

ROADSIDE NATURALIZATION AND TEXAS HIGHWAY 190:  
A COMPARISON BETWEEN BEST PRACTICES  
AND PLANT SELECTION

by

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## ABSTRACT

### ROADSIDE NATURALIZATION AND TEXAS HIGHWAY 190: A COMPARISON BETWEEN BEST PRACTICES AND PLANT SELECTION

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There is much dialog concerning the use of native plants in the roadside environment. From the Highway Beautification of Lady Bird Johnson in the 1960's to the environmental issues of today, designers are focused on ways to incorporate native plant material in the roadside. Through qualitative analysis, this thesis explores best practices for the use of native plant material in the roadside as compared with a unique roadside design in North Texas. In 2003, The North Texas Tollway Authority (NTTA) began design for the Texas Highway 190 Tollway. A new direction for roadside enhancement using native and adapted plant material was created by the Board of Directors of the NTTA and a design team from the engineering and planning company,

HNTB. Borrowing from the Blackland Prairies of North Texas, the designers “stylized” a design concept using native and adapted plant material to create regimented landscape planting beds throughout the 29 miles of roadway. Considered the largest landscape project using native plant material in the State, the design team utilized accepted criteria for the use of native plant material and developed new criteria during the design process.

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# **CHAPTER 1**

## **INTRODUCTION**

Since the 1970's there has been an increasing popularity in the use of native plant material (Schutt, 1999) within the states Department of Transportation agencies. Roadside use of native plant material is seen as a beneficial and useful tool within the development of highway corridors. This document identifies the major criteria for the use of native and non-native plant material in the Texas Highway 190 (President George Bush Tollway) project in North Central Texas and compares these criteria with literature of 'best practices' within the highway industry pertaining to the North Texas area.

### **Research Objective**

The objective of this research is to identify the criteria and practices for the selection and use of plant material within the Texas Highway 190 roadside corridor by the key stakeholders. Qualitative analysis is used to compare these criteria with their selection and use as revealed in the literature review, interviews, and 'Best Practices' as documented by Federal Guidelines, State DOT's, and additional research documentation.

## **Research Questions**

The principle questions explored in this research are:

1. What were the criteria for plant selection within the Texas 190 roadside environment?
2. How do the criteria match with the literature?
3. What is the perception of the success of the planting design among key stakeholders?

## **Definition of Terms**

Aesthetic Enhancement: The skillful manipulation of the landform and careful planning of clearing, revegetation, reforestation, and erosion control operations in order to blend the highway with its surroundings (TxDOT, 2001.)

Aesthetics: A particular theory or conception of beauty or art; a pleasing appearance of effect” (TxDOT, 2001.)

American Association of State Highway and Transportation Officials: (AASHTO) wrote the manual Environmental Stewardship Practices, Procedures, and Policies for Highway Construction and Maintenance (2004)

Biodiversity: A term used to express the total living make-up of the environment: plants, animals, insects, everything. The diversity enables the environment to quickly respond to disturbances, begin the repair process, and regain its natural function (Schutt, 1999.)

Ecosystem: A localized group of interdependent organisms together with the environment that they inhabit and depend on (Encarta, 2003.)

Executive Memorandum, 1994 (E.M.): The E.M. recommended the use of regional native plants, less fertilizers, less pesticides, less irrigation on federal grounds, lands, and federally funded landscape projects... as in highway construction projects (FHWA, 2003.)

Executive Order 13112, 1999 (E.O.): Ordered increased communication and cooperation of all agencies through a National Invasive Species Council to focus on prevention and control of invasive plant species, as well as followed-up with restoration of native plants as directed (FHWA, 2003.)

Geomorphic: Relating to the surface features of the Earth (Encarta, 2006.)

Habitat: The arrangement of cover, food, and water that enables some form of wildlife to maintain itself in a given area (Schutt, 1999.)

Highway Beautification Act, 1965: Encouraged the removal of billboards, screening of junkyards, and landscaping of roadsides (FHWA, 2001.)

Integrated Roadside Vegetation Management (IRVM): A long term approach to vegetation management that systematically evaluates each area to be managed (SAFETEA-LU, 2006.)

Invasive Species: An alien species whose introduction does or is likely to cause economic or environmental harm or harm to human health (EO, 1999.)

Intermodal Surface Transportation Efficiency Act, 1991: (ISTEA) Provided funding for enhancements. One of ten categories of enhancements was landscaping. All



ISTEA projects were subject to the STURRA requirement of native wildflower use (FHWA, 2003.)

Native Plant Species: With respect to a particular ecosystem, a species that, other than as a result of an introduction historically occurred or currently occurs in that ecosystem (Executive Order 13112, 1999.)

Naturalization: The “introduction of native plant communities that generally mimic the species composition and structural forms of unplanned native vegetation occurring in a given area” (Schutt, 1999.)

National Environmental Policy Act (1969): (NEPA) established the notion of avoidance and minimization of disturbance. This law encouraged environmentally sensitive solutions (FHWA, 2003.)

Non-native Plant Species: A plant species that did not originally exist in the United States, but was introduced by humans. A plant moved from a region in which it is native to a new region of the United States where it is not, is also considered “non-native”. A naturalized plant is non-native (SAFETEA-LU, 2006.)

Preservation: The maintenance of something, especially something of historic value, in an unchanged condition (Encarta, 2005.)

Restoration: To restore the topographic shape, hydrologic function, and plant community that existed before disturbance by man (Schutt, 1999.)

Safe, Accountable, Flexible, Efficient, Transportation Equity Act: A Legacy for Users, 2005: (SAFETEA-LU) The new legislation provided federal funds for the control of noxious weeds and the establishment of native species. SAFETEA-LU

expanded the term native plants to include native wildflowers, grasses, shrubs, trees, and vines. Two additional components were also established that integrated roadside vegetation management that, in part, called for systematic evaluation of each area to be managed, with the use of non-invasive, non-native plant material.

Stakeholders: A group not limited to State and local governmental agencies, academic institutions, the scientific community, non-governmental entities including environmental, agricultural, and conservation organizations, trade groups, commercial interests, and private landowners (Schutt, 1999.)

Surface Transportation and Uniform Relocation Assistance Act (1987): (STURRA) is the act that includes the requirement to plant native wildflowers with 1% of a highway project's landscape budget when federal funds are used (FHWA, 2003.)

TxDOT: An acronym for Texas Department of Transportation.

### **Limitations**

The limitations of this study are conditions beyond the researcher's control. Several stakeholders contacted were unavailable for interview. During the interview process one of the stakeholder's involvement in the project proved to be peripheral, but the individual was able to provide insight to the procedures of TxDOT in plant selection and installation techniques.

The study is a comparative study of one highway corridor's planting design using the "best practices" within the highway system guidelines of governmental agencies as described in the literature available to the researcher.

## **Overview of the Study**

The purpose of the study is to compare the design and use of native and other plant material along the Texas Highway 190 roadside corridor with the ‘best practices’ of design and use of this plant material as described in the literature of governmental Department of Transportation agencies and other individuals considered “expert” within the industry, with emphasis on the North Texas area.

Chapter 2 deals with the review and analysis of the supporting literature relevant to this study, including the history of legislation pertinent to the emergence of native plant use along the roadside. Methodology and procedures are discussed in Chapter 3. Results of the interview process are presented in Chapter 4. Chapter 5 is concerned with the summary of findings, discussion, implications, and suggestions for further research.

## **CHAPTER 2**

### **LITERATURE REVIEW**

“What is really desired, however, is attractive and useful roadsides which can be obtained by preserving or creating a natural or an approach to a natural condition in keeping with the adjacent or surrounding country”  
(Bennett, 1936.)

#### **Introduction**

This research explores the use of native and non-native plant material in the construction of Texas Highway 190 in the Dallas/Ft.Worth Metroplex of North Texas, USA, by the North Texas Tollroad Authority (NTTA), and compares the design, with best practices as revealed in the literature review and in interviews pertaining to the North Texas area. Many of the best practices studied are taken from state departments of transportation (DOT's), universities, and research facilities around the country. They are reviewed and consolidated by federal agencies within the Federal Highway Administration (FHWA) into manuals for distribution to the individual states. This review will explore the practices from the federal, Texas Department of Transportation (TxDOT), and NTTA positions.

#### **History**

As early as 1932, a group known as Friends of the Native Landscape, led by landscape architect Jens Jensen, were reporting to the Illinois Department of Transportation on the use of native plant material in roadside planting (Lore, 2003.)

That same year in Texas, the Texas Department of Transportation (TxDOT) hired its first landscape architect, Jac Gubbels, to “maintain, preserve, and encourage wildflowers and other native plants along rights-of-way” (Markwardt, 2004.) Two years later, new maintenance directives were written to delay all mowing, except where safety concerns were at issue, until the end of the spring and summer wildflower seasons.

In addition, the newly formed TxDOT was responding to the Great Depression by hiring crews to build new roads. The design criteria included safety, convenience, comfort, and aesthetics. The roadside was enhanced by providing “adequate drainage, clearing of trees and shrubbery to eliminate blind spots; and by the planting of trees, flowers, and shrubbery to help prevent erosion of the road shoulders and beautify the landscape” (Kite, 2001.)

The newly instituted Office of Landscape Architecture appointed Mrs. Frank W. Sorrell to “lead a Texas citizens’ highway beautification organization to encourage local groups to seek and promote highway improvement in their areas” (Kite, 2001.) Roadside parks were also planned. Local groups were required to donate time, labor, and materials for their local areas due to inadequate funding. Women’s groups stepped forward in the promotion of roadside parks, restriction of billboard advertising and livestock grazing along highways.

With the dramatic effects of The Great Depression and World War II, little was done with regard to enhancement of highway roadsides in Texas. The highway funds after the war and through the 1950’s were allocated to development of Farm to Market

roads and the nationwide Interstate Highway System designed to link the major cities of the country.

### **Highway Beautification Act**

By the 1960's, the highway system was littered with billboards, both usable and dilapidated, junkyards, and other undesirable elements as a result of a lack of regulations restricting the use of roadside rights of way. First Lady, Lady Bird Johnson brought together landscape architects, planners, and engineers, to set new parameters for highway design. The pleasing quality of the George Washington Memorial Parkway with its careful integration into the existing landscape proved “the final incentive” for President Lyndon Johnson as he signed the Highway Beautification Act of 1965 (Fischer, Hohmann, Marriott, 2000.) The President, at the signing said,

“We have placed a wall of civilization between us and the beauty of our countryside. In our eagerness to expand and improve, we have relegated nature to a weekend role, banishing it from our daily lives. I think we are a poorer nation as a result. I do not choose to preside over the destiny of this country and to hide from view what God has gladly given” (FHWA, 2005.)

This act, in conjunction with the Historic Preservation Act of 1966 and the National Environmental Protection Act of 1969, opened the door for the return of landscape architects within the FHWA, an emphasis on roadside beautification, and the use of native plants in roadside environments (Fischer, Hohmann, Marriott, 2000.)

Inspired by Lady Bird Johnson's crusade to beautify the nation's highways, Secretary of Transportation Alan Boyd announced in 1967 the beginning of a competition called “The Highway and its Environment”. The competition was designed to “recognize the efforts and achievements of public agencies and private organizations

in protecting, restoring and enhancing highway beauty” (FHWA, 1996.) In 1990, the competition was broadened and renamed “Excellence in Highway Design”.

### **Operation Wildflower**

In 1973, as an expansion of the Beautification Act of 1965, the Federal Highway Administration (FHWA) administered a voluntary, cooperative program titled “Operation Wildflower” with the National Council of State Garden Clubs. This program called for local garden clubs to pay for or furnish wildflower seeds or seedlings to State highway agencies for planting within the highway right-of-way. Federal funds were then made available for the cost of planting and maintenance (FHWA, 2003.)

### **The Surface Transportation and Uniform Relocation Assistance Act**

The Surface Transportation and Uniform Relocation Assistance Act of 1987 (STURRA) was the first legislation to include the planting of native wildflowers as a requirement in all highway projects with federal funding. At least one-quarter of one percent of the project’s landscape budget was to be assigned for the planting of native wildflowers, separate and in addition to any plant material or seed provided under the Operation Wildflower citizen group initiative (STURRA, 1987.)

One ambiguity within all the legislation to this point was the use of the word “wildflower” (Schutt, 1999.) No definition of the word was given, leaving the state DOT’s with the daunting task of trial and error in their approach to implementing the mandate. Because the state of Texas had already incorporated a wildflower program and the legislation had originated from Texas Senator Lloyd Bentsen, many states used native wildflower seed from Texas in their programs, with poor success. At the time,

there was little dialogue between the various states concerning their experiences with native plant material, leading to additional failures (Lore, 2000.) The use of wildflowers within the landscape was also limited to “scenic enhancements” without thought to erosion control, vegetation management, biodiversity, and the many other attributes of native material (Beautification Act, 1965.)

### **The Intermodal Surface Transportation Efficiency Act**

The Intermodal Surface Transportation Efficiency Act (ISTEA) of 1991 provided a new category of funding for Transportation Enhancement Activities (TEA). Ten categories of enhancement were provided, one of which would be for landscaping and scenic beautification. All ISTEA projects were subject to the STURRA requirement of native wildflower use (Caltran, 2003.) From 1992 through 2005, the T.E.A. has provided over \$1,167,000,000 for landscaping and scenic beautification (Taylor, 2006.)

### **Executive Memorandum**

In 1994, President Bill Clinton signed an Executive Memorandum on Environmentally Beneficial Landscaping, with environmental recommendations that include “environmentally and economically beneficial landscaping practices at Federal facilities and federally funded projects” (Memorandum, 1994.) This document helped to clarify many of the areas of confusion in the existing legislation concerning landscape practices within federally funded projects, including highway roadsides. The overused word “wildflower” was replaced with “native plants”, expanding the plant palette available for planting design. The definition of native plant species was defined as “one that occurs naturally in a particular region, ecosystem and/or habitat without direct or



indirect human actions” (Memorandum–Guidance, 1995.) Regionally grown plant material was mandated, with the intention of advancing five principles for landscape projects:

1. Use regionally native plants for landscaping;
2. Design, use or promote construction practices that minimize adverse effects on natural habitat;
3. Seek to prevent pollution by, among other things, reducing fertilizer and pesticide use, using integrated pest management techniques, recycling green waste, and minimizing runoff. Landscaping practices that reduce the use of toxic chemicals provide one approach for agencies to reach reduction goals established in Executive Order No. 12856 “Federal Compliance with Right-To-Know Laws and Pollution Prevention Requirements;”
4. Implement water-efficient practices such as the use of mulches, efficient irrigation systems, audits to determine exact landscaping water-use needs, recycled or reclaimed water, and the selection and siting of plants in a manner that conserves water and controls soil erosion. Landscaping practices, such as planting regionally native shade trees around buildings to reduce air conditioning demands, can also provide innovative measures to meet the energy consumption reduction goal established in Executive Order No 12902, “Energy Efficiency and Water Conservation at Federal Facilities;” and
5. Create outdoor demonstrations incorporating native plants, as well as pollution prevention and water conservation techniques, to promote awareness of the

environmental and economic benefits of implementing this directive. Agencies are encouraged to develop methods for sharing information on landscaping advances with interested nonfederal parties (Memorandum, 1994.)

In addition, guidelines were to be written, defining in detail the intent of the memorandum and giving definitions of terms (Memorandum-Guidance, 1995.) The guidance was intended to promote principles of “sustainable landscape design and management” (Memorandum-Guidance, 1995.)

### **Executive Order 13112**

Each year approximately \$23 billion nationwide is lost to invasive plant impacts and 4600 acres of land are invaded daily (EO, 1999.) On February 3, 1999 Executive Order 13112 (EO-13112) was signed, establishing the National Invasive Species Council to provide national leadership in the eradication of invasive species for both flora and fauna. The importance with regards to this paper was the inclusion of the corridors of the nation’s highways. Transportation systems facilitate the spread of species outside their natural range, both domestically and internationally (Landis, 2005.) Of particular concern are those species that are likely to harm the environment, human health, site to site movement of maintenance operations, construction equipment, and imported soil or gravel. In addition, some invasive plant material might be inadvertently planted in erosion control, landscape, or wildflower programs (FHWA, 1999.) Millions of miles of highway right-of-ways traverse public and private lands, many with invasive species problems. The open corridors provide ample opportunity for plant movement. Since most invasive species would be determined to be non-native by

definition, the use and source for native seed and seedlings became more important. Salvaging existing native plants in construction corridors, harvesting native plant seed locally for the project, notifying existing growers of upcoming needs far in advance, and contract-growing native plants and seed as cost-effective alternatives became mandates (FHWA, 1999.)

### **Roadside Vegetation Management Program**

In 1994, the FHWA Wildflower Program became the FHWA Roadside Vegetation Management Program, eventually publishing the Roadside Use of Native Plants to create a source of documentation of past legislation, with a “best practices” compilation from all of the states. This created one definitive approach to the implementation of a process started 35 years previously to; “assure water quality, improve erosion control, increase wildlife habitat, reduce mowing and spraying, control noxious weeds, and protect natural heritage along the 10 million acres of land along the roadside rights-of-way within the United States” (Policy guidance, 1999.)

### **Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users**

In August of 2005, the President signed into law the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU.) The new legislation provided federal funds for the control of noxious weeds and the establishment of native species. SAFETEA-LU expanded the term native plants to include native wildflowers, grasses, shrubs, trees, and vines. Two additional components were also established that integrated roadside vegetation management that, in part, called for systematic evaluation of each area to be managed, with the use of

non-invasive, non-native plant material. A preference to native plants was encouraged to the maximum extent possible when creating a plant palette for each eligible project. The state DOT's were to implement the memorandum in every aspect of highway construction projects, including, highway landscaping projects, Transportation Enhancement activities and maintenance programs (SAFETEA-LU, 2005.)

### **Discussion**

Over the past two decades there has been increasing attention and focus on the use of native plant material along roadsides within state Department of Transportation agencies (Schutt, 1999.) Proponents of this practice list numerous advantages that serve the public interest and enhance the environment, categorizing the sum of the practices into "highway beautification" (Lore, 2003.) Though there is little, if any, literature against this movement, there are those who question how such implementation can best be carried out, and call for better definition of terms and methods.

The purpose of this research is not to answer these questions, but to explore the 'best practices' as proposed by various governmental agencies and industry recognized individuals concerning the planting design and implementation of an ongoing project, the Highway 190 Toll Road in North Texas.

Through humble beginnings in 1965 with the planting of wildflowers along highway corridors, the native plant movement has progressed to include environmental and ecological benefits. Mrs. Lyndon Johnson in 1993 said," To me, in sum, beautification means our total concern for the physical and human quality we pass on to our children and the future" (Lore, 2000.)

In her essay “Reassessing Beautification, More than an Aesthetic Goal”, Bonnie L. Harper-Lore lists 8 benefits of using native plants.

1. Erosion control: Many of the grasses and forbs have deep and/or fibrous root systems that add to the strength of a slope and prevent erosion. An associated problem with their use for erosion control has been their long establishment time. However, it has been learned that some cool season, quick-to-establish native grasses do exist and act much like the annual ryes used previously.

2. Vegetation management: A reduction in mowing and spraying are possible with the use and preservation of existing native plants. The Texas Department of Transportation and many others save millions of dollars annually in reduced maintenance.

3. Biodiversity: A diversity of grasses, forbs, shrubs and vines can be planted and maintained in contrast to the conventional mowed grass monocultures. This diversity is ultimately important to global ecology. Locally, the biodiversity presents a dynamic landscape that change through the seasons for the traveling public.

4. Wildlife habitat: Biodiversity of planted or preserved native vegetation provides food and shelter for small mammals and song birds, whose habitat is diminishing elsewhere. No study shows an increase in accidents resulting from our increasing roadside wildlife.

5. Wetland mitigation: Using native plants in wetland creation or restoration is more likely to be successful. The use of regionally adapted plantings will enhance the chances for the success of functioning, diverse, wetland habitats.

6. Endangered species: By protecting native plant remnants, undiscovered endangered species are inadvertently protected. By planting native plants instead of aggressive introductions, endangered species are protected from being displaced by exotics.

7. Water quality: Studies show that the run-off from sod or common turfs is far greater than from deep rooted native grasses. Native grasses capture much of the precipitation in thatch before it hits the ground. The deep roots absorb the run off better. Therefore, normal rainfall has less of an opportunity to pick up fertilizers, agricultural run-off, etc. and end up in state waters.

8. Hardy vegetation: By taking advantage of native vegetation and working with plants adapted to an area's climate, soils, etc., replacements in landscape plantings should be rare. When plants are matched carefully, survival should be assured, eliminating future costs.

And in the end, if the result happens to look pretty, the goal of beautification has also been achieved, with a new aesthetic that reflects the state's natural heritage, regional differences, and natural beauty that highway users travel to see and all take pride in (Lore, 2000.)

From the inception of the native plant movement to the present, practical application of these elements has been difficult due to the ambiguity in definition of terms coupled with preconceptions of the various parties involved as to what constitutes roadside beautification and how best to achieve it (Schutt, 1999.) Further, is beautification, naturalization, or some specific ecological function the final goal? A

combination of many smaller regionally specific functions to each section of roadway can ultimately achieves a larger purpose (Forman, 2005.)

At first, it was the planting of native wildflowers along the roadside to achieve a purely aesthetic purpose. But the exact definition of a native wildflower was unclear. Even Mrs. Lyndon Johnson, the founder of the Highway Beautification movement said years later that “wildflowers” was not the right word for the restoration of native vegetation (Lore, 1998.) In general terms, a wildflower may be applied to an annual or perennial herbaceous plant or group of plants whose flower display is considered visually pleasing and significant in the landscape. “It is considered an aesthetic feature that may not necessarily relate to broader ecological goals” (Schutt, 2001.)

### **Setting Definitions**

Only since the 1990’s has Congressional legislation begun to set definitions of terms and reachable goals for the state DOT agencies. Public perception and participation adds another difficult aspect to the responsibilities of the state DOT’s. In most communities, the state DOT’s have close relationships with many groups that voice opinions concerning the management of the roadways and whenever appropriate cater to their wishes (Shutt, 1999.) These special interest groups may perceive a definition of terms that is somewhat different from academic literature, or the general public. Wildflower enthusiasts perceive “native plants” as wildflowers, where as, native grass enthusiasts may see “native plants” as grasses, conservationists or preservationists see “native plants” as native meadows, prairie restorationists as prairies, and so on (Schutt, 1999.)

Terms, such as, restoration, naturalization, and biodiversity create ambiguity within the discussion of native plants and their role in the roadside (Schutt, 1999.) Native plant species is another term that requires further discussion. Defined as “a plant indigenous to a specific geographic region”, it may extend over hundreds, even thousands of miles (Schutt, 1999.) In 1995, the departments of transportation of Minnesota, Iowa, Missouri, Kansas, Oklahoma, and Texas formed a partnership program, The Prairie Passage, to establish a reintroduction of native prairie along the highway corridor, from Canada to Mexico. Big Bluestem Grass is one of several species that grows throughout the length of the corridor (Jackson, 2003.)

### **Natural Soil Profile and Plant Succession**

There is a direct relationship between the natural soil profile and plant succession.

“As the upper portion of earth altered by plants and other organisms, soil is a rich, dynamic combination of mineral particles, roots, air, water, dead (blackish organic matter, bacteria, fungi, and soil animals. Roots grow, porosity increases as worms move about and roots die, and the composition of air in the pores changes. Water moves up and down, as do tiny soil animals, mineral nutrients, and organic matter” (Forman, 2003.)

Over time, soil formation normally produces conspicuous soil horizons, or layers (Forman, 2003.) This relatively shallow, fragile A-horizon layer of the earth’s surface is the area of plant habitat. Below this layer the soil becomes mineral rich and nutrient poor.

Plant life begins with open areas of bare soil. Seeds find their way to the soil through various means (wind, water, bird and animal droppings, etc.), looking for black, humus soil heavy with nutrients. Weedy, annual plants that quickly produce flowers and



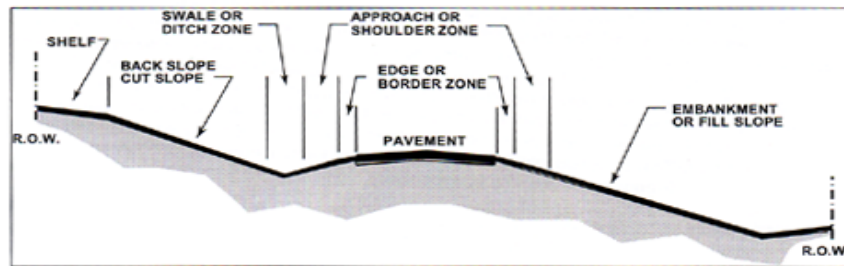
wind-dispersed seeds generally are the first species to develop. As leaf rosettes of expanding plants begin to bump into one another, competition favors the fittest plants. Over time hardy perennials establish, then shrubs, and finally tree forms. As the succession progresses some sun plants will be shaded out by taller shrubs and trees, changing the community of existing plant material within the habitat. Animal life, natural erosion, weather, microhabitat changes are but a few of the criteria that create additional diversity of plant palette. At times one species may dominate an area, for example, the prairie grasses of the plains.

As the plants that are outperformed die, their roots form more nutrient rich humus to perpetuate the plant habitat. These habitats may be small or stretch for thousands of miles. They are alive, dynamic and self-healing to the changes of natural occurrences (Schutt, 2001; Forman, 2003.)

The succession process of the newly created roadside begins in barren, disturbed soils. This barren, imported soil is seeded by the state DOT's with grass or herbaceous annuals generally from a non-native source. Succession starts with generalist species; herbaceous, light-demanding, disturbance tolerant plants with a wide genetic tolerance to environmental conditions. Many are of the opportunistic varieties with dispersal mechanisms allowing them to be carried by wind, clothing, vehicles, and the fur of animals. Non-native varieties from vehicle transport also add to the mix (Forman, 2003.)

## The Roadside

The roadside corridor of a typical highway system is most often an inhospitable environment for indigenous plant material. A roadside is divided into at least four or five zones as measured from the edge of pavement (Figure 1.) These roadways are placed on re-consolidated soils compacted to near maximum density and contoured to a very smooth, unnatural surface. This soil is generally brought in from another site, and is more homogeneous than the existing soil profile. The net effect ecologically, is to reduce the microhabitat heterogeneity of the roadside (Forman, 2003.) Areas of cuts may expose deep parent material that is very different in character from undisturbed soils outside the right-of-way (Schutt, 2001.)

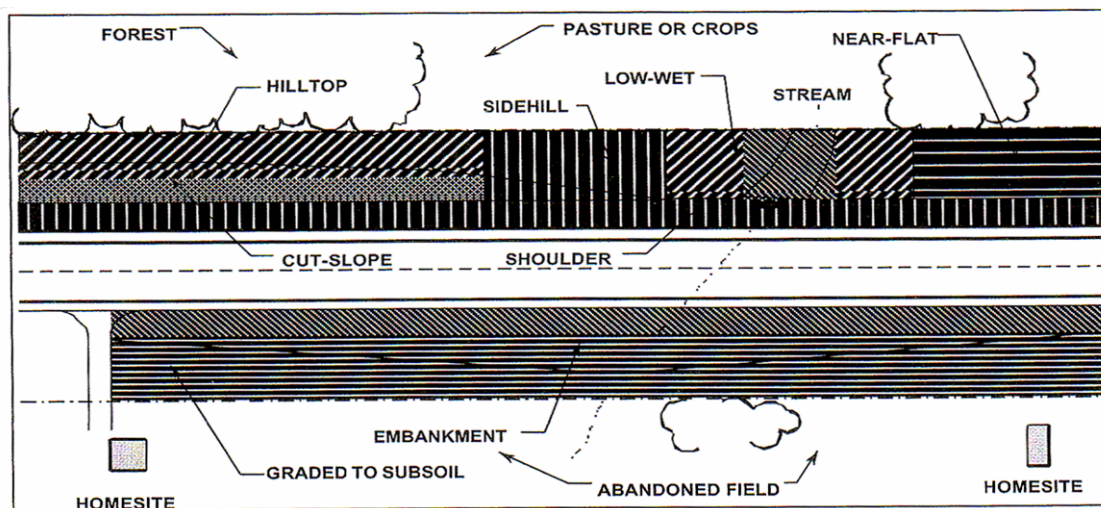


**Figure 1. Typical zones in roadway sections (Schutt, 1999.)**

Slopes approach 3:1 or greater, and stormwater drainage is to be positive away from the pavement usually in a v-shape swale. These swales become collectors of eroded soils different in soil profile from areas outside the corridor. This drainage process also picks up pollutants that find their way to the water supply of the region, creating water quality issues. The roadbed is raised above the surrounding terrain to insure drainage from the lanes of traffic, fragmenting the existing plant and animal habitat, forming a barrier effect to habitat and the natural flow of surface water.

Solar radiation from the paving alters the microclimate of the roadside. Greenhouse gases emitted from vehicles, as well as pollution particles and aerosols accumulate creating diverse effects on surrounding vegetation (Forman, 2003.) The highway corridor is often full of infrastructure used by various agencies such as, electric, gas, water, sewer, and communications lines, as well as, needs of adjacent landowners and users of the roadway (Schutt, 2001.)

The roadside is comprised of as many as nine distinct geomorphic conditions when considered linearly; from high, dry, well-drained soils, to low, moist, wetlands (Figure 2.) These diverse conditions combined with solar exposure changes may occur at every changing segment of roadside. The areas will also be dotted with a variety of adjacent landowners, each with different uses for the roadside (Schutt, 2001.)



**Figure 2. Typical zonal variations found in the roadside (Schutt, 1999.)**

The significance of these landform types is that each will be best suited for a particular type of vegetation community (Schutt, 2001.) The selection of plant material cannot come from a generalized plant list, but must be site specific.

## **Environmental Management**

Environmental management of such diverse areas would be tailored to maximize the habitat diversity within each zone and condition. California Department of Transportation (Caltrans) identified 19 Botanical Management Zones as different ecological resource areas within the state of California. Each zone is managed for the native plant communities they represent. In particular, the intent is to demonstrate the value of native plants to control the spread of invasive species, as well as, the aesthetic potential (Caltrans, 2001.)

Washington State divides its highway system into 24 maintenance areas. The roads are divided into 3 zones from the roadway to the edge of the right-of-way. Each of these zones has different parameters of maintenance allowing for natural growth and succession.

## **Challenges and Assumptions**

Training of maintenance personnel charged with the difficult task of implementing the intent of those who wish to create highway naturalization is woefully lacking (Schutt, 2001.) Traditional DOT vegetation management has been associated with controlling plant height and weed control. Ecological restoration or reclamation requires specialized knowledge at the local level to make critical judgment decisions on environmental and vegetation issues (Schutt, 2001.)

The successful use of native plants in the roadside without human intervention is assumed from examples seen in nature. Desirable traits of climate hardiness, disease resistance, nutrient cycling, and general long-lived stable character occur in nature as a

character of the system as a whole more than the individual plant itself (Schutt, 2001.) At the present time there is not enough known about succession and multiple vegetation communities in disturbed areas to achieve much beyond noxious weed control (Schutt, 2000.) The severely compacted, disturbed soils created during road construction, are lacking in beneficial microorganisms and create an environment very different from the pre-construction landscape, making adaptability of native plant material to the roadside environment difficult (Landis, 2005.)

Another common assumption for the use of native plants is the reduction of maintenance costs. This is true for established, mature plant communities. What is less often discussed is the high development cost to begin the process. Soil rehabilitation, seeding, mulches, mowing, burning, weed control, irrigation, etc. will add significant initial expenditures to the project (Schutt, 2001.) The costs will eventually be mitigated by benefits such as the ones listed below:

1. Reduced use of herbicides will result from native plants out performing exotic or invasive species;
2. Native grasses require mowing once or twice a year in Texas as compared with introduced grasses such as Bermuda;
3. Once established, regionally native plants perform well with the available rainfall and water table of the area, promoting water conservation;
4. Deep rooted native grasses and forbs reduce erosion more effectively than introduced shallow-rooted grasses;

5. Established native material requires less maintenance than non-native species keeping road crews away from hazardous conditions and improving safety (Caltrans, 2001.)

### **Integrated Roadside Vegetation Management**

With the complexities of changing the existing approach to roadside vegetation, a paradigm shift in thinking of the roadside corridor is necessary. In the 1930's the book Roadsides, the Front Yard of the Nation by Jesse M. Bennett, inspired the Front Yard Approach of making the driving experience as pleasant as possible, having the roadway as pretty as our front yards. By the 1950's, with the available farm methods and machinery, plus the advent of agricultural chemicals, a mowed grass front yard look was advanced in the Agricultural Approach.

The energy crunch of the 1970's brought a halt to the labor-intensive, fossil-fuel wasting, maintenance approach. The Ecological Approach of mow less and spot spray had positive effects on the environment. Increased wildlife habitat, enhanced natural beauty, minimized herbicide use and reduced maintenance dollars spent were all positive effects and embraced by the public. The STURRA legislation helped further this beginning by establishing tax dollars set aside for native wildflower planting.

The 1990's and the increased interest in invasive species and environmental issues ushered in the integrated roadside vegetation management approach (IRVM). This cost-effective, ecologically sound method of management, with reduced mowing and additional native material in the rural areas and neatly trimmed areas within the urban environment, was highly supported by the traveling public.

Now in the 2000's a Conservation Approach begins. The high cost of invasive plants, the effect roadways have on adjacent lands, the need for reduced maintenance costs, and the loss of diversity mandates preservation and conservation (FHWA, 2004.)

The traditional approach of a safe, obstacle free off-road area with good sightlines and adequate drainage from the roadway is giving way to the thought of 12 million acres of conservation opportunity (Lore, 2002.) The future is viewing the roadside as a bio-diverse ecosystem blending with the natural surroundings with as little negative impact as possible, while still providing the necessities of highway safety. Native plant communities form an important component within this structure (Forman, 2003.)

### **Twelve Best Practices**

The FHWA consolidated the views and practices from the various states DOT's into several source books and documents including The Roadside Use of Native Plants and The Nature of Roadsides. The Environmental Stewardship Practices, Procedures, and Policies for Highway Construction and Maintenance by AASHTO, and Green Landscaping with Native Plants by the EPA were also written to lend guidance to state DOTs. These texts along with TxDOT publications Landscape and Aesthetics Design Manual and Roadside Vegetation Management Manual and the work of recognized experts in the field will provide the source of criteria determining the use of native plant material and "best practices" for this research. Broad views of practices will be discussed in this research. The detailed exactitude of implementation of these best practices is well documented within the above texts and is summarized below.

### **One. Environmental concerns of water and air quality**

The dense, deep-rooted vegetation thrives without fertilization, is a barrier to noxious weed infestation, and reduces the amount of chemicals and herbicides in the water supply. With the reduction of mowing and edging and the subsequent reduction of pollution levels created by the fossil fuels used in the equipment, air quality is improved and noise pollution reduced (NEPA, 1997.) Fibrous root systems of native vegetation intercept and filter pollutants in storm water runoff before they enter streams, lakes, and wetlands.

### **Two. Costs of installation and maintenance**

Though native grass and forb seed has proven to be less expensive than turf grass seed, there is an increase in site preparation costs to insure a high success rate. Irrigation for a period of 3 to 5 years, compost to replenish the humus absent from the disturbed soil used to create the ROW, and weed and weed seed removal prior to planting add to the initial expense (Lore, 2000.) The addition of shrubs and tree forms will further increase costs. Savings come later in reduced maintenance, irrigation, chemical use, and plant replacement costs. Low water use, future viability and longevity are some of the added benefits and future savings (Caltrans, 2004; Lore, 2000.)

### **Three. Aesthetics**

Though difficult to quantify, beautification is an important, even fundamental reason for native plant use. Many people, while traveling through a naturally landscaped area appreciate the diversity and variety of textures, colors, and shapes of native plants



and the progression of hues throughout the seasons (EPA, 1997.) Native wildflowers and grasses provide seasonal color changes along roadsides, a natural beautification, regional character, and screen undesirable views and objects, when properly designed (AASHTO, 2004.) Richard Forman refers to these criteria as “visual quality”. His study of visual quality included a survey of individuals asked to rank certain scenic views for their high or low visual quality. The results showed people preferred contrast to monotony, natural settings with water, and /or some quaint structure or wildlife to developed land areas (unless the water was polluted). Forman believes more study is necessary to further this body of knowledge, but as Lady Bird Johnson once said, “Where flowers bloom, so does hope” (Forman, 2003.)

#### **Four. Preservation, restoration, and naturalization**

The value of preserved remnants of undisturbed native plant communities has been recognized for some time in wetland areas. Preserving woodland and grassland remnants has also been recognized as having great value. Besides the preservation of local natural heritage and regional identity, these remnants act as indicators of environmental health, enhance diminishing wildlife habitat, and add aesthetic beauty to the area. For roadside managers, protecting quality remnants has environmental benefits such as no cost of planting natives where they already exist, lower maintenance costs than mowed areas, fewer weed problems, species identification for local restoration and naturalization projects, and source for seed harvesting (FHWA, 2004.)

Caltrans has identified 19 quality native remnants along their highways they call Botanical Management Areas that are under development. Texas is involved in the

Prairie Passage Restoration Project, with 5 other states, to preserve and restore the North American Tallgrass Prairie along highway corridors (Jacobson, 2003.) These established prairie communities are surprisingly free of noxious weed infestations. TxDOT has a Rare Plant Management Partnership to categorize rare species within the highway right-of-way (ROW.)

TxDOT identifies various use areas, for example, agriculture, wetlands, woodlands, or rangelands and the importance of specific mowing practices within each area. The importance of plant diversity and growth structure (plant height and coverage), including the use of woody plant material for habitat cover and food, can be attained with proper attention to each area. Roadsides free from disturbances occurring on adjacent lands can be managed as refuges for the preservation of threatened or endangered plant and animal species, as well as, sensitive ecosystems (TxDOT, 2006.)

Restoration projects occur in areas disturbed by construction along the ROW such as wetlands, historical areas, and wildlife habitats. The intent of restoration is to restore a site to the topographic shape, hydrologic function, and plant community that existed before the disturbance of man (TxDOT, 2001.) In the planning stages of a road construction project, an inventory of plant and animal species within the construction area are documented, as well as the area adjacent to the ROW, to determine the degree of habitat value and the appropriate direction of preservation and restoration that will be necessary. Providing a buffer of natural habitat keeps wildlife from becoming pests within urban locations (NEPA, 1997.)

Naturalization projects seek to promote or re-introduce native plants to minimize maintenance or improve the aesthetics of the roadside (TxDOT, 2001.) A recommended minimum dimension of 40' across is required. Areas underneath and surrounding highway interchanges are good choices. The design intent is to create a self-sustaining plant community that will evolve through succession with minimal maintenance requirements (Schutt, 2001.)

#### **Five. Integrated roadside vegetation management (IRVM)**

Bill Hayward is credited with the first IRVM statement in the 1980's. His three principals are:

1. Nature does not allow bare soils to exist;
2. Bare soils are revegetated by successions of plant groups until a most-fit community of plants develops;
3. Disturbance of the vegetative cover reverses the succession of revegetation back to the bare soil starting point, and therefore allows more invasions (AASHTO, 2004.)

Traditional DOT responsibility for vegetation management has focused on controlling vegetation height, weed control, and soil erosion (Schutt, 2001.) Pressure within the state DOT's to do more with less led to the acceptance of ecological principles. The key to success was preventative maintenance and avoiding impacts that disturbed plant associations in the first place (FHWA, 2004.) IRVM encourages stable self-sustaining vegetation with limited and carefully timed use of mowing, herbicides, and tree

removal. These designed native communities naturally discourage the establishment of noxious weed species, promote healthy soils, limit soil erosion and water pollution.

“IRVM starts with good soils management, planting design, and revegetation, and then recognizes proper mowing or restrictions, weeding, pruning and thinning. Manual activities, mechanical tools, and chemical application are combined with cultural and biological methods to develop a vegetation community that requires minimal maintenance and benefits wildlife and its habitat.”

(AASHTO, 2004)

One important component within the IRVM guidelines is to provide broad goals that can be interpreted by individual counties for their specific needs. The goals encourage DOT's to:

1. Provide and preserve safe, functional and environmentally improved corridors of travel throughout the state;
2. Utilize a long-term integrated management program that promotes desirable self-sustaining plant communities. Encourage those plant communities native to the region through preservation and re-establishment whenever possible;
3. Bring about considerable reduction and possible elimination of the use of chemicals as a control method of undesirable plants;
4. Enhance the scenic qualities of the roadsides and their value as wildlife habitat (AASHTO, 2004.)

Texas Department of Transportation in their Roadside Vegetation Management Manual of 2006 paraphrases Executive Order 1-92, “The department will maintain highway vegetation in an environmentally sensitive and uniform manner consistent with

the special conditions presented by local climate, topography, vegetation, and level of urbanization.” Two levels of vegetation management have been established; developed urban and rural. To aid the planners, managers, and workers, the District Engineers will use the level of development of the adjacent property to determine the level of management for each segment of roadway.

“Developed urban highways are highly maintained areas which are predominantly residential, commercial, or services development within metropolitan areas, smaller cities, towns and villages” (TxDOT, 2006.) Rural highways are determined when the surrounding land use is “rural only” (TxDOT, 2006.)

### **Six. Soil management**

Soil Management, including soil erosion control and soil stabilization, is the foundation of project success. Undisturbed soils rich in humus and nutrients provide the conditions favorable for native plant growth, eliminating the need for fertilizers, helping them out-compete weeds, stabilize soil banks thus preventing erosion (Forman, 2003.) Reducing the amount of ROW to be graded eliminates some of the cost of restoration. Complete elimination of weeds and weed seed before revegetation is essential to control of noxious weeds (FHWA, 2004.)

The deep, fibrous root systems of established stands of native grasses provide excellent long term erosion control and soil stabilization. The depth of the root system enables the native plants to access the water table where shallow-rooted introduced grasses cannot. This allows native grasses to grow on poorer soils and resist drought (TxDOT, 2006.)

TxDOT advocates the stockpiling of topsoil from the construction site. The topsoil contains wildflower, native and introduced grass seeds along with sprigs of vegetation from previous seasons before the soils were disturbed. The reintroduction of this topsoil in the ROW after construction completion will jumpstart the restoration process, though not guarantee complete vegetation establishment without some additional plantings (TxDOT, 2006.)

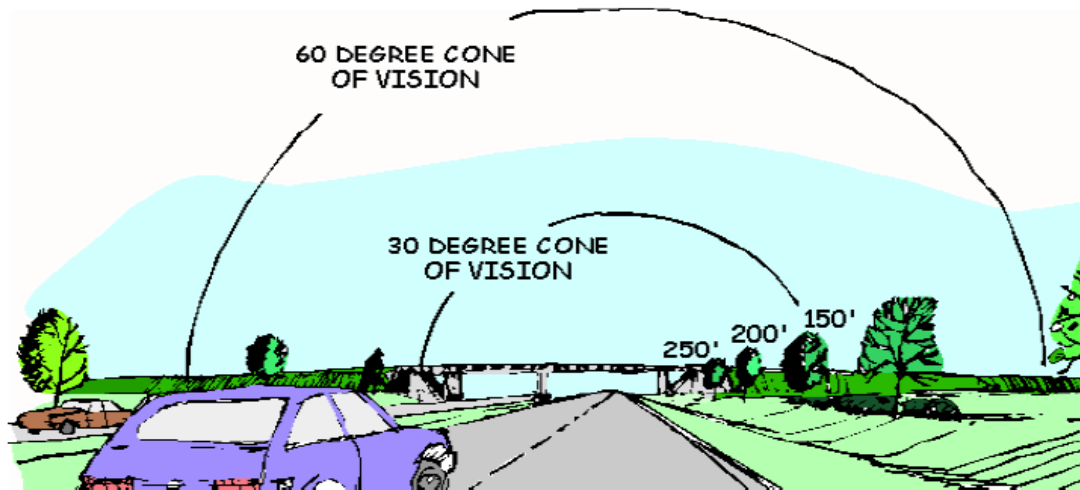
### **Seven. Planting design**

Planting Design will aid in the success of the planting and its acceptance by the traveling public. Adjacent properties, historic sites, and enhancement of local character are all important considerations (Schutt, 2001.)

TxDOT considers the scale of the highway landscape as the most critical aesthetic design consideration. A mile of urban freeway, or one minute of travel time, is approximately 36 acres of right-of-way. However, that one mile may have a view shed of several square miles depending on topography. A typical freeway interchange occupies between 30 and 100 acres (TxDOT, 2001.)

TxDot has developed an approach taking horizon lines, cones of vision, station point, and vanishing points to develop a Law of Perspective related to highway design. With the driver as the station point, traveling at highway speed reduces the cone of vision to 30 degrees, or about 20 ft. on either side of the roadway. The roadside elements perceived by the driver are between 120' – 150' down the highway (Figure 3.) Additionally, objects that have the greatest impact on the driver's perception are those that break the driver's horizon line (defined as the driver's eye level while seated in the

vehicle, generally about 44 – 48 inches). Design considerations are generally limited to areas where they achieve the greatest visual impact. This usually implies vertical elements such as, embankments, cut slopes, walls, and trees will have the most significant impact of the driver's field of vision (TxDOT, 2001.)



**Figure 3. Driver cone of vision on highway (TxDOT, 2001)**

An important element in the design process is to, “include a landscape architect in the design development process to improve the design, environmental and visual quality of the roadsides, and chances of planting success” (AASHTO, 2004.) Knowledge of plants, their characteristics and proper placement within a design are attributes of a proper design. Landscape architects assist with the visual integration of highways and other transportation modes into the fabric of a landscape in a way that blends with or compliments that setting (TxDOT, 2001.) Landscape architects within the TxDOT have 5 primary responsibilities:

1. Safety of the traveling public;
2. Stewardship of land, air, water, scenic, cultural, and historic resources;

3. Mitigation of adverse environmental and cultural resource impacts;
4. Integration of the transportation network into the adjacent landscape;
5. Enhancement of the aesthetic quality of the transportation network (TxDOT, 2001.)

Design criteria when dealing with native plant material would include:

1. Site selection and inventory; Analysis of site conditions to match species with environmental conditions including, soil type, available moisture, slope aspect and angle. Is the site a woodland edge, wetland, grassland? Adjoining properties, their vegetation and function will have an impact on the project (FHWA, 2004.) Native plant material has different functions and needs than ornamental plants. Appropriate use of each is important (Schutt, 1999.)
2. Concept; Finding local remnants of native forbs and grasses are valuable resources as a design model and for seed gathering.
3. Mapping; Used as an inventory of what exists on the ROW; also, mapping statewide communities of native plant material as a resource for plant models and seed. TxDOT lists eleven natural vegetation regions in Texas (Figure 4.) Each region is provided lists of appropriate native seed to be distributed, the percent of each seed for mix, and rate per acre (TxDOT, 2006.)





**Figure 4. Natural vegetation regions of Texas (TxDOT, 2006.)**

4. Preservation; Preservation of existing plant communities. Disturbance of the site as little as possible after controlling invasive plants.
5. Information sharing; An important criterion between state DOT's and local groups with knowledge and interest in the project.
6. Timing; Planting seed at the appropriate time is a very important criterion and should be decided specifically for the site location (Lore, 2000.)

7. Diversity; Diversity in plant material is crucial to creating a self-sustaining habitat. Most native plants are not suited to surviving on their own. Plant communities are groups of plant species that have evolved together. Clusters of plants provide protection from weather and climate extremes for the group as a whole (Schutt, 1999.)

### **Eight. Mowing**

Mowing is an essential part of IRVM. Timing and distance from the shoulder of the road have helped to decrease the amount of mowing necessary to the ROW. Mowing weed infestations before they seed can help eradicate unwanted plant material. TxDOT requires pressure-washing of equipment before and after mowing areas of noxious weed infestation to help reduce the spread of invasive plant material. Mowing only the clear zone, instead of the entire ROW reduces the amount of manpower and equipment use, as well as, promoting diverse healthy plant communities (FHWA, 2004.) Most herbaceous and woody plant material grows from the tips of the plants, whereas grasses grow from the crown at the soil level. Mowing at a higher level, with longer time intervals between mowing promotes native plant stands (Forman, 2003.) TxDOT mows a 15' strip at the shoulder of the road whenever possible, clearly marks non-mow areas, raises the mow height to preserve native material and animal habitat, schedules mows according to seed maturity and mechanically trims areas outside the reach of mowers (TxDOT, 2006) (Figure 5.) Since 1929, TxDOT has delayed mowing until wildflowers have set mature seed and expanded the range of wildflower species (TxDOT, 2006.)



**Figure 5. Strip mowing (TxDOT, 2006.)**

### **Nine. Plant material**

Plant material, both native and non-native, has value in the landscape. As stated before, through legislation the mandates for plant use within Federal and State highway projects expanded to include non-invasive, non-native plant material. Lists of invasive non-native species are available, but lists of non-invasive, non-native species are harder to come by. Sterile cultivars and hybrids are among the safest. Use of this plant material in rural areas is potentially more problematic, especially around nature preserves, parks, and water sources. Use within urban settings where there are less areas of natural vegetation is often more appropriate (Randall, 2001.)

Establishment of native grasses and forbs requires preparation of a firm, highly organic seed bed, with the seed lightly covered with soil. This process allows for initial plant development without the use of fertilizers (Lore, 2003.) Plant diversity is important to continued growth and success. Cover or nurse crops can provide a quick short-term vegetation cover while permanent native species are establishing. Mulching

or temporary erosion control will keep out wind-blown seed from unwanted plant material, as well as, control moisture and temperature fluctuations. Irrigation is necessary for establishment only, and fertilization is not required with proper soil treatment (AASHTO, 2004.) Water-harvesting by micro-terracing the soil to create shallow catchment or detention reservoirs aids long-term development of the plant communities, while reducing the amount of irrigation (Schutt, 2000.)

TxDOT states the plant selection for the ROW is based on their anticipated maintenance needs and species adaptability to the roadside environment. Of critical importance is driver safety. While some native plants are suitable for the roadside, the environmental extremes of heat and cold due to the absence of tall grasses present in most native communities limits the available plant palette. Careful planning is critical for establishment programs (TxDOT, 2001.)

TxDOT cites the benefits of both wildflower and natives grasses mixed for specific, localized areas as providing potential benefits including:

1. Developing over 800,000 acres of roadside wildlife habitat;
2. Reducing erosion losses of topsoil;
3. Reduced maintenance costs;
4. Improved aesthetic beauty;
5. Blending highway ROW into adjacent landscape character;
6. Future viability;
7. Excellent wildlife habitat (food and cover);
8. Adaptation to Texas soils and climate;

9. Resistance to agriculture chemical runoffs;
10. Resistance to invasions of noxious weeds;
11. Preserving part of natural heritage (TxDOT, 2006.)

Native grasses are slow to establish and may appear scattered and spindly on the surface in the first year. Root development more than vegetative growth is common in the first year. A three year minimum is required for reaching maturity. After reaching maturity, few weeds can compete for essential nutrients and water in the soil (TxDOT, 2006.)

#### **Ten. Herbicide and bio-control**

Herbicide and bio-control continue to play an important role in IRVM. No longer is the practice of wide-spread spraying used in weed control. Spot spraying, development of native plant communities, and bio-control methods are now the standard. Bio-controls, such as, beneficial insects and nematodes are a relatively inexpensive and safe alternative to control invasive species (FHWA, 2004.)

TxDOT controls unwanted vegetation through chemical and physical methods. The physical methods include: hand-pulling, hoeing, plowing, trimming and mowing. Species, location, soil type, wind, humidity, temperature, and timing are all variables used to determine the proper herbicide and when to apply it.

#### **Eleven. Prescribed burn**

Prescribed burn is a carefully planned and controlled fire conducted to manage natural areas such as prairie, oak savanna, wetlands and oak woodlands. Prairie plants grow more vigorously when built-up plant materials and shade are removed. Added

benefits are the control of weeds and woody invaders, thatch removal, nutrient recycling, and warming the soil for warm-season plant initiation (AASHTO, 2004.)

### **Twelve. Partnerships and information sharing**

Partnerships and information sharing promotes goodwill with communities, allows citizen groups to feel involved with projects within their community, adds revenue and free labor from these same groups, and expands the knowledge to other groups. Internally within the DOT, review of planning decisions allows all departments to provide input and improve the overall project (TxDOT, 2001; FHWA, 2004; AASHTO, 2004.)

### **Emerging Trends**

Emerging trends of roadside design point toward more use of native material in the ROW of highways and tollways. The increasing importance of environmental issues as dictated through legislation, but also public awareness assures the extended use of native plant material. The public approval and acceptance of the design plan of NTTA for increasing the driving experience by providing a scenic landscape carefully planned for optimum exposure at predetermined focus areas while educating the citizenry on new uses for native material is one part of these emerging trends. That there were added benefits environmentally, introduces the new concepts of variegated roadside and cognitive sensitive design that the researcher would like to introduce in this study as the future of native material in the roadside.

## **Variegated Roadside**

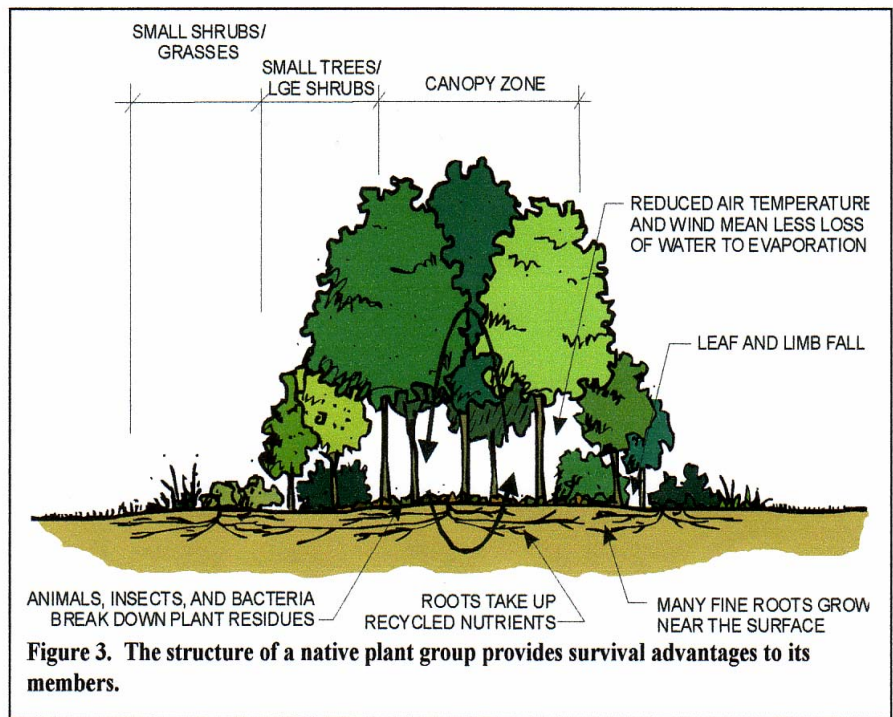
Richard Forman refers to the concept of variegated roadsides as “transforming roadsides into variegated strips of concentrated multiple uses that not only serve ecological and pragmatic goals but also provide visual enrichment” (Forman, 2003.) Roadsides should compliment and enhance the adjacent land use while performing some aesthetic or environmental function. Rural roadsides will provide safe areas for traffic, but can provide wildlife habitats, or wetland restoration areas, as well. Large shrub masses can be used as barriers to trees for collision control instead of metal barriers. Urban areas may use plant material in a more formal setting but added benefits may be air quality or water quality.

The pragmatic approach viewed by DOT professionals is to match the growth characteristics of native plants to the specific functional needs of the roadway and then establish management programs that nurture these capabilities. If silt and water filtration for water quality is the goal then material with high stem and leaf surface areas would be used. If erosion control is needed, plants with deep, fibrous root systems would be planted and properly maintained (Schutt, 1999.)

### **Variegated Roadside Case Study**

As was stated before, urban highway interchanges in Texas range in size from 30 to 100 acres of land. In 1993, a team of landscape architects, engineers, TxDOT managers, and University researchers developed a replanting program for a 95 acre interchange at Loop 1 and Highway 183 in Austin, Texas. Sixty species of plant material ranging from grasses and forbs to shrubs and canopy trees were introduced in a

tightly planted setting shaped to include micro-catchment areas to serve as short-term reservoirs during rain events in the summer and a steady reserve of water in wetter months. Tightly clustered groupings provide protection from weather and climate extremes for the group as a whole (Figure 6.) Temporary irrigation was established using both impact heads on risers and drip tubing on 2-3' spacing to be used until the establishment of the plant material, usually 3-5 years. Native grass and wildflower areas closer to the roadway were seeded. During the first year noxious weed species were removed manually. Plants that died were not replaced and left to decay unless highly visible.



**Figure 6. Structure of a native plant group (Schutt, 2000.)**

Within two years the plants had begun to close in and create the beginnings of a micro-habitat for birds and small mammals. Succession has continued through



competition, invasion, and climate changes. Air and water quality have improved for a natural area adjacent to the highway. Today, the area looks as if no disturbance had ever occurred and the interchange had been gently placed among the native landscape. “The site now contains a diversity of vegetation that can support some of the bird life that would be missing in a park like planting” (Schutt, 2001) (Figure 7.)



**Figure 7. Loop 1 and Highway 183 Interchange, Austin, Texas (Schutt, 2001.)**

### **Context Sensitive Design**

After World War II the construction of the interstate highway system was in full expansion. During this period, the design focus was guided by considerations of cost effectiveness, safety, and mobility. This approach resulted in conflicts with community, environmental and other special interests. Context sensitive design seeks to avoid such conflicts while forming partnerships with communities to meet the needs of transportation and user expectations. To ensure that the character of the transportation facility is appropriate to the surrounding landscape. Identifying visual elements of the

physical landscape and cultural influences imposed on the site by tradition or special interests (TxDOT, 2001.)

The importance of this new concept for native plant material has several criteria. Road alignment has changed from the “straight line is the shortest distance” theory. Horizontal road alignment, or curvilinear alignment, to avoid important landscape remnants and culturally historic elements are added to the equation of road design. Vertical alignment adjustments minimize the need of cut and fill during road construction saving additional landscape remnants, reducing environmental consequences, and in the end reducing costs of roadway construction and conflicts with special interests and communities.

### **Context Sensitive Design Case Study**

A good example of Context Sensitive Design is the Paris-Lexington Road, or Paris Pike, of Kentucky. The pike was a 12.5 mile two-lane country road with a narrow corridor meandering through the bluegrass horse country of Kentucky. Completed in 2002, the Pike was expanded to a 4 lane divided roadway, two 12’ asphalt lanes each direction, with a fluctuating median strip. There is a two foot rumble strip and eight foot grass shoulders. Vertical grade is a maximum 4 percent. The corridor ROW is between 160 to 500 feet in width depending on the fluctuating median. Some of the criteria that came from that process are discussed here.

1. The lead role of the landscape architect through the entire process from design, through community involvement strategies, road alignment, and construction supervision.

2. Use of a diverse group of specialists including a conflict resolution specialist, historic preservation firm, an aerial photographer, geotechnical engineers, surveyors, arborists, and a botanist.
3. Contours of the existing topography and hydrology were made, detailed mapping of existing plant forms and historic elements, extensive field reconnaissance, aerial photography, optimum view sheds determined, and environmental characteristics analyzed.
4. Vertical and horizontal alignment to determine how the road will settle into the surrounding topography, how it will affect vegetation and stream crossings, and which views will be seen. Hills were approached at oblique angles, rather than head on, to allow the road to bend and respond to the surrounding topography. Curvilinear alignment keeps the driver engaged in the driving experience and allows the road to avoid sensitive land forms or vegetation.
5. The corridor was divided into 18 units of varying characteristics related to views, topography, hydrology, tree canopy, and cultural features. Up to 8 alignment alternatives were developed for each unit, positioning the road for best view, minimum cut and fill, and optimum preservation of existing plant forms and historic elements, while preserving AASHTO standards of road construction and safety.
6. Allowing a flexible median, between 30 – 300', additional stands of native plant life were preserved and vertical elevations could be adjusted

to blend better with the terrain, resulting in less cut and fill, and the resulting environmental damage.

7. Clear view shoulders were reduced from 12' of asphalt to 8' of grass and 2' of scored rumble strip. The grass was underlaid with geotextile fabric, compacted clay, and course gravel for stability.
8. Use of timber-faced guardrails were placed in front of tree stands to avoid clearing important native species close to the road, while providing safety within the roadway.
9. Installed native plant material was considered for ecological, as well as, aesthetic characteristics. Every tree removed was replaced with 1-3 new trees identified as characteristic of the region, and integral to the landscape. Seedlings were chosen from no further than 40 miles from the site.
10. As part of the plan before construction, and in conjunction with the local landowners and communities, the adjacent land use was determined to prevent unwanted development (Myers, 2003.)

The project was mired in political difficulties for many years prolonging the design phase, but the final outcome proved to be a model for context sensitive design (See Figure 8.) The Paris Pike is the “model of the well-designed, modern road circa 2002. It is comprehensive in approach, considering topography, drainage, ecology, and driving experience” (Myers, 2003.) It was a model as well for the free exchange of information and bipartisan cooperation of the many consulting entities.



**Figure 8. Paris – Pike Road (Kentucky Transportation Cabinet, 2000)**

### **Texas Highway 190**

The Texas Highway 190 Tollway passes through 7 cities along its 29.2 mile course. It uses plant material native or adapted to the North Texas area, as well as, native and introduced turf to “enhance and upgrade the quality of turf and a comprehensive landscaping project that will add aesthetic and safety features to the road” (NTTA, 2004.) There are 330 acres of seeded Bermuda and Buffalo mix and 125 acres in 34 focus areas of enhanced landscaping, containing 92 acres of irrigated planting beds surrounded by 41,000 lineal feet of mow curb. Those beds include more than 2,600 trees, 300,000 shrubs, ornamental grasses, and plants native or adapted to the

North Texas area. At a cost of \$10.4 million dollars for the landscaping plant material and \$2.2 million for the turf, it is the “largest single installation of native plant material in the State of Texas” (NTTA, 2004) (Figure 9.)



**Figure 9. Typical design concept of bands of planting material (Scott, 2006.)**

In 2003, HNTB, an engineering, architectural, and planning firm, was hired to create the NTTA System-Wide Design Guidelines Manual for all enhancements of the roadway, including plant material. Information within this manual includes planting design guidelines and plant material selection (NTTA, 2003.)

A four-step process was used to determine key areas that would serve as important “interfaces” with the surrounding communities (NTTA, 2003.)

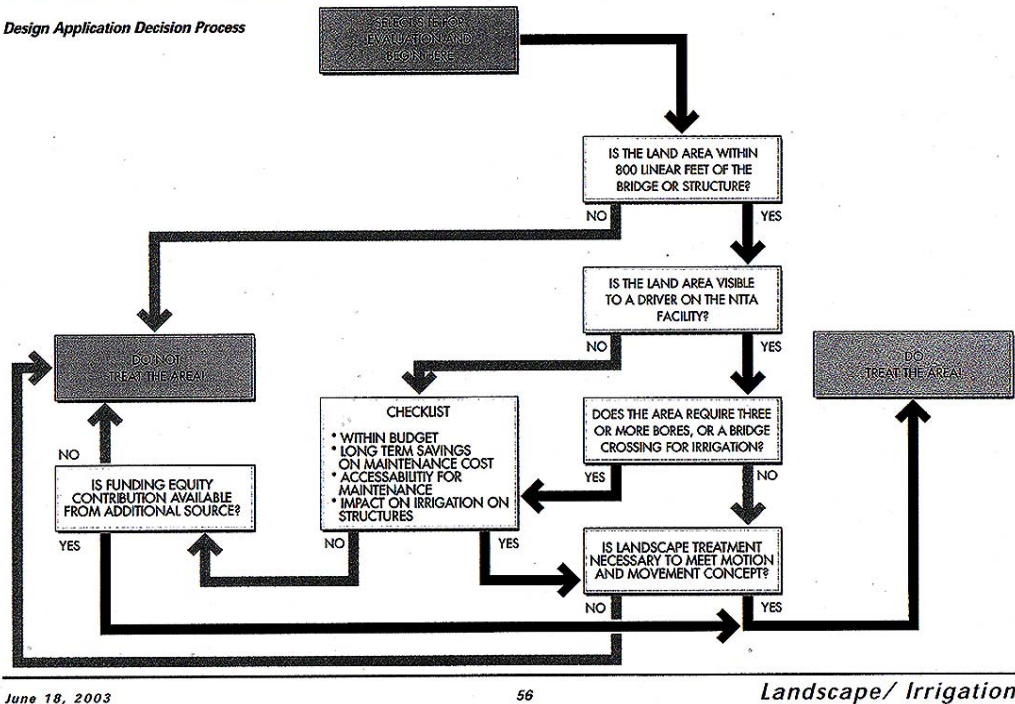
Step 1. Selecting focus areas. Important interfaces or “focus areas” were selected from key interchanges, main lane plazas, underpasses and overpasses.

Step 2. Site/View Shed Analysis. After the focus areas were selected, comprehensive site analysis was conducted. View shed analysis was undertaken from the perspective of the patrons driving the tollway rather than the views looking in to the toll system roadway from the bordering communities (NTTA, 2003.) This perspective was referred to as “view from”. In conjunction with view shed analysis, soil fertility and rock stratum, water and power source location, and accessibility were determining factors for design consideration.

Step 3. Categorize the Focus Area. Focus areas were categorized into four types based on size, shape, topography, and view shed analysis. Though areas were chosen within each category, design criteria for each area would differ and budget and site analysis would eliminate some of the areas.

Step 4. Design Application within the Focus Area. Based upon the findings above, design application within designated focus areas would begin. While many factors in the site analysis affected the design, the views controlled by the design were critical (NTTA, 2003.) Areas outside the “view from” were considered opportunities for the adjacent communities to participate in the landscape treatment of the focus area. (Figure 10) shows a flow chart of the application decision process (NTTA, 2003.)

Design Application Decision Process



June 18, 2003

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Landscape/ Irrigation

Figure 10. Design application decision process (NTTA, 2003.)

### Conclusion

Governmental agencies, both federal and state, have provided a large body of data supporting the use of native plant material in roadside highway use. There are concerns as to the proper design process of these criterion to the roadway so as to best ensure the goals of the states DOT's and the goals of the public. A compilation of best practices as discussed in relevant literature has been outlined. These best practices as determined from review of existing literature will be the basis for comparison with the Texas Highway 190 Toll Road.



## **CHAPTER 3**

### **METHODOLOGY**

#### **Introduction**

The design criteria used in the plant selection for Texas Highway 190 offer some understanding of why native and adapted plant materials are becoming more widely used along Texas highways. New criteria are also revealed for design application of this plant material in the roadside corridor. This research on the plant selection criteria and design process utilized a qualitative approach as one uniquely suited to uncovering the unexpected and exploring new avenues (Marshall and Rossman, 1995.) Broad views of practices were discussed in this research. The detailed exactitude of implementation of these best practices is well documented within the literature.

#### **Research Design**

A structured, standardized protocol (Patton, 1987) of open-ended questions was used to collect interview data from respondents. The questions and the order in which they were asked were designed to establish a conversational tone; thus, questions were open-ended, permitting the interviewer to probe for more additional information as opportunities for follow-up and clarification presented (Marshall and Rossman, 1995.) Each question was intended to provide a deeper understanding of the criteria for plant selection and use along the roadside corridor of Texas Highway 190.

## **Key Stakeholders**

Key stakeholders are individuals with first-hand knowledge, participation, and ownership in the decision making process. A group of these individuals who played key roles in establishing design criteria and plant selection for Texas Highway 190 were identified for this research.

Each was chosen for their participation and contribution from different disciplines within the decision-making process. Individuals were selected to give a broader perspective of the project including those involved in the planning phase, consultation, project management, installation, TxDOT, NTTA, etc. The names were gathered in two ways: first from individuals within the research branch of Texas Transportation Institute that the researcher was interviewing for background information during the literature review and secondly, during initial phone and email conversations with key stakeholders. The researcher would ask for names of other key stakeholders that could provide information from a different perspective. This technique led to additional names to contact for interviews.

Respondents were assured through the Consent Form of anonymity as a condition of their acceptance to participate in the interview process, based on the assumption that anonymity would allow interviewees to be more open and objective with their answers. All interviews were tape recorded.

Twelve key stakeholders were asked to participate in this research, and six consented to being interviewed. A brief description of the roles held by each respondent in the Texas Highway 190 project follows.

1. Respondent One held a project role analogous to that of owner/client. This individual was an employee by North Texas Tollway (NTTA).
2. Respondent Two was involved with the planting design of the project.
3. Respondent Three was involved with the project management of the project.
4. Respondent Four worked for the landscape company awarded the contract for installation of the plant material along the project roadway.
5. Respondent Five worked for the planning department of one of the cities the Texas Highway 190 serves.
6. Respondent Six was employed by Texas Department of Transportation (Tx DOT) and acted as a consultant for the project.

The goal of the interview process was to gain knowledge and insight into the design and implementation of the plantings along the roadside corridor of Texas Highway 190. Data triangulation involves the use of a variety of data sources and is used to “guard against the accusation that...findings are simply an artifact of a single method, a single data source, or a single investigator’s bias” (Henderson, 1991.) Triangulation of data gathering and interpretation was used to gain an understanding of the process involved in the design criteria of plant selection and implementation of plant material for the project. This approach to understanding provided important information and perspective from three previously unrelated sources. “By drawing on other types and sources of data, observers also gain a deeper and clearer understanding of the setting” (Taylor, 1984.)

The first part of the triangulation was the literature review featuring criteria gathered from practices developed through the various states DOT's and research facilities within the Federal Highway Administration (FHWA.) As these DOT's have developed various processes through trial and error, the information has been studied and synthesized by the FHWA into best practices documentation for use as criteria to determine the most appropriate use and application of native plant material. This FHWA research was apart and unrelated to the Texas Highway 190 Project. In conversations with respondents associated with TxDOT and Texas Transportation Institute (TTI), minimal, if any consultation was provided for the selection process.

The respondents or key stakeholders within the project comprised the second part of the triangulation, providing specific information concerning the selection and design process and the amount of information used from the scientific literature as illustrated in the literature review of this research. The eighteen (18) interview questions can be found in Appendix B.

The interviews were initially arranged by telephone conversations with the key stakeholders (Appendix A.) The interviews were conducted at each respondent's office during normal business hours. The interviews were recorded digitally and transcribed by a professional transcriber. The transcribed interviews were then read and compared for commonalities of terms, information, and facts to give the researcher a basis for identifying criteria used in the design process for plant selection in the roadside corridor of Texas Highway 190. Due to the length of the interviews, selected interview transcriptions can be found in Appendix D. The full interview transcriptions can be

found at the University of Texas at Arlington in the office of the School of Landscape Architecture.

The third part of the triangulation was obtained through observation by the researcher. Driving the Texas Highway 190 provided a view shared with the patrons of the Texas Highway 190, as well as, gaining a perspective of the “driving experience” (Interview, 2006.) Walking in the planted areas provided close inspection of plant health, variety identification, and overall appearance of the site. The researcher is a graduate student of landscape architecture. Observations were made and pictures taken before the interview process, but after the literature review.

The literature review set a base of core knowledge about the subject of this research, determined by recognized experts in the industry. The open-ended interviews with key stakeholders of the project enabled informants to address the process they used to reach their design and implementation decisions. The observations and literature review enabled the researcher to compare the two perspectives for commonalities and differences as seen in the final project.

Through ethnographic interpretation of the interviews a systematic understanding of the design criteria process was obtained from the perspective of those involved (Spradley, 1979.) Through document analysis as a form of content analysis, or hermeneutics, to obtain historical information from literature review (Henderson, 1991), best practices as described in literature were obtained by the researcher. Site analysis was based on information obtained from the literature review and consisted of visual

observations by the researcher walking through 8 of the focus areas, and visual observation from the road of an additional 14 focus areas.

### **Research Questions**

The research questions addressed by the data collection process were:

1. How did the design process compare with previous research as uncovered in the literature review?
2. What outside influences were involved in the design decision process?
3. How did the final design evolve?
4. What are the implications this design criteria process has for future projects of similar intent?

### **Conclusion**

Design criteria for the selection and use of native and adapted plant material for the Texas Highway 190 tollway were revealed using the qualitative method of research. Open-ended interviews, historical literature review, and researcher observations were used in triangulation to compare commonalities and differences in these design criteria between the best practices as learned in the literature review and criteria for selection and use of native and adapted plant material as determined by interviews with key stakeholders in the design and implementation process for Texas Highway 190.

## **CHAPTER 4**

### **INTERVIEW RESULTS**

#### **Introduction**

As previously stated, the purpose of open-ended interview questions is to allow the respondent the opportunity to elaborate on topics of interest, as well as, open new avenues of discussion. A deeper understanding of each topic of discussion is encouraged. This chapter is organized by the eighteen interview questions asked the respondents in the order they were presented.

The decision to enhance the Texas Highway 190 roadside beyond the extent of typical highway specifications of introduced Bermuda grass to control erosion grew from the lobbying efforts of the partnering cities the tollway connects. Once the decision to establish an enhanced roadway was made by the Board of NTTA, the firm of HNTB was engaged to formulate system-wide guidelines to create continuity throughout the system.

Feasibility studies were done from existing systems in other states, most notably, the Green Ribbon Authority in Houston, Texas. The design team at HNTB found an opportunity to incorporate native plant material in the planting design. During the interviews the informants shared information on the design process for plant selection, criteria used for plant selection, difficulties and challenges that were met, lessons learned, and their thoughts on the success of the project.

It was found through the interviews that environmental criteria were not considered to be as important as aesthetic consideration. Aesthetics and seasonal interest were by far the main determinants for plant selection. The high aesthetic expectations posed by the board of NTTA have challenged some of the criteria for plant selection on Texas Highway 190.

**Q 1. How Did the NTTA Initiate the Planting Design Concept for Texas Highway 190?**

The NTTA was prepared to treat the roadside of Texas Highway 190 as a typical highway roadside until one of the cities the tollway would traverse lobbied for increased roadside enhancement. As one respondent noted, the original intent of the NTTA was to treat the roadside corridor of the new Texas Highway 190 Tollway as “highway roadside” with “no initial direction that NTTA was going to landscape the area” (Interview, 2006.) A traditional highway corridor is concerned with vegetation height, sight lines, soil erosion, and weed control as the major responsibility of the DOT’s (Schutt, 2001.) Typical application would be an introduced grass seeded on the graded, disturbed soil after construction.

Recognizing “one of our last areas for development”, one of the cities lobbied for “the opportunity for some highway enhancement, landscaping, and increased level of maintenance” (Interview, 2006) in a Partner Program much like the one they already shared with TxDOT for US 75, a major artery through the city.

As more than one respondent stated, the NTTA was reluctant to hand over design and maintenance of a portion of their roadway to one city. The NTTA “wasn’t interested in that happening because if there was just one little section that was



enhanced but it wasn't done the whole way...there would not be any continuity to the look on 190" (Interview, 2006.) Wanting to work in cooperation with the local communities, but faced with the possibility of having each of the 7 cities bordering Texas Highway 190 creating different, individual design and maintenance criteria for the segment of roadway within their city limits, the NTTA developed a plan of its own.

As was stated in Chapter 2, HNTB was hired in 2003 to create the NTTA System-Wide Design Guidelines Manual for all enhancements of the roadway, including plant material. Information within this manual includes planting design guidelines and plant material selection (NTTA, 2003.) As one respondent noted, "...system-wide guidelines were what developed the idea of landscaping the tollway. They may have determined that nice bridges were more important, and nothing to be spent on landscape" (Interview, 2006.) In addition TxDOT, the City of Richardson Planning and Development Department, and several private professionals acted as non-paid consultants providing valuable assistance as well.

## **Q 2. What Was the Plant Selection Process for the Roadside Areas of Texas Highway 190?**

Members of the Board of NTTA and a team from HNTB traveled to Florida, California, Arizona, and Houston, Texas on "feasibility studies" to discuss best practices and "lessons learned" from existing projects of similar nature (Interview, 2006.) Houston's Green Ribbon Project was especially influential because of the use of native plant material in mass, monoculture plantings and defined planting areas. One respondent noted, "...in Houston they saw these other areas with natives but were using them in a more formal setting" (Interview, 2006.)

As one respondent noted “the design team developed the criteria...to be prairie-like” (Interview, 2006.) As the design process progressed, additional outings were made to local growers of native grasses and The Texas Agricultural Extension Service trial gardens to see native plant material indigenous to North Texas.

### **Use of guidelines**

The budget would not allow intensive use of ornamental landscape plantings throughout the NTTA system. “Our criteria were you have one-half million dollars per mile to work with for enhancements...for landscape and irrigation” (Interview, 2006.) The question became, “how do you determine where you’re going to spend your money? A “little bit along the whole way” or “spend it all in a couple of areas” were the initial choices (Interview, 2006.) Numerous site visits were required to establish the most strategic or key locations to maximize the impact within the budget. As one respondent noted, “we drove up and down the highway from all directions and from cross-streets...looking at grade changes, curves...to get the biggest bang for the buck” (Interview, 2006). Areas that were, “highly visible to the driver” were determined to be the greatest value by the Board of NTTA.

As described in Chapter Two, a four-step process developed in the System-Wide Design Guidelines was used to determine key areas, or focus areas, that would serve as important “interfaces” with the surrounding communities (NTTA, 2003.)

### **Design criteria**

The NTTA wanted, “this beautiful highway, different from other toll roads, with no wildflowers” to “look designed from its installation all the way through, not in 5 or

10 years, from day one, all the way down to the spacing of individual pots” (Interview, 2006.)

The NTTA specifically rejected the planting of wildflowers, as seen in TxDOT applications along the highway corridors of Texas. It is a common occurrence along Texas highways for individuals to park along the clear zones, leave their vehicles, and take their children in to the wildflower covered slopes for picture taking (Interview, 2006.)

“The tollway has to make a lot of money to support itself, to build new systems and the way they make money is by putting a large amount of cars on there and moving them very quickly. Adding wildflowers would only encourage people to stop and park on the side of the road and it becomes a safety issue and slows cars down”  
(Interview, 2006.)

In addition, the NTTA felt the use of wildflowers left an “unkempt” or weedy appearance, and not in keeping with the aesthetics of the tollway (Interview, 2006.)

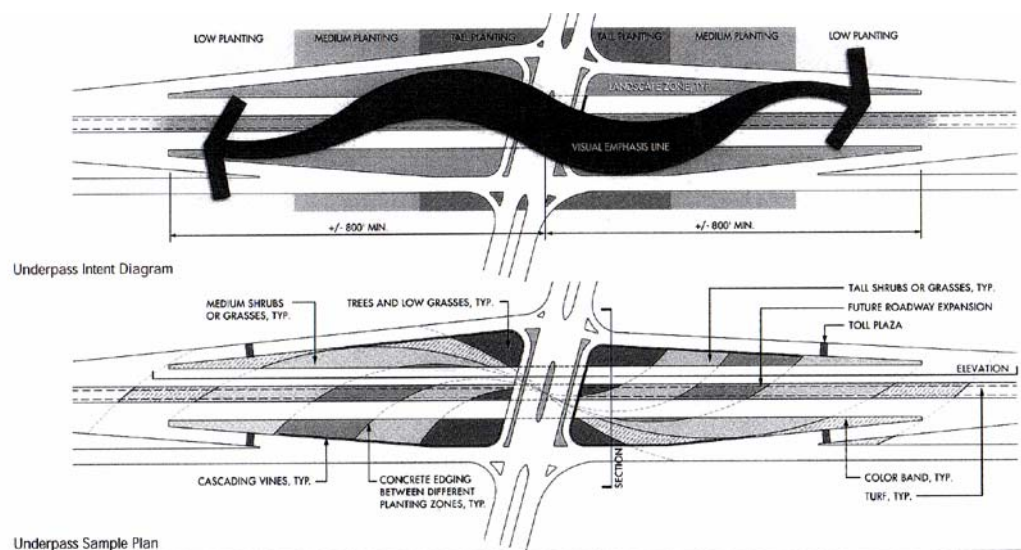
### **Driving experience**

All of the respondents noted that “driving experience” was an important criterion. Since the driver “had to pay extra to go on the roads that they (NTTA) owed the user some sort of experience to come out of it”. (Interview, 2006) The design “intent of the NTTA is to provide for a pleasant user experience throughout the system. Well designed landscapes are an integral foreground element that enhances the driver’s experience” (NTTA, 2003.)

### **Motion and movement**

The sense of motion and movement was an important criterion for plant placement and variety determination. Movement and motion were mentioned by all of

the respondents. Traffic in motion, plants in motion (i.e. native grasses), the planted beds placed with flowing curvilinear mow strips creating defined borders moving through turf areas (Figure 11.) Additionally, the movement of the beds from one side of the highway, across the median and continuing along the opposite side of the roadway would increase the experience of movement like cars passing and changing lanes. “As you are coming around a curve, maybe you see a strip here peripherally on the right and we want to pick up that plant as it crosses the median to the other side. As you’re going at high speed, you pick up a color over here and then you see it again around here” (Interview, 2006.) The design intent was to have the driver’s eye being led back and forth along the roadway to different focal areas by the movement of the planting beds.



**Figure 11. Design schematic showing motion and movement (NTTA, 2003.)**

The design team also found that the angle of the rows of plants could influence the sense of flow. Material planted “perpendicular to the direction of travel gives you an unintentional impediment to travel. You feel like you ought to be slowing down or

stopping...you feel like you are going faster than you are because you are clipping by perpendicular objects” (Interview, 2006.) Parallel planting gives no sense of “change” and “you lose the sense of movement through consistency” (Interview, 2006.) Rows placed diagonally toward the oncoming traffic keeps the eye of the driver looking slightly forward, moves with the flow of traffic, and gives depth to the planting beds (Figure 12.)

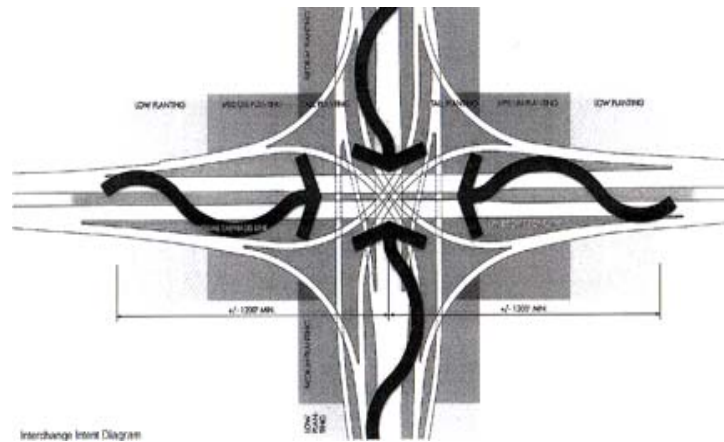
“The concept of movement and motion was to weave this plant material in a linear fashion back and forth across the travel lanes in a way similar to the way cars pass and change lanes and move back and forth and so you’ll see the plant material move from one side of the road to the median to the other side, and it was our intent to have these planting beds reinforce the idea of movement and motion with the traffic”  
(Interview, 2006.)



**Figure 12. Planting material moving across Texas Highway 190 (Scott, Fall/2006.)**

## View sheds

The designers calculated that a vehicle travels 800 feet in 7 seconds at highway speed. The optimum size of the planting beds including both sides of the roadway and the median would extend 800 feet either side of the focus area, or 1600 feet total (Figure 13.) This would be the design area using the criteria mentioned above for determining usable focus areas. The area would only include view areas within the ROW “highly visible to the driver” (Interview, 2006.) The planting material would be placed shortest to tallest as the planting beds came closer to the center of the focus area.



**Figure 13. View shed (NTTA, 2003.)**

As one respondent noted from his work with city planning, there is always the concern of making beds too small to be noticed by the drivers and passengers in vehicles of passing traffic. They had used as a minimum, “one foot of bed length for each mile per hour within a given roadway. A 45 mph zone would require a minimum of 45 lineal feet of bed length”. The faster the speed limit of the particular roadway, the

more “materials principals analysis” is required, as determined by, “What scale, texture, color, size, spacing, etc, are needed to make an impact on the driver” (Interview, 2006.)

### **Plant material**

All of the respondents were in agreement with the criteria for plant selection. As one respondent noted, “it had to be prairie-like, very drought tolerant, soil tolerant, look good, and have seasonal interest” (Interview, 2006.) Another reflected that it was done as a “collective process, with each design team member bringing in a list of favorite plants”. As specific site conditions were addressed, they would begin to “weed out” plant material (Interview, 2006.) One comment was, “they wanted big expanses of textures and colors, while minimizing as much maintenance as possible” (Interview, 2006.) “They (NTTA) wanted the scale of these beautiful masses of wildflowers along the roadside, but without using them” (Interview, 2006) (Figure 14.)

One respondent summed it up with, “...one was aesthetics. They had to look good. Two, they had to kind of reinforce a prairie-like feel. Three, they had to be very, very drought tolerant. And four, they had to be soil tolerant. They had to be able to deal with bad soils or mildly altered soils and that’s kind of the criteria we went by. Oh, and be relatively maintenance friendly” (Interview, 2006.)



**Figure 14. Mass of *Salvia greggii* along Texas Highway 190 (Scott, Spring/2006.)**

One respondent said that even though the plant material being suggested was either native or adapted, they were concerned with “reaction to irrigation” and “problems when planting 10,000 of the same plant material in any given area” (Interview, 2006.) One concern by one respondent was “when you are dealing with a partially native pallet, there are only so many suppliers and only so much material out there” (Interview, 2006.) Plant material would be specified in several sizes to accommodate the large quantities needed. One respondent added, “I did not get the feeling that the schedule of the project prohibited the grower from getting the material ready to go” (Interview, 2006.)

One respondent reiterated the “prairie concept...with a dabbling of trees,” and the criteria as maintainability, survivability, drought tolerance and adaptability”



(Interview, 2006) (Figure 15.) These lists were measured by the criteria mentioned for focus areas as stated above. The lists were narrowed down, and submitted to officials at the City of Richardson, as well as, individuals with experience and knowledge in the use of native plant material for suggestions and recommendations. No specific lists were recalled except to note that the original design intent specified almost exclusive use of grasses. Site visits to native grass nurseries, native habitats of species under consideration, and the Texas Agricultural Extension Service trial gardens were helpful in the plant selection.



**Figure 15. The stylized prairie design. (Scott, Fall/2006)**

The design was to be a garden setting rather than a natural habitat. The designers determined there were not enough native plant selections of sufficient aesthetic quality to complete the plant palette for the roadway. As one respondent noted,

“We couldn’t find enough native plants, at least in our mind, that had some of the aesthetic qualities that we wanted” (Interview, 2006.) The search widened to include proven adaptive plant material of aesthetic quality and seasonal interest. The chosen plants were taken through the same process of evaluation described above (Appendix C: List of Plant Material.)

Tree selection had three main criteria as listed by the respondent; “little or no irrigation needed once established, soil tolerance, aesthetics with seasonal interest” (Interview, 2006.) The use of tree material to replicate a native prairie environment would suggest small stands. Eastern Red Cedar (*Juniperus virginiana*), Burr Oak (*Quercus macrocarpa*), Big Tooth Maple (*Acer grandidentatum*), and Mesquite (*Prosopis glandulosa*) were first choices. TxDOT does not allow trees above 4” caliper to be within 30’ of the roadway for safety reasons. This restriction would place the tree stands of Burr Oak and Big Tooth Maple on sloped areas higher up the ROW. Many of the Eastern Red Cedars planted in the first stages of construction died due to lack of irrigation and the fragile nature of ball and burlap tree material instead of container grown material. Species such as Eastern Red Cedar required too much water and were not as soil tolerant as expected (Interview, 2006.)

### **Q 3. Why Were Native Plants Included In The Design?**

The commitment on the part of the NTTA to do a “large-scale aesthetic” treatment to their tollway, but to remain within budgetary constraints necessitated plant material with as “low maintenance requirements as possible” (Interview, 2006.)

Two reasons, one respondent said, “one, they’re sustainable. They don’t use a lot of water and they’re less prone to pests, so less maintenance” (Interview, 2006.)

“The Texas experience”, noted one respondent, “and I think for longevity and less maintenance. I think it was just the beauty of these plants aesthetically. How they wave in the wind, how it would give you this feeling of motion as you’re driving along the highway. This is a way to make that experience (of driving the tollway) more pleasant in a stressful situation” (Interview, 2006.)

In using native material, one respondent stated, “this is their home and once established, they will do well with little, if any supplemental watering” (Interview, 2006.) There was an additional desire from the City of Richardson to use native material “wherever possible”. Their “indigenous adaptability and choice of excellent performers for this area and this climate and so on...environmental conditions, as far as North Central Texas. Also, the micro-climate of the roadside is a lot different than an open pasture.”

#### **Q 4. What Criteria Were Used for Determining Native Plant Material?**

Most respondents responded to this question by discussing plant characteristics such as plant height, aesthetic quality, texture, seasonal interest as the criteria most used for plant selection. “Sideoats grama (*Boutelona curtipendula*) may provide great roadside erosion control, but it has almost no aesthetic value” (Interview, 2006.)

“The nursery industry and the agricultural extension agents were used to designate the plant material as natives”, said one respondent (Interview, 2006.)

As one respondent suggested, “Availability is a key thing, what’s available, what are the proven performers, what brings to the table the textures and colors the designer wants” (Interview, 2006.)

No respondent suggested that any specific scientific criteria were used to determine if a plant species was indigenous to the North Texas ecological region.

**Q 5. What Percentage of the Plant Palette Were Native Plants?**

Though no respondents were absolutely sure, two suggested between 65 – 70%. “I would probably say, the trees were native to Texas, as far as varieties, now the number of plants I’m not sure, but as far as the varieties I would say probably 70% of it is native” (Interview, 2006.)

**Q 6. Why Were Non-Native Plants Included in the Design?**

Large amounts of plant material non-native to the North Texas region were used in the design. When asked this question, one respondent said, “To expand the plant pallet” (Interview, 2006.) Another noted, “One is aesthetics. We couldn’t find enough native, at least in our minds that had some of the aesthetic qualities that we wanted....we felt we would intersperse some of these heavily adapted species to spice up the design and still not give up any of the drought tolerance or necessarily the disease tolerance as well” (Interview, 2006.)

The choice for four-season interest was also a concern, especially with the grasses. “Flame Grass (*Miscanthus sinensis* ‘*Purpurescens*’) turns kind of bronzy color this time of the year in the Fall and Winter...and people will know the different seasons through changes in the plant material. They wanted to have that sort of ongoing color variation and texture, color, etc. throughout the whole year. And then the grasses, when they’re in their dormancy, they’re beautiful” (Interview, 2006.)

**Q 7. What Literature or Scientific Study Was Done in Developing This Plant Selection?**

None of the respondents had any knowledge of literature recommendations for the use of native plant material.

“A lot of plant books on native plants are range books and not landscape books” (Interview, 2006.) The respondent went on to say the seed rates of application in the literature most often relate to prairie settings. The desired effect for the roadside is a more densely populated, landscaped environment. “It’s the scale of the area...you couldn’t afford to plant a pasture at that level, but if you want a full bed of it, you’re going to have to plant it full. But, for a long time there has not been much available information on the use of native plant material in a landscape setting” (Interview, 2006.)

As another respondent noted, “One of the native growers wanted to see more of a mix. He didn’t like the structure...but there is almost like a Dallas mentality of planting...we tend to do this banding of things: a lawn, a shrub, and a tree row. This whole systematic thing of foreground, middle ground, background, but done so rigidly... that’s something we’re comfortable with here. There was a whole exercise for NTTA of this branding exercise. This is a corporation and the landscape, the paint colors, signage, wall treatments...could be a brand identity for NTTA” (Interview, 2006.)

Driver expectations were a concern as well, though no driver preference research was done. Drivers on tollroads are customers, “and we did this to give the driver a better experience than he would normally get on your average, everyday freeway” (Interview, 2006.)

**Q 8. How Does the Choice of Planting Design Compare with Literature Recommendations on the Use of Native Plant Material?**

There was no literature review on the use of native plant material done before the design portion of the design. As one respondent noted, “I’ve never sat and compared it, so I can’t really tell you...this whole thing was done for aesthetics” (Interview, 2006.)

**Q 9. What Are the Perceived Benefits of the Planting Selection of Texas Highway 190?**

In the literature review, there were several benefits established from the use of native plant material. Lower water and maintenance needs were benefits seen by the informants. As one respondent noted, “The native plant material is going to require less supplemental watering than something that is introduced and not well-adapted to this area” (Interview, 2006.) As another respondent said, “...we’re not running mowers over the slopes” (Interview, 2006.)

“Well we have almost 100 acres of native and adaptive plants out there. We’d love to know how big an affect that has on the carbon monoxide levels...in scrubbing the carbon dioxide from the air and at producing oxygen” (Interview, 2006.) He went on to say “You can use low-water use native plant material and still have the kind of visual affect that you’re looking for”.

The aesthetic element was mentioned by all of the respondents, as one noted, “...it shows something different through all the seasons. It’s interesting to drive the tollway after a nice rainstorm and see the gray foliage highlighted with purple flowers on the ‘Silverado’ Sage (*Leucophyllum frutescens* ‘Silverado’.) Also, there is enough mass to the planting that the plant material reads very well” (Interview, 2006.)

One unexpected benefit was summed up as “public education...stepping outside the box of traditional, what I call, North Dallas landscaping” (Interview, 2006.) One respondent said it this way,” besides the obvious improvement of their day-to-day commute by having a beautiful environment to drive through... but if they see native materials, non-traditional materials, in a traditional way of planting...they may go home and put some native grasses in their backyard” (Interview, 2006.)

**Q 10. What Is the Perceived Success Rate of the Existing Native Plant Material Used in the Texas Highway 190 Project?**

There was no data to support any of the respondent’s answers, though the perception was a high percentage of success. One respondent felt it was in the 92-94% range.

Another said “high, very high. The only two problems that I’ve seen are just a couple pf varieties of grass seem to have struggled and I think Mexican Feather Grass (*Stipa tenuissima*) is one (also Little Bluestem Grass, *Schizachyrium scoparium*) and then the Upright Junipers (Eastern Red Cedar) have shown, from the initial planting, a real bad success rate and its gotten better” (Interview, 2006.)

Mexican Feather Grass is a non-native species. A discussion of native species and non-native species will be covered in Chapter 5. Another respondent mentioned the use of 4” pots planted in drip irrigation grids that were 18” OC as struggling because of lack of water to such a small root ball. He went on to mention three grasses that under-performed: Little Bluestem Grass (native), Mexican Feather Grass, and Flame Miscanthus (which is non-native) (Interview, 2006.)

Over-watering was thought to be the cause of the decline of the grasses mentioned above and under-watering for the cedars. The “learning curve” of getting the

irrigation system adjusted, especially in the beginning of the project led to under-performance of several species.

**Q 11. What Is the Perceived Success Rate of the Existing Non-Native Plant Material Used in the Texas Highway 190 Project?**

No data was available to support any responses, though the perception of the respondents was a higher percentage than the native plant material. One respondent said that he did not know the exact details, but thought it was about the same, “in fact, it’s probably easier to keep the non-natives alive because they’re more tolerant to irrigation. So, initially you probably had a little more success with the non-natives but I think long-term, that the natives will take care of themselves better” (Interview, 2006.)

As one respondent said the success rate may be higher for the non-natives, but “there are fewer of them” (Interview, 2006.) Two species that performed above expectations were the *Miscanthus* varieties of Adagio and Graziella (*Miscanthus sinensis* ‘Graziella’ and ‘Adagio’.) He went on to say, “I think it could be that the non-natives want a little bit more water and I think maybe that may be why they did better” (Interview, 2006) (Figure 16.)





**Figure 16. Red Yucca in foreground are slow to establish, while Flame Grass in background dies out (Scott, Fall/2006.)**

**Q 12. What Is the Time Frame For Satisfactory Cover of the Shrubs and Grasses in the Roadside of Texas Highway 190?**

Because of the expectations of the project, the normal coverage period of 2 years used by TxDOT was not an acceptable time frame. As one respondent said, “after probably a third of the growing season, if it’s not covering, then it’s being replaced...we want pretty instant (coverage)” (Interview, 2006.)

**Q 13. How Long, In Terms of Growing Seasons, Will an Intensive Maintenance Program Be Required For Each New Phase?**

The knowledge that native plant material requires a longer establishment period was discussed by the respondents. “We anticipate here we’d need three years. If we plant one gallon native grasses, within three years they would be full size and cover”, said one respondent. He went on to say, “...native plants don’t equal zero maintenance.

The fact that these are all in rigid beds, in masses, just by its nature means some routine maintenance” (Interview, 2006.)

The aesthetic expectations of this project brought one respondent to say, “Forever. They are never going to be able to relax on that planting. They’re going to have to sharpen up every season” (Interview, 2006.) Another respondent noted, “I think it will have to be maintained, including irrigation, as an ongoing cost of doing business...we can dramatically reduce the amount of irrigation, but I don’t think we can just abandon it” (Interview, 2006.)

#### **Q 14. What Are the Lessons Learned from the Plant Selection of the Texas Highway 190 for Future Projects?**

Respondents were reminded that “lessons learned” could be both positive and serendipitous discoveries, as well as, negative situations that would not warrant repetition. Examples of lessons learned are:

1. Doing more research was talked about by three of the respondents, “make sure you do good research” and “seek out other opinions from those in the research field” (Interview, 2006.)
2. “Experimenting in a smaller area with the proposed plant material, but having the same environmental conditions”, said another respondent (Interview, 2006.)
3. Seeing plant material in its native setting and transplanting the material from its natural setting to the disturbed soils of a roadside environment does not guarantee success. The adaptability of transplanted material to different soils, watering conditions, pollution, wind from traffic, maintenance machinery, etc. created strikingly different circumstances for the plant material to thrive. One

respondent provided the example of some specimen Mesquite trees (*Prosopis glandulosa*) that were donated from the Extension Service facility. The trees were casualties and had to be replaced prompting one of the NTTA Board Members to ask the question, “How can you kill a mesquite?” “It doesn’t like to be moved... it’s not a park, it’s a roadside” came the reply (Interview, 2006.) Another respondent noted, “After seeing Cedars growing out of the caliches rock ledges, the assumption is they do well in poor, shallow soils, but when you plant Cedar that’s grown in a nursery setting in vermiculite soil and placed in the roadside conditions many failed” (Interview, 2006.)

4. Another lesson discussed was the “absence of evergreen plant material” to create a “spine” within the planting beds during winter dormant periods of the grasses and perennials (Interview, 2006.)
5. Another respondent felt the design team should have fought harder to bring wildflowers into the mix since that is “one of the first things that come in a disturbed landscape” and to, “look more at the surrounding landscape and try to pull that in. The landscape in Garland (one of the participating cities) is really quite lovely and so that was pulled in” (Interview, 2006.) The respondent felt the design was too “rigid”.
6. The medians could have been wider and more irregular to accommodate existing remnants of plant material or allow for terrain changes like some of the projects the respondent had worked on previously. Rather than cutting through so deeply to keep straight, level roadways, or as the respondent said, “To blast right

through rather than thinking of things like, well, let's just pull it apart here”  
(Interview, 2006.)

**Q 15. How Has the Plant Palette Changed Between Phases of Construction?**

The plant palette was modified subtly, as plants used in the beginning either underperformed or were determined to be inappropriate. Plants that did not “reinforce that prairie-feel” such as the Bur Oak were “substituted” (Interview, 2006.) Mesquites and Desert Willows (*Chilopsis linearis*) were used in some of the locations, but not all, “but it's consistent enough from one end to the other that it's not something you feel” (Interview, 2006.)

Two of the grasses were also substituted because of poor performance, the Flame Miscanthus and the Little Bluestem Grass.

**Q 16. Was This Project Partially Funded by, or Subject to Any Federal or State Provisions?**

The project is a tollway and not subject to the same requirements or approvals for enhancements that state supported highways are. As one respondent summed it up, “...no tax dollars were put into this. This was all revenue, capital improvement funding” (Interview, 2006.)

**Q 17. How Did the Use of This Plant Palette and the Subsequent Design Address Any of the Following Criteria?**

Twelve criteria ranging from aesthetics and maintenance to environmental issues that have been discussed within the literature as pertaining to the use of native plant material were listed one at a time to each of the respondents. They were then asked to briefly discuss the impact each of these criteria had on the decision-making

process for the use of the native and adapted plant material in the Texas Highway 190 roadside corridor. The criteria are discussed below.

### **Aesthetics**

“It was all built on aesthetics” said one Respondent (Interview, 2006.) “That was the key”, said another (Interview, 2006.) “We call it sustainable aesthetics”, said another (Interview, 2006.)

Another respondent elaborated this way, “I think the commitment on the part of the NTTA to spend this amount of money, if you boil it back down to why, it’s aesthetics. They want a beautiful turnpike and they want their paying customers to enjoy that beautiful turnpike. Otherwise they could have just seeded Bermuda and mowed it every couple of weeks” (Interview, 2006.)

### **Water usage**

Although one respondent ranked it number 2 or 3, it was still a “big selling point of the plant pallet, that it would eventually be lower maintenance and low water consumption” (Interview, 2006.) The selling point was to the Board of Directors of NTTA. The savings in lower maintenance, including irrigation needs, was a strong component in convincing the Board to adopt this planting design. Another respondent added, “High. Not high consumption. High regard” (Interview, 2006.)

### **Roadside naturalization**

None of the respondents saw this as a naturalization project. As one respondent said, “we weren’t trying to do an erosion control or make it look natural. We were

trying to...a contrived feel, so to speak". (Interview, 2006) When asked this question, one respondent summed it up with, "Zero" (Interview, 2006.)

### **Adaptability**

There were two directions of thought to this criterion. It was important that the plant material be "well adapted to this region... the heat, amount of cold, the amount of water, the slopes, the soil, etc" (Interview, 2006.) The designers did not want the plant material to "morph" over time. It was to stay the same and avoid succession. The 18" wide mow curbs were installed to "eliminate plants migrating to other areas" (Interview, 2006.)

### **Air quality**

From a design standpoint none of the respondents felt it was a criterion. As one respondent put it, "I don't think that was a big consideration with the Board...we don't get Federal dollars" so there are no funding issues, but "regional air quality is a huge issue" and this is "one of the benefits" from using the native material (Interview, 2006.)

One respondent felt the use of Cedars would "add to the pollution problem with particulates, and in this case, pollen source that's very much an aggitant to a lot of people" (Interview, 2006.)

### **Future viability**

The respondents agreed that future viability of plant material that would "sustain itself over a long period of time" was an important consideration. Another type of future viability was the use of this planting design to create a theme or brand as part

of NTTA identification within their road systems, the “whole system-wide, the whole overall, the lighting... and continuity” (Interview, 2006.)

### **Water quality**

Water quality was “not a driving factor in the decision-making, but anytime you prevent erosion, you’re helping water quality” (Interview, 2006.) Another respondent noted, “Although that wasn’t a specific criterion, we knew that if we did this right it would improve water quality, especially the root masses of some of these native grasses are great filters for what they do” (Interview, 2006.)

### **Erosion control**

The NTTA established Bermuda Grass (*Cynodon dactylon*) to control erosion as construction was completed for each segment of roadway. The enhancements were “carved out” of the Bermuda (Interview, 2006.) Erosion control was a very high priority for the roadway, but not as a criterion for using the native plant material (Interview, 2006.)

### **Soil rehabilitation**

Soil rehabilitation was not a design criterion for the use of native plant material in the Texas Highway 190 project.

### **Weed control**

The highly maintained, aesthetic appearance of the Texas Highway 190 tollway made weed control a high priority. The uses of native grasses were employed to, “provide shade structure for the soil and not only inhibit weeds from growing but out

compete them” (Interview, 2006.) Also, the use of heavy mulches in the design was designated for weed control.

### **Maintenance**

Maintenance was a major criterion in the selection of the plant material and bed design. “The intent would be low maintenance, lower maintenance over time. Lower than a more traditional, more formal, more ornamental landscape installation” (Interview, 2006.) There were several reasons for using native plant material. Low water use after establishment and the cost savings and less maintenance of irrigation systems were a big part. The known ability of native material to shade out noxious weeds after establishment reducing the amount of chemical spray required. As one respondent put it, “these plants will eventually just smother out undesirable plants” (Interview, 2006.) A thick layer of mulch was also maintained within the planting beds during establishment to further reduce the growth of unwanted weedy plant material. “The research of HNTB found that” fertilization was unnecessary with the addition of humus rich compost and the ability of native material to thrive in existing conditions (Interview, 2006.) The 18” wide mow curbs were designed with large radii to allow large mowers to maneuver easily around the planting beds and drive on the curb eliminating the need for trimmers.

Another maintenance factor that was borrowed from the Toll Systems of Florida and California required the installation contractor to provide maintenance and plant replacement within the bed areas for 2 years. This would include irrigation and repair,



weeding, plant replacement, everything except the mowing. This made the contractor, “strongly motivated to do a great job putting it in” (Interview, 2006.)

### **Irrigation**

As one respondent said, “...the use of the plant materials on most projects would have limited the need for irrigation but because of political issues with this project and requirements set forth by the NTTA Corporation, we were required to put those irrigation systems in the project” (Interview, 2006.) Another respondent said “...we looked at irrigation as the means to the end, you know, irrigation wasn’t the priority, the plants were the priority, irrigation was the support system” (Interview, 2006.)

“Irrigation was a big issue. We went through an enormous amount of research and we used the top irrigation consultant in the world for the control system, Aqua Engineering.” said one respondent (Interview, 2006.) It was determined that drip irrigation would be used and that it would be a “sacrificial system”. “After three to five years when we knew everything was established, everything needed to be able to stand on its own and in fact, many of the plant materials we chose cannot tolerate irrigation after the first year” (Interview, 2006.)

Everything was irrigated by plant type using on-site weather stations and fiber optic controllers. The weather stations can be programmed “in the field or from a computer at the main controller” (Interview, 2006.) Everything is run by computer from maintenance headquarters and can be programmed by day, week, or month.

Planting in masses proved to be helpful for zoning of the irrigation. Each species within a planting bed, “it’s all zoned separately” (Interview, 2006.)

The efficiency of the system saved NTTA enough money to “pay for a full-time person just to run the irrigation control systems and that was the intent” (Interview, 2006.) There is a lot of “tweaking” to be done to a system as sophisticated or “cutting edge” as the NTTA system for Texas Highway 190. Two of the respondents attributed the “learning curve” of setting the proper amount of moisture to each species requirement to the under-performance of some of the plant species. As one said, “I don’t know if it was over watered or under watered and over watering is an issue with some of this” (Interview, 2006.)

Though the original design intent was to allow the irrigation system to eventually be shut down, the corporate requirements for maintenance and aesthetic appearance of the roadside will require the supplemental use of irrigation for the life of the project. As one respondent said, “I think we can definitely reduce, dramatically reduce the amount of irrigation but I don’t think that we can just abandon...I think our standards are, you know, different (than TxDOT)” (Interview, 2006.)

**Q 18. Has There Been Feedback From the Public Concerning the Plant Selection for the Texas Highway 190 Project?**

There was no data supporting any feedback from the public. Most of the respondents are professionals that moved to new projects after completion of the Texas Highway 190 project and few had heard of any feedback positive or negative. Comments from associates or friends were generally positive. One nursery had contacted NTTA for a “plant list” after receiving several requests from patrons that had

seen plant material while driving the tollway. As was discussed earlier, “public education” was an unexpected benefit of the project. There had been no contact from native plant societies or preservation societies.

### **Conclusion**

The NTTA developed a unique planting design for Texas Highway 190. A mutually beneficial relationship with the partner cities was established to create an enhanced driving experience along the tollway. Native and adaptive plant material was used to create a stylized prairie setting within the roadside through massed planting areas of monoculture species within curvilinear mow curbs.

Few of the criteria suggested by the literature for use of native material were used for plant selection, though some new criteria were established. The primary new criterion established within this design was the use of plant material normally associated with naturalization projects in regimented mass plantings with mow curbs to discourage succession of plant material or establishment of natural habitats. An ongoing maintenance program will be required to keep the high level of aesthetic appearance expected and to ensure that the mass plantings will remain intact and migration of additional species will not occur.

Aesthetics and drought tolerance were the primary criteria for plant selection, with water use as the only environmental criterion considered. Plant material non-native to the North Texas region was also used to expand the aesthetics of the plant palette.

Little scientific research or literature consultation was performed before plant selection, though the importance of this practice was listed as one of the lessons learned.

Additional lessons learned were the difficulty of adapting native plant material to the highly disturbed roadside, the challenges of establishing a workable irrigation program for native species, and the loss of whole planting beds of monocultures when conditions either environmental or of improper maintenance procedures attack a species.

The expectations of driving experience of a tollway were seen to be higher than those of a highway and required a different approach to the design and maintenance of Texas Highway 190. Federal guidelines for enhancement are not required for funding in a privately owned tollway system.

**CHAPTER 5**  
**CONCLUSION**  
**AND**  
**IMPLICATIONS FOR FUTURE RESEARCH**

**Introduction**

The North Texas Tollway Authority used a unique palette of native plant material in a roadside environment along the ROW corridors of Texas Highway 190. The designers created a structured, gardenesque use of native plant materials to enhance the driving experience of the paying public.

One purpose of this research was to examine the design intent for this planting design and to determine the criteria used for selection of plant material within the project. A second purpose was to compare this gardenesque design with the design use of native plant material in roadsides as described in the literature review in this research. Since the inception of native plant use as dictated through legislation from the Highway Beautification Act of 1965 through SAFETEA-LU of 2005, the initial benefit of aesthetic enhancement eventually grew to environmental issues to define the uses of native plant material in highway construction projects. Third, personal observation of the completed Texas Highway 190 project will tie together the commonalities, differences, and relevance to the profession of landscape architecture for the future use of native plant material on highway corridors in North Texas.

## **Discussion**

The interviews revealed a detailed and lengthy process of design development. Numerous trips to Florida, California, Arizona, and Houston for feasibility studies of similar projects, site analysis, and discussion with irrigation and native plant specialists preceded the design. Balancing the aesthetic intent within the budget, determining the criteria for focus areas and the number of areas that could be developed took approximately one year. This followed the same general process employed by TxDOT and others in determining enhancements within the roadway. A greater number of focus areas in so few miles and the intent to utilize native and adapted material in a structured garden setting were outside the normal budget capacity of TxDOT policy.

This new emphasis on using native plant material for aesthetic qualities as the major design element has created unexpected results. For example, one respondent said, “patrons of the tollway have been asking the names of some of the plant material at the local nurseries and at NTTA” (Interview, 2006.) Planting in masses enables the observer to single out species rather than seeing the entire landscape as a whole. This phenomenon has brought additional approval and acceptance for the use of native plant material in circumstances previously reserved for non-native ornamentals. Where some observers have seen native plantings as “weeds in a field”, now they see the possible application in their home gardens.

## **Design Criteria**

The NTTA chose an approach to design that differs from the use of native plant material within the literature review. For example, one respondent described the design

intent as a “stylized prairie” (Interview, 2006.) Native plant material was used to tie the tollway into the “blackland prairie of the surrounding landscape” (Interview, 2006;) however, the plants were organized in defined beds with concrete mow curbs to discourage the unwanted migration of plant material into the defined areas. The plant material was used in monoculture masses, planted on prescribed centers, in diagonal rows relative to the roadway. Small stands of trees would be interspersed, as in a prairie setting, but with even spacing, and strategically placed. No planting design enhancement was intended beyond the view of drivers on the tollway.

As was noted in the literature, native plant material has been traditionally used to naturalize an area by planting many varieties of grasses, forbs, trees and shrubs in a random pattern to replicate the ecological niches of the surrounding landscape and to change and develop through succession. In this research, the design observed to be gardenesque, as seen in the neat, orderly plant configuration of a corporate campus. Any encroachment of one species to another was discouraged, purposely avoiding succession.

### **Plant Material**

The planting design intent of the NTTA was to establish an aesthetic use of native plant material whenever possible, and to expand the plant palette into adapted, non-native plant material when native plant material to fill the aesthetic intent was unknown to the designers. Two species native to the North Texas region, Bur Oak (*Quercus macrocarpa*) and Sideoats grama (*Boutelona curtipendula*), were removed from the original list for aesthetic reasons. As one respondent noted they did not

provide the native prairie “feel” (Interview, 2006.) Sideoats grama is the state grass of Texas and the Bur oak is one of the few large, majestic tree forms that grow in the black land prairies of North Texas.

As was learned from the interview process, little scientific study or literature review was used to determine plant material indigenous to the North Texas region. When asked what percentage of the plant material was native to the North Texas region the respondents were uncertain, speculating that between 60 – 70% of the material was native. Looking at the plant list and number of each species planted, as provided by NTTA, the researcher found that 24% of the turf used was native (*Buffalograss*, *Buchloe dactyloides*) and 76% of the turf was non-native (*Bermuda*, *Cynodon dactylon*, and *Weeping Love Grass*, *Eragrostis curvula*.) The landscape ornamentals of trees, grasses, shrubs and vines were divided into 25% native and 75% non-native plant material. The planting list may be reviewed in Appendix B. After review of the plant list provided by NTTA, the researcher concluded:

1. Trees: There were ten (10) species used in the planting design of which seven (7) were considered native to the North Texas region. Three (3) were native to south and west Texas.
2. Shrubs: There were six (6) species used in the planting design of which none (0) were considered native to the North Texas region. All six (6) were native to south and west Texas.



3. Grasses: There were twelve (12) species used in the planting design of which four (4) were considered native to the North Texas region. Four (4) were native to south and west Texas, and four (4) were non-native to Texas.
4. Vines: There was one (1) species used in the planting design of which one (1) was considered native to the North Texas region.

There were four species reported to be underperforming, and the researcher found the Weeping Love Grass underperforming in areas. Of these species two were native (Little Blue Stem, *Schizachyrium scoparium*, and Eastern Red Cedar, *Juniperus virginiana*), one was native to south and west Texas (Mexican Feather Grass, *Stipa tenuissima*), and two were non-native to Texas (Flame Grass, *Miscanthus sinensis* 'Purpurescens' and Weeping Love Grass).

Adapting native plant material to the roadside environment proved to be challenging. The Little Bluestem Grass needs 3-5 years to cover adequately. The requirement of NTTA for immediate coverage made this species unacceptable to the project. Given the adequate establishment period could this have been an acceptable selection for the planting design? This would have been an opportunity to use another plant material indigenous to the North Texas region. The Weeping Love Grass was observed to be failing in drainage areas where the probability of excessive moisture was prevalent. The Mexican Feather Grass was failing on some hillsides and thriving on others, but was thin in drainage areas. Water availability of both too much in some areas and too little in other areas was suspected for the failure. Eastern Red Cedars were

under watered at the beginning of the project causing mass failure (Interview, 2006.)  
The cause of failure of the Flame Grass is unknown.

As was noted in Chapter Four, availability of specific scientific information was said to be lacking for native material in the landscape setting. Most literature of native material was dedicated to range use. The researcher was able to find information from existing governmental agencies, as discussed in the literature, which specifically addressed many of the areas of difficulty discussed in the interviews. The adaptation of native plant material outside its natural habitat is well documented, as are coverage expectations and water needs. The highly disturbed roadside environment creates an eco-climate different from most locations, certainly the natural setting. With the large quantities of plant material used in this and other roadside projects, more research or consultation should be done for this unique environmental setting.

### **Mass Plantings**

The use of plant material in mass monocultures was conceived for several reasons as discussed by the respondents. At minimum tollway speeds of 60 mph, single species of plant materials are overlooked, or lost if part of a broad palette of species. In the literature, the use of many species randomly dispersed is the primary design principle for rural sections of roadway. In urban settings ornamental shrubs or annual color plantings in masses at intersections, overpasses, and underpasses are often designated.

The NTTA design was to intentionally highlight a limited number of native and adapted plant species by planting them in structured masses allowing the viewer a

longer exposure to individual species. The plants were staggered by height from short, to medium, to tall with tall being closest to the focus area. The large masses of monoculture species also provided an opportunity to create zones of irrigation enabling the maintenance crews to monitor and adjust the water needs for each species of plant material.

By observation, the difference between the NTTA roadside and urban plantings by TxDOT is the selection of plant material used within the bed design. Seeing large masses of native and adapted plant material, some of which are not utilized by TxDOT in the context of a roadside setting, is striking and unique (Figure 17.) In this picture Mexican Feather Grass is encircled by Soft-tip yucca (*Yucca recurvifolia*), then Buffalo Grass, and an outer band of Miscanthus (*Miscanthus sinensis 'Adagio'*) and Indian Grass (*Sorghastrum nutans*.)



**Figure 17. Texas Highway 190 (Scott, Fall/2006.)**

This approach harkens back to the original initiative for the use of native wildflowers in the roadside of Lady Bird Johnson's Highway Beautification. Both

approaches utilize native plant material to create attractive and pleasurable driving experiences. One difference being, the original intent of Highway Beautification was to merge the ROW with the adjacent landscape using masses of native wildflowers growing by the roadside and stretching into the horizon (Figure 18.)



**Figure 18. Typical ROW of bluebonnets in Waco, Texas (TxDOT, 2006.)**

TxDOT spreads 60,000 lbs. of wildflower seed annually (FHWA, 1999) along newly planted areas, and existing areas that require additional enhancement. Every state DOT has utilized the Transportation Enhancement program to establish some form of wildflower program along their highway corridors (FHWA, 2003.)

The Texas Highway 190 project borrowed, as a conceptual design element, the native prairies of the region, but made no provisions to enhance any area beyond its ROW. In truth, given the nature of urban growth around tollway systems, there will be no prairie adjacent to the roadway. As one respondent noted, the adjacent cities see the tollway as a “high development area” and pushed for increased landscape enhancement along the roadside. It would be interesting to know if any of the patrons of the tollway

understand the correlation or reference to a prairie when viewing the structured gardens of the roadside.

### **Environmental Issues**

Much of the literature referred to the evolution in the use of native material to provide the environmental benefits that the plant material provides in nature. Soil, water, and air quality, restoration, reclamation, and naturalization are issues usually associated with native plant material today. Most of these attributes were outside the list of criteria for selecting the plant material for Texas Highway 190.

As discussed in Chapter Four, during the interview process each respondent was asked to address the relative importance of the use of the plant palette and the subsequent design for the following criteria associated with the use of native plant material as found in the literature review: aesthetics, water usage, roadside naturalization, adaptability, air quality, future viability, water quality, erosion control, soil rehabilitation, weed control, maintenance, and irrigation.

As was previously stated, aesthetics were the overwhelming criteria, with water usage, adaptability, future viability, weed control, maintenance and irrigation also considered criteria used to determine plant selection. The other criteria, roadside naturalization, air and water quality, erosion control, and soil rehabilitation were considered “added benefits”, but not determining factors. Naturalization was strongly rejected. Given the need for succession in a naturalized landscape, it might be difficult to design a structured garden using the concept of naturalization.

The condition of air quality, circa 2006, and the impending restrictions coming from the EPA because the North Texas area does not comply with federal air quality standards, would have provided an opportunity for research and promotion of air and water quality as environmental benefits associated with native plant material. Does native plant material provide measurably better air quality control than non-native material?

By observation, the design criterion of diagonal rows of evenly spaced plant material and carefully manicured beds with no thatch growing between plants will not provide the erosion control of a natural setting. A thick layer of mulch is present, but may not impede runoff on steep embankments.

### **Future Viability in the Texas Highway 190 Environment**

In studies of native material documented in the literature review, the importance of the “plant community as a diverse assortment of plant material, co-habiting and ever-changing, provides the environment that contributes to the success of the individual plant species” (Schutt, 1999.) One of the respondents noted that water usage will be less with the non-native plant material, but is that really the case? The shrub and tree species from far West Texas are in a region of less annual rainfall than the North Texas area. In this research, native plant material referred to plants indigenous to the Blackland Prairie of North Texas. During the interview process some of the respondents seemed unsure of the plant species origin, referring to plant material as native species that were non-native to the North Texas region.

Due to the on-going aesthetic expectations of the project, the irrigation system will be needed for the life of the project. Proper zoning and irrigation levels will be crucial to balance the proper amount of moisture for optimum aesthetic appearance without over watering these sensitive plants. What would the minimum number of watering days per month be to preserve the aesthetic expectations of NTTA and still fulfill the directive of water conservation? Though this native plant material is very hardy in a natural setting, it does not always have an optimum appearance. Restoration projects design for the eventual abandonment of the irrigation system after plant establishment but are less concerned with a gardenesque aesthetic appearance. Weed control on Texas Highway 190 is accomplished by the shade provided by native and adapted plant material, and not by a reliance on heavy layers of mulch in the beds as in this design.

The aesthetic requirement of “instant coverage” created difficult expectations for native species. As was discussed in Chapter Two and Chapter Four, late successional native plant material take 3 – 5 years to reach coverage. The NTTA required coverage in one-third of a growing season.

Single species plantings of native material planted in garden settings have been shown to “lose vitality over time” (Schutt, 2001.)

“Native plants evolved as part of a system of interrelated organisms and processes. Any qualities of hardiness and vigor must be referenced to those conditions. Selecting a preferred plant out of such a system and inserting it into a completely different set of environmental parameters will likely not be successful” (Schutt, 2001.)

The loss of whole sections of plant species within some of the planting beds along Texas Highway 190 brings into question the longevity of the plant material through adaptability and establishment (Figure 19.) One of the concerns for mass plantings of monocultures voiced by a respondent was the effect of disease or inadequate watering requirements destroying whole beds of plant material. Examples would be the loss of large portions of the Eastern Red Cedars, the Little Blue Stem grass, Mexican Feather Grass, and Flameleaf Miscanthus. Succession of plant species was one of the attributes of native ecology rejected in the design. As one of the respondents noted, “The aesthetic quality and expected appearance of the roadside will require an ongoing need to change out underperforming plant material as a cost of doing business” (Interview, 2006.)

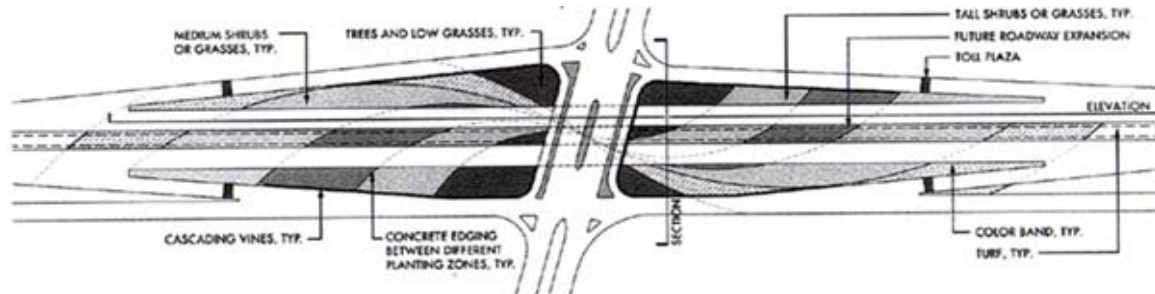


**Figure 19. Mexican Feather Grass underperforming on Texas Highway 190 (Scott, Fall/2006.)**

Another problem is the observation by the researcher that some species were placed in inappropriate ecological zones. This reveals a flaw in the design criterion for mass monocultures planted in sweeping bands that start on a hillside ROW, move down



through a median, go across a drainage swale and finally move up the opposite hillside (Figure 20.) Such a design crosses several moisture zones, from very limited moisture on the hillside to prolonged wet conditions in the medians and drainage areas. Mexican Feather Grass, for example, was observed to thrive on an embankment, but was unable



**Figure 20. Detail of motion of planting masses (NTTA, 2003.)**

to survive in drainage swales (Figure 21 and 22.) Perhaps a design change to incorporate a planting of moisture tolerant plant species running through the drainage swales planted with Bushy Bluestem (*Andropogon glomeratus*) or Switch Grass (*Panicum virgatum*) could prove aesthetically compatible with the design theme while providing more site specific plant material. By observation, it was noted that these drainage areas are without plant material and showing the beginnings of erosion. Given the benefit of native grasses with their large root masses and ability to filter and buffer runoff, as stated in the literature, a design change will be necessary to protect the roadside.



**Figure 21. Mexican Feather Grass from embankment to swale (Scott, Fall/2006.)**

The absence of evergreen material was also an observation. During dormant periods when the grasses are trimmed back in February, "...it's not until June that you really see a re-growth" there is bareness to the landscape (Interview, 2006.) In future plantings there will be some masses of broadleaf evergreen shrub material to "breakup the grasses" (Interview, 2006.) Do the grasses need to be trimmed so early, or all at once? Could the trimming be scheduled to avoid the drastic appearance of the visual loss of all of the ornamental grasses at once?



**Figure 22. Weeping Love Grass and Soft-tip Yucca struggling in the drainage swale (Scott, Fall/2006.)**

The degree of success of the planting design of Texas Highway 190 will not be known for some time. The first phase is only two years old and the final sections of plantings are not yet completed. Much of the concept is “experimental” (Interview, 2006.) The use of a small number of favored species within 34 individual areas in a garden setting is “likened to a botanical garden where the emphasis is on the aesthetic character of individual plants rather than the ecological integrity of the environment” (Schutt, 1999.)

An important value with the success of this project will be to increase the choices of native material planted in the roadside. Will that be enough to warrant such large expenditure for an enhancement of the roadside? Seeing large sections of mass monoculture plant failure may discourage public enthusiasm for adding native plant

material to the residential landscape. One concept that was brought out in the literature and in this research, is that future roadsides will be evaluated for the important benefits they can bring both to the environment and to the community. Texas Highway 190 does not have any research data to show environmental improvement for the region or whether the public aesthetically prefers this design over another. Texas Highway 190 is not a public highway. It is a privately owned tollway, and as such, brings different expectations and uses. It is not funded or maintained by TxDOT, but rather by private investors and is run as a business. In North Texas, tollroads have brought high-end development along the frontage areas, and a well-manicured, aesthetic landscape along its ROW will help the communities adjacent to the system bring in that development (Interview, 2006.)

### **Limitations**

There were challenges and limitations during this research study. The number of key stakeholders interviewed as key respondents limited the researcher from obtaining a wider variation of opinions about the project. Having only landscape architects responding to the questions might have skewed the perspective. Limitations of time and resources prevented the researcher from seasonal observations of the roadway over a longer period of time to measure plant performance.

### **Importance to the Profession**

During the environmental movements from the 1990's through today, landscape architects have played an important role in design, plant knowledge, restoration, wetlands mitigation, and a multitude of significant environmental aspects of highway

construction. Texas Department of Transportation (TxDOT) has staff landscape architects to take the lead role in environmentally sensitive situations, as well as, mitigation within historical and significant cultural entities.

The landscape architects role in the construction of Texas Highway 190 did not have the significance of a project like Paris Pike as discussed in Chapter Two, but served the profession in several ways. Writing the manual of guidelines for all enhancements from bridge and lighting aesthetics to planting material assured the project would be aesthetically cohesive to the patrons of the tollway. The added level of expectations from patrons paying to use the roadway prompted the owners of the tollway to increase the level of visual enhancement. This created an opportunity for the landscape architects to propose new uses for native and adapted plant material for the roadside.

The new use of native plant material on Texas Highway 190 is the greatest challenge and opportunity brought about by this project for the profession of landscape architecture. Developing the fragile, indigenous plant material in an environment that is completely man-made and creating conditions for the material to thrive. New irrigation techniques are being developed to create micro-climates for the different species. Although this should be one of the strengths of the project, it leads to one of the failings of the project in the researcher's view. All of the respondents welcomed the opportunity to create a landscape that was not the "typical North Dallas landscape", described as non-native, high water use ornamentals (Interview, 2006.) The designers developed a planting design using low water use plant material to demonstrate the ability of using

native, and drought tolerant plant material in an aesthetic garden setting. The gardenesque aesthetic expectations of the NTTA require on-going irrigation for the life of the project. The water requirements may be less than some non-native ornamentals, but an opportunity for conservation has been passed over. As the drought conditions, circa 2006, in North Texas have proven, water restrictions should be built into any large scale project. Too many bottomland hardwood forest stands have been sacrificed to build more reservoirs to support the needs of high water use landscapes. This is an area that landscape architects could address.

The use of masses of monocultures to create large aesthetic visuals for the drivers as they travel at highway speeds is an ongoing experiment. As was shown in this project, some plants work better than others. The enormous quantity of each species used made the project a very expensive experiment. To determine, after planting, that Flame Grass was not an appropriate plant material suggests the replacement of over 10,000 plants. More research could have been done to determine proper landscaping plant materials for the various ecosystems. The vertical slopes of the ROW are a different ecosystem than the drainage swale. As previously discussed, the broad curving planting beds that pass through several eco-zones with the same masses of monoculture proved to be detrimental to the survival of species like Mexican Feather Grass, Weeping Love Grass, and Little Bluestem. This project suggests the need for landscape architects to become more knowledgeable of the plant material indigenous to the region of the project and to expand their ability to recognize different ecosystems within a site and the difficulty in moving native and adapted plant material into the disturbed soils of the

roadside. Landscape architects must be able to balance design, use, and expertise with plants and ecology.

Another criterion that was important to the Board of NTTA and the designers in the beginning was the benefit of lower maintenance when using native plant material. Where this is true in a natural setting or naturalization project, the decision to discourage succession and retain the high aesthetic requirement by the NTTA will require more maintenance than otherwise needed. Did the design team anticipate this?

Providing a composite of the cultural heritage of a region and an education forum for the citizens of communities to learn more about the indigenous plant material that is around them is a great opportunity for the profession. The difficulty with Texas Highway 190 is that the 75 percent of plant material is not indigenous to the North Texas area. The NTTA has not researched the public to see if this design is more appealing than some other enhancement, or to see if this stylized prairie is preferred to a more natural prairie design. The lack of contact from native plant societies, or the public in general, questions the viability of this design concept.

Another important challenge is how to utilize the Texas Highway 190 design methodology to incorporate more of the environmental aspects that native plants offer. More research is needed to establish levels of air and water quality enhancement that this design technique may provide and utilize these benefits in the planning phase.

From the Paris Pike of Kentucky study, mentioned in Chapter 2, the use of context sensitive design was discussed and the importance of landscape architects as leaders in the initial planning stages of road construction, setting road elevations and

road alignment to benefit the driver as well as the environment and culture of the region. Texas Highway 190 is not an example of this sensitive design. It slices its way through the countryside with no connection to the adjacent landscape, no saving of existing native plant remnants, and large amounts of soil disturbance during construction. The Board of NTTA determined to have no enhancement to areas beyond the ROW or to use native wildflowers in the design. Does this ‘reach out’ to the community or enhance cultural preservation to the region?

One of the respondents said, “What was done on the Texas Highway 190 is a highly stylized native prairie that is far less significant than a sensitively carved road through a true native prairie. These latter places allow a person traveling at high speed to take in the grandness of the real thing. Honestly, I think that seeding the entire tollway with a mixture of native grass and wildflower seed would have had more impact and saved a tremendous amount of dollars spent on irrigation and annual maintenance” (Interview, 2006.)

The design team from HNTB and their consultants embarked on a new strategy for the use of native and adapted plant material in large scale roadside planting enhancements. Client needs, expectations, and restrictions are part of every project. Could the designers have negotiated for a more sensitive design utilizing more of the benefits of native plant material and more control of road alignment criteria? Regardless, they have opened new challenges and opportunities for the profession by introducing the use of native and adapted plant material to a region, “that has not been forward thinking in considering water conservation and the use of more appropriate plant material” (Interview, 2006.)



## **Suggestions for Future Research**

This study provided background of how the Texas Highway 190 planting design was created, the process involved, and the comparison with literature of legislative initiatives leading to the establishment and increased use of native plant material. Many new questions appeared as the research progressed.

1. What are the environmental consequences provided by the plantings in such areas as air and water quality?
2. If benefits are present, should this increase the uses of native and adapted plant material?
3. If benefits are present, what is the perceived value to NTTA and the public?
4. What is the aesthetic impact of the planting design on the public driving Texas Highway 190?
5. Does the public prefer the structured design of Texas Highway 190 as compared to a naturalized design?
6. Should the research developed to establish the plant palette for Texas Highway 190 serve as a model for the plant selection process for future highway projects?
7. Why did certain species under perform after planting?
8. Which species did particularly well and should be repeated on future projects?
9. What are alternative design strategies that embrace an ecological approach while still adhering to a more traditional gardenesque aesthetic?
10. Should research be conducted toward understanding the challenges of adapting native plant material to the specific environment of the roadside?

11. How has the Texas Hwy 190 planting design changed the perceptions of the public towards native plant use in residential landscapes?
12. Given the need for succession in a naturalized landscape, could a structured design like Texas Highway 190 be accomplished utilizing mixtures of species?

### **Summary**

This study compares the Texas Highway 190 roadside planting design with the best practices for use of native plant material as derived from federal and state highway agencies, as well as, individuals with specific expert knowledge in the field. Texas Highway 190 uses native and adapted plant material to enhance 34 important focus areas along its 29 mile journey.

Introducing native and adapted plant material into the roadside helped to create acceptance of this plant material into the design criteria in an area that has not been associated with conservation uses of plant material. It was found in this study that although a large amount of time was devoted to feasibility studies of existing highway systems of similar design intent and site surveys of the roadside of Texas Highway 190, little scientific research was done prior to the design phase about the fragile nature of the native plant material when relocated to the disturbed soils of the roadway.

Aesthetic qualities were the predominant criteria for plant selection with the assumption that all natives and regardless of their use or location adapted plant material will have the qualities of environmental benefit and overall plant resilience that they have in their natural setting. Through scientific review it was found that there are at least nine different geomorphic conditions within a roadway. Each condition requires

specific species to thrive in those conditions. The design of Texas Highway 190 uses sweeping bands of monoculture plantings that cross several geomorphic conditions, from high steep slopes to drainage swales, through the narrow medians and up the other steep ROW. It was observed that specific species could perform well in certain areas, but poorly in others.

This calls into question the basic design intent that has aesthetic appeal in a two-dimensional plan drawing, but does not appear to reflect the three-dimensional reality of the roadside. Though the landscape is relatively new, there have been numerous areas of plant failure and replanting costs. The absence of thriving plant material in the drainage swales questions the designs ability to provide erosion control.

Whether this landscape will establish and become a thriving plant community will not be known for some time. The absence of natural habitat and succession will create new boundaries for adaptation of native plant material. More study of this project should be done to determine if this plant material can be successfully utilized in a gardenesque roadside planting.

These enhanced focus areas are only portion of the Texas Highway 190 roadside landscape. The majority of the roadside is non-native Bermuda Grass mowed at a minimum height from ROW to ROW. When the tollway ends, maintenance of the continuing highway is maintained by TxDOT. While driving the tollway in early spring while Bermuda is dormant, the contrast in appearance of the brown short-cropped tollway to the green, lush wildflower meadows of the TxDOT controlled roadside are striking. Would this native meadow be another way to connect the focus areas within

the tollway. The original intent of NTTA was to have no wildflowers in the design. By observation, the dormancy period grasses, including ornamentals, creates a prolonged period of bare beds and roadside.

Another observation by the researcher concerns the structured, gardenesque appearance of the focus areas. The respondents stated the enjoyment in creating a landscape that was not the typical “North Dallas” look. No Indian Hawthornes or Crepe Myrtles, or any of the plant material in structured bands from tall to short that is associated with most of the planting designs of the area. This design is very much in keeping with that structure; only the plant material has been altered. One of the difficulties with sustaining this design concept on Texas Highway 190 is the very nature of the plant material and its need for habitat to thrive.

A close watch on the progression of the establishment of the landscape design on Texas Highway 190 will benefit and possibly promote the use of native and adapted plant material into more and varied uses. Water conservation in North Texas is relatively new and use of this plant material will be of great service to the environment of the region.

APPENDIX A

SAMPLE OF PHONE REQUEST FOR INTERVIEW

Hello Mr./Ms \_\_\_\_\_,

I am writing my graduate thesis this fall as a case study on the planting selection of the roadside corridors of Texas Highway 190. The literature review will look at historical and current use of native plant material in the roadside, design decisions, and other issues that affect such use.

The information for the Texas Highway 190 project will be gathered from interviews with the participants in the decision making process of plant selection, as well as, any literature or documentation I might be allowed to use from the participants concerning the project.

May I contact you further regarding information for this study and schedule an interview.

Thank you for your time,

John Scott

APPENDIX B

INTERVIEW QUESTIONS

- 1) How did the NTTA initiate the planting design concept for Texas Highway 190?
- 2) What was the plant selection process for the roadside areas of Texas Highway 190?
- 3) Why were native plants included in the design?
- 4) What criteria were used for determining native plant material?
- 5) What percentage of the plant palette were native plants?
- 6) Why were non-native plants included in the design?
- 7) What literature or scientific study was done in developing this plant selection?
- 8) How does the choice of planting design compare with literature recommendations on the use of native plant material?
- 9) What are the perceived benefits of the planting selection of Texas Highway 190?
- 10) What is the perceived success rate of the existing native plant material used in the Texas Highway 190 project?
- 11) What is the perceived success rate of the existing non-native plant material used in the Texas Highway 190 project?
- 12) What is the time frame for satisfactory cover of the shrubs and grasses in the roadside of Texas Highway 190?
- 13) How long, in terms of growing seasons, will an intensive maintenance program be required for each new phase?
- 14) What are the “lessons learned” from the plant selection of the Texas Highway 190 for future projects?
- 15) How has the plant palette changed between phases of construction?
- 16) Was this project partially funded by, or subject to any federal or state provisions? For example, the federal Transportation Enhancement program, STURRA, AASHTO, FHWA – Roadside Use of Native Plants, TxDOT, etc.



17) How did the use of this plant palette and the subsequent design address any of the following criteria?

- Aesthetics
- Water usage
- Roadside naturalization
- Adaptability
- Air Quality
- Future viability
- Water Quality
- Erosion Control
- Soil Rehabilitation
- Weed Control
- Maintenance
- Irrigation

18) Has there been feedback from the public concerning the plant selection for the Texas Highway 190 project?

APPENDIX C

PLANT PALETTE AND QUANTITIES

<u>Common Name</u>	<u>Botanical Name</u>	<u>Quantities Planted</u>
<b>Shade/Canopy Trees</b>		
(N) Texas Red Oak	Quercus texana	54
(N) Chinquapin Oak	Quercus muhlenbergii	15
(Non) Vasey Oak	Quercus pungens var. vaseyana	29
(Non) Bigtooth Maple	Acer grandidentatum	59
<b>Evergreen Trees</b>		
(N) Eastern Red Cedar	Juniperus virginiana	679
(Non) Blue Point Juniper	Juniperus chinensis 'Blue Point'	49
<b>Understory/ Accent Trees</b>		
(Non) Desert Willow	Chilopsis linearis	325
(N) Mesquite	Prosopis glandulosa	63
(N) Mexican Plum	Prunus mexicana	97
(N) Possumhaw Holly	Ilex deciduas	266
(N) Flame Leaf Sumac	Rhus lanceolata	1,069
<b>Tall Grasses</b>		
(Non) Adagio Japanese Silver Grass	Miscanthus sinensis 'Adagio'	16,031
(N) Big Bluestem	Andropogon gerardii var. gerardii	7,462
(Non) Flame Grass	Miscanthus 'Purpurescens'	10,506
(Non) Graziella Japanese Silver Grass	Miscantuis sinensis 'Graziella'	3,927
(N) Indian Grass	Sorgjastri nutans	5,256
<b>Medium Grasses</b>		
(Non) Broomsedge Bluestem	Andropogon virginicus	22,277
(Non) Bushy Bluestem	Andropogon glomeratus	15,725
(N) Little Bluestem	Schizachyrium scoparium	65,356
(Non) Mexican Feather Grass	Stipa tenuissima	94,187
(Non) Pine Muhly	Muhlenbergia dubia	2,448

### Low Grasses and Vines

(N)	Buffalograss	<i>Buchloe dactyloides</i>	81,621 sy.
(Non)	Bermuda	<i>Cynodon dactylon</i>	161,303 sy
(Non)	Weeping Love Grass	<i>Eragrostis curvula</i>	91,718 sy
(N)	Virginia Creeper	<i>Parthenocissus quinquefolia</i>	274

### Shrubs and Perennials

(Non)	Santolina	<i>Santolina chamaecyparissus</i>	30,251
(Non)	Autumn Sage	<i>Salvia greggii</i>	16,894
(Non)	Red Yucca	<i>Hesperaloe parvifolia</i>	5,234
(Non)	Soft-leafed Yucca	<i>Yucca recurvifolia</i>	2,294
(Non)	Texas Green Sage	<i>Leucophyllum frutescens</i> 'Green Cloud'	5,001
(Non)	Texas Sage	<i>Leucophyllum frutescens</i>	5,105

N – Native to North Texas Region

Non - Non-native to North Texas Region

APPENDIX D

INTERVIEW TRANSCRIPTIONS

## Interview #1

Interviewee said: “[**Dictation begins...**] “Our criteria was you have one half million dollars per mile to work with for enhancements. Okay. For landscape and irrigation. So the idea was, ‘Well how do you go about determining where you spend that money. Do you spend a tiny bit along the whole way and just have it get lost or do you spend it all in a couple of locations? How do you determine where you’re going spend your money?’ So we came up with an area called focus areas where we would say, ‘Okay, there are four kinds of focus areas. There are interchanges, main-lane plazas, underpasses and overpasses. And they determined that there are two ways to look at this. You either put your improvements where the driver looks at them or you put your improvements so the neighborhood looks at them. And they determined that since the drivers were paying for, that we would focus only on what the driver saw. Not what the neighborhood saw and that was a big decision up front and it guided all the design from there on out, because you can see it, like for example, in an overpass situation...”

Interviewer said: “It’s all down in the...”

Interviewee said: “Yeah, the drivers don’t see much of that unless it’s on a corner. So, that had a real low priority for us. So, we would look at areas and do a view-said and a site analysis where we would look at every intersection and say, ‘Okay, when you’re driving along this, what can you see and what can’t you see?’ And then we would map it. Say, ‘Okay, moderately visible areas, highly visible areas, and areas that were not significant.’ And long with that we did soil borings where we would say, ‘Yes. Soil depth is more than two feet or it’s less than two feet.’ And that kind of...and where’s the water service? Are we going to have to come far, far away to get water or not, kind of thing. And so this is what we did to every focus area in and along the George Bush Turnpike. Okay? Focus area applications, there’s just like four kinds, you know, one that might be very rectilinear and others that might have great big open views and we had, like types, where we would say, ‘Okay, this is treatable space but it’s not very significant and...”

Interviewer said: “Right. Or it’s narrow so that would mean you’re going to limit your plant material to this and this. Okay. No problem.”

Interviewee said: “Right. Um, hum. Okay? And so we would look at it from that way. Okay, when you’re driving down the road, where is the area that’s important to see? And we determined, like for example, in this area, this green area is what was important for the driver to see. The cities can do what they want out here and enhance it, but this is where we’re going spend our money. Okay. Then we had, actually, a decision matrix where we would say, ‘Okay. Let’s evaluate the site.’ We determined that 800 linear feet was seven seconds, essentially, you know at speed. At least I think that’s what it was. And so we would say, ‘Okay, we want to stay within 1,600 feet, essentially, of the bridge structure or the focus area and that’s where we’re going to put our money. So, we would look at it, and we said, ‘Is the area we want to treat within that 800 feet each side of the focus area?’ If it was, then we’d look over here and say, ‘Is it visible to the driver?’ If it is we would say, ‘Okay. Does it require more than three bores or a bridge crossing for irrigation?’ Or we would say, ‘Okay, you know, anything more than that it just costs too much money to make it viable.’ If it doesn’t, is the landscape treatment necessary to enhance this move and motion aspect? And then we would go ahead and treat it. If you ran into problems along the way, like you had to bore a lot or it wasn’t within an area where there was accessible irrigation lot and everything, we really had to consider whether it was worth it to do it or not.”

Interviewer said: “Within the budget, long-term savings on maintenance, accessibility for maintenance, impact on the...okay...so you had certain criteria that would be...”

Interviewee said: “Yeah. We’d look at and the sometimes you would say, ‘No, we’re just not going to treat it.’ Okay?”

Interviewer said: “Alright.”

Interviewee said: “And then we would do design schematics. We would look at things and say, ‘Okay, for example, this is where the George Bush meets the Dallas North Tollway.’ And we would say, ‘Okay, we well we want this crescendo activity, and you know, when you...you want to come up to an area, experience it, and then go back out of it.’ So we would have a low planting and a medium planting and a high planting. It’s kind of the buildup as a concept. Okay. And then we would look at it. ‘Okay, what’s, what shapes enhance movement or motion or imply it?’ And so

we have these weaving areas or gentle swerving curves and things like that.”

Interviewer said: “Within the design process of the beds?”

Interviewee said: “Right. Yes.”

Interviewer said: “Okay.”

Interviewee said: “And so we would look at that and we would say, ‘Okay we have our low areas, our medium areas, our high areas and this is what you see when you’re coming along.’ Like in a main-lane toll plaza, you’d see, you know, low medium, high but you, you know, you would have some sway through here so that it kind of pulled the driver through, you know, as they would drive through here.”

Interviewer said: “Just one second here.”

Interviewee said: “Sure.”

Interviewer said: “So, I’m looking at this same plan view but as we’re, and the green is low...okay. Oh, no, that’s tall...”

Interviewee said: “Yeah, um, hum.”

Interviewer said: “And then low...”

Interviewee said: “Um, hum.”

Interviewer said: “So, actually, this one’s reversed.”

Interviewee said: “It is, it is, and the reason we had to reverse it is because security wouldn’t let us put anything taller than 24 inches within “x” number of feet of a toll booth for security reasons.”

Interviewer said: “Um, hum.”

Interviewee said: “And so, you know, we had to...”

Interviewer said: “But your whole design criteria are to keep this movement...”

Interviewee said: “Everything is low...”



Interviewer said: "...as cars are moving into lanes, you're moving..."

Interviewee said: "Right."

Interviewer said: "Okay."

Interviewee said: "That, that was the idea behind it. Okay?"

Interviewer said: "I understand."

Interviewee said: "This ended up having to go away. You know? We weren't allowed to put trees up near this area to kind of mask at the building. We just weren't allowed to. Visual emphasis line, this whole idea of movement. Well how do we make it move? And, you know, you'd have this material that would pick up here and then pick it back up here as we go through here and just have that feel to it. This happens to be Marsh, the intersection of Marsh. Again, you can see this area, you know, that's highly visible to the driver. That's where we spend our money. Where as an overpass like this, you know, we spent money up high where you could see it, but very little down here, maybe just Buffalo sod or something like that. You know?"

Interviewer said: "Um, hum. Um, hum. So, all, okay, on this our main lanes are above everything then, so we're..."

Interviewee said: "Right. So we can see some, we can see the trees and everything or if we're on a big corner, you know like at Rosemeade, I know that you've driven that as you're heading East at Rosemeade, you get that whole bank that you can see. Even though it's overpass, you get, you know, a mile's worth of views by driving along that. So, everyone was a little bit different but the idea was we just didn't spend money where you couldn't see it. In the medians, when we did medians, again, our 800 feet, but you had barriers. Okay. And one thing that kind of messed everything up was we were already done with our project or mostly done when the NTTA had like two or three fatalities from crossovers within a week. Okay. And so immediately they went out and put a barrier down one side all the way and lot of our median plantings that used to be highly visible aren't so visible any more. Okay. So that's it, one of those things that just kind of happens. Plant pallet...we did a lot of research into plants. Trees, again, we looked for trees that could do with, we had several criteria. One, they had to do well with little to no irrigation once established.

Two, they had to be soil tolerant. Okay? And three, they had to look good and have some seasonal interest and so we looked at some plants, some of them like the Big Tooth Maples that are not typically thought of as being a useful plant but they're great because they don't need a lot of soil and they are very drought tolerant, for example, and so we went through here and we had to be careful, like for example, Bur Oak had to be way off the freeway because of the size of the acorns they drop and things like that. So, anyway, we looked at this and said, 'Okay, we can use these kinds of shade trees and this is, Evergreen trees.' Here's a couple that we decided that we could use. We tend toward these two because they do well in shallower soils, but if you've got deeper soils, these two will work as well. As you know, we try and stay away from monocultures whenever we can because of what disease may or may not do to things. For understory or accent trees, we went so far as to use Mesquites. Mesquites at a distance look great..."

Interviewer said: "Um, hum...I'll bet..."

Interviewee said: "...and they emphasize these, this kind of prairie feel. While we were trying to design an obvious man-made landscape, we wanted it to have that prairie-like feel, not some East Texas woodland feel. So, if you notice out there, shade trees are used few and far between and very spotty, at best. These trees are used in groupings and massings but, again, not in great big, huge beds. They're prairie-like. They're just in spottings of trees here and there. Okay. Shrubs, same criteria, this dry, drought-tolerant material that has seasonal interest but that can, you know, live without a whole lot of care and effort and a big piece of that was grasses. Ornamental grasses, you know, are kind of coming into their own as far as use because they can do so many things and they're drought tolerant. They look good in the winter and in the summer and the other thing about movement and motion is, the whole idea when grasses are blowing in the wind, again, reinforces that same idea that we were looking for. Medium grasses, a lot of the same kind of prairie grass, like Little Bluestem. In the wet areas like down in the trenches, we use Bushy Bluestem and Broom Sedge Bluestem and they are a wetland plant. And if you'll drive up across the tollway, you'll notice areas are always wet even though they're not irrigated and they have these seeps in the rock and that's, that's really our only choices in areas like that. So, there was a lot of give and take. On all the wall we had vines to kind of soften up that hard

surface. Again, all vines that do well natively here with a minimum amount of grass. There are areas within the intersections where the NTTA wanted the ability to be able to put Winter Rye if they really wanted to green an area up. I don't that they've ever done that. I haven't seen it anyway. But then we had the Weeping Love grass and Buffalo grass, again, low maintenance, and if you know our standard details and some things like this. How do you treat it? You know? I think you've notices over in the Irving section, they had a wall collapse."

Interviewer said: "Oh, really?"

Interviewee said: "Yeah, and our whole deal was, 'What do we have to do to the soils above these walls to keep them from attributing greater potential to making a wall collapse?' Fortunately, those walls collapsed before we did anything to them."

Interviewer said: "[laughter] Oh, we..."

Interviewee said: "They blamed...blamed for them."

Interviewer said: "I know which ones you're talking about. Yeah."

Interviewee said: "Talked about existing soils. Our soil testing, you know, where, what was there and what needed to be done to make them better. Irrigation, irrigation was a big issue. We went through an enormous amount of research and we used the top irrigation consultant in the world for the control system. Their name, Aqua Engineering, in, in, it's Boulder, Colorado. Okay. And we determined that we would use a drip system but that it was a sacrificial system. That after three to five years when we knew everything was established, everything needed to be able to stand on its own, and in fact, many of the plant materials we chose cannot tolerate irrigation after the first year. So, irrigation, we irrigated everything by plant type and with weather stations and fiber optic controllers. Okay. So, at any given time a guy can sit down at a computer at the NTTA and say, 'Okay, my Little Blue Stem grasses are established. They are all on program A. I turn off program A for the year.' Or set it to where program A only runs once in July right after you mow it for the first time. You know, so it's, the idea is this water control system would adapt itself to the plant materials and the grasses that looked better with a little bit of water would get it and those who didn't, we could easily turn it off without effecting any of the others."

Interviewer said: “Would that, I mean, you do have these massings, like you’ll have these Little Bluestem and then you’ll have Miscanthus or a Red Yucca or something. Would that program differentiate the different plant types within a planting bed?”

Interviewee said: “Yes. Yes, it’s all zoned separately.”

Interviewer said: “And then that same zone, I mean, if he was going to turn it off for Little Bluestem along the entire corridor, he could do that?”

Interviewee said: “Yes. Yes.”

Interviewer said: “Basically from...wow! That’s pretty sophisticated.”

Interviewee said: “It was. It was incredibly sophisticated. It took a lot of effort...we went and looked...we went and visited different places all over the country where they’ve tried to do this same thing. The toll systems in Florida and Arizona and all over, and then we went through a big pre-selection system for the manufacture itself, you know, RainBird, Toro...”

Interviewer said: “[inaudible]”

Interviewee said: “Yeah. We had a presentation, preliminary presentation where six vendors that make these kinds of control systems came in. After we all looked at it, we selected down to two, which was RainBird and, oh I can’t believe that I’ve forgot their name. That’s terrible of me.”

Interviewer said: “Irritrol?”

Interviewee said: “No. It’s, it’s one that’s not very well known here and they are very well known on the West Coast and they [inaudible]. I’m going to think of them here in just a minute. But we ended up using them and they, their controllers are great. You can control them in the field to program them that way. You can control them from a computer and they can work off of a local weather station or one back at the controller. They just do some great things and they found in a job this big, you can actually save enough water to pay for a full-time person just to run your irrigation control systems and that was the intent, and we strongly encouraged them to do just that because especially in a system like this, there’s a lot of tweaking that needs to be done. You

know? Miscanthus, in this area, might have 18 inches of soil and in this area it might have 9 inches and so you can't control the irrigation for that Miscanthus through the whole system because it doesn't, they have different needs. And so for the first couple of years, you have to have somebody that can tweak that a little bit and make sure it works. You can see areas on the tollway now where you can go by there and see big beds of something or big patches have died out, where some tweaking needs to be done and one of the best things we ever did on this project was required the contractor to fully maintain and operate the system for three full years after they finished. Okay. And by doing that, not only were they strongly motivated to do a great job putting it in because they were going to be responsible to repair everything that went wrong, but they would be responsible to tweak this system to the point where plant materials aren't dying and if they are, they've been replaced and that they were weeded. One of the biggest concerns everybody had out here was, 'Are these going to look mangy when we're done?' but the idea was if you could get that plant material to grow up and shade the ground and everything that they would pretty much take care of themselves. And that's kind of been the way it's worked out. So the contractor had to weed a lot the first year or two."

Interviewer said: "So you're saying that he had to take the full installation and maintenance project for everything from plant material, irrigation, maintenance..."

Interviewee said: "For three years following installation."

Interviewer said: "...for three years. Okay."

Interviewee said: "It's the best thing we ever did."

Interviewer said: "Not just irrigation but everything?"

Interviewee said: "Everything, everything. Put new mulch on every year, everything but the mowing. A lot of these native grasses needed to be mowed once a year so they did that. We have an entire section of maintenance specifications, what they had to do. A little, few interesting things we have talked about, there's enough drip line in that project to go from the NTTA headquarters, wrap around the Capitol building in Austin and come all the way back. There's just that much of it out there. It's a lot. Plant materials, lets see you look at some of these plant materials, there's, that's

the plant list right there and, you know, there's forty one thousand feet of mow curb, you know, and that's what seven or eight miles of mow curb. There's, let's see, almost a half million square yards of top soil preparation, you know, where they had to mix in the compost and the mulch."

Interviewer said: "Half a million yards?"

Interviewee said: "Yeah, square yards and then cubic yards there's thirty six thousand cubic yards of compost that was used. So there's a lot of stuff that went into this and a lot of the deals there was a couple things for example Little Bluestem grasses, there was seventy thousand Little Bluestem pots planted, thirty thousand Santolina, you know, just incredible volumes of turf and grass and containerized plants that went into this. They had to grow about half of them custom for the job because you just couldn't get them any where. A lot of the grasses..."

Interviewer said: "That's going to be one of the questions that I have, I mean, because I know that seems to be one of the difficulties in doing the native material is finding enough availability and so some of the projects are trying to get them designed early enough where they can actually go out and cost out and bid out and have people actually, to grow when you say I'm going to need thirty thousand Santolina or, you know, or whatever, and I am sure you probably, so that's the way you did it? You actually contracted out growers through..."

Interviewee said: "No, we didn't. What we did is we pre-qualified general contractors and in the end we only had two that were even qualified to even bid it. Okay. And what they did was they looked at it said, 'Okay, well we've got thirty intersections. We know which ones we are going to start at and we're just going to...' One of the requirements is they couldn't have anymore than five intersections being constructed at any one time because, again, it slows traffic down. So the idea was well, we know we can find enough plant materials for five or six intersections and so they immediately started to grow the ones for the ones after that, and they would just use the ones they could readily buy up front. A lot of the times they would finish an intersection and just leave one big bed empty because they couldn't get that plant material yet."

Interviewer said: "Okay. How many total planting areas are there?"

Interviewee said: “There are thirty-four intersections.”

Interviewer said: “Thirty-four inter...and that was the final criteria that you were basing it, you had priorities of...you ended up...”

Interviewee said: “Yeah, we looked at a whole bunch and we said, ‘Okay these thirty-four are worth while.’”

Interviewer said: “And they were at intersections, that turned out to be the best, the most bang for the buck?”

Interviewee said: “Right. Intersections or toll plazas.”

Interviewer said: “Uh, huh.”

Interviewee said: “And then things like, for example, major intersections like the George Bush and the Dallas North Tollway we would say, ‘Okay, were not just going to spend a half million on this we are going to spend one and a half million on this.’ And then...”

Interviewer said: “So this is like three intersections or something?”

Interviewee said: “Right, yeah, we’re going to, and we did a lot of that upfront we sat down and we would do just trash paper overlays and square footages and say, ‘Okay, let’s take a first shot at it. Let’s design what we think is right.’ and so the design team would get out and we would design thirty-four intersections just in general slaws.”

Interviewer said: “Did you have it down where you could cost it out buy square foot witch would include your irrigation, your everything and so you could just say...”

Interviewee said: “Okay, you’ve got to, and we had big fights about that sitting around the table with the design team. We would sit here and we would look at each other and they’d come back, ‘This is the greatest.’ I’d say. ‘I’m sorry, you’ve to cut back twenty percent. Figure out how you’re going to do it.’ You know, and there was a lot of give and take. We would sit, ‘Okay, I need twenty thousand feet over here,’ and another guy would say, ‘Well I really don’t, well I’m sure on this I really don’t need it,’ and we would pass area back and forth, so to speak, until we would get it to where we needed it to be. And then to fine tune and tweak it, once we got the designs laid out the way we wanted it and we

knew we were in the ballpark then we would tweak planting sizes if we had to. Like, you'd get in an area, for example, where you've got, this example here, this bed here we knew we all wanted it to be Adagio Silvergrass but we didn't have enough money so we'd do half of it in five-gallon and half of it and one-gallon and then, again, just reinforce that movement of motion while it was first designed and yet it would get us back in budget where we needed to be."

Interviewer said: "And eventually it would grow out and it'll be..."

Interviewee said: "And you won't be able to tell. Um, hum. So that's why it ended up being, what, 410 pages long."

Interviewer said: "Shall we do my questions?"

Interviewee said: "Sure."

Interviewer said: "Have you done, is this, I mean, I don't know..."

Interviewee said: "Yeah, I'm pretty much through. I just wanted you to know where this came out off."

Interviewer said: "I would love to be able to get black and white copies."

Interviewee said: "Tony Lucido will probably be able to give you a real copy and if he doesn't let me know and I will make a black and white one for you. Okay?"

Interviewer said: "Okay. I only need the, I mean, obviously the section that I'm working on. I'll tell you what. Would you kind of come this way so that I make sure, I don't want to get out of our room here. Okay. First question, and we may have already gone over some of this..."

Interviewee said: "Some of it. Um, hum."

Interviewer said: "How did the NTTA initiate the planting design concept for Texas Highway 190?"

Interviewee said: "Well the concept itself they left to us but the design, system-wide guidelines were what developed the idea of landscaping of freeway."



Interviewer said: “Okay. So the first step was that they gave, they wanted to have guidelines first?”

Interviewee said: “Yes.”

Interviewer said: “And then, and that came before the design concept?”

Interviewee said: “Right.”

Interviewer said: “Where there would be certain guidelines that were be set up?”

Interviewee said: “Right. Uh, hum. Cause when we started this no one knew whether or not landscape was going to be a priority for them. They may have determined that nice bridges where more important, okay so, and then nothing to be spent on landscape.”

Interviewer said: “And I guess because this was a tollway that they weren’t mandated to create, you know, like, you have to have a quarter of one percent of all the money spent on has to go to native plant material and stuff? Any of the memorandums in the STURRA or AASHTO or any of that stuff?”

Interviewee said: “No. Not to my knowledge. No. Everything I understood from them was they just felt like that if people had to pay extra to go on the roads that they owed the user some sort of experience to come out of it and their Board felt real strongly about that and that’s how that resulted.

Interviewer said: “Okay. What was the plant selection process of the roadside areas of Texas Highway 190?”

Interviewee said: “Okay. First, the design team developed the criteria. We discussed earlier that it had to be prairie-like, so to speak, it had to be very drought tolerant, and it had to be soil tolerant, and along with some other little things like, you know, depending on the specific area it couldn’t have more than a four inch caliber trunk or ect., and then it had to have seasonal color, and so we took those criteria and kind of backed into it and said, ‘Okay, what works here?’ We spent a lot of time with John Snowden, I don’t know if you know who he is or not but he’s the closest thing to a native grass expert you can find in the area and he’s very good. He helped us a lot on, ‘Okay, where can you use this type of plant versus this kind of plant,’ and he would show us big areas of these out in their native habitat where they’re not

irrigated and everything and we used that data to help develop and fit it into our concepts.”

Interviewer said: “So some of your plant selection process was to actually travel out...

Interviewee said: “We did, yes.”

Interviewer said: “...to native areas and see the plant material in its native habitat?”

Interviewee said: “Yes and we did a lot of that. Okay, and because not everything was native a lot of the adapted plant materials we used, for example like Santolina, for example, it met all the criteria so then it was a matter of, ‘Okay what issues are we going to run into here? How does it react to irrigation?’ And we spent a lot of time with large contractors, too, saying, ‘Have you ever had a problem when you planted 10,000 of these in a given area?’ Or...”

Interviewer said: “So you knew the plant material you were kind of headed for...

Interviewee said: “Correct.”

Interviewer said: “...then you would go out and talk with people or go visit areas?”

Interviewee said: “Yes.”

Interviewer said: “Did you go to other states at all?”

Interviewee said: “We did. We went to Florida and to Arizona and California, particularly, and we looked at things there. Some of the plant materials we used are from each of those areas. We went to Houston, another area, but not all of them fit this criteria and none of them that that prairie feel that we were looking for and so we, more than anything, tried to learn lessons from where we interviewed with these different toll agencies and highway departments. For example, we were unsure whether we would do an irrigation system at all when we started but that was one of the “lessons learned” that we got out of visiting with all these different departments is, yeah, ‘Were you to do this again what would you do differently?’ and we would take that, those helps and put it back into are design up front.”

Interviewer said: “Why were native plants included in the design?”

Interviewee said: “Two reasons, one they’re just, they’re sustainable. They don’t use a lot of water and they’re, I want to say immune, but they’re less prone to pests, they’re less maintenance, they use less water, all that which are factors both especially from the toll agency’s prospective in maintenance dollars. You know, St. Augustine grass out there you’ve got to mow it one a week, for example. Where a native grass we can put in there we don’t have to use a pesticide, we very rarely have to irrigate, and we mow it twice a year. Okay. So those are huge dollar savings over the life of the project that they didn’t have to spend. So that was one of the big reasons.”

Interviewer said: “What criteria were used for determining native plant material? Knowing that it was, I mean, that this would be considered native as opposed to non-native?”

Interviewee said: “Uh, huh. As just designers we looked a lot for plant characteristics. There were some plants that obviously would have been great native plants as far as being drought resistant and disease resistant but that we felt were unattractive. So, we didn’t use them. So, one of our big selection criteria was how does it look and, for example, I’m trying to think of the, what’s the, Sideoats grama grass, for example, I mean, the great roadside erosion control type grass but it has almost no aesthetic value. So one of our large criteria was what does it look like and we looked at dozens and dozens of native grasses and from those picked the ones that we thought held some aesthetic value and then verified that they could tolerate the irrigation and the soils and things like that that were there.”

Interviewer said: “So was there scientific testing done on this plant material to actually, I mean...”

Interviewee said: “No.”

Interviewer said: “...within...”

Interviewee said: “We relied pretty heavily on just written literature on the subject and on experts like John Snowden and others to give us some experience on that.”

Interviewer said: “And you said, you said earlier that the NTTA specifically said not to use wildflowers.”

Interviewee said: “Correct.”

Interviewer said: “Could you elaborate on that a little bit?”

Interviewee said: “The tollway has to make a lot of money to support itself to build new systems and the way they make money is by fitting a large amount of cars on there and moving them very quickly. If the tollway was as bogged down as other highways, they, no one would use it. So, they go to great efforts to make sure that cars move quickly and efficiently and they felt like adding wildflowers to the system would only encourage people to stop and park on the side of the road and you’ve seen on the other highways setting their kids out in the wildflowers, take pictures, and it becomes a safety issue and it slow cars down and they don’t want that and so we are specifically told no wildflowers.”

Interviewer said: “Would you also elaborate a little bit on something we spoke of before we started the interview, which was about the design intent, the movement, the sense of flow that you were trying to create that added to, well I guess, an aesthetic look of what we are trying to achieve but also a practical application that you really were trying to design to have cars moving quickly? Would you talk a little about that?”

Interviewee said: “Yes. Yeah, one of the early concepts we came up with was this whole idea of reinforcing movement and motion, the sense of movement, to encourage vehicles to clip along at a normal pace and if you planted, for example, rows of plants perpendicular to the direction of travel that gives you, it actually, it’s an unintentional impediment to travel. You feel like you ought to be slowing down or stopping and it makes you feel like you’re going faster than you really are because you’re clipping by perpendicular objects. If you put planting exactly parallel to the drive, you loose the sense of motion because it’s consistent. You’re just driving along and there’s no change. So our concept of movement and motion was to weave this plant material in a linear fashion back and forth across the travel lanes in a way similar to the way cars pass and change lanes and move back and forth and so you’ll see the plant material move from one side of the road to the median to the other side, and it was our intent to have these planting beds reinforce the idea of movement and motion with the traffic.”

Interviewer said: “Thank you. What percentage of the plant pallet were native plants?”

Interviewee said: “I’d say two-thirds. Okay.”

Interviewer said: “And why were non-native plants included in the design?”

Interviewee said: “One is aesthetics. We couldn’t find enough native, at least in our mind, that had some of the aesthetic qualities that we wanted. We just couldn’t get enough and so we felt like we would intersperse some of these heavily adapted species to spice up the design and still not give up any of the drought tolerance or necessarily the disease tolerance as well.”

Interviewer said: “What literature or scientific study was done in developing this plant selection? We’ve talked a little about that already.”

Interviewee said: “I wish I could tell you that there was some exact format, method that we followed. It was a little less, it wasn’t as scientific, it was that it was a whole combination of things like, okay, and to be honest with you, we started out with aesthetics, you know. Let’s gather a list of a hundred plants that we think look good and then let’s start to carve. And so we would gather that and then we would research and read what we could find by a local plant expert, Howard Garrett, etc. you know, and John Snowden and others, which of these hundred plants that we like meet our criteria and it was just whittled down and carved from there into where we were left with a batch of plant materials that met all the criteria and that served our purpose.”

Interviewer said: “Did we discuss the specific criteria for plant...”

Interviewee said: “I think so. But again, one was aesthetics. They had to look good. Two, they had to kind of reinforce a prairie-like feel. Three, they had to be very, very drought tolerant. And four, they had to be soil tolerant. They had to be able to deal with bad soils or mildly altered soils and that’s kind of the criteria we went by. Oh, and be relatively maintenance friendly.”

Interviewer said: “Not free, but friendly.”

Interviewee said: “Yes.”

- Interviewer said: “How does the choice of planting and design compare with literature recommendations on the use of native plant material?”
- Interviewee said: “Um, it’s, to my knowledge, other than just spraying, you know, wild native seeds on the side of the road, this was probably the largest native planting exercise I know of in the state. I mean we went kind of above and beyond the call of duty, I think, to make sure that this was native friendly sort to speak. I’ve never sat and compared it, so I can’t really tell you.”
- Interviewer said: “I know that, you know in literature I’ve read and that we talked about at lunch, you were, and I think I talk about this a little later, but your intention was to stay away from naturalization where quite often you see in the literature when they’re talking about the native use of plant material it’s for rehabilitation or restoration or and your goal was completely away from that.”
- Interviewee said: “Yes. Yes. Yes, it was, this is, this whole thing was done for aesthetics. I mean, that was, because as far as erosion control, it was controlled. There was turf, okay, of one sort or another on there that were controlling the soils. We did this to give the driver a better experience than he would normally get on your average, everyday freeway. So there wasn’t a lot of, you know, I want to say noble thought behind it. This was to make the driving experience better.”
- Interviewer said: “Okay. What are the perceived benefits of the planting selection of Texas Highway 190?”
- Interviewee said: “Well we, like I said, it wasn’t the reason for doing it, but we tried to do some little studies, for example, to determine what, and we were very, we weren’t very successful and be able to tie down hard numbers, and I wish someday somebody will be able to do this. But we do know, for example, we would love to be able to do some kind of study now knowing that we have almost a hundred acres of plants, native and adaptive plants out there. We’d love to know, for example, how big an affect that has on the carbon monoxide, for example, okay. What benefit does that planting give back to the community, in scrubbing the carbon dioxide from the air and things, at producing oxygen. And why we can’t, we know that it is positively affecting that, we can’t say we, we were with our limited budgets and fees we couldn’t spend a lot of time trying to do...I mean that’s worth a thesis all in itself I think.”

Interviewer said: “Yes.”

Interviewee said: “And it would be very interesting to see how that turned out. And I think also, it’s just public awareness, I think a lot of people now look at that freeway and say, ‘That’s interesting. What is that grass?’ And if they can find out, we hope that that will encourage people to realize that you don’t have to plant something, a gardenia, to make your backyard nice. You can use low-water use native plant material and still have the kind of visual affect that you’re looking for.”

Interviewer said: “As were talking, I’m thinking, you know, one of the benefits that might be also from just adding to what your saying in more of a naturalized setting, where you have dozens of plants in a small area, having yours where they’re, they’re in masses gives the viewer, I mean, you can see a bunch of Red Yucca and so it hits you.

Interviewee said: “Yeah.”

Interviewer said: “What is that plant? As opposed to there’s just so many. What is the perceived success rate of the existing native plant material used in the project?”

Interviewee said: “I wish I could tell you. I know they had specific problems with a couple of plants and I suspect that a big portion of those was trying to get the irrigation system adjusted. They had some big patches of Mexican Feather grass die off up front and that is almost surely because of irrigation. Mexican Feather grass doesn’t do well with irrigation. You give it a little bit to start it and then you just leave it alone. And I suspect that that, you know, maybe even a third of that might have had to be replanted at one time or another. Santolina is, again, particularly touchy towards irrigation and that I’m sure had some issues to work through. We tried to warn the contractor up front on a lot of these that they would have to be very, very careful with some of them. And there is a learning curve there that I’m sure had to take place. A lot of the Junipers didn’t do very well and that surprised me, giving that they’ll grow on solid rock. And we don’t, I’m not sure why again that may be irrigation related. But overall, it’s tending to fill in and do what it was intended to do and I think that in general, I think that if you look at some of the other projects, like I-75 up in Allen, or in, even I-75 down

through town here where TX DOT is, similar project, you'll find that a lot of these non-native or non-adaptive that are heavily dependent on irrigation are very spotty and patchy right now, where I believe that in the long-run, the George Bush will sustain itself much better over time."

Interviewer said: "What is the perceived success rate of the existing non-native plant material?"

Interviewee said: "About the same. I can't say that I've seen any difference. In fact, it's probably easier to keep the non-natives alive because they're more tolerant to irrigation. Okay, so you, initially anyway, you probably had a little more success with the non-natives but I think long-term, that the natives will take care of themselves better."

Interviewer said: "What is the time frame for satisfactory cover of shrubs and grasses along the roadside?"

Interviewee said: "We anticipate here we'd need three years. That's the reason we selected the maintenance period that we did. Okay. We figure if we can plant one gallon, for example, one gallon native grasses that within three years they would be full size and cover."

Interviewer said: "Okay. So your choice of planting size had to do with the ultimate goal that you were trying to achieve of three years, in other words, you know, doing a six inch pot or five inch pot of something it would have taken longer, so that had some determination..."

Interviewee said: "Yes, yeah, had we been, had the budget to do five gallon everything we could have cut down that maintenance time to eighteen months, for example. We would have been fine. But we wanted to just make sure that everything had plenty of time to fill up. So, in our research, as kind of spotty as it was, we determined that that's how long we would need to make sure things filled in."

Interviewer said: "Okay. How long in terms of growing seasons, will an intensive maintenance program be required for each new phase that you go through?"

Interviewee said: "Could you repeat that again?"



- Interviewer said: “Well, you’ve just answered really. How long in terms of growing seasons, will an intensive maintenance program be required for each new phase? Three years?”
- Interviewee said: “At least three years. Yeah, now we were very careful to warn them, that, you know, native plants don’t equal no maintenance. The fact that these are all in rigid beds with...in masses and everything else, just by its nature means that they are going to have to do some routine maintenance on all of it. And they were willing to take that on, and that’s one of the things that I think everybody needs to realize that just because you use natives, while it may cut down on your maintenance costs and efforts, it certainly doesn’t eliminate them.”
- Interviewer said: “Well you, and you run into some separate issues, I guess in that, or do they do, do they spray? Do they use spray herbicides and stuff?”
- Interviewee said: “They are allowed to. Yes. The contractor is.”
- Interviewer said: “Because, of course, once you get into when you’re around all those grasses and stuff, you can’t use those broad, I mean, the same herbicides so there’s a lot of hand weeding, isn’t there?”
- Interviewee said: “There is, like for example, we allowed the contractor to use Round-up in spot-spray applications until the plants could grow up and cover the ground enough where Bermuda grass wouldn’t be, it wouldn’t want to live there. But until that ground covers up, Bermuda is just going to go crazy. So they had the option to go out and spot-spray, if they would like. And that often is one of the better ways to take care of it.”
- Interviewer said: “Your turf-mix was...did I see in there that it was a combination of Buffalo and...”
- Interviewee said: “We sodded the Buffalo grass in areas and it was scheduled to not be mowed. Okay, so, you know we talked about low, medium and high plant materials. Buffalo sod was one of our low plant materials that we figured could grow up, you know, twelve inches.”
- Interviewer said: “So that would actually be in planting areas, as opposed...”
- Interviewee said: “In planting areas.”

Interviewer said: "...not the turf areas?"

Interviewee said: "In the turf areas it's common Bermuda and there was a whole other reason we went that direction and that, I believe, is working out well."

Interviewer said: "Is the Bermuda overtaking the Buffalo? Have you..."

Interviewee said: "No, we separate it with a large, an eighteen inch mow curve for that very reason to keep them separate."

Interviewer said: "What are the lessons learned, you had talked about lessons learned that you got from other people. What are the lessons learned from the plant selection of the Texas Highway 190 for future projects?"

Interviewee said: "Um, one, like I said, if I had it to do it again, I'd do more research on certain plants, for example, like for example, the Cedars. We made the rookie mistake, for example, of just saying, we see Cedars growing out of the caliches rock all the time, they must do really well in shallow poor soils. That's not necessarily the case when you have Juniper that's grown in a nursery setting in vermiculite soil. You see what I mean? So there are some things that we could learn from that way, go back and so okay now, just because you see it in this condition, does that mean it's equivalent here? We could....it would have been better had we had a little more rigid plant research methodology. The problem we had is we couldn't find much. We learned far more traveling to these different Departments of Transportation asking them questions, than we ever did reading on anything. I would have like to have done a little more of that, hopefully, in an area that was more similar to our region. We had a hard time finding anybody who'd done anything like this here. You know, because when you think about roadside planting, you think of Phoenix and California. I mean that's where they do it, but they're not necessarily equivalent to what we have here."

Interviewer said: "So, the plant material would certainly be different wouldn't it?"

Interviewee said: "Yes, it would and their approach to it is different, too. You now, in Arizona, they spot-drip irrigate everything and it doesn't in the least bit look like prairie, so our approach to irrigation

would have to be completely different and as such, changes the way we approach planting designs as well.”

Interviewer said: “They use fewer plants and more specific plants?”

Interviewee said: “In an acre, they might use 30 plants is all. For example, where an acre here, we might have 1,500 plants. So there’s a huge difference to their approach. We had to use irrigation mats, you know, to cover everything so that when one plugged it didn’t matter. You got irrigation from the ones around it. They don’t do that. They point-source irrigate everything with one dripper, you know, and we can’t do that here.”

Interviewer said: “Was there thought on the regionality of the area in choosing the plant material, in that, you know obviously, you were saying that you’d looked at Houston and you’d looked at some other areas, but the plants, so was there some thought to all that?”

Interviewee said: “Yeah, yeah, there is. We wanted to again, we had Board Members that would say things like, ‘Ooh, I sure would like to see some Roses’, for example. Or, ‘Wouldn’t it be great to see some Indian Hawthorne?’ Or we actually had some peer reviews from other consultants in the area that asked why we didn’t use Liriope and Indian Hawthornes kind of thing. One that we were really set on and we fought really hard for it was that the plant materials we used needed, even if they weren’t native, had to have that North Texas Prairie feel to them. And we tried to limit our plants use and selection to that genre, so to speak of plants.”

Interviewer said: “Um, hum. We’re getting close to the end.”

Interviewee said: “Oh, no problem.”

Interviewer said: “How was the plant pallet changed between phases of construction?”

Interviewee said: “Um, you saw the first go at it in here.”

Interviewer said: “Okay.”

Interviewee said: “Okay and you’ll see that when we got to here we dropped a lot of these plants that did not reinforce that prairie-feel as much as we felt like they should. For example, Bur Oak, you won’t find a Bur Oak in here, you know, because it doesn’t really...when you

think of....you might think Post Oak when you think of Texas Prairie, but you don't think of Bur Oak. We used a lot of trees that were, tried to mimic that just rolling hills and clusters of trees and so shade trees are few and far between here, very few. We used mostly for prairie trees, for example."

Interviewer said: "In that later phase?"

Interviewee said: "Yes, uh-hum. And so as we went from this kind of a guideline into actual construction documents, we moved further and further in the direction limiting our pallet to what reinforced prairie-type feel."

Interviewer said: "Okay. Was this project partially funded by or subject to any federal or state provisions, for example, the Federal Transportation Enhancement Program, STURRA, AASHTO, Federal Highway?"

Interviewee said: "No **[laughter]**. To my knowledge no, and I remember some conversations of we don't want to have any outside funding because it would change what we could and couldn't do and they wanted to be able to do whatever they wanted. This was all toll money, no federal money involved. That's part of the reason they could get away with some of the contracting that they went through. You know, limiting who could bid and who could not and things like that."

Interviewer said: "Okay. I've got a list of a few things here."

Interviewee said: "Sure."

Interviewer said: "How did the use of this plant pallet and the subsequent design address any of the following criteria? Aesthetics, obviously that was..."

Interviewee said: "That was key, probably the first thing we looked for."

Interviewer said: "First, second, third, and fourth things **[laughter]**."

Interviewee said: "Yeah, I mean that..."

Interviewer said: "Alright. Water usage."

Interviewee said: "Yeah, really high on the priority list."

Interviewer said: "Roadside naturalization."

Interviewee said: "Very little. Like I say, we weren't trying to do an erosion control or make it look natural. We were trying to...a contrived feel, so to speak."

Interviewer said: "Adaptability."

Interviewee said: "We, uh, we really didn't want it to adapt very much, you know what I mean? We didn't want it to uh, and maybe I'm using the term in a different way than you would. We didn't want, we didn't want this project to morph over time. We wanted it to stay kind of like it was."

Interviewer said: "So, plants succession and adaptability that would overshadow others..."

Interviewee said: "Avoid succession."

Interviewer said: "Trying to avoid that."

Interviewee said: "Okay. Yeah, and in a lot of ways we eliminated it specifically by use of mow curbs in areas where certain plants tend to migrate. We would enclose them in mow curbs to keep that from happening."

Interviewer said: "Okay. Air Quality."

Interviewee said: "Yes, that was always a consideration. What can we do to make, at least get back a little bit."

Interviewer said: "Future Viability."

Interviewee said: "That was big, too. Because we wanted to make sure that whatever we planted would sustain itself over a long period of time. And a lot of the plants like, all of the Bluestems, which we, you know, the four or five varieties of Bluestem we used, they're probably the biggest number of plants here, you know. They self-seed and that was a big issue with us. Okay, well, these plants, we know are always going to be fine because they are always going to be seeding themselves or always going to regenerate. Mexican Feather grass same way. Buffalo grass same way. We wanted things that, Sumacs. Most all of the

plants we selected, there's a few exceptions, but most of them regenerate themselves and are long term solutions to..."

Interviewer said: "Now that sort of goes against what you had just said about the adaptability in that they self-seed and all, they rejuvenate and replenish themselves and..."

Interviewee said: "Yeah, we just didn't want them to...to...I guess what I was more worried about was the succession thing that we didn't want one plant material to take over the others. We wanted it to stay where it was, but to sustain itself in its given location."

Interviewer said: "Um, water quality."

Interviewee said: "Um, although that wasn't a specific, you know, criteria, what we did, we knew that if we did this right it would improve water quality, especially the root masses of some of these native grasses are great filters for what they do."

Interviewer said: "Erosion control."

Interviewee said: "We, like I said, they're, it was a concern that we use something that would keep erosion from happening, but I can't say that was a huge criteria in that it was controlled before we got there and then we just kind of stirred it up temporarily."

Interviewer said: "Controlled?"

Interviewee said: "Meaning they had established turf everywhere. We dug up the turf to put this stuff in."

Interviewer said: "Oh, I see. Okay."

Interviewee said: "Okay. Now in the new sections of George Bush Turn...you know or the Eastern section or wherever you go, you will, yes, that's a bigger concern and it will establish this type of planting at the same time of doing the turf establishment everywhere else."

Interviewer said: "Okay. Soil rehabilitation."

Interviewee said: "Yes, that was uh, we knew this soil was really bad and one of the key components of that was using this compost for a good use to rehabilitate the soil itself and the grasses in and of themselves,

the maintenance practices, like for example mowing. When we mow the grasses, they are mulch-mowed. They're, you don't go pick it up. So we..."

Interviewer said: "We talked at lunch a little bit, but if you could tell me just briefly again the process because to rehabilitate the soils that you actually brought in a layer of compost."

Interviewee said: "Yes, we did. In fact in most of the areas we actually used a microbe solution, where we sprayed microbes all over the ground to put some life back in the soil. Okay to aerate it naturally, naturally aerate it and we also put a layer, a three inch layer of compost over every area that was to be planted and tilled it into a nine or ten inch depth."

Interviewer said: "And this included turf areas?"

Interviewee said: "In the turf areas where we left the Bermuda, we did the microbe solution and added some compost as a top dressing, but we didn't till it in those areas, we let the Bermuda come up through it."

Interviewer said: "So if I understand, I'm understanding something here I think, that the...in the order of activities along this tollway, all the completion, everything would be completed and they would plant Bermuda throughout and then you would come in and do your enhancements after the fact."

Interviewee said: "That's the order, that's the order this went in."

Interviewer said: "Okay."

Interviewee said: "And that's only because George Bush Turnpike...there's federal laws and everything saying how many months you have following construction before the soil has to be stabilized. And this project was not ready to go when the George Bush had to be stabilized, so they put a temporary grass solution on the slopes to hold the soil down until we could get in there and do our thing."

Interviewer said: "And as your progressing, West into the Irving area where some of the newer sections are, has that, that has changed now, in that you're doing the all of it at once, or..."

Interviewee said: "When it can be done that way, but even then we're finding it...let's say you finish your freeway in July. Okay? The

mortality rate of the plants planted in July is really poor and it would be more cost efficient to just spray some rye grass down, water it, and stabilize the soil and come back in November and plant the other plants.”

Interviewer said: “I see. Okay.”

Interviewee said: “So I’d like to, in a perfect world, yes, you could go in there at the right time and put this in, but scheduling often doesn’t allow it.”

Interviewer said: “I see. Alright. Weed control.”

Interviewee said: “Uh, that was a big deal especially with our native grasses. We wanted grasses that got tall enough that actually provide a shade structure for the soil and it would not only inhibit weeds from growing, but out-compete them (for a lack of a better term.) You know, you get, Bluestem grasses, for example, they will out-compete Bermuda for water every day and that was one of our criteria, when we looked at that was how well will it compete with the things around it for the water that’s available. And so that was a big concern.”

Interviewer said: “Maintenance.”

Interviewee said: “Another big one. Uh, grasses, one of the reasons we used native grasses was you get a lot of bang for your buck, as far as planting, you know, it grows relatively quickly and you have to mow it once a year versus 50 cycles like you do a turf grass. Uh, so that was a big deal, in addition to that, you know we used the shrubs that we used are not shrubs that need to be pruned and taken care of.”

Interviewer said: “Salvia greggii’s and Yucca’s?”

Interviewee said: “Yeah, just stuff that looks good by themselves and that we don’t have to go out and do a lot to them. So, so maintenance was really big, in fact, the toll agency department that managed this project was the maintenance part, so it was a big issue for this.”

Interviewer said: “Irrigation.”

Interviewee said: “Uh, again we looked at irrigation as the means to the end, you know, irrigation wasn’t the priority, the plants were the priority,



irrigation was the support system for it. So, we made all our irrigation decisions based on our ultimate goal of the plants and because the plants had such very specific needs as far as not enough water, too much water, by plant species and everything, that when you kind of went down through everything it dictated what irrigation system and design we would use. Okay.”

Interviewer said: “Did you find that you would, you were planting, uh, like in one area or let’s say a planting area, and you’re going to have five or six or ten different plants, were those plants set together with irrigation in mind as one of the criteria in determining how...what plant selection would be?”

Interviewee said: “Yes it was, but we also left open the idea that no matter, for example, trying to get...here’s a good one. Yeah, three different plant-types. We made sure that this was one zone, this was another zone, this was another zone, so that if we had to water this that’s just fine. We didn’t have to water these two, okay?”

Interviewer said: “Another good reason for the massings as opposed to...”

Interviewee said: “Right.”

Interviewer said: “Because you could really...”

Interviewee said: “Yeah, that way we never...”

Interviewer said: “Set them apart.”

Interviewee said: “...mixed plants that weren’t compatible, so to speak, you know we made sure that we never put a group of plants in an irrigation area that needed a lot of water, if it didn’t.”

Interviewer said: “It had different requirements.”

Interviewee said: “Right. We were pretty careful about doing that.”

Interviewer said: “Okay. Has there been feedback from the public concerning the plant selection for the Texas Highway 190 Project?”

Interviewee said: “That’s, you’re going to have to ask Tony Lucido about that. You know I have people that I know personally that just have seen the job, make lots of comments to me, but one if they don’t like it, they’re not going to tell me and two you know, and it’s

hard, you know, I know too much about it to be objective. You know I drive by it and I look at it and I see all the things that weren't intended or you know, you can see...nothing is worse than architect that goes back and looks at the work he's done cause he sees everything that's wrong with it, all the problems or, 'Ooh, I should have made that come out this way' or whatever so, the comments I've heard is 'Oh, it's finally looking the way it should.' Okay? So, it looked pretty rough for the first 18 months. It wasn't maintained very well. I understand they had some rollover in the contractor from a management standpoint. But now I'm starting to hear things like, 'Yeah, that looks like we thought it would' or 'It's looking better everyday' kind of thing."

Interviewer said: "So when did this project start? From your aspect of it, the planting..."

Interviewee said: "It started August of '02, is when we started design. Okay."

Interviewer said: "First plants hit the ground?"

Interviewee said: "We had 13 months, 13 months to design it, first plants went in the ground April of '04. Okay. So were coming up on our three years for this Garland segments."

Interviewer said: "Uh-hum."

Interviewee said: "And some of the urban segments, you know, have barely been done, 17, 18 months."

Interviewer said: "I haven't driven the Garland section. I should go there. That's probably the most completed isn't it?"

Interviewee said: "It should be, yes. I haven't been out there in quite awhile either."

Interviewer said: "I know, yeah."

Interviewee said: "Like the middle sections, like Independence and things, you know I've been by there and that's starting to fill in and look like it was intended, you know, but I haven't been out to Garland recently."

Interviewer said: "Okay Is there any other information you'd like to pass on or anything that we haven't covered that you think is important?"

Interviewee said: “I don’t think, we kind of covered everything I can think of anyway. Oh, one I want to tell you the names of the other people that **[inaudible]**...”

Interviewer said: “Okay. I’m going to turn this off then and we’ll...” **[dictation ends]**

## Interview #2

- Interviewer said: **[Dictation begins...]**
- Interviewer said: “Okay, thank you. And we’re going to be talking today about the Texas Highway Extension now out in North Texas, what’s called the George Bush Tollway.”
- Interviewee said: “Um, hum.”
- Interviewer said: “And can you just kind of give me...is there anything you would like to start with about it or just kind of give me an overview of how you’re, or you were first approached to be involved?”
- Interviewee said: “The involvement with the City of Richardson in this project started between the Deputy City Manager, Dan Johnson, and his relationship with Jerry Hebert, the Executive Director of NTTA. Jerry Hebert used to be Deputy City Manager for the City of Richardson before Dan Johnson came in. Dan Johnson and Jerry Hebert were close friends, professionally, and personally and when Jerry left to go to NTTA and Dan came to the City of Richardson, they continued that relationship even closer because they live very close together in Richardson when Dan moved over here and Jerry was very much interested, while he was at the City of Richardson, in the look and the appearance of the community. And Jerry was our liaison between our department and the City Manager’s office, Jerry Hebert was. So, we worked very closely with him and U.S. 75 that goes through Richardson is U.S. Highway that would be TXDOT-maintained and TXDOT-improved, but the decision was made by Richardson, during the last improvement process for U.S. 75, that we wanted some higher level of maintenance and higher level of look for U.S. 75 than what TXDOT was willing to provide. So the City of Richardson put a lot of interest in a higher level of landscape improvements along 75 and a higher level of maintenance of the landscaped areas and the roadsides along 75. So, the City of Richardson took over that responsibility and consequently our department, Parks and Recreation in the Parks Division, part of what I’m responsible for in the city, is charges with the maintenance with U.S. 75 as it goes through Richardson. So, what you see in Richardson is not a typical TXDOT maintenance or level of improvement. Other communities will call us and ask us how we get TXDOT to do this for us. TXDOT does not doe

this for us. We do it. So, Jerry, when he went to NTTA, the tollway at that time was in very unkempt condition. The maintenance along the roadsides was very lacking and there had not been really any attention placed on maintaining the roadsides in a good manner. Jerry, with his background being in Richardson and high level of maintenance that we put along U.S. 75, abide his feelings of what he wanted the roadsides of NTTA to look like and HNTB was hired to come up with some maintenance programs for NTTA and Jerry said, 'Just call the City of Richardson and do what they do.' Because he knew that what we did was successful. So, the consultants for NTTA would call us and ask us, 'What do we do? When do we do it? How do we do it?' And we would give them our recipe for how we maintain our area to get our roadsides looking the way that they do. And then the consultants applied that to some management practices that they passed on to NTTA and said, 'Here's what you need to do.'"

Interviewer said: "Is this that book of guidelines?"

Interviewee said: "I have not seen what was actually developed."

Interviewer said: "[inaudible]"

Interviewee said: "But I had some people from NTTA kind of calling me and asking me some of the same questions at the same time. So, I was getting it, kind of, from both ends."

Interviewer said: "Um, hum."

Interviewee said: "But, consistently they were continuing to upgrade their level of maintenance along 75 and it was, everything was looking better. There was some interest, from the City of Richardson's standpoint, that the George Bush Tollway, which goes on our North side of our community – separates us from Plano and part of Dallas – we were interested in the Tollway having attractive appearance like U.S. 75 has in our community. So, the City of Richardson was interested in seeing what could be to allow for the opportunity for some highway enhancement, landscaping, and increased level of maintenance. So, Dan Johnson approached Jerry Hebert, asked Jerry if the Tollway Authority would do it, and Jerry was not receptive of that. So, Dan asked him, 'Well, if you're not going do it, let us do it in the City of Richardson. We'll make it look better. We'll do the enhancements. We'll do

the improvements.’ And Jerry wasn’t interested in that happening because if there was just one little section that was enhanced but it wasn’t done the whole way, other communities could kind of pick up and do their own thing and there would not be any continuity to the look on 190. So, Jerry wasn’t interested in letting each individual community do its thing. But Dan Johnson wasn’t willing to let it rest. He was very interested in what it looks like because the appearance of Richardson along George Bush is just as important as the appearance of Richardson along U.S. 75. That is the image that a lot of people have of our community that may not ever come into our community and it’s important to us that our roadsides, whether they be arterial, collector, or residential streets, have a very good appearance to them and especially thoroughfares like U.S. 75 and George Bush have a very attractive frontage to them. So, I think Jerry Hebert just finally got tired of Dan Johnson prodding him on the issue and Jerry said...and this is in *Reader’s Digest* form and I wasn’t there but this is what I’ve been told...Jerry just finally said, ‘Okay, Dan. I’ll let the Board decide this.’ Because Dan wasn’t giving up on it. Dan wanted this frontage to be a lot better than what it was. It’s our last areas for development. Large, high-tech development is along that corridor of U.S. 190 or, I guess, Texas 190, now George Bush Tollway. So, Jerry took it to the Board and the Board decided, ‘Let’s take a look at what’s...what are other people doing? What’s out there?’ And the Board took trips to Arizona, Florida, I believe they went to California and I think there was one other state that they went to, may even have been in Texas, and looked at what other toll road authorities do in landscape enhancements and improvements to their highways. And they got the interest to do something on George Bush. So, Dan Johnson was capable of getting some attention drawn to this corridor, not just through the Richardson area but the entire length. Of course, Dan was interested, primarily, in the Richardson area but now the Board of NTTA had the vision to do something the entire length. And when the design got started with HNTB working on it, HNTB contacted me at the City of Richardson and said, ‘What have you seen that’s been successful along U.S. 75 in your landscape work there that could apply to George Bush?’ And so we sat down. We started talking about scale, texture, color, all the types of things that you would normally kind of start delving into from a materials principles analysis in looking at any landscape design, but now we’re doing it at a speed of 60 miles an hour and what changes and what’s...what makes the most impact and what gets lost at that

60-mile-an-hour process. And as we went forward with the process, each generation of drawings that HNTB would generate, they would send a set to me to red-line, give them our opinion. Now, we didn't have any authority to veto anything that they were doing. We didn't have any opportunity to, or didn't exercise, didn't want to exercise, any opportunity to do the designs for them but we certainly reviewed and critiqued plant materials they were using, beds, size of beds, and got into a lot of the color texture elements to try and make the end result a successful result, whether it was in the Richardson section or whether it was in Garland or whether it was in Carrollton."

Interviewer said: "Um, hum."

Interviewee said: "It didn't make any difference. The whole thing...what applied in our area would apply any place else. But we helped them through the entire aspect of it and, in fact, some of the plant material that was proposed early on in the process, and that's...for this one to carry out and to be successful just the concepts of where the beds were had a lot to do with the relationship of the plant materials that were being used. So the plant material had to come into the schematics very quickly so that we could actually start evaluating how these things were going to blend together and work together and a lot of the plant material that was proposed by HNTB, I had some very uncomfortable feelings with on some of the plan material."

Interviewer said: "Can you remember any specifics?"

Interviewee said: "Uh..."

Interviewer said: "I mean, was it native material, non-native material?"

Interviewee said: "The...the design parameters were to, which were very, very good and very legitimate, were to keep the water consumption low, to be water-wise, water-conscious, and they started off with almost a pure grass design and I tried to encourage the incorporation of more vertical elements – more trees and more shrubs – and not just grasses or almost all only grasses. There's been kind of a swing in our profession lately of almost using too much grass, in my opinion, in a landscape design, and I'm talking ornamental grasses, and not using enough of an available plant pallet to make an attractive landscape. I think grasses are being overdone. Definitely a time when grasses were underutilized and

I enjoyed the opportunity of seeing grasses integrated into landscapes that really added another element. And one that we certainly appreciate on U.S. 75 is the Pampas grass and that animation that the Pampas grass gives throughout the year. As the traffic moves, the grass is moving. It's in constant state of movement, almost, which is nice. That animation is not there on a lot of other plant materials and grass is one that can give you that, and grass can give you multiple colors of relief throughout the seasons and give you interesting characters and shapes and forms just as it matures and its seed head develop. So, grass has a very unique element that it can lend in the landscaping if used appropriately and the appropriate varieties are selected. But some of the initial selections of grasses along 75, and one thing that we've been trying to push in Richardson is changing our plant pallet to plants that are either native to or extremely well adapted to North Central Texas and not trying to work so much with exotics and trying to make them work and then replant them after we have either severe droughts or sever winters and actually trying to work with things that go through our city's known changes on a broad scale and work extremely well and..."

Interviewer said: "Let me interrupt for just one moment."

Interviewee said: "Sure."

Interviewer said: "If you've completed your thought."

Interviewee said: "Well, the...one thing I was getting into is some of the grasses that were selected were true natives but they were not grasses that were going to work well in that setting. They were not grasses that would have been successful in that area and I enlisted the help of the Texas Agricultural Research Station and Dr. Reed to help us on this to actually show, to get HNTB involved, and to bring them into this and to vision Dr. Reed's test plots at the Ag Research Station and show that landscape architects and the planners at HNTB what that plant looks like and is going to look like and, 'I don't think that's what you want in that setting, but here's what you're planning for.'"

Interviewer said: "Um, hum."

Interviewee said: "To actually see it in practical application, as opposed to a photograph in a plant catalog or on a website that shows a very nice specimen in one location..."



Interviewer said: “Were any of those grasses used in the final design?”

Interviewee said: “Some of the grasses that they had identified to use in the beginning were okay. Several of the grasses they had identified to use were ones that we highly, highly, highly recommended that they not use those plants and they select something else. And after I had a chance with Dr. McCay and Dr. Reed at the Ag Research Station to show them applications of those grasses and to also convey to them their concerns and feelings about them, a lot of those grasses were changed and taken out and not used. And I think...”

Interviewer said: “Um, hum. Cause they still use a lot of the grasses...”

Interviewee said: “They use a lot of grasses but there are a lot of changes that were done to the species that were selected based upon the input of Dr. McCay and Dr. Reed and actually seeing the field plots...”

Interviewer said: “I understand John Snowden made a lot, though. They consulted John Snowden on those as well.”

Interviewee said: “John, was involved in some of the early plant selections and we’ve worked with John on some habitat enrichment projects that we’ve done here and we utilized John and we utilized his nursery for a lot of our plant material from time to time, but some of those plants that John had recommended were not plants that would have been suited to that location and would have done well.”

Interviewer said: “Um, hum.”

Interviewee said: “One of the problems...one of the big problems with several of the grasses that they were selecting were that they were too long and lanky and they do what’s call lodging. The grasses actually, over one season, grow up their very dense and full but they start laying down. It almost looks like a pasture where cattle have bedded down and you have areas where the grass is just laying horizontal and it’s supposed to be vertical. That lodging is very unattractive and there’s no way to get that grass vertical again once it lays down on its own. And then to get in and maintain that grass is very difficult, and the grasses have to be maintained. The grass isn’t just planted and then left.”

Interviewer said: “Um, hum.”

Interviewee said: “That grass has to be cut and a lot of the biomass has to be removed. Some of the grasses, the biomass can be left in place. A lot of it has to be removed and taken out of there. So, the maintenance aspect had to be considered. How are you going to maintain this area? Not just what are you going to plant and what does that individual plant look like, but can you maintain that plant in that type of environment?”

Interviewer said: “Um, hum.”

Interviewee said: “With traffic going by you? This was before the Jersey barriers were installed, also. So, it was open median between the lanes. And you have to consider the maintenance operations and how equipment is going to be moving through there to maintain it and get that biomass out. And can it happen? Can it work? So...”

Interviewer said: “Let me...”

Interviewee said: “There were a lot of aspects that went into our review process that wasn’t just take a look at it and see if it’s going to look pretty...”

Interviewer said: “Or to see how this applies to some of the questions, because...”

Interviewee said: “Sure.”

Interviewer said: “...and some of what we’re talking about actually moves into some further questions. So, we’re going to continue with this vein.”

Interviewee said: “Sure.”

Interviewer said: “How did the NTTA initiate the planning design concept for Texas Highway 190, was my first question. We’ve kind of touched on that in that from one of the...would he be the head of the parks here, Dan?”

Interviewee said: “No. Dan Johnson is Deputy City Manager for the City of Richardson...”

Interviewer said: “Deputy City Manager. His involvement, then...”

Interviewee said: “With Jerry Hebert...”

Interviewer said: “...with Jerry Hebert...”

Interviewee said: “The Executive Director of NTTA...”

Interviewer said: “That’s sort of, that had a lot to do with the initiation, I guess, in of what they were trying...”

Interviewee said: “That pressed the issue to even be on the table in first place, is the relationship between Dan Johnson and Jerry Hebert...”

Interviewer said: “Do you think...”

Interviewee said: “...on how Richardson would like to have seen its roadside area improved and enhanced like we’ve done 75, but then Jerry not willing to let individual cities do it by Dan continuing to press the issue let us do our area. Jerry saying, ‘No.’ and Jerry finally saying, ‘Let me take this to the Board and let the Board decide it.’”

Interviewer said: “Were they...was the initial concept to just have it as turf with no...?”

Interviewee said: “The initial concept that Jerry Hebert had for it, to my understanding, was highway roadside. Like you would see between I-35 between Dallas and Austin.”

Interviewer said: “Um, hum. You get all sides. **[laughter]**...There you go.”

Interviewee said: “That’s...that gets into some area of...I don’t know how much of that is sensitive information, Interviewer. I don’t know how much of it is...and I wasn’t involved in the discussions that were going on between Dan Johnson and Jerry Hebert. But...”

Interviewer said: “You...”

Interviewee said: “...there was no initial direction that NTTA had that we are going to landscape this area in convincing the Board that that’s what they needed to do.”

Interviewer said: “Uh...”

Interviewee said: “That didn’t...that was not my...”

Interviewer said: "The beauty is that it has..."

Interviewee said: "...understanding of it."

Interviewer said: "...the beauty of it is that it did finally happen."

Interviewee said: "And it was...it was with the interest of the City of Richardson to do something with the appearance of the NTTA roadside within the City of Richardson that pressed the issue forward about improving the roadside system-wide."

Interviewer said: "What was the plant selection process for the roadside areas of Texas Highway 190? Now, this is...I'm saying...we've been talking about this because this plant selection process..."

Interviewee said: "Um, hum."

Interviewer said: "...talks about these grasses and how this process evolved and, from what I'm understanding, their consultant, HNTB, had some ideas and they also...you worked as a consultant for those ideas...they would also send you..."

Interviewee said: "No. They...they were the consultant. I wasn't a consultant to them."

Interviewer said: "You weren't considered as...City of Richardson was not used as a consultant?"

Interviewee said: "Well, I...I look at the context of a consultant as somebody that's a paid professional providing expertise into a project. This was all free."

Interviewer said: "Okay."

Interviewee said: "We were providing assistance to HNTB so that the design would turn out successful."

Interviewer said: "Um, hum."

Interviewee said: "That was our interest. That the design would be successful and HNTB..."

Interviewer said: "And you would protect the interest of the City of Richardson?"

Interviewee said: “Absolutely, but in doing so, that precipitated into, hopefully, a successful design for the whole stretch.”

Interviewer said: “Right.”

Interviewee said: “We weren’t interested in just what our area was going to look like. We didn’t try and determine whose going to get what type of treatments in any other place, but whatever would work here would work well for anybody.”

Interviewer said: “Well then that...I think early on it became apparent that was going to be the goal, is that there would...they would find some sort of a concept that would work...”

Interviewee said: “Absolutely.”

Interviewer said: “...the entire tollway and so all the seven or nine cities that are involved were all...”

Interviewee said: “Yes.”

Interviewer said: “...would be the same?”

Interviewee said: “Yes. Yes.”

Interviewer said: “And so my...I didn’t mean...by providing the interest for the City of Richardson, you were providing the interest for all the others, as well?”

Interviewee said: “Yes. Yes.”

Interviewer said: “Um...”

Interviewee said: “You know, when you said ‘consultant’, I thought you meant from a paid consultant standpoint.”

Interviewer said: “Well...”

Interviewee said: “No, we were not that.”

Interviewer said: “Yeah.”

Interviewee said: “We were...we were here, open, and available to do anything that we could for NTTA and, in this case, their agent. And the way that we look at the consultants in our practice here at the City of Richardson, we look at them as an extension of our staff. They’re just like a part of us.”

Interviewer said: “Um, hum.”

Interviewee said: “And I looked at HNTB as that same element for NTTA. That when I was talking to HNTB, I didn’t look at it as me doing the job for HNTB, that they were going to turn around and get paid from NTTA for the work that I was giving them. I looked at it as I was helping NTTA and that was the full reason of our involvement was trying to help NTTA and just looking at HNTB as an extension of that...”

Interviewer said: “Because the City of Richardson had a vested interest...”

Interviewee said: “Absolutely.”

Interviewer said: “...in how this came out.”

Interviewee said: “Absolutely.”

Interviewer said: “Right. And...yeah, well maybe...I...I...I guess I was just trying to establish, from what our early conversation...”

Interviewee said: “Um, hum.”

Interviewer said: “...that plans and designs that were create with HNTB would come here and the you would...”

Interviewee said: “Um, hum.”

Interviewer said: “...you would review them, red-line them...”

Interviewee said: “Yes.”

Interviewer said: “...as, even...”

Interviewee said: “Exactly.”

Interviewer said: “...we won’t call it a consultant basis, but as a friendly basis?”

Interviewee said: “Sure. I guess in a...”

Interviewer said: “Colleague basis.”

Interviewee said: “...Maybe in a true sense of a consulting basis, yes. Too many times it’s looked at as a consulting basis as a fee-base. There was absolutely no fee-base on this.”

Interviewer said: “Um, so the plant selection process initially started as a typical TXDOT approach, then it moved into there was going to be a consistent...first...then it was to...the City of Richardson wanted an enhancement that they would perhaps use themselves, and then it became a system-wide enhancement. It started off with more grasses, then as...how did it evolve into...and what we’re going to get into is...well, in fact I can start with that. Why were native plants included in the design?”

Interviewee said: “It was an interest that HNTB had, I believe, initially, to use natives.”

Interviewer said: “Um, hum.”

Interviewee said: “It was something that I certainly stressed upon them very strongly was to use natives, and wherever possible to use North Central Texas natives.”

Interviewer said: “Um, hum.”

Interviewee said: “That this is their home and once established, they will do well with little, if any, supplemental watering. This initial establishment was going to require irrigation. There was no way around it and the interest was also to reduce the level of water that was going to be on an ongoing basis to sustain the landscaping. And I don’t know that I had any influence upon HNTB in wanting to use native material but it was certainly an interest on our side that native material be used wherever possible, wherever possible. So, that was a mutualistic relationship that we had going into it. An understanding that we...”

Interviewer said: “From both sides?”

Interviewee said: “...we’ve got to be water-wise and we’ve got to use what’s available to us to make this work. And there was a plant pallet

discussion that went on with HNTB where they actually gave a presentation at NTTA about the different plant materials that they were thinking about using and we were used as a sounding board to help provide some input back to them on some of the plant material that they had put together on that pallet. And this is during the schematic phase. And we told them pros and cons of what we felt about the different plant materials that they were bringing up. And they had some of their maintenance people in the room at that time. HNTB, excuse me, NTTA did, and HNTB landscape architects and, I believe if I'm not mistaken, that Tony Lucido was there when he was working for TXDOT. I think he was in that initial meeting, along with Patrick Haag..."

Interviewer said: "Um, hum."

Interviewee said: "...who's, Tony worked for Patrick at TXDOT and I think both of those guys were in that meeting, too, when that happened. And so we...it started with a very broad pallet and then it was kind of narrowed down and then when we started getting and putting things on drawings, it was getting much more specific about specific varieties of material."

Interviewer said: "But the..."

Interviewee said: "...that was..."

Interviewer said: "...the natives were brought in because of their adaptability of the indigenous adaptability that they possess and water conservation..."

Interviewee said: "Exactly."

Interviewer said: "...maintenance issues, and..."

Interviewee said: "Yes. Not so much maintenance in the beginning. Not so much maintenance in the beginning. It was more excellent performers for this area and this climate and so...environmental conditions, as far as North Central Texas."

Interviewer said: "Okay."

Interviewee said: "From there it started narrowing down a little bit later into maintenance practices that worked well, and then also what worked well in that particular micro climate along the highway,



which is a lot different than open pasture not anywhere close to a highway.”

Interviewer said: “Right. Well, and...the soil, the type has been changed dramatically once you get into a roadway from where all of these plants are. So, even though they may be indigenous to the area, they are not indigenous to the soil characteristics of a roadside.”

Interviewee said: “Right.”

Interviewer said: “What criteria were used for determining native material? And you’ve kind of discussing this.”

Interviewee said: “Um, hum.”

Interviewer said: “Plant material that was...that was adaptable or that occurred naturally in this North Texas region. Would there be any other criteria that would be used for determining what would be a native plant?”

Interviewee said: “It wasn’t just limited to native.”

Interviewer said: “I understand.”

Interviewee said: “Native was stressed but it wasn’t just limited to native.”

Interviewer said: “We’re getting to that.”

Interviewee said: “Plant books that we have. *Plants of North Central Texas*. That was used in the initial part to take a look at...to find out as much as we could about some of the varieties that were being talked about.”

Interviewer said: “Um, hum.”

Interviewee said: “And those were broad context with a lot of plants that we weren’t real familiar with because we don’t typically use them in a landscape setting. So, we had to get familiar with a lot of...a lot of plant, pretty quick. A lot of the plant that were proposed were range grasses that a range manager would be a lot more familiar with than a landscape architect. Somebody like Dr. Reed really helped out because he was...his forte was grasses. Period.”

Interviewer said: “So he was, obviously, very influential in...”

Interviewee said: “Extremely.”

Interviewer said: “Um, hum.”

Interviewee said: “Extremely.”

Interviewer said: “What percentage of the plant pallet were native plants? Do you have any idea?”

Interviewee said: “I don’t even remember what that first display board looked like when we sat down during the schematic period and just started looking at individual plants and saying ‘yes’ and ‘no’ to different ones. I have no idea how many were...what percentage would have been native. If it was...if it was non-native, it had to be very well adapted to this area.”

Interviewer said: “To be...”

Interviewee said: “To be one that would be on that board if it stayed on that board.”

Interviewer said: “That leads us to this questions. Why were non-native plants included in the design?”

Interviewee said: “Some of the plants that are there are plants that give us some variety and color and texture that we can’t get from an available plant, but yet are high performers for this area. Some of them are improved varieties of plants that may be native in genus but particular species may be an improved variety that gives a better show, such as *Salvia greggii* was used in a lot of areas but there is another one that was highly, highly recommended to be used that is shown to be extremely successful in Arizona and a very low water requirement area, and it was actually a variety that Dr. McCay, at the Ag Research Station, has developed.”

Interviewer said: “What is it? Do you remember?”

Interviewee said: “[inaudible]...a Royali, I believe it is. And there’s an example of it at the Ag Research Station. When we took a look at the grasses with Dr. Reed, Dr. McCay was able to show us some of the varieties of plants that’s he’s been working on. Add Dr. McCay’s *Salvia* adjacent to *greggii* adjacent to Benny Simpson’s *Salvia* all in one bed out there and we could show them the

performance levels of the different ones. Also talked about the maintenance levels of the different ones and how much more maintenance greggii requires as opposed to these other varieties. To get greggii to flower you're going to have to maintain it."

Interviewer said: "You know, one of the big issues, of course, in both literature and in talking to people, so far, you know, is availability of a lot of this plant material."

Interviewee said: "Um, hum."

Interviewer said: "I know that sometimes when I've gone to arboretums and different, and extension services and stuff, a lot of these plant materials that they're looking at are very adaptable and high performance but they're not really used very much in a commercial sense yet and so getting the availability, do you think that availability had to do with some of the choices, let's say of going ahead with the greggii over one of these other salvias?"

Interviewee said: "The schedule of the project, I did not get the feeling that the schedule of the project prohibited the grower from getting the material ready to go."

Interviewer said: "Of whatever they chose?"

Interviewee said: "Right. It was my opinion that the design of the material that was used, the overall end result was more important than a specific timeline of having this project completed by a certain day."

Interviewer said: "Um, hum."

Interviewee said: "So, if the interest had been there to have a grower provide all the material, which in essence you would go through one process to get the grower selected, then you contract with the grower to grow everything that you need for the project, then bid the installation...the construction and the installation of the landscape areas to another contractor to actually bid and then they just get the material from who you already have a contract with to grow it. You could use anything you want. It's another step in the process to go through, to select your grower and get your grower going."

Interviewer said: "Before you selected your installer?"

Interviewee said: “Um, hum. Yeah.”

Interviewer said: “I don’t think that that was done this way on this project.”

Interviewee said: “No, it wasn’t. No, it wasn’t. And I have no answer on why it wasn’t.”

Interviewer said: “Um, hum.”

Interviewee said: “But that option was certainly there because materials like Dr. McCay’s Salvia was used in an extensive planting project in Arizona. It obviously had to be grown first.”

Interviewer said: “Um, hum. It does, I mean, Arizona is a very different climate than North Texas.”

Interviewee said: “Um, hum.”

Interviewer said: “He found that it worked as well here as there in his trials out there?”

Interviewee said: “Um, hum. With what he has seen from that plant’s performance here, it looked like that plant was going to perform just as well here as it was performing in Arizona. And require substantially less maintenance than greggii.”

Interviewer said: “I’d like to see it, but does it look like greggii?”

Interviewee said: “It grows...”

Interviewer said: “Is it bushy?”

Interviewee said: “It’s higher. It grows taller. Has a larger leaf structure. The plant itself has more color and texture to it than greggii does. A prolific bloomer and does not require the cutting that greggii does to produce the bloom.”

Interviewer said: “Hum. Are you using it in Richardson?”

Interviewee said: “We’re finding some applications that we want to use it. It’s a pretty unique plant.”

Interviewer said: “I’ll have to look for it. I haven’t. What literature or scientific study was done in the developing of this plant selection? And

we're talking about some of that. The conversations with Dr. McCay and Dr. Reed and..."

Interviewee said: "They were the ones that we wanted to bounce everything off of. I've used them in the past on other projects where I wanted their opinions and ideas on what we were doing because we don't do a cookie-cutter approach. We're always looking to improve everything that we do and sometimes, maybe, we're pushing the envelope and we go, 'Is this going to work?' So, I use the Ag Research folks as a big resource to us to bounce things off of and say, 'What do you think? Have you seen this work? Have you seen this application or is there another way to look at it? Is there something else that would be better?' So, actually, sitting down and red-lining the drawings and applying what we, collectively as a group of park planners and landscape architects here at the City of Richardson, together saw, you know, it wasn't just me looking at these drawings. It was my staff of park planners also looking at these and we would sit around a critique them together, after we had had a chance to look at them individually. So we were kind of pooling our own design resources, within our own minds, together to try and help as best we could. But then also, trying to look at the plant material that was being used and educate ourselves better on those particular varieties. So, it was a good exercise for us to go through. But we didn't...we didn't get into the process of trying to identify a lot of other plant material that they needed to be using. Once they had kind of gone through their schematic plant pallet process of, 'What do you think about these? How have these performed for you? Would you use these in these areas? Here's what we're thinking about? Do you see anything that's a particular problem? Something we need to mark off the list.' Once we got past that, we didn't try to force anything on them but we did try to open up the idea of thinking of using some things that may not be on that, maybe, in area, like Dr. McCay's material. We tried to use more trees. One of the problems with using trees in a roadside setting is just the danger of a car going off of the roadway, having enough time to recover, or able to recover, without striking the tree, and we've got trees along 75 but they're set back away from the highway. And there are stipulations that TXDOT has for placement of trees within the right-of-way."

Interviewer said: "Thirty feet back."

Interviewee said: “They have to [inaudible]...back...and we respect that and we appreciate that but to just have a full system of grass and really no over-story, we didn’t think was going to read off very successful and was not going to be very entertaining for the drive, because on the Tollway, you can just about accomplish the same thing on George Bush as you can accomplish on LBJ. So why would somebody want to pay the tolls and be on George Bush as opposed to just being on LBJ? Well, hopefully, less congestion but maybe you give them experience that adds to the value of that toll – not just the utilitarian value of what the roadway...does not take into account the esthetic appeal.”

Interviewer said: “Do you think that that, as a result, I mean, that thought came into the Board process when they finally decided on, ‘Well, maybe we should embrace this idea?’”

Interviewee said: “I was so disconnected from that process, as far as what the Board said. All I knew was that they liked what they saw at the different locations and they thought it would be good here. I hope that’s what they thought. I would think that that’s what they can see. Is that paying your money gets you a higher level of service, so to speak?”

Interviewer said: “Um, hum.”

Interviewee said: “And more of a return to your user of the facility, rather than just the almost totally utilitarian aspect of the TXDOT process of just providing a highway.”

Interviewer said: “You know, I’ve heard the term ‘Prairie’?”

Interviewee said: “Um, hum.”

Interviewer said: “That though they weren’t replicating a prairie, because it’s a more gardenesque design. If you were to agree with a term like that.”

Interviewee said: “Um, hum. Yes. Yes.”

Interviewer said: “But it was sort of inspired as from the prairie style to be more...and then, so that would...they took that and then...”

Interviewee said: “That’s the ecosystem that we’re in. The Blackland Prairie.”

Interviewer said: “Right. So, wouldn’t you, in your discussions...”

Interviewee said: “Uh, huh.”

Interviewer said: “...prairie, I’m assuming sort of came up in discussions about the plant selections and I know they talked about the sense of movement and continuing that sense of movement, which I think was one of the reasons they wanted to go with the grasses. The sense of movement.”

Interviewee said: “The animation. Um, hum.”

Interviewer said: “Yeah. So, were those sort of terms discussed and...?”

Interviewee said: “Well, really early on we talked to them about what happened with our Pampas grass on 75 and the animation and how it added to the experience of seeing it and the scale of it, as well, because Pampas is not a small grass. And at 60 miles an hour you can see it. You can feel the texture of it.”

Interviewer said: “Um, hum.”

Interviewee said: “You can capture the motion of it. Whereas, 60 miles an hour, Buffalo grass is not going to achieve a whole lot. **[laughter]** It’s just, it’s going to be lost. It’s going to be lost.”

Interviewer said: “I haven’t really found any of the Buffalo grass out there. I keep hearing about the Buffalo grass. I haven’t actually...”

Interviewee said: “Yeah. There’s some. But it’s not substantial enough in difference and character between their mowed Bermuda grass areas that people can distinguish and appreciate the difference in it and we found that...and we tried to relay this to NTTA, with our experiences on 75, that at 60 miles an hour, ground cover like grass, is there and anything that you get that’s not substantially larger and different in texture than that, it’s going to just continue to be basically an expansion of the grass area. The reason jasmine beds...they’re just about that. They’re just an extension of the grass because at 60 you’re losing a lot of the texture. The color difference is there but you’re really not gaining that much texture relief with the Asian Jasmine, as opposed to just the mowed Bermuda grass. And our Bermuda is not even irrigated out there.”

Interviewer said: “Do you think that the Mexican Feather achieves that even though it’s really low?”

Interviewee said: “Uh...”

Interviewer said: “They have large areas of the Mexican Feather.”

Interviewee said: “The have some large areas of the Mexican Feather that are not quite filling in well and the sparseness of some of those beds is a problem and the use of the Mexican Feather was something that was discussed with them with Dr. Reed and he sternly about expect what’s you’re seeing out there when you use it because it’s going to be hard to control, for one thing. Readily recedes in areas that you don’t want it. So it’s going to high maintenance to control it in other areas of grasses that you don’t want it coming up in. It will thin itself out, too. So, it’s not necessarily going to be a full daunting, even though that’s what you’re trying to achieve. So, Mexican Feather has a nice character feel and relief to it, but a lot of that is so fine in texture that it’s difficult to pick up at the speeds that people are traveling.”

Interviewer said: “Well, where it’s full and it covers, it shows up nicely, I mean, because just the way it lays and stuff but it doesn’t show up, I guess, at 60 miles an hour, it’s hard, I mean, you’re looking at it and you can’t really tell necessarily what it is because of the way it is.”

Interviewee said: “Um, hum. Um, hum. Right.”

Interviewer said: “It’s not...doesn’t have a...because it doesn’t stand it doesn’t really sway and all that. It’s just has this matting sort of a feeling to.”

Interviewee said: “Yeah.”

Interviewer said: “But that...that’s the one that I’ve noticed the most that seems to either be working well in an area or hardly working at all.”

Interviewee said: “Um, hum. Um, hum.”

Interviewer said: “But...and in talking with one of the interviewees, I...there was the discussion about it that has to do with the irrigation because the irrigation is so...I mean, this is such a complicated irrigation system.”



Interviewee said: "Um, hum."

Interviewer said: "And just the whole level that it's going to take of the landscape managers. It goes way beyond your TXDOT sort of mentality of **[inaudible]**."

Interviewee said: "Um, hum. It does. In the...almost every planting bed is on a slope."

Interviewer said: "Yes."

Interviewee said: "There's very little of it that's flat and it's difficult to get uniform precipitation distribution."

Interviewer said: "Even and drip?"

Interviewee said: "Yes. And particularly, even more so probably, with drip. Drip doesn't work for us. We've got some bubbler situations. We used to have some drip installation. We've had to pull our drip out. And our bubblers, bubblers don't grow trees well at all. So, we've had to find some different approaches. We're in the middle of at \$1.2 million landscaping project on U.S. 75 right now. Some landscape enhancements. We can't plant it. We're ready to plant it. We're ready to finish the project out but we can't plant it because we're in water restrictions right now. We're putting in huge numbers of trees and grasses in our area and not using drip and we're not using, you know, a few bubblers but not many."

Interviewer said: "What is it? Popups?"

Interviewee said: "We're providing uniform coverage."

Interviewer said: "Hum."

Interviewee said: "What I've found in application with drip and in application with bubblers is that you're putting the water out at the base of a tree and you're going to help establish that tree pretty well. But getting that tree to grow out and to stretch out and to become as large as it can be and to continue to grow and develop, the root system on a tree far exceeds the drip line of the tree. Far exceeds it. In fact, the root system of a tree will go three times the diameter of the drip line and most of the root system that's really

the most productive to the tree, is to the outside of that edge and within the top 12 – 18 inches in the soil. So, if your bubblers are at the base of the tree, it's only during the establishment of keeping that ball wet or that root system, initial root system wet to establish that tree that that bubbler is any good. Once those tree roots grow out, they are growing beyond the limits of where water is being applied. They are getting zero benefit from that bubbler or that drip head."

Interviewer said: "Right. Um, hum. Is it the general intent of most of these irrigation systems just to get the...for establishment and then aren't these plants, and especially the trees, supposed to eventually [inaudible]?"

Interviewee said: "If that's what you want, but if you look at a planting bed that is in a median that's crowned or in a roadside that's sloped and in an area that's between six lanes of traffic and four lanes of frontage road or three lanes of frontage road, that's hardly the natural environment that it's used to. What natural precipitation that we get is running off. It's not like our Blackland Prairie that's particularly, primarily flat."

Interviewer said: "Um, hum. Um, hum."

Interviewee said: "So, you're losing a lot of the water potential for, and filtration just with the setting that those trees are in. Whether it's a crowned median or a roadside that's sloped. Then you have a microclimate that's extremely much harsher than a tree that's growing in a prairie setting somewhere or in a creek bed setting somewhere. That tree is not going to grow and develop like it normally would. That tree is going to remain small and undeveloped, and it's going to look stunted and it's never going to look good, and it's always going to be stressed and it's always going to be prone to insects and diseases. If you give the root system an opportunity to get the moisture that it needs to provide the nourishment that's necessary for that tree, that tree is going to grow and develop and it's going to prosper extremely well. And the way that you need to do that is not put water at the base of the tree but put water where the roots are going to be growing. You need to distribute that water evenly. There's a concept that no water...we don't want to put any water out because we're going with native plant material. We can't do that in our environments. Not with what we're working with. We're trying to provide an improved landscape setting and something that's an enhanced

roadside appearance. We're not trying to put the Climber Meadow adjacent to our roadways. There is zero appreciation of the motorist driving by the Climber Meadow and seeing what is a native prairie sitting out them. It's going to be a bunch of weeds to them."

Interviewer said: "Do you...so when you plant and you set your irrigation, there's...the intent is that you'll irrigate this for the life of the project?"

Interviewee said: "Absolutely. Absolutely. If we want the plants to prosper, if we want the plants to grow to their full potential, if we want the plants to provide the best show that they can, the best cover that they can, whether that be fall color or whether it be flower color, whatever it may be, we're taking these plants and putting them in a location that they are not adapted to. I don't know of anything that's adapted to being in this concrete jungle that we have."

Interviewer said: "Um, hum. Right."

Interviewee said: "On such slopes that we're putting them on. That's not their natural habitat. So we're plucking them out of a river bank and we're putting them next to a highway and saying, 'This is your natural environment.' That's not true. Absolutely not true."

Interviewer said: "Um, hum. Just because you grow naturally before this highway was here in this same spot, it's not going to..."

Interviewee said: "Sure. Yes. This highway is not that creek bank."

Interviewer said: "That's right. Okay."

Interviewee said: "Not at all. So what we're doing is we're trying to give these plants, which require less water, supplemental watering because they do well normally with the natural precipitation that grows in their natural growth location. We're putting them in a non-natural growth location. We've got to give them some enhancement because the microclimate is drastically different in that roadside as opposed to the creek bank."

Interviewer said: "Okay."

Interviewee said: "They are exposed to, just a lot more things out there."

Interviewer said: "I understand."

Interviewee said: "Yeah. And we've got to give them a little bit more for their own well-being so that they are able to live in that kind of environment."

Interviewer said: "We're going to get into a little bit more of that as we go."

Interviewee said: "Okay."

Interviewer said: "I'm going to ask you a question that...how does the choice of planting design compare with literature recommendations on the use of native plant material?"

Interviewee said: "A lot of plant books on native plants are range books and not landscape books. And in range applications on things like grasses, if it's talking about a seeding rate for establishment, it's talking about a seeding rate for establishment in a prairie situation or a range situation. So, you have to adapt the way that most of the native plants or the soil conservation service materials are developed for the identification of what most of these native plants were initially were even written up under. Adapt that to something that you want to really give it an opportunity for success and mass planting and your seeding rates are going to be way above what it would be in a pasture setting. You couldn't afford to plant a pasture at that level but if you want a full bed of it, you're going to have to plant it full. You're going to have to get the seed count per square inch high enough that you're going to get a good cover, you know, of material. It's getting better with the use of native material and the available material that's out there on actually how to use them. But for a long time there has not been much available information on the use of native plant material in a landscape setting."

Interviewer said: "Um, hum. And the highway setting is even more limited."

Interviewee said: "Yes, yes, yes it is because of the scale of the area. A lot of what's used in plant books now and native plants is taking a specimen plant of one particular plant, maybe a Muhly, and, you know, this Muhly is going to, you know, be in an intimate setting in a court yard or in a back yard setting off a patio, and this is what it's going to look like. Well, when you're putting a bed together that's for 60-mile-an-hour traffic; you're not taking a look at just the shape of that one plant. You have to consider

what the mass of the plant is going to look like and the length of that bed is the mass of the plant...”

Interviewer said: “You think?”

Interviewee said: “...and the length of it. The depth of it is important, too.”

Interviewer said: “Was that part of the reason for using the mass plantings along 190 so that you could, at 60 miles an hour, identify, I mean, there’s fewer plants and they’re planted in masses so you’re getting, you know, you look at a hundred of them instead of one?”

Interviewee said: “Yes. I used an analogy with HNTB as we were talking about speed and the relationship of bed length to speed. In a planting design approach that we used in Boulder, when I worked in Colorado, we did a lot of annual beds in Boulder. We did a lot of ornamental beds and as a rule of thumb, we would not plant any ornamental or annual bed that was less than one foot long for every mile per hour of speed on that thoroughfare. So, if it was in a residential area, our beds could be smaller, but if they were on arterials, our beds had to be longer. You know, if the traffic was 45 miles an hour, the minimum length of that bed was 45 feet. Minimum. And in annuals, that gets to be very expensive, very quick. So you have to make a decision. No postage stamps would go out. No little small dot of color. “

Interviewer said: “Right.”

Interviewee said: “It was going to be appreciated and it was going to be effective or it wasn’t going to be done.”

Interviewer said: “I know that they looked at, in their guidelines study, they took how long, you know, to get a 12-second view of something, how long...and I think they came up with a sort of a formula of 800 feet on either side of their main focal point, let’s say it’s an overpass, was sort of your minimum; although I’ve noticed many of the beds out there are not 800 feet long on either side. They’re not 1,600 feet long.”

Interviewee said: “Um, hum. Um, hum. Right. But what they’ve done is that with the curvilinear approach that they came in with their design in trying to get that capture, that view from the distance as you drive into it and through it, that curvilinear approach was for the

motion, to give you feel of motion through the beds, as well as the movement of the plant material and the animation of the plant material. But I also tried to encourage them to use, where those line cross the road and went over into the median, to still respect that minimum length of that bed, which in that case would be the depth or the width of it, that one-mile per hour. Don't go less than that if you want to be successful with what you're doing because otherwise it's too small."

Interviewer said: "It's a dot."

Interviewee said: "It's going to be gone. It's lost. There was some beds that they were proposing using Red Yucca in and the beds were solid Red Yucca, and these were huge beds, gigantic beds. My red-line comment to them was, 'Don't do that – beds that large – because you can't maintain those beds. You can't get into those beds and get the trash out of them that's blown into the middle. Nobody can get in there. You can't walk through that stuff once it grows up."

Interviewer said: "Um, hum."

Interviewee said: "Only make it wide enough that you can reach from both sides and still be able to get to the middle of it. Dr. Reed showed them a practical example of a problem they had in the Ag Research Station where they had one traffic island in the parking lot that was solid Red Yucca and they were having rodent problems, rat problems at the Ag Research Station. They couldn't figure out where they were coming from. They were coming out of that bed because predators can't get in there. There's no control issue in there and the rats had a perfect living environment and would just come and go from the billing just as they pleased."

Interviewer said: "Um, hum. Hum."

Interviewee said: "And it would have been the same problem for them because the rats caused problems for the irrigation system. Rats caused problems in girdling trees and vegetation, as well, even shrubs. So, you don't want those things there and you've got to spread that habitat out so it does not create something like that. In some areas, there are still some areas that are too wide, once the Red Yucca fills in on it's own, which it will do. They sucker up, the small ones, fairly prolifically and it will be a solid mass. Then it's going to be difficult to do some of that maintenance that's

necessary and could harbor some rodents. So, some things were looked at as just an accent line and not a full accent bed. Create a line at the back or the edge of this particular bed and highlight the plant that's in it and let that red line just kind of create just kind of a highlight through it.”

Interviewer said: “Um, hum.”

Interviewee said: “But the concept of capturing that vision for 12 seconds or whatever is with the assumption that you have, and this is something I really didn't grasp from their concept, I don't drive and allow my concentration to be on something for 12 seconds uninterrupted. I can't do that. I've got to keep my eyes moving. I've got to keep my concentration moving to other locations – beside me, in front of me...”

Interviewer said: “Well...”

Interviewee said: “...and there are vistas and there are views that are opened up but to be able to capture attention for a 12-second period and to convey something during that 12 seconds and how long do you have to do it, that would be a good theory in practice. I can't drive that.”

Interviewer said: “Well, maybe that's to allow you to, I mean, I don't know. I am following what you're saying. Yes. You would not be able to watch the whole thing but I think the idea was, and I applaud them for it, at least the approach was to do exactly what you're saying. Not create these little tiny postage stamps, but to create vistas that, even if you're looking, you're coming back to and they've given a full experience.”

Interviewee said: “Yes.”

Interviewer said: “As, you know, even if you don't look at the full 12 seconds, you get the full experience, obviously.”

Interviewee said: “Yes. Yes. If they're too small, you're not going to effective. If they're too small and you're not going to be able to carry the thought out, and we ask them to drive 75 and look at how small some of our plantings are that are on 75 and understand that those are just enhancements along the roadway, that we're not really able to capture a landscape feeling, like what we're doing. It's just more a beautification statement. Whereas now what we're

doing and what we're building out there are much larger, much more expansive areas that we are actually trying to capture a feeling of going from a forest into a prairie. And those were the concepts that were used in what we were doing. They tried to stay away from the trees almost entirely because they were concerned about the liability factor."

Interviewer said: "I think they started with some trees in the Garland area but it started to slip away because, for one thing, once they've had some accidents and they had to put up the median dividers and stuff..."

Interviewee said: "Those were the **[inaudible]**."

Interviewer said: "...they started to, this is just from what I've been told, but also the concept of within a prairie you have long expanses of the prairie with smatterings of trees but in a stand and that that was their approach, but, do you think that they...so you believe that maybe there was lag...they should have more trees within this context?"

Interviewee said: "The original designs that we were seeing had no trees. So, they did bring some trees. We requested them to bring some trees in because they needed some vertical relief."

Interviewer said: "Um, hum."

Interviewee said: "There wasn't enough of it at all in there and they did start bringing some trees in and they told us, 'If it's behind a guardrail, then we can propose trees. If it's behind a wall, then we can propose trees.' So, we started showing them locations where they could do trees and do trees successfully. Or if it was along the frontage, they weren't too concerned about the speed of traffic along the frontage roads. The speed of traffic along the highway...if it was off the back of a curve along the frontage there was a separation point but it was, 'Can a vehicle go off the highway and hit it?' And if it's protected in that location then we were okay and we started putting in opportunities for trees in those areas. And those were picked up and were used. One tree that I suggested that they use, and because it is native, is the Cedar tree but I also suggested that they use the female tree and not the male tree and that's the way it was bid. Now, Tony called me when they were getting into the planting process and he said, '(Interviewee), how do you select a male versus a female?' and I said, 'You've got to do it.' The plant, first of all, has to be



beyond a juvenile states so it's developing, you know. Either the pollen or the berries and you select it for the berries in the Fall and the Winter or you select it for the pollen in the late Winter early Spring when it's going to be pollinating out. Don't put those males out there. Don't put the pollen along the edge of the road but go ahead and put the females out there and you'll have the berries but you're not going to be bringing in an agitator or an aggravator to people's allergies. And I don't know how successful they've been. They have had very poor success in a lot of areas with the transplants of the cedars that they have used. And I am assuming that they were dug is the problem that their having a problem with as opposed to pot varieties, potted plants."

Interviewer said: "They were using the...they were using the ball and burlap that weren't properly cured for...and then they also found out that there was an irrigation issue that they weren't..."

Interviewee said: "If they had used...we have found that potted material is by far much more successful than ball and burlap. We will use ball and burlap more of a last resort than we will as our primary. The...some trees of Benny Simpson's...I got approval from the Ag Research Station for them to use some of Benny Simpson's research actually on George Bush. Some of his Desert Willows are used at Waterview and George Bush."

Interviewer said: "And Mesquites."

Interviewee said: "They have some Mesquites there but the Desert Willows that are planted on each side of Waterview on the South side of George Bush, there's, I believe it's five and five. Five on one side of Waterview, five on the other, are some of the research stock that Benny had at the Ag Research Station. And the Ag Research Station needed the space in that plot and for them it was a benefit to get the trees out of there but they didn't want to just cut the trees down and I didn't want to see the trees cut down. I asked them to use Benny's trees and it's real close to Benny's trees or Benny's test plots, you know, when Benny passed away that research stopped. Nobody else was carrying it on and we found a location that was close to the Ag Research Station where people who worked there and people who know Benny can see kind of the perpetuation of his work go on."

Interviewer said: "Have you noticed, I mean, the...in their, again in their guidelines they established hot areas, you know, hot topic areas

or, you know, and so they sort of classified areas and so all of the material is, the planting bed material, is centered around overpasses and exchanges and stuff like that...”

Interviewee said: “Yes. And toll booths, toll plazas.”

Interviewer said: “Yes. Uh, huh. Exactly. You agree with it that that was, I mean...”

Interviewee said: “Yeah. I think what they did and rather, there was no way they were going to have the money to go end-to-end, non-stop. There was no way. And they can also add some interest by concentrating it in high visibility areas. I understand the toll plazas are a prime, important place to do it. A lot’s lost at a toll plaza, though, because your mind is thinking about something totally different and you’re not appreciating what’s there. There were some areas in Richardson that were at overpasses that had nothing there and I just, you know, it just was not going to be acceptable. We had to have more done in certain locations. So, we showed them that there had to be some bed expansion. They had to, first of all, incorporate some beds in that area and it had to be, it needed to be a certain size and certain length.”

Interviewer said: “Do you feel like the causes of the vertical quality of the slope and stuff gives you more opportunity to really show off your landscape and all as opposed to some of the flatter areas that were, where you just set some out on the main roadway area and all?”

Interviewee said: “Um, hum.”

Interviewer said: “Does it give you a better backdrop or pallet to plant to?”

Interviewee said: “It gives you a good pallet. There are some stretches of roadway that, I think, could have more potential applied to them or exhibited more potential than what was actually captured, I think, in the design and an example is U.S. 75 where George Bush crosses it. From each direction, either east bound or west bound, you have an aspect where you’re going down hill as you’re approaching 75 and then you come back up to cross 75. So, you have a vertical presentation of the center of the road right in front of you. As you’re approaching 75 you have a vertical bed potential right in front of you. And some thing that you can capture relief on from a great distance and actually, you know,

have it coming right at you. I thought that could have been stronger. For whatever reason, they decided not to go there and I think it may have been how difficult they perceived it to be to get irrigation in the median at those locations. But, we were willing to provide the taps for them to get there, to get to it. For whatever reason, neither one of those approaches really happened. They have unique opportunity at Waterview and Independence on George Bush because of the depth and the scale of the area on the North side of the roadway. You have a large hill or berm that rolls from the tollway to the North back over to the frontage road on the North side of that at really, I think, the best display location that there could be along the roadway system. A unique area and they took, they used it very well but the initial design did not have anything on the South side of the road. Everything was on the North side. So, there were some interests in adapting some of that to be, I guess, more representative with some of the landscaping and not so heavily just in one location or another.”

Interviewer said: “Let me ask you a question here.”

Interviewee said: “Uh, huh.”

Interviewer said: “Where were the perceived benefits of the planting selection of Texas Highway 190?”

Interviewee said: “Perceived benefits?”

Interviewer said: “Perceived benefits of the planting selection?”

Interviewee said: “Continuity. A uniformity in feel of driving that stretch of roadway, that even though what’s done in Richardson is not the same as what’s done in Garland but it’s similar enough that you, there’s no big break in the transition from one to the other. So, it’s a comfortable feel. There’s enough mass to the planting that the plant material reads very well. Large plantings of Bushy Bluestem, as an example, that I really enjoy watching it come along and get mature because it shows something different through all seasons and it’s just one of the plants that continue to give a seasonal change and effect out there that keeps it from being just aesthetic design. It’s not always the same thing. It’s interesting to drive the tollway after a nice rainstorm and see the gray foliage highlighted with purple flowers on the Silverado Sage. You know, color and texture was a very important thing

that we tried to work through on this. So, there's a lot of interest in doing it with plant material that was effective at doing it very well in getting those contrasts put together. But then little moments of time that make them real attractive in a splash of color that kind of surprise the motorist and that's the rainstorm and the Silverado comes out. I think that the availability of replacement stock sets it up for a good success because most of this material is readily available to us, not something that was only available if they had chosen to go by grower to specially grown. And I think that they are learning as they go how to manage it so the management practices and principles are...and are coming into play now. It's starting to be successful. So, I think that the ease of maintenance, for the most part, is helping out. I think the selection of the material that's going to work good in that setting is..."

Interviewer said: "From an aesthetics standpoint?"

Interviewee said: "Um, hum."

Interviewer said: "Or how about from an environmental standpoint? Do you see the perceived benefit of that or?"

Interviewee said: "As opposed to a different plant pallet being used? Is that what you mean?"

Interviewer said: "Yes. Well, yes. Does this, the benefit of this plant pallet? Does this plant pallet benefit the environment? We're talking about aesthetics, a sensibility to, or availability, management practices are starting to come in line and it should reduce management, maintenance on it."

Interviewee said: "Sure. Sure. The water consumption, even though once these plants are established, I still believe they are going to continue to need supplemental watering because of the microclimate they're in. The native plant material is going to require less supplemental watering than something that is introduced and not well-adapted to this area."

Interviewer said: "Um, hum."

Interviewee said: "So, the water consumption here... **[Speaking to some who entered the room]** Yes sir. Oh, he said he was going to try to be here at 3:00 if he could but he would definitely be here by 3:30."

Unknown Speaker: I was waiting for you to howl at me.”

Interviewee said: “Sir.”

Unknown Speaker: I said I was waiting for you to howl at me. Pardon the interruption.”

Interviewee said: “That’s okay. **[Now speaking to interviewer]**...the other varieties could have been selected that could have been a problem with water, heavy water consumption and not been successful in such a harsh microclimate. I think the plant selection ended up being a bit of an overall benefit for the highway in a lot of areas. Again a lot of grass. A lot of grass and that was not my critique to exercise.”

Interviewer said: “Just for your knowledge, in talking with Tony, I think they also agree because of the dormant period, the extended dormant period with the grasses once they do their final cut before they reappear, is leaving some holes and so I think that they are taking that tact as well that maybe some evergreen material in there might enhance that a little bit more.”

Interviewee said: “I appreciate that. I...”

Interviewer said: “Just to let you know.”

Interviewee said: “Yeah, I started off by saying I think the pendulum has gone too far and that I think this is an example where’s it’s gone too far. I’m glad to see that Tony shares that and I can appreciate where he’s coming from. This gives Tony and NTTA a starting point.”

Interviewer said: “Yes.”

Interviewee said: “This is not the be all, end all.”

Interviewer said: “This is an experiment?”

Interviewee said: “It gives him an opportunity to take this design and adapt it and embellish it and to find what is the best, most successful out there and replicate it again and again. If he has failures in other places, don’t keep hitting your head against the wall but change some things out.”

Interviewer said: “Because of the size and scope of the project and the amount of plant material, it’s so large that it has gotten attention and it’s giving people the opportunity to see what works what doesn’t work within all this system. I’m wondering if this is going to be something, and certainly more people should write on it, that could help some of the DOT systems and city systems and stuff like that because what they find, I think especially in the management side and, of course, in plant materials that works and doesn’t work, I think is going to be an important...and I think that could be one of the benefits, myself, is that this is kind of a laboratory for what might...I see this being...I think the use of natives as a plant material, just from my literature review and, you know, is growing every year. It’s being embraced every year but there are a lot, I mean, there’s still a lot of if’s and wonders and scratching of heads as to what works and doesn’t work.”

Interviewee said: “Um, hum. Exactly. I had hoped that there could have been more, or at least a successful use of extensive wildflower plantings along 190. When we went to the first schematic plant pallet review meeting, I took some examples of wildflowers, North Central Texas natives that, managed as perennials, I thought could do very well out there for them on a seasonal basis. The HNTB design didn’t go there but that doesn’t mean that Tony and others may not decide that they want to go there with it. We have wildflower planting program in Richardson and historically over the years, we have used non-natives. We would go for an annual wildflower show. More for the bang. Go for the big color. Go for the show. And it’s greatly appreciated by people that live her and people that drive through our community. We have adapted that into native North Central Texas wildflowers and selected locations in our natural areas, in native locations, even where our roads go through some our parks that are native and natural, doing some of that. So, we have kind of two-level or two-tiered wildflower planting program here. They have a unique opportunity for some wildflower display areas that can just be gangbusters out there.”

Interviewer said: “They, but that was a mandate from the Board that that would not be done.”

Interviewee said: “Oh, is that right? I didn’t know that.”

Interviewer said: “So, actually, even from HNTB that they are, that was one of the stipulations is there will be no wildflower.”

Interviewee said: “Why?”

Interviewer said: “From a safety standpoint, they don’t want people...”

Interviewee said: “Kept going into...”

Interviewer said: “...stopping and putting their kids up on there because this is such a fast-track thoroughfare, they specifically...”

Interviewee said: “Makes sense.”

Interviewer said: “Yeah. Forbid them to use wildflowers in any way.”

Interviewee said: “I didn’t know that.”

Interviewer said: “Which was interesting to me.”

Interviewee said: “That is...that is...it’s very appropriate because every place we do wildflowers, parents are putting the kids in there and they’re getting the pictures or making pictures of themselves.”

Interviewer said: “And they didn’t want that.”

Interviewee said: “And I can appreciate that. I did not know that. I did not know that.”

Interviewer said: “What is the perceived success rate of the existing native plant material used in the Texas Highway 190 project?”

Interviewee said: “Perceived success rate, I’ll say, is very high. Very high. The only two problems that I’ve seen are just a couple of varieties of grass seem to have struggled and I think Mexican Feather is one of them, and then the Cedars have, the Upright Junipers have shown, from the initial planting, a real bad success rate and it’s gotten better to now where there’s very few of them that they’re actually losing as they are replacing them. The rest of it, I think, has been very good. Little spots here and there but those are little tweaks that just need to be worked out. A lot of it over watering in some locations where the irrigation system is causing some problems on some steep slopes. They just can’t get it dried out enough.”

Interviewer said: “What is the perceived success rate of the existing non-native plant material?”

Interviewee said: “Existing non-native?”

Interviewer said: “Within the planting along that highway?”

Interviewee said: “Oh, I think everything they’ve used has been very successful. I don’t know that I would distinguish between the materials that they’ve used as, you know, and I’m looking indigenous in North Central Texas, I’m looking at all of it as well-adapted native material. Even though it may not be native to North Central Texas, a lot of it is native to Texas that’s been relocated up here. I’m just kind of putting it all in the same boiling pot.”

Interviewer said: “Okay.”

Interviewee said: “I’m not trying to separate them out between North Central Texas versus something that may be Hill Country or further West.”

Interviewer said: “What is the timeframe for satisfactory cover of the shrubs and grasses on the roadside of Texas Highway 190? You know, I, that question, really, I brought that up because in my readings, I know that TXDOT has a certain timeframe that a plant must reach cover or you’re not allowed to use that plant or at least in some of their literature.”

Interviewee said: “Hum.”

Interviewer said: “I don’t know if they actually…”

Interviewee said: “Yeah. I’ve known that.”

Interviewer said: “And so there is a certain, I mean, if, that’s what, has something to do with the plant pallet and what you can use, is will it cover in, theirs is a two-year period. Will it cover it two years? If it won’t cover in two years, we can’t use it and that’s one of the reasons why natives have been slow to be used is that they don’t fall into that criteria, necessarily. It takes them, sometimes, a bit longer to actually reach full cover unless you plant them a lot closer together.”

Interviewee said: “Um, hum. Um, hum.”



Interviewer said: "I mean, that can...but anyway so that's, that's..."

Interviewee said: "It could be a detriment in and of itself."

Interviewer said: "That is the reason for that question is do you think that there's a, do you think there's a timeframe in any of the discussions of, 'Well, we want this to reach full cover in a certain amount of time.' Or do you think, or how long do you think it will take to reach full coverage?"

Interviewee said: "Well, some of it, probably beyond full cover. Some of the areas of the Busy Bluestem are so tight together it's hard to really get the real sense of what a Bushy Bluestem looks like because you can't see enough of the plan because they are so close together in some areas. I don't perceive a shallowness or too much of a separation of the plant material to see that there's not almost good cover initially with their plantings, that when they went in, they were getting good affect initially. Now, nobody expects a bed to be ultimately 100% when it's initially planted. So, I think everybody has a period of time that they are patient for a grow-in, for full dense cover. But I did not get, I did not perceive, and didn't hear anybody talk about a sparseness of planting or sparseness of cover from day one when those plants went in. so, I think that the planting relationships, for the most part, were pretty good. Some of them, again, may have been a little bit too close."

Interviewer said: "I think that they, from what I understand, I mean, and not knowing that before I had written these questions, because of the nature of this particular project being a tollway and not a Texas highway, privately funded and the expectations, they actually demanded pretty much full coverage almost from, as you just said, from planting."

Interviewee said: "There needed to be a bang there up front. Yeah."

Interviewer said: "And that's what they did."

Interviewee said: "Yeah,"

Interviewer said: "How long, in terms of growing seasons, will an intensive maintenance program be required for each new phase of or forever?"

Interviewee said: “Forever. They are never going to be able to relax on that planting. Never. They’re going to have to sharpen up every season and rediscover their failures and zone in more of their success as they go through it. They will never be able to sit back on their haunches and say, ‘Well, it’s there now. We can take it easy.’”

Interviewer said: “And that would include the irrigation?”

Interviewee said: “The irrigation, absolutely. Absolutely.”

Interviewer said: “What are the lessons learned from the plant selection of the Texas Highway 190 for future projects?”

Interviewee said: “Well, I hope we learned looking for outside resources to help sharpen your skills of plant selection, like Dr. Reed gave assistance. Don’t be afraid to ask others what they think and look for those opinions of others. We’re not hanging our hat on anything here because we’re just glad we had the opportunity to help. By hanging our hat on anything we’re not pulling our own. It was an NTTA project and I think NTTA should be applauded for what they did. Successes are, I think, are very evident of what they’ve accomplished. They’ve come a long way from a stance of, ‘No, I don’t think we want to do that.’ to putting on a pretty good show out there.”

Interviewer said: “Is...and lessons learned don’t necessarily mean the failures.”

Interviewee said: “Failures.”

Interviewer said: “And then my questions was intended to see both sides of it in that we’ve talked about some plant material that may be have not adapted as well and so I think tweaking your plant material, would you agree, is one lesson that you always learn with and...”

Interviewee said: “Um, hum. Yes. Yes. Absolutely.”

Interviewer said: “...but on the good side of it, there are certainly lessons that, you know, putting forth the effort that they’ve put into to create this is very evident.”

Interviewee said: “Um, hum. And you’re going to get varying opinions from plant specialists of what to do and what not to do. The “experts”. Some of them will tell you, ‘Do it this way and this is the plant

that you could use in that situation.’ Don’t just sit back and just take that one perspective or that one opinion. Seek out other opinions. Seek out other exposures or opportunities to find out more about that because somebody else may have a totally different opinion, because that was certainly found out here. There are definitely different opinions about a lot of that initial plant material and even some of the plant material that was used now, but what somebody may have thought was just going to be a gang buster out there, you know, just the plant you ought to use, well, maybe they think that but take a look at it in practical application. This is not what you want, I don’t think. Is it?”

Interviewer said: “How is the plant pallet...oh, go ahead.”

Interviewee said: “Almost to the point of, on something this large and this unique style of putting some of this plant material that was considered in a setting that it had never been used before, try it before you do it. Find a place to actually give it a practical application and see exactly how it’s going to perform. It’s not always possible to do that. You can’t always have maybe a growing season or two that it may take to do that. Try and find specific examples of how that plant has been used. If somebody is recommending some to you and it’s a plant you’re not familiar with, intimately familiar with, before you put your reputation in using it into that setting; find it and where it has actually been used over a period of time. Find out its successes. Find out its features and see if it is in fact what you intend it to be for what you’re trying to...”

Interviewer said: “And by that you don’t necessarily mean in its native setting?”

Interviewee said: “No.”

Interviewer said: “But in a practical setting that would be similar to what your...”

Interviewee said: “Yes. Yes.”

Interviewer said: “...criteria is.”

Interviewee said: “And we do that. As we’re looking at using a new tree, like Pond Cypress as an example, in a grove setting, okay I don’t want to see it as an individual plant in a catalog or in a pot growing in a nursery. I want to see it in a grove setting. Show me the locations and I will go look at those and I will see if that is exactly what it is that I do want. So, and I think it behooves us as

planters and landscape architects to do that investigative work, to not put that burden upon the client or whoever we're under the employee of in doing this work to see if it's successful for them. It behooves us to do that research before we ever present it forward and say, "This is what you should do."

Interviewer said: "How has the plant pallet changed between phases of construction from Garland to Irving?"

Interviewee said: "You can see some differences in the concentrations of different types of material, but, again, it's consistent enough from one end to the other that it's not something you feel. You don't feel a sharp transition as you go from one to the other. I think it reads very well. It transitions from one to the other well and I think, even though some people may not see Mesquite in a lot of other locations, it's not surprising that they would see it where they do. It's not a dramatic difference in transitioning one from the other and it's not a dramatic difference in the type of plant material that's used in just one setting. So, the Desert Willows work well where they are, even though they may not be in other locations."

Interviewer said: "To your knowledge, was this project partially funded by or subject to any Federal or State provisions, for example, the Transportation Enhancement Program, STURRA, AASHTO?"

Interviewee said: "I'm not familiar with any outside funding that was put in on this. I don't know what NTTA used. I'm not aware of any step in funding. I doubt it. With some of things that we went through, I don't think it went through any TX DOT reviews so I don't think it could have been stepped. I'm not familiar with any funding sources that they may have had. Any of those. I would say, I believe it was probably all NTTA money."

Interviewer said: "One of the reasons for that questions is, in my research, again, I have that, you know, with STURRA and stuff where they started to bring in these, where you know, the a quarter of one percent of all landscape dollars were to be used for native plant materials and stuff like that, and so it started to come into to law that you were to use a certain amount and so I was wondering if this project was subject to any of that and you said no."

Interviewee said: "Not to my knowledge."

Interviewer said: "Yeah."

Interviewee said: “Not at all. I don’t, I can’t, I don’t know of any Federal or State restrictions that were placed on this project whatsoever. Not at all. **[speaking to another person]**...”

Interviewer said: “I will go quickly because we’re almost done.”

Interviewee said: “Okay. Sure.”

Interviewer said: “I’ve got several words here and what I want you to do is just kind of give me your sense of if they were considerations when you were doing the design and the plant selection or and if so what kind of priority would they have had. And so the question is, how did the use of this plant pallet and this subsequent design address any of the following criteria: Aesthetics?”

Interviewee said: “It was all built on aesthetics, in my opinion.”

Interviewer said: “All built on aesthetics. Okay.”

Interviewee said: “Um, hum. Um, hum. And everything was selected and used...the aesthetic appeal of that plant in that setting was a high, used in high regard as a to whether or not that would be a successful plant or not.”

Interviewer said: “Water usage.”

Interviewee said: “High. Not high consumption. High regard.”

Interviewer said: “High regard.”

Interviewee said: “Um, hum.”

Interviewer said: “Roadside naturalization.”

Interviewee said: “Zero.”

Interviewer said: “Yeah. You’ll have to speak up.”

Interviewee said: “Oh, I’m sorry.”

Interviewer said: “Zero.”

Interviewee said: “Zero.”

Interviewer said: "Adaptability."

Interviewee said: "High. High concern because if it did not have a good level of adaptability to this region, it was not considered a successful plant, in my opinion."

Interviewer said: "Air quality."

Interviewee said: "I was talking about with the cedars or the Upright Junipers, high from that regard. As far as cleaning the environment, cleaning the roadside emissions and that type of thing, it really wasn't a consideration, but don't add to the pollution problem with particulates, and in this case, pollen source that's very much an aggitant to a lot of people."

Interviewer said: "Further viability."

Interviewee said: "I think it was high."

Interviewer said: "Water quality."

Interviewee said: "Don't know that water quality, as far as runoff, reduction, and erosion, that type of thing, was really a consideration. Would have been nice if we had a raw water source to be able to utilize instead of potable water, but just the nature of the business the cities along the way had to provide the water taps themselves."

Interviewer said: "Um, hum."

Interviewee said: "And nobody has the ability to provide raw water for a stretch of highway like this in place at this time. So, it would have been good if we could have had a raw water supply as opposed to a potable water supply but wasn't feasible."

Interviewer said: "Erosion control."

Interviewee said: "During construction it was high. I don't know if any considerations are actually applied to it during the design for after construction period."

Interviewer said: "This particular plant pallet wasn't really considered...we're doing this because of the erosion control qualities that..."

Interviewee said: “No. Yeah. Don’t know of anything that was applied there. We did make some recommendations to them on mulches and mulch covers, nettings to hold the mulches in place so that the mulches did not wash away. Practical experience, excuse me, that we have on U.S. 75 with some mulch problems and what we’ve done to correct those and hold that mulch. So, from erosion, we did talk to them about mulch erosion and keeping it down.”

Interviewer said: “Soil rehabilitation.”

Interviewee said: “Don’t...we talked about some soil amendments, recommended some soil recommendations as far as plant bed amendments but nothing from the standpoint of what’s the long-term benefit of the soils with these particular plants being used, metrification, or anything like that.”

Interviewer said: “Weed control.”

Interviewee said: “Mulches, we talked about that. A lot.”

Interviewer said: “And mulches being part of the design and the application so...”

Interviewee said: “Yeah, yeah.”

Interviewer said: “Was weed control an important consideration?”

Interviewee said: “Um, hum. Very much so and we also worked with them on a chemical control program from the very beginning on U.S. 75 or on George Bush, before the landscape project ever got started on chemicals.”

Interviewer said: “Maintenance.”

Interviewee said: “Big. Major. I always pounded maintenance with this think. I always looked at what they were doing from a maintenance standpoint. Don’t design it with an eye or an ear towards what’s going to happen in this thing daily. You set yourself up for failure. So, to me, the operations and maintenance of it was critical if it was ever going to work.”

Interviewer said: “Irrigation.”

Interviewee said: “Critical. Major. Big, big consideration, including the control system that they were using, the master control system. Because

we have a master control system and we kind of educated them on what we use and how we use it, how important it is for water application and proper management of the water.”

Interviewer said: “Has there been any feedback from the public concerning the plant selection of the Texas Highway 190 project? Have y’all heard from your constituents?”

Interviewee said: “I’ve heard from my wife **[laughter]**. She loves driving it when those Texas Sage are blooming. Yeah. And she’s not saying that because of anything I did with the project. She just likes seeing it at certain times with that.”

Interviewer said: “But from your department, you’ve not heard from, I mean, if people do call in you don’t let you…”

Interviewee said: “Constituents?”

Interviewer said: “Yeah.”

Interviewee said: “No, not really.”

Interviewer said: “Okay.”

Interviewee said: “I’ve just heard some people just saying off hand that they like what they’re seeing but there’s nothing specific enough that I can really relate to, to say that they like this, they like that or one thing or the other. I’ve just heard people say, you know, they’re glad to see it happening and I think probably more so than just leaving it as a highway roadside.”

Interviewer said: “Anything else you’d like to say? We… I’ve talked you to death **[laughter]** what else can be left.”

Interviewee said: “Yeah. I know. Not that I can think of. Not that I can think of.”

Interviewer said: “Okay.”

Interviewee said: “It was a fun project to work on. It was good group of people to work with at NTTA. Wade was super. Wade was so non-challenged, I guess, by asking us to be involved and to provide critique. He was generally interested in what we had to say and, you know, I’m glad that we had the opportunity to provide some input into the process. NTTA learned a lot from this and I think



that they can see that what they did on the Dallas Tollway, the old section, you know, down Mockingbird and Lovers, and Northwest Highway stretch, some of that that was just forgotten for so long, now I think they've kind of stepped up in their own eyes, their own perspective of what they need to be doing in other areas. I know they can't change those vertical slopes of white chalk that are there. They can at least, they're paying some more attention and putting a little bit more effort into some of those areas that they had just totally turned their back on before, and recognize that maybe they do have some due diligence to, you know, help improve the setting that their roadways are in."

Interviewer said: "In my conversation with Tony yesterday, to get to his office I actually drove up the old tollway, through that whole area..."

Interviewee said: "Yeah."

Interviewer said: "...and so I remarked, at the time, of saying, 'You know it was...I had never really thought about, as I drove this tollway before, until I've seen this tollway and said now, as I was driving today I was just noticing how, you know, the difference. We're not trying to be judgmental.'"

Interviewee said: "Yeah."

Interviewer said: "And he said, 'Well, we've been looking at it as well and we're feeling like that now we have to go back and we're actually looking at studies of what we can do to enhance that to try to bring that so that it compares with this, with the new tollway, with the 190.'"

Interviewee said: "Sure. And...and...their thought process will be forever changed from having zero thought into it, like North Dallas tollway was done, and continue to be maintained up until just very recently, to building George Bush and not considering landscaping, it was an after thought, to now building sections of tollway and thinking of landscape improvements upfront. So..."

Interviewer said: "They've raised the bar here, haven't they?"

Interviewee said: "Yep."

Interviewer said: "For them and for others that are, I think, others entities that do tollways and stuff as well, I think."

Interviewee said: “It’s too bad we couldn’t have had a trail system the entire length of it.”

Interviewer said: “You guys didn’t push hard enough. **[laughter]** You got something. You got something. **[laughter...dictation ended.]**”

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## BIOGRAPHICAL INFORMATION

John Mark Scott graduated North Texas University in 1973, with a Bachelor of Science degree in Psychology. In 1998 he began a career change, earning an Applied Degree in Horticulture in 2000 and a Masters Degree in Landscape Architecture in 2007. He currently owns a Design/Build landscape firm, specializing in residential landscape architecture.