

Abridgment

Roadside Vegetation: Player or Pest?

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The relationship of roadside vegetation to common maintenance problems is explored. The focus is on the composition and health of roadside vegetation as an indicator of and participant in the overall cost of highway maintenance. The concept of "plants as engineering materials" is introduced. The concept involves examination of two basic issues: roadside design details and the engineering characteristics of roadside vegetation. It is suggested that a need exists to carefully examine design details that foster problems with vegetation and to consider how to use the engineering characteristics of vegetation to reduce roadside maintenance costs.

As a landscape architect involved in public practice and education for most of my career, I had been involved tangentially in transportation projects for a number of years. In 1987, we were approached by the Texas State Department of Highways and Public Transportation (SDHPT) to assist in the development and execution of a new, broad-based highway beautification program. As part of that contract, SDHPT asked that we focus on beautifying the state's highway system and reducing roadside maintenance costs. These two charges are, if taken together, antithetical. It is not possible to add ornamental plant material to the roadside, regardless of its hardness, without increasing the maintenance burden to some extent. Yet, we have taken this charge to heart, and it has resulted in the research initiative described here.

For the most part this is not a technical paper. Its purpose is to challenge some of the fundamental beliefs that influence our current approach to roadside maintenance and to initiate a new dialogue about the development and administration of roadside management programs. The emphasis is on the role of roadside vegetation. It is suggested that, of all roadside components, vegetation is the least understood and therefore the most frequently misused and abused. Fundamental questions are raised about the perception and application of vegetation on the roadside, and suggestions are offered as to how views should be changed.

CONTEXT OF ROADSIDE VEGETATION MANAGEMENT PROBLEMS

Roadside vegetation management is universally viewed with mixed emotions. On the one hand it is recognized as the primary material for erosion control and surface stabilization. In other forms, ornamental trees, shrubs, groundcovers, and wildflowers are viewed as "beautification." However, from a maintenance point of view, roadside managers more fre-

quently find themselves locked in mortal combat with the vegetative community of the roadside. Police actions and outright wars are waged annually to remove unwanted vegetation from some parts of the roadside and, in other instances, to get anything to grow at all. Each growing season, roadside managers descend on the roadsides with armies of mowers, grade-alls, front-end loaders, and spray rigs to seek out and destroy the enemy.

It appears that, as roadside managers, we have accepted the inevitability of this seasonal cycle as something akin to the rise and fall of the tides. However, those who accept the inevitability of the vegetation management cycle fail to recognize that plants on the roadside are responding to habitat conditions created by the design of the roadside. The conditions are created by the design of roadside features that make the roadside favorable for plant growth and development. The fact that plants respond to unique microhabitats is seldom recognized in the design of structures and the development of roadside maintenance strategies.

In addition to the design problems associated with unexpected or unwanted plant habitats, there are the characteristics of the plants themselves. Plants, like people, are different in terms of their behavior and their abilities to perform certain tasks. It can be demonstrated, for example, that some plants have decidedly better hydraulic characteristics than others (i.e., some resist flow, whereas others lie down and form a smooth, hydraulically efficient mat that protects the channel and reduces the accumulation of silt). Yet, there is little evidence in the literature that the transportation community has given much thought to these specific vegetation qualities. Herein lie the problems.

Perception of Vegetation as a Maintenance Liability

Except for the redeeming qualities of erosion control and decorative appeal, roadside vegetation is, more often than not, considered a liability. In general the maintenance community accepts this as part of the cost of doing business and proceeds to attack the same old problems with each new growing season. Everyone in the roadside management field has intimate knowledge of these seasonal, vegetation-related headaches. However, for the sake of review, some of the all-time favorites are listed:

- Mowing,
- Brush removal,
- Pavement edge encroachment,

- Problems with vegetation and structure interfaces (i.e., signs and poles, guardrails, walls, headwalls and endwalls, and expansion joints in pavement and riprap),
- Obstruction of drainage ways, and
- Blockage of drainage structures.

These problems are not only annual annoyances but also significant drains on manpower and financial resources. It is estimated that Texas spent more than \$50 million on mowing state-maintained rights-of-way in 1988 and an additional \$5 million on herbicides for vegetation control. No direct figures were available for the cost of herbicide application, mechanical removal of vegetation, cleaning of ditches and culverts, and other problems directly related to the quality and behavior of roadside vegetation. A conservative estimate is on the order of \$250 million. This is not exactly a small sum, yet even at this cost transportation departments across the country watch their budgets escalate and accept the problems as inevitable. It is suggested that this need not be the case.

Vegetation and the Highway Environment

First let us examine the context and environment in which and about which we make daily vegetation management decisions. Three fundamental perceptions influence and cloud decisions about roadside vegetation maintenance:

1. The perception of the roadside: In general the highway design community tends to view the roadside as what is "left-over" after the highway and its appurtenances are accommodated within the available right-of-way. This perception is termed "green scrap syndrome."

2. The perception of the highway landscape: The highway corridor is generally viewed as being the same as or an extension of the landscape by which it is bounded. For example, if a highway passes through a rural setting, it is considered a rural road, and it is generally accorded the attributes of the adjacent agricultural, forest, or range land. This leads to the unrealistic belief that whatever occurs on or adjacent to the original corridor can be regenerated after construction. Let us call this the "green fantasy syndrome."

3. The perception of roadside plant communities: Plant communities are, for the most part, viewed as little "green things" with personalities that are generally at odds with what would be considered acceptable public behavior in good engineering circles. In other words, they display those antisocial types of behavior that obstruct and defy permanent solutions. This perception is characterized as "green belligerence syndrome."

TOWARD NEW PERCEPTIONS OF THE HIGHWAY LANDSCAPE

Although each of these perceptions may have been overstated for dramatic effect, they are real and must be changed to come to grips with roadside maintenance costs. The significance of each perception will be outlined briefly along with examples of how each relates to the cost of maintaining the roadside.

Green Scrap Syndrome

Anyone who has ever tried to compile cost figures for roadside maintenance is familiar with green scrap syndrome. If we look at a typical cross section of maintenance budgets, we will find figures for mowing contracts, purchase of herbicide materials, and in some cases for the cost of spraying. All other maintenance costs are more often associated with the hard structures (i.e., drainage structures, bridges, pavements, signage and delineation, and guardrails and safety hardware). Given the abstract nature of the roadside, it is not difficult to understand why this perception persists, and it is a major deterrent to developing an understanding of the role of vegetation as a highway construction material.

We must recognize that the roadside is not just a collection of green scraps. Consider for a moment the basic functions of the typical highway right-of-way. The immediate shoulder provides information, lighting, emergency stops, runoff, and recovery. The middle zone is usually occupied by drainage channels and structures. The back slope is used to access adjacent properties, provide buffer space between adjacent land use, and provide space for large information standards and lighting apparatus. Seen in this light, the roadside is a far busier place than generally thought. Looking closer, it also becomes apparent that the prevalent material, with the exception of the pavement, is the "green stuff." We also know that if that "green stuff" is in poor health or is not appropriate for the job at hand, unpleasant things occur. Some of the more common problems include accelerated erosion and siltation and blockage of drainage ways and structures, which can also lead to pavement and embankment failures.

Green Fantasy Syndrome

Though the nonpaved portions of the right-of-way closely resemble the adjacent landscape, they are, in fact, quite different. In most cases changes made along the construction corridor realign the microenvironmental conditions to the extent that the right-of-way becomes totally different from its immediate surroundings. Topsoil is disturbed; drainage patterns are changed, which affects overall moisture relationships; slopes and orientations are modified; and the existing vegetation community is effectively destroyed. Ecologists refer to this phenomenon as a catastrophic event. This term is often used by "environmentalists" with great emotional appeal, even though it is out of context with the term's real ecological significance. The net result of a catastrophic event is a new beginning. A new ecological succession begins, in which the forces of nature begin the creation of a new biotic community in harmony with the new conditions. Change is not necessarily bad; it is just different.

The green fantasy syndrome does not recognize the reality of this powerful natural process. We spend untold dollars every year trying to save or fight Mother Nature, and we usually lose in either case. It is important that we, as designers and managers, look more closely at the ecology of the roadside and develop a better understanding of the microenvironmental and successional processes that will occur in the new environment.

Consider for a minute the unique environmental conditions of the roadside. It is hotter and more prone to drought, soils are generally poor and highly compacted, slopes are generally increased perpendicular to the centerline, the air quality is poor due to exhaust emissions, and runoff is generally more polluted in the immediate right-of-way zone. Given the harsh environmental conditions and comparing these conditions to the body of research published on highway vegetation, we find that most of the work has been done using typical agricultural research methods. Most often this means the use of small field plots, 2 to 3 m square, with generally friable, well-drained, and hospitable soils. In most cases the plots are flat, with slopes of 1 percent or less. Temperatures are not influenced by pavement mass, and the air and water are generally clean. Although some generalizations and extrapolations are possible from research using these methods, the aggregate results must be viewed as inconclusive at best because there is no way to realistically duplicate the extreme environmental conditions of the roadside.

On the other hand we know that plant communities do flourish on the roadside, even though we may not completely understand the reasons. Because our attention is usually devoted to the problem areas, we often forget that a much greater percentage of the roadside is all right. This strongly suggests to me that there is a great deal yet to be learned from more careful examination of the conditions and circumstances that lead to this success.

Green Belligerence Syndrome

The earlier "tongue-in-cheek" remark about waging annual war on unwanted roadside vegetation is an appropriate analogy. There can be little doubt that plants like Johnsongrass, varieties of thistle, and other noxious weeds are a headache. However, these are only a fraction of the total roadside plant community. Too often these problem plants draw attention away from a much broader issue of plant suitability.

Different plants have varied preferences for habitat and behave differently depending on the situation. In reviewing a cross section of highway planting specifications it was found that, in almost every case, the roadside is treated as a homogeneous environment, when nothing could be further from the truth. This simple oversight disregards the functional zones of the right-of-way noted earlier. Planting each zone of the roadside with the same plant material is democratic; however, unlike some of today's clothing, "one size does not fit all."

By planting uniformly over the entire cross section of the right-of-way, we essentially surrender the opportunity to design the surface material of the roadside in accordance with the function it is to perform. We would certainly never design a pavement cross section in this way. Yet this is exactly how we design our roadsides. In a majority of the cases we are lucky. The plants sort themselves out through the process of natural selection, and no one thinks too much about it unless problems arise.

If you look closely at the plants growing in older, more established roadside communities, you will see that they have sorted themselves into associations that reflect the microha-

bitat conditions. Plants with higher moisture requirements will colonize the swales and borrow ditches. Lower-growing species and those most tolerant of frequent mowing will show up on the immediate shoulder. The taller grasses and woody species will colonize the guardrails, walls of drainage structures, fence lines, and any other location that is protected from mowing machinery.

This suggests that we look more closely at the message Mother Nature is trying to send us and begin exercising our design prerogative by establishing plant communities in concert with the function of the particular roadside zone. To do this, we must be better students of how plants perform in the roadside environment. We must recognize that the highway is a demanding environment and that the plants are not being used to produce food, fiber, or red meat. Plants on the roadside are engineering materials and should be understood and used in that frame of reference. The background research we have done to date (reference list available from the author) strongly supports the notion that plants can be developed and used in this way. However, little has been done to develop the information necessary to put these simple principles into practice.

The concept of plants as engineering materials is simple but generally overlooked. In the years ahead we should set a goal to better understand the engineering properties of plant materials so that they can be used more efficiently and effectively to reduce the cost of roadside maintenance. The following principles should govern research in this area:

- The roadside is not just leftover space. It is a necessary and functional part of the highway. It is used to provide safety, drainage, access, and information to the traveling public.
- Each zone of the right-of-way has a different function and should be treated differently with respect to the vegetation that is used in that zone.
- The roadside environment is a structure. By its design and use it is a unique environment. It has nothing in common with agricultural fields, home lawns, forests, or other manifestations of the landscape, and must be understood in terms of its unique ecology.
- Plants are different with respect to their preferences for habitat and the functions they can serve on the roadside. They should be used more effectively as part of the materials selection process.
- Plant-structure relationships contribute to many vegetation management problems and can be corrected by more careful design consideration.

Research in this area will require patience and will take a number of years to reach the objectives outlined. It must be undertaken with the realization that roadside maintenance takes place in an environment of many interconnected systems that cannot be effectively examined out of context. Progress will begin slowly and gain momentum with each new insight. The savings that might accrue from any single discovery or improvement in our maintenance know-how will probably be small. The real benefits will be realized in the aggregation of small discoveries and by continuing the search for simple, common-sense maintenance solutions.