**TECHNICAL MEMORANDUM**

**Task 3 Deliverable: Summary of Survey Results and Draft PVC Recommendations Technical Memorandum**

**NCHRP 14-41, Permanent Vegetation Control Treatments for Roadsides**

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**TASK REPORT:** The following pages summarize the work completed in Task 3.

## Summary

This technical memorandum presents the work performed in Task 3 of NCHRP 14-41, *Permanent Vegetation Control Treatments for Roadsides*. This memorandum provides a summary of the survey of practice sent to all departments of transportation requesting information regarding their use of permeant vegetation controls designed to prevent or significantly retard the growth of unwanted vegetation around roadside appurtenances and along roadsides.

## Overview

The goal of the NCHRP 14-41, *Permanent Vegetation Control Treatments for Roadsides*, is to collect information on current departments of transportation (DOT) practices, institutional obstacles, and the concerns that state agencies have regarding permanent vegetation control (PVC) treatments. The research team will identify additional methods and technologies that DOTs are piloting, additional guidance required, and how DOTs would use the findings from this research.

## PVC Survey Results

The NCHRP 14-41 project’s web-based survey and interview process was designed to optimize responses by balancing the length and the level of detail requested of the respondents. The draft survey and interview questionnaire were reviewed by the Institutional Review Board (IRB) for Human Subject Protocols for compliance and sent to the NCHRP panel for approval prior to deployment.

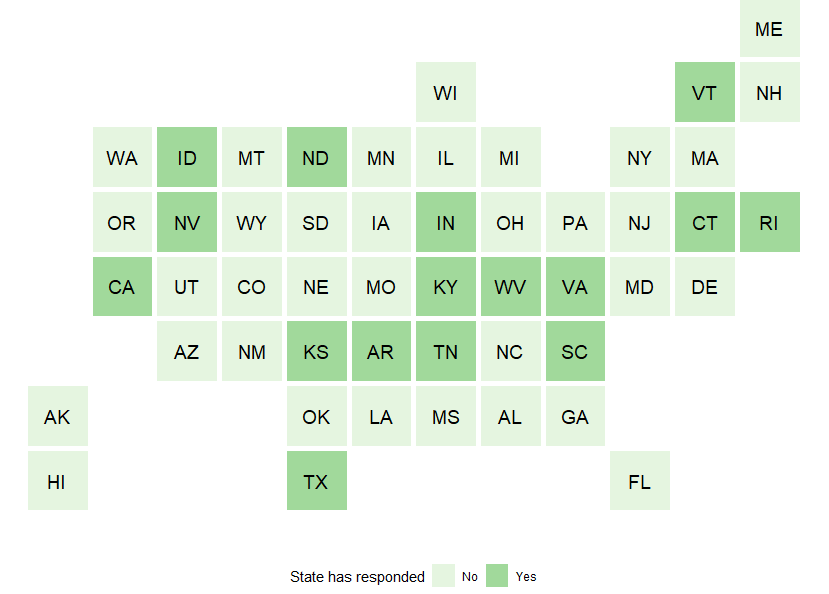
An email invitation to participate in the web-based survey was sent to the maintenance directors at all state DOTs as well as a representative sample of local agencies. The objectives of the survey are the following:

* Gather information on current practices, institutional obstacles, and the concerns that

DOTs have regarding PVC treatments;

* Gather information on the selection process implemented by DOTs;
* Identify any missing applications that require further guidance (e.g., controls for use with cable barriers);
* Identify any innovative methods or technologies that DOTs have experimented with; and
* Gather information on any additional guidance that is required.

Sixteen states responded to the survey with some states giving multiple responses based upon regional differences. The key findings of the survey are highlighted in this chapter. Figure 1 illustrates the U.S. map showing the DOTs that responded to the survey. Table 18 shows the DOT respondents.



**Figure 1. Survey Responses by States.**

The survey contained multiple questions related to vegetation control treatments, such as current state practices, institutional obstacles, and the concerns that agencies have regarding PVC treatments. Table 1 lists the questions used for this survey.

**Table 1. List of Survey Questions.**

|  |
| --- |
| **Survey Questions**  Question 2: Contact information (Name, Agency, Location, Area of Responsibility, State, Title, Address, Phone Number)  Question 3: Does your agency currently use non-herbicide PVCs for preventing or significantly retarding the growth of unwanted vegetation around roadside appurtenances and along roadsides?  Question 4: Does your agency have a published/established protocol for using non-herbicide PVCs?  Question 5: If yes, please provide the most current document and/or a website link in the text box below. If the document is not publicly available through your agency's website (i.e., internal to the agency), please submit the document via email at [pvc@tti.tamu.edu](mailto:pvc@tti.tamu.edu).  Question 6: If your agency does not have an established protocol, please provide any details of non-herbicide PVC methods or practices currently underway within your agency or region in the space below or in a return email at [pvc@tti.tamu.edu](mailto:pvc@tti.tamu.edu).  Question 7: Has your agency collected data or performed research regarding any of the following worker safety aspects of the performance of non-herbicide PVCs? Please select all that apply. (Installation, Maintenance)  Question 8: Has your agency collected data or performed research regarding any of the following cost aspects of the performance of non-herbicide PVCs? Please select all that apply. (Installation, Maintenance, Direct Labor, Materials, Equipment, Management/ Planning)  Question 9: Has your agency collected data or performed research regarding any of the following material performance aspects of the performance of non-herbicide PVCs? Please select all that apply. (Material integrity, Longevity, Ease of installation, Retrofit capabilities, Maintenance, Impacts of mowing, Impacts of ice/snow, Impacts of storm water runoff, Effectiveness)  Question 10: Has your agency collected data or performed research regarding any additional aspects of the performance of non-herbicide PVCs? If yes, please describe.  Question 11: If you selected any of the performance aspects options above, please provide the most current document and/or a website link.  Question 12: If you have PVC performance data that is NOT compiled in a formal document, please summarize that information in the space provided or in a return email at pvc@tti.tamu.edu. |

**Table 1. List of Survey Questions (Continued).**

|  |
| --- |
| Question 13: In what locations does your agency use non-herbicide PVCs? Please select all that apply. - Selected Choice (Guardrails, Median barrier systems, Edge of pavement, Gore areas, Embankments, Other (Please specify))  Question 13\_Narration: In what locations does your agency use non-herbicide PVCs? Please select all that apply. - Other (Please specify) – Narration.  Question 14: If you selected any of the options above please provide the most current document and/or a website link. If the document is not publicly available through your agency's website (i.e., internal to the agency), please submit the document via email at [pvc@tti.tamu.edu](mailto:pvc@tti.tamu.edu).  Question 15: If your agency does not have an established protocol, please provide details of PVC implementation in the space provided or in a return email at pvc@tti.tamu.edu.  Question 16: What types of non-herbicide PVCs does your agency currently use? - Selected Choice. (Minor Concrete Pavement, Standard Concrete Pavement, Asphalt Concrete Pavement, Rock Blanket, Gravel Mulch, Weed Control Mat (Fiber), Irrigated/Ornamental Vegetation, Native and Non-Irrigated Vegetation, Rubber Weed Mat, Organic Mulch, Asphalt Composite, Other (Please Specify))  Question 16\_Narration: What types of non-herbicide PVCs does your agency currently use? - Other (Please Specify) - Narration  Question 17: If applicable, please provide information regarding other types of PVC usage.  Question 18: If your agency no longer uses a specific non-herbicide PVC, please provide details regarding performance and/or reason for discontinuing use in the space below or in a return email at pvc@tti.tamu.edu.  Question 19: What selection criteria does your agency use regarding the type of non-herbicide PVC specified? Select all that apply. - Selected Choice (Roadway context, e.g., urban, suburban, rural, Aesthetics, Other (Please Specify))  Question 19\_Narration: What selection criteria does your agency use regarding the type of non-herbicide PVC specified? Select all that apply. - Other (Please Specify) - Narration  Question 20: Please provide details below regarding information your agency considers important for inclusion in a guidance tool for selecting appropriate non-herbicide PVC or in an email at pvc@tti.tamu.edu.  Question 21: May we contact you for a follow-up mail and/or telephone interview? |

The survey responses are listed in the following tables. The focus is DOTs’ use of non-herbicide PVCs for preventing or significantly retarding the growth of unwanted vegetation around roadside appurtenances and along roadsides.

**Table 2. Responses for Survey Questions 3 and 4.**

|  |  |  |  |
| --- | --- | --- | --- |
| Q. No. | Questions | ‘Yes’ Response | ‘No’ Response or Skipped Question |
| 3 | Does your agency currently use non-herbicide PVCs for preventing or significantly retarding the growth of unwanted vegetation around roadside appurtenances and along roadsides? | AR, CA, ID, NV, TX | CT, IN, KS, KY, ND, RI, SC, TN, VT, VA, WV |
| 4 | Does your agency have a published/established protocol for using non-herbicide PVCs? | AR, CA, TX | CT, ID, IN, KS, KY, NV, ND, RI, SC, TN, VT, VA, WV |

Arkansas, California, North Dakota, Nevada and Texas supplied documents/website links to their PVC documents in response to Question 5 as shown in Table 3.

**Table 3. Responses for Survey Question 5.**

|  |  |
| --- | --- |
| State | “Yes” Response |
| AR | ARDOT Standard Specifications of Highway Construction 2014 edition  <http://web/standard_specifications.aspx> |
| CA | Caltrans Roadside Management Toolbox  [www.dot.ca.gov/design/lap/landscape-design/roadside-toolbox/index.html](http://www.dot.ca.gov/design/lap/landscape-design/roadside-toolbox/index.html)  [www.dot.ca.gov/design/lap/landscape-design/research/weed-and-pest-research.html](http://www.dot.ca.gov/design/lap/landscape-design/research/weed-and-pest-research.html) |
| ND | The only area we are doing this is using asphalt under guardrail. |
| NV | <https://www.nevadadot.com/projects-programs/landscape-aesthetics>  We do not have protocols for using non-herbicide PVCs but it is the policy of the State of Nevada that landscape and aesthetics will be considered along with all other design factors in all transportation projects throughout their life cycles. Please see link above for more information. |
| TX | https://tti.tamu.edu/ |

Question 6 requested information regarding non-herbicide PVC methods or practices currently underway that may not be included in a published document. Table 4 shows these responses. A majority of the agencies without a published protocol reported the use of concrete, mulch, or some other kind of aggregate material.

**Table 4. Responses for Survey Question 6.**

|  |  |
| --- | --- |
| State | Question 6 Responses |
| AR | Aggregate material, asphalt or concrete along wire rope safety fence mow strip, guardrail, median barrier, edge of pavement, ditch paving and other non-vegetated areas. Filter blanket and rip rap slopes. |
| CA | We also use copious amounts of gravel mulch, wood mulch, and paving (pervious if possible), to minimize areas where unwanted vegetation can grow.  There is not a statewide protocol to decide with non-herbicide PVC methods are used but there are standard guidelines in place for this. Standards available at this location  <http://ppmoe.dot.ca.gov/des/oe/construction-contract-standards.html> |
| ID | We use mowing, disking, grading, rock armor, concrete surface treatments, mats and non-irrigated native vegetation. |
| IN | We do place aggregate/millings or concrete in some cases under some infrastructure. |
| ND | The only area we are doing this is using asphalt under guardrail. |
| NV | In urban areas we use rock mulch and DG. |
| RI | We have begun using asphalt millings under and around guardrail and other areas where vegetation growth is problematic. |
| TX | We treat guardrails in high traffic areas with concrete. |

Table 5 shows the worker safety research data categories collected for Question 7. California and Connecticut have conducted research in the areas of installation and maintenance, while Texas has only conducted research concerning installation.

**Table 5. Response for Survey Question 7.**

|  |  |  |
| --- | --- | --- |
| State | Worker Safety Aspect | |
| Installation | Maintenance |
| AR, , ID, IN, KS, KY, ND, NV, RI, SC, TN, VA, VT, WV | N/A | N/A |
| CA | ✓ | ✓ |
| CT | ✓ | ✓ |
| TX | ✓ | x |

Table 6 shows show the responses to the request for data regarding cost aspects of the performance of non-herbicide PVCs. The most common type of research conducted is about the cost aspect of materials with California, Connecticut and Texas all having conducted research on materials. California has conducted research that includes installation, maintenance, equipment, materials, and direct labor.

**Table 6. Response Matrix for Question 8**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| State | Cost Aspect | | | | | |
|  | Installation | Maintenance | Equipment | Materials | Direct Labor | Management/ Planning |
| AR, ID, IN, KS, KY, ND, NV, RI, SC, TN, VA, VT, WV | N/A | N/A | N/A | N/A | N/A | N/A |
| CA | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| CT | ✓ | ✓ | x | ✓ | x | x |
| TX | x | ✓ | ✓ | ✓ | ✓ | x |

The matrix in Table 7 shows the material performance aspects reported by different agencies.

**Table 7. Response Matrix for Question 9.**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| State | Material Performance Aspect | | | | | | | | | |
| MI1 | L | EI | R | M | IM | ICS | ISW | E | MIL |
| ID, IN, KS, KY, ND, NV, SC, TN, VA, VT, WV | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| CA | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| CT | x | ✓ | x | x | x | x | x | x | x | ✓ |
| RI | ✓ | ✓ | ✓ | x | ✓ | x | x | x | ✓ | ✓ |
| TX | ✓ | ✓ | ✓ | ✓ | ✓ | x | x | ✓ | x | ✓ |

*Note: 1Material integrity = MI, Longevity = L, Ease of installation = EI, Retrofit capabilities = R, Maintenance = M, Impacts of mowing = IM, Impacts of ice/snow = ICS, Impacts of storm water runoff = = ISW, Effectiveness = E, MIL = Material integrity longevity*

Table 8 shows the additional aspects on which research may have been carried on by different agencies.

**Table 86. Individual Responses for Question 10 and 11.**

|  |  |
| --- | --- |
| State |  |

|  |  |
| --- | --- |
| CA | Anecdotal information sharing between districts on performance. Multiple research topics. Please see research at these locations. <http://www.dot.ca.gov/design/lap/landscape-design/research/weed-and-pest-research.html>  <http://www.dot.ca.gov/design/lap/landscape-design/roadside-toolbox/index.html> |

|  |  |
| --- | --- |
| NV | We only collect labor, materials and equipment usage for landscape maintenance in general. |
| TX | We tried ground rubber tires but after installation and a few rain storms they all washed away. |

Question 12 requests the respondent to provide PVC performance data that is NOT compiled in a formal document. Responses are shown in Table 9.

**Table 9. Individual Responses for Question 12.**

|  |  |
| --- | --- |
| State | Response for Summary |
| CA | Rubber mats have limited longevity under guardrail. Minor concrete is more effective but takes considerably longer to repair after a guardrail hit. Most often field maintenance does not repair the concrete. |
| CT | The Connecticut Department of Transportation has used both processed aggregate and bituminous on projects in the past, only below new guiderail. Based on the limited success and maintenance issues associated with those projects, the specification was revised to Turf Establishment, which currently is controlled with herbicides. |
| RI | It works well initially, but it does not last as long as we would like. It is not a permanent solution. |

Table 10 lists the locations where non-herbicide PVCs are used. All of the respondents using PVCs listed guardrails. A majority of the respondents also use PVCs at median barrier systems and along the edge of the pavement. The other locations include sign posts, gore areas, embankments, and medians.

**Table 70. Response Matrix for Question 13**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| State | Location | | | | | | | |
| Guardrails | Median barrier systems | Sign Posts | Edge of pavement | Gore areas | Embankments | Medians | Other |
| IN, KS, SC, TN, VA, VT, WV | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| AR | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | x |
| CA | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| CT | ✓ | x | x | x | x | x | x | x |
| ID | ✓ | x | x | ✓ | ✓ | x | ✓ | x |
| KY | ✓ | ✓ | x | x | x | x | x | x |
| ND | ✓ | x | x | x | x | x | x | x |
| NV | ✓ | ✓ | x | ✓ | x | x | ✓ | x |
| RI | ✓ | ✓ | x | ✓ | x | x | x | x |
| TX | ✓ | ✓ | x | ✓ | ✓ | ✓ | x | ✓ |

California listed the other location as slope paving under structures. Texas stated PVC use at rest areas and travel centers. Table 11 contains the document links for the Table 10 data.

**Table 81. Individual Responses for Question 14**

|  |  |
| --- | --- |
| State | Response for Documents and/or Website |
| AR | ARDOT Standard Specifications for Highway Construction 2014 edition http://web/standard\_specifications.aspx |
| CA | http://www.dot.ca.gov/design/lap/landscape-design/roadside-toolbox/index.html |
| ID | https://apps.itd.idaho.gov/apps/manuals/OperationsManual/Operations\_Manual.pdf https://itd.idaho.gov/env/?target=BMP-Manual/ |

Table 12 lists individual responses for question 14, providing the respondent’s details of PVC implementation if they do not have an established protocol.

**Table 92. Individual Responses for Question 15**

|  |  |
| --- | --- |
| State | Response for Details |
| ID | We only have protocol for mowing and non-irrigated vegetation: https://apps.itd.idaho.gov/apps/manuals/OperationsManual/Operations\_Manual.pdf |
| KY | Chip seal is commonly used as a PVC on most new road construction and rehabilitation of existing highways. Concrete apron is used as a PVC on all median cable barrier. |

Table 13 is the response matrix of the types of non-herbicide PVCs used. The most common types reported by the respondents are minor concrete pavement, weed control mats, asphalt composite, native and non-irrigation vegetation, asphalt concrete pavement, and rock blankets.

**Table 13. Response Matrix for Question 16**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| State | Types of non-herbicide PVCs | | | | | | | | | | | |
| MCP | SCP | ACP | AC | RB | RWM | GM | OM | WCM | IOV | NIV | Other |
| KS, SC, TN, VA, VT, WV | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| AR | ✓ | x | ✓ | x | x | x | x | x | x | x | ✓ | x |
| CA | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | x |
| CT | x | x | ✓ | x | x | x | ✓ | x | x | x | x | x |
| ID | ✓ | x | x | x | ✓ | x | ✓ | x | ✓ | ✓ | ✓ | x |
| IN | ✓ | x | ✓ | x | x | x | x | x | x | x | ✓ | x |
| KY | ✓ | x | x | ✓ | x | x | x | x | x | x | x | x |
| ND | ✓ | x | x | x | x | x | x | x | x | x | x | x |
| NV | x | x | x | x | ✓ | x | ✓ | x | ✓ | ✓ | ✓ | x |
| RI | x | x | x | x | x | x | x | ✓ | x | x | x | ✓ |
| TX | ✓ | ✓ | ✓ | ✓ | x | ✓ | x | ✓ | ✓ | x | x | ✓ |

*Note: Minor Concrete Pavement = MCP, Standard Concrete Pavement = SCP, Asphalt Concrete Pavement = ACP, Asphalt Composite = AC Rock Blanket = RB, Rubber Weed Mat =RWM, Gravel Mulch = GM, Organic Mulch = OM, Weed Control Mat (Fiber) = WCM, Irrigated/Ornamental Vegetation = IOV, Native and Non-Irrigated Vegetation = NIV*

Individual responses for question 15 include asphalt millings used by Rhode Island and rock rip rap– a rocky rubble material that is placed along the roadway used by Texas.

Question 17 requested information regarding alternative types of PVC usage. The responses are shown in Table 19.

**Table 14. Survey Response for Question 17**

|  |  |
| --- | --- |
| State | Response for Other types of PVC usage |
| CA | Crumbcrete - Version of concrete using crumb rubber as the aggregate |
| ID | https://apps.itd.idaho.gov/apps/manuals/OperationsManual/Operations\_Manual.pdf https://itd.idaho.gov/env/?target=BMP-Manual/ |
| TX | Placed under bridges and low light areas. |

Question 18 wanted information regarding the reasons of discontinuation of using a specific non-herbicide PVC. California reported the inadequate longevity of weed control fiber mats and rubber mats; it also cited the cost and additional requirements of using concrete.

Table 15 shows the responses regarding the selection criteria used to choose which type of non-herbicide PVC should be used.

**Table 15. Response Matrix for Question 19**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| State | Roadway Context | Roadway Classification | Aesthetics | Performance of roadside appurtenances | Other |
| CT, IN, KS, SC, TN, VA, VT, WV | N/A | N/A | N/A | N/A | N/A |
| AR | ✓ |  |  |  |  |
| CA | ✓ |  |  |  | ✓ |
| ID |  |  |  |  | ✓ |
| KY |  | ✓ |  |  |  |
| ND |  |  |  |  | ✓ |
| NV |  |  | ✓ |  |  |
| RI |  |  |  | ✓ |  |
| TX | ✓ | ✓ |  |  |  |

Table 16 shows the responses of agencies that selected “other” for Question 19. A glitch with the survey question did not allow for multiple selections.

**Table 10. Individual Responses for Question 19**

|  |  |
| --- | --- |
| State | Response for “Other” |
| CA | Roadway context, classification, geometry, aesthetics  Above choices did not lock in - tried to pick them all.  All, but this question only lets me select one. |
| ID | All of the above |
| ND | Standard practice |

Table 17 provides details that the agencies consider important for inclusion in a guidance tool for selecting appropriate non-herbicide PVC. Indiana reported ease and cost of installation and maintenance to be important details used as guidance; California listed the cost benefit ratio, longevity, and ease of replacement; and Idaho reported the type and longevity of both short and long-term PVC, the environments where it would be most effective, cost, as well as the installation and maintenance needs.

**Table 17. Individual Responses for Question 20**

|  |  |
| --- | --- |
| State | Response for Guidance Tool |
| CA | Mainline structural section for treatments in gore areas Maintenance preference for selection of PVC treatments Corridor themes for type of treatment and color preferences  Cost benefit ratio. Longevity. Ease of replacement.  Context sensitivity, considering any existing Corridor Master Plans, ease of maintenance (we do not use Rock Blanket where Maintenance can use sweepers, because they say that it requires hand-sweeping/blowing), Stormwater considerations, fire safety (wood mulch vs. gravel mulch), and overall cost. |
| CT | We would focus efforts on environmentally sensitive areas. |
| ID | Consideration should include short-term PVC (including type and longevity) and long-term PVC (including type and longevity), area(s) or environment where it is most effective and practical, selection criteria (listed above), cost, installation and maintenance needs of the item, etc. |
| IN | Cost of installation.  Cost to maintain. Ease of installation.  Ease of maintenance. |
| TX | Been using concrete on all guardrail and cable barriers across the state. |

## Summary of Survey Results

The results of the survey of practice did not reveal any new and innovative practice by the DOTs. The majority of the PVCs listed are those found in the 2011 AASHTO *Guidelines for Vegetation Management (1)*. One issue regarding the information obtained from the survey and from the literature is that PVCs are often not specified as such. Many DOTs do indeed use PVCs, but they may be specified as part of a larger unit in the design/construction process. For example, placing concrete under guardrail is part of many guardrail construction manuals and/or specifications. One of the main reasons for using concrete under guardrail is to prevent vegetative growth at that location. However, concrete at similar locations is generally not labeled as a PVC.

## Follow-up Interviews

Interviews conducted by the research team were aimed at gathering more detailed information regarding DOT usage of PVCs. States were selected based upon the survey results. The objectives of the in-depth phone interviews are to obtain detailed information on innovate selection processes implemented, experiences with implementing innovative methods or technologies, additional guidance required, and how DOTs would utilize the findings from this research. The states selected for follow-up interviews were Arkansas, California, Idaho, Rhode Island and Texas. We requested that the selected DOT interviewees provide available information on the use of PVCs, such as specifications, manuals or any written information. Each state DOT representative was sent an email requesting a preferred date and time for telephone interview. Thus far only Idaho, Rhode Island and Texas have responded to that request. Researchers sent second request emails.

Follow-up interview questions are as follows:

1. Are familiar with the ASSHTO *Guidelines for Vegetation Management*?
2. Do your specifications/manuals specifically identify PVCs? Or are they part of a greater design/construction unit such as guardrail, gore areas, etc.?
3. What is your experience regarding PVC longevity/effectiveness?
4. What is your experience regarding ease of installation, repair, replacement, etc.?
5. What is your experience using PVCs for new and retrofit applications for ease of installation, worker safety, etc.?
6. Other issues?
7. What kind of guidance would you like to see in an interactive tool?

Thus far only none of the DOTs interviewed acknowledged familiarity/use of the AASHTO *Guidelines for Vegetation Management*.

### California Interview scheduled for today

### Idaho

The Idaho Transportation Department (IDT) stated that they do not use conventional PVCs regularly. IDT referred two sources for any practices related to the roadsides. These are the *Operations Manual* (*2*) and *Best Management Practices (BMP) Manual* (*3*). Their most commonly used method relating to PVC is the use of low growing vegetation in areas where limited vegetation is desired. The areas adjacent to and underneath most roadside appurtenances are generally managed using mower and weed eaters. Often in more rural areas the vegetation not cut by mowers is left in place around the roadside appurtenance post, etc. More urbanized areas may receive a greater level of maintenance. The use of low growing vegetation at locations generally using impervious PVCs is viewed as advantageous for its green infrastructure related benefits.

IDT uses soil sterilents in some areas that require no vegetation. Gravel may be used at the edge of pavement to control vegetation and to minimize the spread of fire. The IDT has used rubber mats as PVC; however, they found them to be problematic to install and replace in areas such as guardrails. The mats were time consuming to install whether new construction or as a retrofit application.

IDT expressed an interest in PVC guidance regarding appropriate installation locations, maintenance issues and requirements, and effective longevity.

### Rhode Island

The Rhode Island Transportation Department (RIDOT) referred to their *Standard Specifications*

*For Road and Bridge Construction (4), Section 213 – Placement of Millings Beneath Guardrail*. This specification calls for the placement of recycled asphalt millings to be used as a PVC underneath guardrails. This is their most commonly used PVC. The asphalt millings are also used at the edge of pavement. RIDOT stated that the asphalt millings are easy to install in new construction, repair and retrofit applications.

The most frequent problem seen the DOT is improper installation. Their specification calls for the following:

* Millings to consist of bituminous material removed during cold planing operations and ground or crushed such that 100% of the material passes a 1-inch sieve.
* Millings placed at all guardrail locations less than 2 feet from the edge of the existing pavement, or as indicated on the Plans, and/or as directed by the Engineer.
* Grade beneath the guardrail such that the finish surface of the millings is flush with the bituminous berm or edge of pavement.
* Millings shall be placed to a point 1 foot behind the guardrail post, and shaped, compacted and sloped to drain away from the pavement.

### The step that in generally not completed by some contractors per the RIDOT specification is the compaction of the asphalt millings. According to RIDOT, compaction is critical to the performance and longevity of the PVC. The compaction process is more readily accomplished when RIDOT personnel conduct the installation process.

Another PVC used by RIDOT is organic wood mulch obtained through clearing and grubbing operations on the roadside. The chipped wood is spread onto areas to control vegetation. Effectiveness and longevity is less than the asphalt millings as the mulch decomposes and can easily be dislodged.

RIDOT requested that the interactive guidance tool be intuitive. Experience with other such tools was found to be too complicated and/or more troublesome than just finding the desired information through other sources.

### Texas

The Texas Department of Transportation (TxDOT) referred to their *Metal Beam Guard Fence (Mow Strip)* MBGF (MS)-17 (x) that calls for the use of reinforced concrete or asphalt pavement mow strip with an 18” x 18” or 18” diameter minimum leave out. Prior experience using PVCs includes vegetation mats and herbicide mats and tiles. These products had limited success. They were expensive to install and did not have a reasonable effective longevity relative to the cost of installation and maintenance. TxDOT now uses only concrete and asphalt materials in locations needing PVC as they did not find enough success with other applications to warrant their use.

Table 8. State DOT Survey Respondents

|  |  |  |
| --- | --- | --- |
| State | Title | Agency/Organization |
| **AR** | State Maintenance Engineer | Arkansas Department of Transportation |
| **CA** | Senior Landscape Architect | California Department of Transportation |
| **CT** | N/A | Connecticut Department of Transportation |
| **ID** | Roadside Program Manager | Idaho Transportation Department |
| **IN** | Roadside Maintenance Specialist | Indiana Department of Transportation |
| **KS** | Bureau Chief of Maintenance | Kansas Department of Transportation |
| **KY** | Roadside Environment State Administrator | Kentucky Transportation Cabinet |
| **ND** | State Maintenance Engineer | North Dakota Department of Transportation |
| **NV** | Chief Maintenance and Asset Management Engineer | Nevada Department of Transportation |
| **RI** | State Highway Maintenance Operations Engineer | Rhode Island Department of Transportation |
| **SC** | Vegetation Manager | South Carolina Department of Transportation |
| **TN** | Transportation Manager 2 | Tennessee Department of Transportation |
| **TX** | Director of Maintenance | Texas Department of Transportation |
| **VT** | Stormwater Tech | Vermont Agency of Transportation |
| **VA** | State Roadside Vegetation Manager | Virginia Department of Transportation |
| **WV** | Assistant Director Maintenance Division | West Virginia Department of Transportation/ Division of Highways |

## Draft Recommendations for PVC Treatments

The goal the NCHRP 14-41 project is to produce up-to-date and user-friendly guidance for transportation agencies to facilitate the selection of appropriate PVCs that will be effective in preventing or significantly retarding the growth of unwanted vegetation around roadside appurtenances and along roadsides. One key issue found for this project is the use of a PVC within a greater unit of construction or as some other use not specified as PVCs. While the material used serves as a PVC, it not designated as such. A few examples are shown below.

### Alabama

The Alabama Dot *Standard Specifications for Highway Construction 2006 Edition* has several practices that are used as PVCs but are not called out as such in the document. These include:

* Aggregate Slope Protection
* Riprap
* Slope Paving Slope
* Concrete Median Strip (x).

### Arkansas

The Arkansas State Highway and Transportation Department *Standard Specification for Highway Construction* has Section 632 Concrete Island (x).

### Arizona

The Arizona DOT *Standard Specifications for Road and Bridge Construction*, Item 919-1 is concrete gore paving (*x*).

### Colorado

The Colorado DOT *Standard Specifications for Road and Bridge Construction* contains the item Median Cover Material. This consists of the construction of a cover over the median area or over other areas. The materials listed are bituminous median cover material, concrete, patterned concrete and stone (x).

**Minnesota**

The Minnesota DOT *Standard Specification for Construction 2018* has slope paving choices of concrete and stabilized aggregate (x).

### Wyoming

The Wyoming DOT *Standard Specification for Road and Bridge Construction* has an item for minor concrete paving (x).

### New and Innovative PVCs

A search of the literature, DOT documents and websites found little in the way of innovative practices or new materials. Many products and materials are of the typical PVC types but with different product names. One product was found that may have potential for use and different from typical PVCs use. The product is called Concrete Canvas®. According to the manufacturer it is a flexible, concrete filled geotextile that hardens on hydration to form a thin, durable, waterproof and low-carbon concrete layer, essentially, concrete on a roll. These new construction materials are called Geosynthetic Cementitious Composite Mats (GCCMs) and are used as an alternative to conventional concrete. Information regarding this product can be found at their website <https://www.concretecanvas.com/>.

### Recommended PVCs

The PVC measures can be categorized into three basic strategies that include impervious surfaces, pervious surfaces, and select vegetation establishment. Impervious surfaces are designed to cover the designated area, not provide a growth medium for plant materials, and minimize maintenance activities adjacent to the travel lanes. While impervious types of PVC are very effective, they can be more expensive to install and require some maintenance. The most commonly used PVCs are some type of concrete and asphalt. The PVC recommendations are based upon those found in use by DOTs in the survey results, literature and DOT websites and documents. These recommendations include those found in the AASHTO *A Manual for Roadside Vegetation Management* (*1*).

### Impervious PVC Surfaces

#### Minor Concrete Pavement

* + Effective, medium cost relative to other PVCs
  + Easy installation for new construction, but not retrofit applications
  + Can be used on side slope/embankment locations
  + Aesthetic choices for colors and patterns
* Standard Concrete Pavement/Stamped Concrete
  + High effective longevity
  + High initial cost relative to other PVCs but low life-cycle cost
  + Can be used on side slope/embankment locations
  + Aesthetic choices for colors and patterns
* Asphalt Concrete Pavement
  + Easy installation
  + Medium cost relative to other PVCs
  + Aesthetic choices for colors and patterns
* Asphalt Composite
  + Medium cost relative to other PVCs with low life-cycle cost
  + Easy to install and repair
  + Seamless application minimizes vegetation growth in joints
  + Good for retrofit applications
* Asphalt Millings
  + Medium to low cost relative to other PVCs
  + Easy installation
  + Uses recycled asphalt millings
* Rock Blanket
  + Resistant to wind dislodging materials
  + High cost relative to other PVCs t but low maintenance costs
* Rubber Weed Mat
  + Medium cost relative to other PVCs
  + Good for new and retrofit applications
  + Easily repaired and/or replaced
  + Aesthetic choices for colors and patterns

### Pervious PVC Surfaces

* Gravel Mulch
  + Low cost relative to other PVCs
  + Low relative maintenance
  + Uses common equipment for installation
* Organic Mulch
  + Medium to low cost relative to other PVCs
  + Provides erosion control
  + Allows for stormwater runoff infiltration
* Weed Control Fiber Mat
  + Medium to low cost relative to other PVCs
  + Allows stormwater runoff infiltration
  + UV stable
  + Fire retardant
  + Easy repairs/replacement
  + Retrofit applicable but more expensive

### Selected Vegetation Establishment

* Low-growing Vegetation
  + Medium to low cost relative to other PVCs
  + Allows stormwater runoff infiltration
* Irrigated/Ornamental Vegetation
  + Medium to low cost relative to other PVCs
  + Allows stormwater runoff infiltration
  + Aesthetic choices for colors and patterns
* Native and Non-Irrigated Vegetation
  + Low cost relative to other PVCs
  + Self- sustaining after establishment
  + Competes with weeds

## References

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