machinery; our time; and, in fact, our entire lives and living environments. Because man is an intelligent, inventive, acquisitive, ambitious, and--all too often--a greedy creature, by his very existence, he scratches the surface of the earth much more deeply than any other animal. It is for this reason that he should both understand and cooperate technologically and spiritually with nature.

The monotonous conformity of concrete forms combined with man's answer to nature, uniform grass, seemed to be a totally inadequate solution aesthetically and economically. This juxtaposition of concrete and grass does little to challenge the human spirit. I voiced the idea of transposing both the appearance and significance of the flat man-made areas of my paintings with similar shapes or roadway and airport runways and, in addition, planting the otherwise grass-covered areas with color: wildflowers arranged according to my design. The concept amounted to an actualization of what I had been painting only on somewhat of a grandiose scale in a three-dimensional context. The aesthetic would be the same, but the opportunities for human participation would be greatly enhanced. The contract between slabs of austere concrete designed by airport engineers for traffic pattern purposes and shapes of color defined with waving fields of wildflowers might stir individuals to consider that opposites can coexist for the benefit of both. The lyricism and beauty of wildflowers would be a challenge to our sense of design.

In working with the administration of the Dallas-Fort Worth Airport, phase one of the Dallas-Fort Worth Wildflower Works was launched. Literally tons or hundreds of millions of seeds have been planted along the International Parkway as part of this project. In endeavoring to cover thousands of acres of land, with 12- to 15-in leafy material, there are bound to be ecological and economic impacts. We are continually seeking answers to such diverse questions as, What kind of impact would wildflowers have on modifying or cushioning sound? Which plants would require less water? and How can native materials be planted with root systems at different levels, thereby better using soil nutrients, eliminating the need for costly fertilizers, and aiding soil erosion?

A big advantage of native materials is their economic saving in mowing. Through the use of chemicals applied by the ropewick system, taller competitors can be virtually eliminated without the expense of mowing. Findings indicate that it would cost from two to three times as much energy to plant and maintain the average suburban lawn as it would a comparable-sized food crop. If I could start with this aesthetic challenge, foresee ecological benefits, and wind up with a savings in the cost, how could parks, highways, transportation corridors, other airports, and public places afford not to be composed into wildflower works of art?

REHABILITATION OF INTERSTATE SAFETY REST AREAS IN IOWA

Harold Dolling

Four pairs of safety rest areas on Iowa's Interstate Highway System were constructed and available for public use during 1966. These rest areas were built before a design guide was available. In upgrading these facilities, they had to be completely accessible to the handicapped and, in addition, were to provide additional parking, ground lighting, waste water dump for recreational vehicles, waste water pond or lagoon improvements, sidewalks to tables, rest room upgradings, additional landscaping, and general upgrading of outdated items.

In the first contract, the design guide indicated that an additional parking facility was needed for 52 cars and 22 trucks at each site. This was not practical based on existing topography. The final design provided for 36 cars, 10 recreational vehicles, and 16 trucks at each site. The parking was less than desirable because of the topography. The high price tag of $1 000 000 for modifications was high compared with the original $250 000 to construct the entire complex. The lagoons needed to be improved as part of the total contract, which originally cost $14 500 to build. Due to changes in the environmental requirements, the refurbished lagoons cost $199 000.

In subsequent improvements, it was noted that the lagoons would require enlargement and appropriate arrangements would have to be made. An alternate solution considered was the replacement of the five conventional water closets with microphor low-water-volume toilet fixtures in each building. This was done in subsequent rest areas and water use has been reduced 45 percent or more. Rest area rehabilitation is a challenge, particularly when total costs are considered. For future rest area rehabilitation, I recommend the Federal Highway Administration Technical Advisory Publication T-5140.8 (August 10, 1979), Rest Area Design Charts, which is based on data developed by Minnesota officials. This is an excellent planning and design tool.

DEVELOPMENT OF THE McALLISTER FREEWAY--SAN ANTONIO

Mel Steinberg

Steinberg made a presentation on the development of the McAllister Freeway as it relates to the roadside. His presentation indicated that the freeway was a showplace for roadside development.

INTERRELATIONS OF VEGETATIVE MANAGEMENT AND EROSION CONTROL FOR A SOUND ROADWAY ENVIRONMENT

Sam Garrett

(Garrett's presentation was not available for publication.)

COMPARISONS OF AGRONOMIC AND ECOLOGICAL APPROACHES TO ROADSIDE MANAGEMENT

L.E. Foote

Roadside management came into existence gradually over time as a scientific and administrative approach to roadside maintenance. In the 18th and 19th centuries, roadside vegetation was generally cut by hand (and later by machine) for forage. Roadsides were pastured by staked or free-roaming animals, burned, farmed, or neglected. Often, the roadsides were cut to avoid fire hazard or to provide good visibility against lurking highwaymen, to clear brush, and to provide a neat appearance.

With the scientific agriculture movement of the

Table 1. Comparisons of the agronomic and ecological approaches to roadside management.

Factor	Agronomic Approach	Ecological Approach
Action	Direct	Indirect
Appearance	Neater, more formal, more cared for, more structured, man-formed	More natural, less cared for, less structured, nature formed
Vegetation	Monoculture, single best species	Heteroculture–broad group of species to fit a group of conditions
Inputs	Energy, labor, money, equipment, materials	Time, management, education, seed
Cost	Higher	Lower
Soil	Added inputs applied so it can be treated as a single-like item	Inputs applied to fit a range of edaphic conditions–treated as a mosaic
Fertilizer	Blanket applications, may have to repeat	More single element or unbalanced application to favor certain spaces at cost to others
Nitrogen	Applied, may have to frequently repeat	From legumes and/or soil as much as possible
Weeds	More of a problem	Less of a problem
Public perception of weed problem	Less of a problem	More of a problem
Herbicides	More use, broadcast, for group of plants–more done at one time	Less use spread throughout season, spot application, more for single species
Wildlife habitat	Low to moderate	High
Fire hazard	Low	High
Energy	High inputs	Low inputs
Mowing	More frequent, more area	Less frequent, less area, may not mow at all
Time response	More rapid	Slower, needs more time

late 1800s and early 20th century, agronomists advocated roadside mowing for weed control purposes. For almost the entire first 50 years of this century, mowing, tillage, and crop rotation were the main weapons available to fight weeds. The only one of these that could be readily used on roadsides was mowing, though some states also used fire on a regular basis. Considerable agronomic research efforts were directed at weed control through mowing during the first 30 years of this century.

Starting in the early 1930s, many states added roadside development units to their highway departments. These units often contained trained landscape designers, sometimes agronomists, and generally engineering personnel. The idea that the roadsides were the front yards of the nation and the concept of the complete highway (right-of-way fence to right-of-way fence) were stressed. Roadsides were more frequently mowed and treated in an agronomic manner like a well-cared-for lawn. This approach continued through into the 1960s and chemical weed control was added to the program. Through manuals and training, the approach became institutionalized into many highway department operations.

In the late 1960s, a different approach developed. This was generated by rising costs, increased roadside acreages, environmental and ecological concerns, and the wider knowledge of and appreciation for the ecological approach to vegetation management as put forth by the science of land management. The formal definition of rangelands included public rights-of-way. Table 1 compares the differences in the agronomic and ecological approaches to roadside management. From a review of this table, it will be readily apparent why, in today's era of shrinking funds for transportation agencies, the trend in roadside management has been toward the ecological approach--i.e., the applied science of range management.

MANAGEMENT OF ROADSIDE VEGETATION: SOME PRINCIPLES FROM RANGE SCIENCE

Roger Q. Landers, Jr.

Roadside vegetation is both virtuous and villainous. On the one hand, it may provide welcome shade at rest stops; on the other, an immovable object for an out-of-control vehicle, avenues of wildflower beauty or routes of weed infestations, restful scenery or depressive monotony, and erosion stabilization or pavement destruction. Management makes the difference. Because roadside vegetation is most often a mixture of plant species, its management is more often based on principles from range rather than agronomic sciences. In other words, roadsides are more like rangeland than farmland.

Plants growing in the right-of-way tend to be the same kind as those growing on adjacent land. There are some striking exceptions to this, but generally they are responding to a similar climate and soil. These broad vegetational types of naturally occurring communities of trees, shrubs, forbs, and grasses provide the basis for management. Types change with different rainfall amounts and patterns. The dry summers and mild moist winters of southern California produce chaparral communities; the moist summers and snowy winters of New England produce deciduous forest communities.

Disturbance of the natural vegetation along the roadside during the process of road construction, repair, or maintenance usually initiates a sequence of changes in vegetation during the recovery process. An area begins to revegetate, with a tendency over many years to become similar to the adjacent vegetation. Dandelion, quackgrass, Johnsongrass--the list of species that are capable of moving into relatively new sites and staying there is almost endless. Some of these become permanent members of the community along with the native plants from across the right-of-way line.

We might explore the possibilities of selecting the proper species and manipulating them in the proper way to establish a self-maintaining roadside vegetation. It sounds good, but there are problems. In the first place, it is difficult to find stable combinations of species acceptable for roadside needs. Where annual rainfall averages more than 15 in, the vegetation tends to grow too rank with woody plants and shrubs to be tolerated. In other words, the naturally occurring community is not acceptable as a roadside vegetation despite the low maintenance potential.

The Illinois model indicated that, when you plant lawn grasses in a climate that supports natural communities of tall grass, prairie, and oak forest, the vegetation is not self-maintaining. The Iowa model used taller grasses, primarily smooth bromegrass for an initial installation. After a period of vegetation, although the roadside is not self-maintaining, the Iowa condition is subsidized to a lesser extent