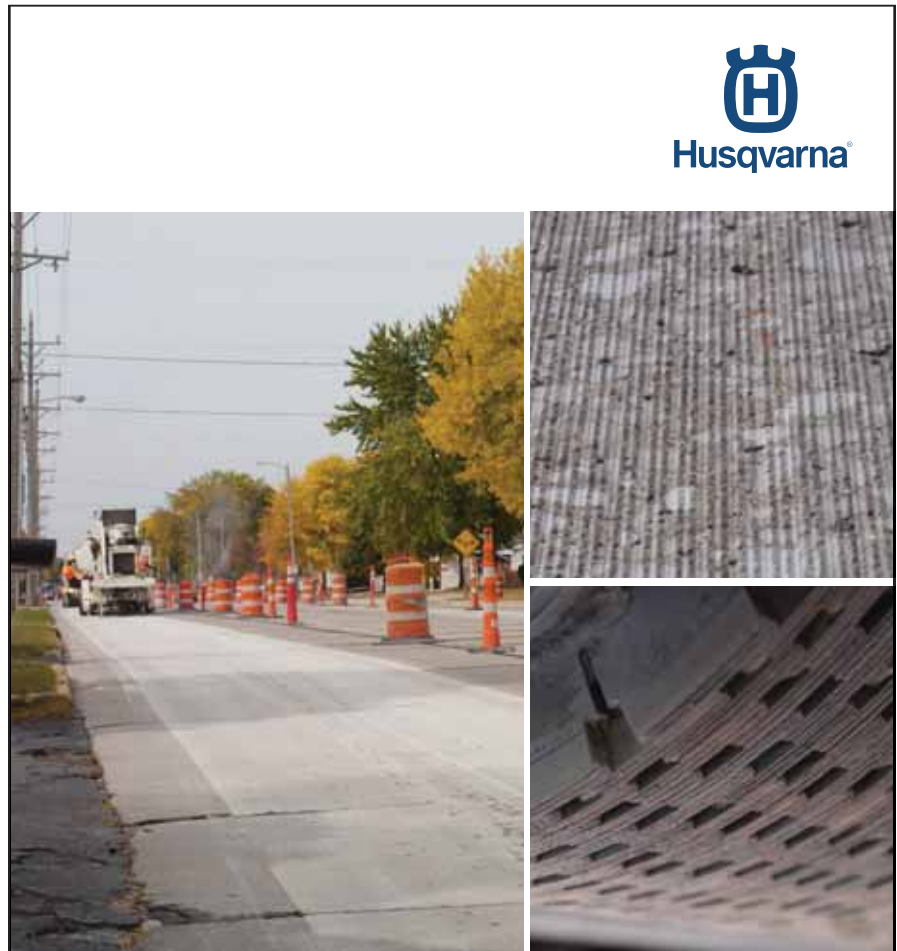
provide a stable competitive vegetation under guardrail.

In Delaware, zoysiagrass appears to be competitive enough to prevent weed incursion, at least in the first year after establishment. It will be interesting to continue observation of zoysiagrass sod plots to see how frequently hand trimming is required and if it remains competitive under the guardrail. Based

on the performance of zoysiagrass in lawns in Delaware, it is expected to start to grow into the adjacent median. **R&B**

Barton is an associate professor and extension specialist at the University of Delaware.

For more information about this topic, check out the Maintenance Channel at www.roadbridges.com.



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