



Comparison and Assessment of Mechanical and Herbicide-Chemical Side-Trimming Methods of Managing Roadside Vegetation by the Texas Department of Transportation (TxDOT)

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Cooperative Research Program

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16. Abstract <p>The project compared and assessed the mechanical and herbicide-chemical side-trimming methods that TxDOT uses to manage roadside vegetation. This report discusses safety, effectiveness, and economic costs of these methods. It also shares industry best management practices by appending comments of several resource professionals concerned with side-trimming operations for vegetation management on rights-of-way.</p> <p>The researcher based his assessment on information and data that TxDOT's Vegetation Management staff had provided, and information and perspectives on rights-of-way from resource management professionals associated with other state DOTs as well as other agencies involved in vegetation management.</p> <p>The report emphasized that TxDOT seeks to collaborate with stakeholders to determine the best and most appropriate side-trimming methods for various unique ecological and cultural situations across Texas.</p>					
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**COMPARISON AND ASSESSMENT OF MECHANICAL AND
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MANAGING ROADSIDE VEGETATION BY THE TEXAS
DEPARTMENT OF TRANSPORTATION (TXDOT)**

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DISCLAIMER

This research was performed in cooperation with the Texas Department of Transportation (TxDOT) and the Federal Highway Administration (FHWA). The contents of this report reflect the views of the authors, who are responsible for the facts and the accuracy of the data presented herein. The contents do not necessarily reflect the official view or policies of the FHWA or TxDOT. This report does not constitute a standard, specification, or regulation.

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INTRODUCTION

Keeping trees from becoming safety hazards along roadsides can be challenging for vegetation managers. If left unchecked, overgrown trees can block the visibility of motorists and become safety hazards. Typically, there are only a few options to control this problem: remove the trees entirely or prune the tree with mechanical or chemical methods. Mechanical methods include using power equipment (saws, chainsaws, power pruners, etc.) to physically cut and remove the problem limbs and vegetation. Chemical methods are focused on spraying selective herbicides for vegetation removal. Some herbicides can effectively prune back only the treated limbs or the entire tree can be treated.

The focus of this study is to examine the trade-offs between aesthetic and safety sight-distance considerations of roadside vegetation management in a highly constrained State budgetary environment.

The goal for this report is to objectively compare and assess both mechanical and herbicide-chemical (hereafter herbicide) side-trimming methods for roadside vegetation management in the following areas:

1. **Safety Issues.** The safety of the general public, TxDOT employees, and wildlife.
2. **Effectiveness.** Regardless of the method employed, either method must be effective at removing trees and vegetation from encroachment along roadways. The longevity of each method, and need for repeat applications, will be examined.
3. **Cost Analysis.** Considering the miles of side-trimming required throughout the State, cost is an important factor to consider. Total costs of material, mobilization, and personnel will be examined.

4. **Industry Best Management Practices.** Successful results by other industry (including other departments of transportation) using these side-trimming methods can provide useful information for determining best management practices for TxDOT.
5. **Aesthetics.** Trees provide a variety of aesthetic values for the roadside environment including screening, noise abatement, reduction of pollution, and mitigation of temperature extremes. This is important to the general public as indicated through their involvement with this side-trimming issue at both local and state levels. Maintaining aesthetics is clearly an important issue related to strategies used for side-trimming vegetation along roadways and will be examined. Factors related to “tree value” (certain species of trees in some areas of the State, and the roadside context where they grow, are higher than the value of other species in different regions of Texas) are also discussed.

The report concludes with a set of context-dependent recommendations that should allow TxDOT to identify the various situations where mechanical or herbicide applications of side-trimming methods for roadside vegetation control are most appropriate.

METHODS

The information, opinions, and findings in this report were based on the following methods and materials:

1. Information and data provided by the Vegetation Management Staff at TxDOT.
2. Information and perspectives provided by resource management professionals associated with other state departments of transportation and agencies involved with vegetation management on rights-of-way.

3. Concerns expressed by private citizens.

4. The author's own professional background and experiences based on 30 years of conducting research on the ecology and management of vegetation, including wildlife habitat.

The primary focus of this report is related to what TxDOT personnel consider "side-trimming" or the pruning and removal of branches and limbs that obscure roadside lines of sight or road signs and markers from motorists' field of view. Issues related to the felling and removal of whole trees for roadside vegetation management are not directly considered here, although many of the concerns related to side-trimming also apply to whole tree removal.

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COMPARISONS AND ASSESSMENTS

SAFETY

The safety of the general public, TxDOT employees, and wildlife populations is the top priority when it comes to vegetation management along highway rights-of-way. This importance of this concept—safety—is axiomatic. This is common sense and there is no other substitute for safety as a top TxDOT priority. Safety was the universal top concern and priority of all agency professionals who responded to the author’s queries regarding Best Management Practices for side-trimming along highway rights-of-way.

Safety to the General Public.—Maintaining line-of-sight views around roadside curves, and keeping roadside signs and markers visible to motorists is the central and fundamental motive behind side-trimming for vegetation control along highways in Texas or any other state, for that matter. Thus, common sense dictates that with respect to the safety of the general public, it probably does not matter whether side-trimming is done by mechanical or chemical means, at least during the period of time *after* the side-trimming occurs. Mechanical removal of vegetation is immediate, whereas the burn-down of foliage after application of herbicides may take several days or even weeks. This difference, while certainly present, is probably negligible.

It is important to point out that *during* the period of time when side-trimming occurs is another matter, however, when it comes to the safety of the general public. This is because mechanical applications of side-trimming will typically require a TxDOT or contractor's crew to close one or more traffic lanes in order for the trimming crew to set up equipment and trim a section of roadway safely. Closing one or more lanes, even when done correctly, presents potential hazards to motorists. Closing traffic lanes for whatever reason, including mechanical side-trimming, can result in traffic delays, and can heighten the likelihood of collisions between or among motorists. Application of herbicides for side-trimming, on the other hand, typically does not require the closing of traffic lanes like it does for mechanical side-trimming. Typically, TxDOT crews apply herbicides in a mobile manner that goes with the flow of the traffic and typically does not obstruct traffic.

Safety to TxDOT Employees. —Mechanical side-trimming clearly involves safety hazards and risks that far exceed those related to herbicide applications for side-trimming vegetation. This is because, as noted above, mechanical side-trimming involves the closure and obstruction of one or more traffic lanes so that crews can create a safety zone for both themselves and passing motorists. This requires TxDOT crews to set up cones, hazard lighting, place personnel in correct locations for flagging at each location or section where mechanical side-trimming will occur. Each of these activities requires TxDOT personnel to put themselves at risk; they are literally “working in traffic” as they set up and tear down vehicle obstruction lane(s) during the course of a mechanical side-trimming operation.

There are also additional safety concerns to TxDOT employees involved with mechanical side-trimming operations. Even when personnel get high levels of training, running chain saws and similar power equipment is inherently dangerous. TxDOT employees and contractors also

run the risk of encounters with bees, poisonous snakes, poisonous plants, and falling limbs during mechanical side-trimming operations. During the warm season, equipment operators also run the risk of heat stroke and dehydration. Injuries from handheld power saws, anaphylactic shock from bee stings, envenomation from snake bites, and injuries from falling limbs all have the potential to be fatal to TxDOT personnel, not to mention the potential of being struck by oncoming vehicles.

Herbicide applications for side-trimming minimize the mechanical safety risks noted above to TxDOT employees. During the herbicide application process, TxDOT employees and contractors are not subject to encounters with bees, poisonous snakes, or falling limbs. Risks of heat stroke and dehydration to personnel are minimized because workers apply herbicides from a truck rather than physically working on the ground. The absence of the need to close or otherwise obstruct traffic lanes, as noted above, is another safety advantage for workers implementing herbicide control of roadside vegetation.

Some may argue that application of herbicides to control vegetation entails certain environmental safety hazards not present in mechanical methods of side-trimming. A complete assessment of environment hazards related to applications of herbicides is beyond the scope of this report. However, this point is addressed in the Environmental Impact Statement completed by TxDOT. An Environmental Impact Statement has been conducted by the TxDOT Vegetation Management Program and all the herbicides that are used by TxDOT have been evaluated. In addition, the following points must be noted:

- All herbicides used by TxDOT are licensed by the Environmental Protection Agency. Their application in Texas is regulated by the Texas Department of Agriculture. All are listed as nontoxic to wildlife.

- All herbicides used by TxDOT are applied according to labeled directions.
- TxDOT conducts comprehensive training and continuing education classes for all personnel who apply herbicides for vegetation management.
- All TxDOT herbicide applications are done under the direction of personnel who receive a “**Noncommercial Political Pesticide Applicators License**” through an agreement between TxDOT and the Texas Department of Agriculture. Individual licenses must be renewed annually. *This is above and beyond what is required by State and Federal regulations for the approved applications of these herbicide compounds in the State..*
- All TxDOT herbicide applications are to follow guidelines and directions in the *TxDOT Herbicide Operations Manual*, and *Labels and MSDS (Manufacturer’s Suggested Delivery Systems) Sheets for TxDOT Herbicide Operations Manual*.
- TxDOT typically reviews, researches and tests new herbicide compounds and mixes for at least five years before they are used in regular roadside management applications.

The two manuals mentioned above represent state-of-the art techniques with respect to environmental safety issues related to herbicide application for side-trimming control of roadside vegetation. Specific assessments of the level of training provided to TxDOT personnel to implement the guidelines in these manuals is beyond the scope of this report, but is assumed for the purpose of this report to be more than adequate.

Safety to Wildlife.—All herbicides are chemically engineered to disrupt one or more physiological processes or pathways in plants that drive photosynthesis. As such, since

terrestrial and aquatic animals do not have physiological pathways based on photosynthesis, the direct mortality of wildlife related to herbicide applications is non-existent.

Concerns about herbicide applications resulting in direct mortality to wildlife (primarily birds and fish) have been expressed by some members of the public in relation to herbicide applications of side-trimming by TxDOT. However, the author believes that no specimens or carcasses found in relation to applications of herbicides for side-trimming control of vegetation along roadsides have been collected or submitted to a professional pathologist for necropsy and assessment of cause of death. Complaints can be filed with the Texas Department of Agriculture. In the future, if suspected vertebrate carcasses are presumed to be related to mortality from herbicide applications for side-trimming activities are identified and collected, they certainly should be submitted to a credible wildlife or fisheries pathologist for identification of cause of mortality. Texas Department Agriculture would be in charge of such a situation and would be the Agency to submit the samples to a pathologist.

In the past, there has been concern about by-products in the manufacture of herbicides, such as dioxin, that can cause morbidity and mortality in vertebrates. Compounds such as dioxin were present in certain herbicides as a by-product of the chemical manufacturing process. However, the nine different herbicides listed in the *TxDOT Herbicide Operations Manual*, and *Labels and MSDS (Manufacturer's Suggested Delivery Systems) Sheets for TxDOT Herbicide Operations Manual* are approved for application by the Environmental Protection Agency and Texas Department of Agriculture because such concerns do not exist for presence of these by-product compounds. Finally, The Environmental Protection Agency (EPA) has evaluated the toxicity of all pesticides to wildlife; the herbicides presently used by TxDOT are considered non-toxic to all wildlife.

EFFECTIVENESS

Regardless of the method employed, either mechanical or chemical side-trimming techniques must be effective at removing trees and vegetation from encroachment along roadways. The longevity of each method, and need for repeat applications, is considered in this section of the report.

Longevity and Repeat Applications. —Texas is a huge state that encompasses 10 distinct ecological regions. The annual rainfall and temperature gradients in Texas are vast. For example, East Texas Piney Woods averages more than 45 inches of annual rainfall, whereas the Trans Pecos region receives less than 10 inches. Temperatures grade from sub-tropical in South Texas, where a series of 5 to 10 or more frost-free winters is common, to the Panhandle Plains where winter blizzards and extended periods of winter freezes are common. The diverse temperature and rainfall gradients that occur across Texas are the primary drivers that result in a diverse and highly variable range of vegetation productivity across the state. Because of this range, it is impossible to identify a single, one-size-fits-all rule or guideline with respect to longevity and need for repeat application of side-trimming activities for vegetation control along roadside rights-of-way in Texas. As such, both mechanical and herbicide methods can be considered effective with respect to vegetation control by side-trimming. Both mechanical and herbicides are clearly effective methods for reducing biomass and removing vegetation. There are, however, some common concepts and principles that can be applied to assessing the relative differences of effectiveness between mechanical and herbicide applications for side-trimming.

Mechanical Methods. —Mechanical methods such as sawing, pole pruning, etc. physically remove encroaching vegetation by cutting it and allowing it to fall on the ground and be removed immediately, at a later time, or allowed to decay. Regardless of the follow-up

method to remove debris on the ground, the primary goal of the operation, which is to maintain lines of sight, and keep roadside signs and markers visible to motorists, is achieved immediately.

The longevity of vegetation control and need to reapply treatments obviously varies by the region of the state in relation to rainfall, temperature, and vegetation productivity as noted above. However, the common response of vascular plants to pruning and partial removal of branches, limbs, twigs, etc. is to resprout by way of *adventitious buds*. Adventitious buds develop in places other the end of a twig or in leaf axils. They appear because physical and chemical pruning stimulate their development. Adventitious buds are a mechanism whereby plants can respond rapidly to pruning and replace lost growth quickly so that the new foliage can develop and send food reserves to the roots of the plant for the next growing season. Typically, adventitious and axial buds, which drive regrowth in pruned woody vegetation, resprout more quickly in response to mechanical pruning compared to herbicide pruning.

Herbicide Methods. —Compared to mechanical pruning methods, which have immediate effects, herbicides typically have a more delayed (i.e., relatively slower) response with respect to vegetation removal. After herbicide applications, it typically takes several days for the compound to react with and kill the foliage, and then several more days or weeks for the foliage to drop to the ground. The resulting dead twigs and branches may persist for several months to years, depending on the species of tree that was treated. However, even with the residual twigs and branches that remain after a herbicide application, visibility objectives related to restoration of lines of sight and removal of obstructions that hide roadside signs and markers can be achieved.

Because herbicide applications (herbicides will kill the axillary buds and prevent resprouting) also stimulates development and sprouting of adventitious buds like physical pruning does, the window of time needed for reapplication of chemicals will be somewhat longer

than mechanical methods, in addition to being somewhat delayed because of the burn-down period. Again, absolute guidelines here are impossible to provide, given that various species of trees respond differently, and vegetation productivity varies tremendously across Texas.

Thus, there are two primary trade-offs with respect to the effectiveness and longevity of mechanical versus herbicide treatments for side-trimming: mechanical treatments are immediately effective but may be potentially shorter in terms of duration than herbicide treatments, and herbicide treatment may have a delay in their immediate effectiveness, but will remain effective longer than mechanical treatments because of how plants respond to herbicide compared to mechanical treatment.

One concern from public individuals about the use of herbicides for side-trimming is that they are *too effective*. That is, under certain conditions, herbicide spray can drift, land on, and kill non-target vegetation, such as roadside vines, wildflowers, native grasses, and other desirable vegetation that does not obstruct lines of sight and cause safety hazards. The problems of drift and related mortality inflicted on non-target vegetation are addressed in the section on “Elements of Compromise” below.

ECONOMIC COSTS

Mechanical Methods. —TxDOT data indicate that total costs of mechanical removal for side-trimming control of roadside vegetation ranges from approximately \$1,000.00 to \$3,000.00 per mile of road side treated. This includes personnel, equipment, and other direct and related expenditures such as supplies, fuel, etc.

Herbicide Methods. — TxDOT data indicate that the total cost of herbicide applications for side-trimming control of roadside vegetation averages approximately \$140.00 per mile of

roadside treated. This includes personnel, equipment, and other direct and related expenditures such as supplies, fuel, etc.

This report did not make total state-wide annual cost estimates for expenditures related to mechanical versus herbicide control of roadside vegetation. Presumably, the number of miles treated per year varies, and total annual costs can be easily obtained by multiplying the number of miles treated by each method by the average cost per mile for each method. What really matters is the differential between the per mile costs related to mechanical method versus the costs related herbicide method for side-trimming roadside vegetation.

Thus, assuming an average cost of approximately \$1,500.00 per mile for mechanical pruning, this is nearly 11 times, or 1,071% more than the cost of herbicide applications per mile. Or, considered from the opposite perspective, costs of herbicide applications for side-trimming are less than 10% of the total costs required to execute mechanical side-trimming methods and achieve similar management objectives. Given the dire current (2011) condition of the budget of the State of Texas, it is clear that TxDOT has no alternative but to consider the use of herbicide applications for side-trimming and control of roadside vegetation wherever and whenever possible.

INDUSTRY BEST MANAGEMENT PRACTICES

Successful results by other industry (including other departments of transportation) using mechanical and herbicide side-trimming methods can provide useful information for determining best management practices for TxDOT. In the course of compiling background information for this report, the author contacted a number of resource professionals who are involved with, or responsible for, side-trimming operations for vegetation management of vegetation on rights of way. Their comments are appended below.

From the Oklahoma Department of Transportation:

I've worked with ODOT (Oklahoma Department of Transportation) for the past 25 years and as a whole they don't have a big tree management program. The biggest reason is they mow every acre of roadside that they can at least once a year: that is essentially their tree management program. In areas where they cannot mow the main factors that facilitate mechanical or chemical tree management are as follows:

1. To my knowledge, ODOT has done very little side-trimming (mechanical or chemical) along the state highway system. I would imagine mechanical side-trimming would not be well received due to the ragged look and we do recommend the use of Krenite S (which can be used as a side-trimming herbicide if necessary). Mechanical side-trimming is a common practice along our county roadsides, however.
2. Safety is the main factor, both mechanical (95% chainsaw removal followed by stump treatments) and herbicides (some foliar summer applications and dormant basal applications) that facilitate ODOT tree management efforts (this can be sped up by ice storms which usually increases the priority placed on ODOT Tree Management efforts).
3. Some tree management occurs along some of Oklahoma's Scenic Byways in eastern Oklahoma to try and keep highway vistas open.
4. I don't know of any tree species that get special consideration if they are creating any type of maintenance issue, I would bet our state tree, redbud, gets whacked to the ground as much as any other nuisance tree.
5. A fair amount of ODOT tree management efforts revolves around controlling willow that is clogging drainages. This is obviously done to prevent road flooding.

From a Private Consultant in Texas:

With respect to mechanical versus herbicide methods of side-trimming for vegetation management along highways, the cost differential between the two methods is certainly a major driver in favor of herbicides, although the aesthetics from herbicides are not as good. However, we prefer to use herbicides over mechanical methods in most cases, especially where there are oak trees, because power saws and pruners can spread oak wilt disease. Probably needs to stress the oak wilt spread more.

From the Arkansas Highway Transportation Department

Arkansas uses a "little of both" [mechanical and herbicide methods] for side-trimming. Boom mower results are unsightly, and leave a ragged look that needs to be followed up with trimming with pole saws for a more "finished look." We use Krenite S (a bud inhibitor) on overhanging limbs. Application of Krenite S is on deciduous trees, late in the growing season, so that the brown-down period coincides with natural, seasonal leaf mortality. As a rule of thumb, the closer our activities are to Little Rock, the more scrutiny they receive. We receive virtually no complaints about herbicide applications for vegetation control on highway rights-of-way in rural areas such as the Mississippi Delta. People there are accustomed to widespread use of herbicides in farming, and are not bothered by use of herbicides on highways.

From a Utility Company

We use herbicides to suppress regrowth under power lines. Herbicides represent a good and effective approach to controlling regrowth of woody vegetation. After initial clearing of powerline

corridors we try to return on a 5-year cycle. It is common to also shred woody vegetation mechanically and treat stumps with herbicides to prevent or delay regrowth.

From an Electrical Utility Company Forester

Maintaining vegetation along rights-of-way is a high stakes situation for both utility companies and agencies such as TxDOT. We need to maintain corridors to minimize chances of outages and arcs between lines and vegetation that can start fires. TxDOT has the charge of maintaining lines of sight and corridors of visibility, which while different from us, is still highly important and related to what we do.

Our preference is to implement whole tree removal by felling wherever possible. Our philosophy is to solve a problem once, wherever possible, so that we don't have to keep going back again and again. Our overall goal is to use the most cost-efficient means to get the job done.

From the Louisiana Department of Transportation

In situations where there is a pressing, immediate safety concern to restore line-of-sight or other roadside safety zones, we use mechanical pruning to correct the problem immediately. Otherwise, we typically spray roadside vegetation with Krenite S to maintain safety zones and lines-of-sight. In rural settings, where agricultural land uses are prevalent, we may use Garlon 3 in certain situations. In urban settings, we typically do more mechanical side-trimming than herbicide side-trimming.

AESTHETICS

Trees provide a variety of aesthetic values for the roadside environment including screening, noise abatement, reduction of pollution, and mitigation of temperature extremes. This is important to the general public as indicated through their expressed concerns in both conversation and through letters to the editors of local newspapers about the issue of mechanical versus herbicide applications related to side-trimming. Maintaining aesthetics is an important issue that will be examined in this section, along with factors related to “tree value.”

The “Uglification” Issue.—Aesthetic concerns about the use of herbicides for side-trimming roadside vegetation are clearly at the root of the controversy that resulted in this report. There is no question that, as noted above, herbicide applications for side-trimming take longer to manifest and then fade into the background of the landscape, than mechanical applications when it comes to vegetation removal. Clearly, it is the delayed response of vegetation to herbicides, both from brown foliage and then from the decay and fall of residual twigs and branches, that is of concern to the public and resulted in the term “uglification” in both direct comments to

TxDOT personnel, administrators, legislators, and in numerous letters to the editor in various newspapers.

However, given that herbicide application costs are less than 10% of the costs of mechanical application costs for side-trimming, it is economically unfeasible for TxDOT to completely abandon use of herbicides for roadside vegetation management, especially in these times of record State fiscal deficits.

From the standpoint of safety, it is also unreasonable for TxDOT to cease all efforts using herbicides for side-trimming. The resultant loss of life and property from vehicle accidents related to excessive roadside vegetation is both politically and morally unacceptable.

Elements of Compromise.—The question then, is where can TxDOT find some elements of compromise to meet their mission as an agency to provide the most practical and economical elements of motorist safety along roadways and yet also meet a legitimate concern about roadside aesthetics from the taxpayers? The following are some proposed recommendations for aesthetics of roadside vegetation management in the context of motorist safety or TxDOT to consider as this process moves forward:

1. *Herbicide applications have different aesthetic effects on different species of trees.* For example, the evergreen foliage on live oaks killed by herbicide has much more contrast with background foliage and vegetation compared to other species such as mesquite, huisache, and hackberry.
2. *Therefore, minimize use of herbicide applications for live oak vegetation control where possible.* This point is especially pertinent along roadside corridors, especially in areas around or near urban and suburban zones, and on areas designated as scenic by-ways, insofar as economically and politically feasible.

3. ***Mechanical control of live oak also has the potential to be aesthetically unpleasing if it results in a “ragged” appearance.*** Thus, if mechanical methods are used for live oak obstruction control, there are also aesthetic considerations that are warranted. Disease issues, such as the potential to spread oak wilt from power saws and pruners, also need to be considered.
4. ***Avoid using herbicide applications for widespread and generic “corridor maintenance.”*** Long brown and gray swaths of dead twigs and branches along otherwise scenic roadsides are not aesthetically pleasing. There may be ways to mitigate this aesthetic problem.
5. ***Rather, use herbicide applications, wherever possible or appropriate, on small isolated sites.*** Identify judicious placements of spot locations to keep roadside signs and markers visible.
6. ***When herbicide applications are necessary, use such applications where possible in a “seasonal manner” on deciduous vegetation.*** That is, apply herbicides to deciduous species such as mesquite, huisache, hackberry, The seasonal application of herbicides to deciduous tree species works with the vegetation in an aesthetic manner such that the foliage dies during the season (i.e., late summer or fall) when it would otherwise die naturally in relation to the annual life cycle of the particular plant. This is a common practice in Arkansas.
7. ***Herbicide applications in live oak areas of the state should also be restricted to fall, as noted in point 6 above.*** Furthermore, herbicide side-trimming is more desirable than mechanical side-trimming in oak-growing areas of Texas because herbicide applications

have far less potential to cause spread of oak wilt fungus. This is because there are no open wounds on trees from herbicide applications.

8. ***Herbicides can clearly impact non-target vegetation under wrong conditions or applications.*** Minimizing “drift” of herbicide sprays during windy conditions, applying the absolute minimum amount of application from spray nozzles or other application techniques, are critical for minimizing the impacts of herbicides on non-target vegetation.

The Concept of “Tree Value.”—Different species of trees and roadside vegetation have different economic and aesthetic values to different people. That a large, live oak tree along the street of a residential or suburban neighborhood can enhance the real estate value of the property where it is located is beyond argument. Roadside shade from large pine trees is clearly one of the appealing aspects of driving through East Texas nearly any time during day light. Large mesquite and hackberries along residential lanes and suburban areas are also high-value trees that may not lend themselves to generic pruning with herbicides. Ornamental shrubs, wild-growing vines, and other flowering woody and herbaceous species all are key parts of the Texas roadside landscape that make car travel enjoyable throughout so many parts of the state.

Thus, when it comes to management of roadside vegetation, TxDOT should consider the concept of “tree value” in the context of how such vegetation is managed over time. What this means is that areas of “high-value” trees and vegetation should be identified and managed in ways that protect and enhance the aesthetics of these roadside trees and woody plants, insofar as possible, when motorist safety is concerned. Such areas would include urban and suburban areas, scenic by-ways and other areas of special aesthetic concern identified by TxDOT and

agency stakeholders. These are factors that cannot necessarily be quantified, but rather must be identified by professional opinion and expert judgment.

Simply switching from complete herbicide control to a blanket policy of mechanical pruning for side-thinning is not necessarily a complete or practical answer to the problem, even if cost was no object. As noted above in the comments from The Oklahoma Department of Transportation, “*I would imagine mechanical side-trimming would not be well received due to the ragged look... .*” Thus, aesthetic considerations come into play with mechanical side-trimming as well. Furthermore, the potential problem of spreading oak wilt pathogens from infected to healthy trees via power saws and pruners may actually create an aesthetic problem far greater than any aesthetic problem created from herbicides.

As things relate to aesthetics and side-trimming vegetation for roadside management, neither mechanical nor herbicide methods represent a one-size-fits-all application that is ideal. Both methods have their merits and limitations with respect to both aesthetics and economics, along with the safety and effectiveness issues as noted above.

CONTEXT DEPENDENCE

Striking the balance between economics and aesthetics for side-trimming roadside vegetation is clearly a context-dependent issue for TxDOT. There are roadside landscapes, such as those in agricultural, rural and rangeland vegetation contexts, where the economic advantages of herbicide applications for side-trimming will clearly suffice and should cause little or no resultant controversy. The situation described above from the Mississippi Delta in Arkansas is a notable such example. There are other roadside contexts, such as areas predominated by high-value trees along scenic by-ways, residential areas, suburban and exurban zones, where the economics of herbicide applications should probably be trumped by the appropriate (i.e.,

minimizing the “ragged look” factor) application of mechanical methods of side-trimming when possible and where feasible. Concerned citizens will certainly continue to demand that aesthetic issues take precedence in such roadside contexts.

Based on the data and other background information provided by TxDOT for this report, the agency is clearly interested in working with stakeholders and identifying these different context-dependent applications to identify the appropriate side-trimming techniques for the appropriate situations. The overarching goal should be for TxDOT to implement the best side-trimming management practices for roadside vegetation management that are most appropriate for the context of each ecological and cultural situation across the State of Texas.

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