

**BEST PRACTICES LIBRARY FROM THE ENVIRONMENTAL  
STEWARDSHIP PRACTICES IN CONSTRUCTION AND  
MAINTENANCE COMPENDIUM**

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# ABSTRACT

The objectives of this National Cooperative Highway Research Project (NCHRP) 25-25 Task 29 are to create and test a process for identifying best practices from *Environmental Stewardship Practices, Procedures, and Policies for Highway Construction and Maintenance* (Compendium) and to establish recommended procedures for updating the Compendium on an ongoing basis. This NCHRP report describes the development of an evaluation process, the observations of the two Working Groups that applied the test process to two sections of the Compendium and the outcomes of their effort. This NCHRP report also describes the potential value that this process could deliver in the way of a library of screened Best practices, a methodology for linking the vetted sections to the AASHTO Center for Environmental Excellence's online Compendium and a protocol for keeping the Compendium current.

# EXECUTIVE SUMMARY

The compendium of *Environmental Stewardship Practices, Procedures, and Policies for Highway Construction and Maintenance* (Compendium), produced under NCHRP 25-25 (04) in September 2004, represented an important step in expanding awareness of environmental stewardship in terms of specific practices and procedures as well as general policies and programs. The primary intent of the Compendium was to enable transportation agencies to more fully benefit from one another's experience and to help them more fully integrate stewardship into all aspects of their work. The Compendium was well received as an encyclopedic compilation of current practices; however, practitioners found the document daunting in its breadth: this led to an interest in differentiating generally accepted standard practices from lesser known practices that offer high value.

The objective and scope of this research project, Task 29, included the design and testing of a process to screen and update the Compendium consistent with the ultimate goal of creating and continually updating a library of Best stewardship practices. The research team tested the process by supporting and facilitating two Working Groups that each reviewed and selected Best practices from an assigned section of the Compendium. Anticipated benefits in enhancing quality, communication, and information exchange included:

- Ø Successfully engaging the construction and maintenance community in using the Compendium and thereby establishing a sense of ownership for this resource,
- Ø Using the vetting process as a vehicle for establishing communities of practices among practitioners, all towards an end of sharing Best practices and lessons learned among departments of transportation,
- Ø Creating tools for Compendium website users to offer suggestions and candidate Best practices, and to volunteer as Working Group members, and
- Ø Compiling and having the opportunity to communicate within the AASHTO members' construction and maintenance staffs a distilled list of Best practices drawn from the Compendium.

## *Findings*

- Ø Working Groups comprised of four to six, motivated, geographically diverse, experienced, and decisive subject practitioners were highly successful.

- Ø The subsections within each chapter proved to be an appropriate scope for Working Group reviews. For example, Chapter 4, Construction Practices for Environmental Stewardship, has twelve subsections ranging from stewardship practices at work areas to roadside vegetation management. DOTs typically have staff responsible for issues pertaining to a variety of these sections.
- Ø The Steering Group should review the Compendium in its entirety to determine priorities for selecting Best practice topics using the process established in Task 29. The nine subject chapters of the Compendium present 88 separate subsections. Many of the subsections are in related topic areas, and Working Group members invariably possess expertise in more than a single topic area. By capitalizing on the breadth of expertise of Working Group members to review more than one subsection, it is anticipated that the number of Working Groups required to vet all 88 topic areas would be only a fraction of that number.
- Ø The Working Group comprised of members who had previously worked together accomplished its objective more quickly than the Working Group that had not.
- Ø The Working Group comprised of members who had previously worked together was comfortable conducting all meetings via conference calls. The Working Group comprised of members who had not previously worked together believed that a face-to-face kickoff meeting would have built team effectiveness faster.
- Ø Both Working Groups appreciated that the Steering Group had provided initial evaluation criteria.
- Ø The initial evaluation criteria, “beneficial<sup>1</sup>, practical, and cost-effective”, were appropriate.
- Ø It was valuable to afford Working Groups the latitude to develop additional evaluation criteria that are tailored to the area(s) of practice under review.
- Ø A Working Group summary reporting tool for ratings (matrix) saved time and facilitated decision-making for the Working Group.
- Ø The review process created opportunities for Working Groups to engage colleagues for their insights and contributions, which enhanced the quality of the review while expanding awareness and use of the Compendium.

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<sup>1</sup> During the study, this criterion was further defined as, “environmentally beneficial” and it is referenced this way from this point forward.

- Ø There is value in the Working Groups having the discretion to fine tune and edit the descriptions of practices that are “nearly eligible” as Best practices such that they can then qualify as Best practices.
- Ø The roles of facilitator and administrative support are pivotal to the success of the process.
- Ø Members of both Working Groups deemed the screening process itself a Best practice and recommend its inclusion in the Compendium as a Best practice.

### ***Conclusions***

The research described in this report resulted in the creation of a process for screening Best practices within the Compendium. This process can be replicated and applied to the entire Compendium to develop a comprehensive library of Best practices, which would enhance the value and use of the Compendium, leading to heightened awareness and continual improvements in environmental stewardship practices.

The most important element for success is the caliber of the Working Group members. The next most important element is their ability to coalesce as a team.

### ***Recommendations***

The Compendium should be screened in its entirety for selection of Best practices, using the process established in Task 29. The suggested approach is to engage the Center for Environmental Excellence to sponsor the efforts of a program leader and chapter leaders knowledgeable in the subject area to oversee Working Groups comprised of experienced practitioners, a facilitator, and administrative support staff. In addition to screening, continually updating the Compendium and managing the efforts of chapter leaders, the program leader would manage the data, suggestions, and volunteer resources that users offer through the Compendium’s newly created links.

For Working Groups that do not have a previous history of working together, it is recommended that members travel and meet for a kickoff meeting. Subsequent meetings could be via conference calls.





# 1. BACKGROUND

Over the past several years, many state departments of transportation (DOTs) and their federal counterparts have moved with remarkable speed in embracing the principles of environmental stewardship. This movement has been driven by numerous DOT senior managers, predominantly representing the policy, planning, and environmental disciplines. The vast majority of activities which define whether a DOT's practices are consistent with environmental stewardship occur in the areas of construction and maintenance. Yet, until the publication in 2004 of *NCHRP 25-25 (04), Environmental Stewardship Practices, Procedures, and Policies for Highway Construction and Maintenance* (Compendium), there was relatively little in the way of reference material or engagement in environmental stewardship on the part of leaders, managers, and front line staff in these two critically important areas (where the rubber meets the road, literally).

The Compendium represented an important step in expanding awareness of specific practices and procedures as well as general policies and programs focused on environmental stewardship. The primary intent of the Compendium was to enable transportation agencies to more fully benefit from one another's experience and to help them more fully integrate environmental stewardship into all aspects of their construction and maintenance activities. The Compendium was well received as an encyclopedic compilation of current practice. In 2005, with support of the AASHTO Center for Environmental Excellence (Center), the Compendium was reproduced as an online searchable document with the intent of increasing its accessibility and ease of use by construction and maintenance personnel.

The preface of the original Compendium states: "This document should be viewed as a starting point for DOTs, to increase exposure to and utilization of a range of environmental stewardship practices in use or under consideration. It is hoped that as a starting point, DOTs will find ways to use and continue to update and extend this resource and fill the inevitable gaps, accelerating environmental stewardship and implementation of environmental practice across the country."

The Compendium as a whole has tremendous value, but many practitioners prefer to have highly successful practices distinguished from those accepted standard practices. This was strongly reflected in the discussions that occurred during the 2005 AASHTO Spring Meeting when representatives of both the Construction and Maintenance subcommittees agreed that the next step for the Compendium would be to distinguish Best practices from the rest of the pack. This project, NCHRP 25-25 (29), (Task 29), stems from that decision. It presents and tests a plan to "mine" this encyclopedic

compilation of practices to produce a library of vetted Best practices and to develop a process to regularly review the Compendium and augment it with new practices. The expectation is that this process could be applied to the entire Compendium in future efforts over time to produce a library of Best practices that would sustain the Compendium's relevance.

There were three objectives to Task 29. The first objective was to design and test a process for screening and updating the Compendium to produce a library of Best practices. The second was to establish recommended processes to sustain the Compendium as a relevant source of proven environmental stewardship practices. The third objective was to determine how to identify those Best practices within the Compendium on the Center website while keeping the entire Compendium accessible to users.

## 2. RESEARCH APPROACH

The scope of Task 29 included the design and testing of a process to screen and update the Compendium consistent with the ultimate goal of creating and continually updating a library of Best stewardship practices. The process involved identifying technical experts in the fields of the selected sections of the Compendium who would review the practices and procedures and reach conclusions about which practices represented Best practices. The research team developed the process with the guidance of a Steering Group<sup>2</sup>. The Steering Group identified two topic areas that would be the subjects of “pilot tests” of the process. With these two topic areas selected, the Steering Group then identified and recruited experts for two Working Groups<sup>3</sup>. Each Working Group reviewed and selected Best practices from an assigned topic area of the Compendium. The research team tested the process by supporting and facilitating the two Working Groups, reviewing observations of the process with the Steering Group, and incorporating refinements into a recommended process for future use. Beyond the development of a library of Best practices, additional goals included enhancing the quality of the Compendium, fostering communication within and among Departments of Transportation, and sharing knowledge and lessons learned. Anticipated benefits included:

- Ø Successful engagement of the construction and maintenance community in using the Compendium and thereby establishing a sense of ownership for this resource,
- Ø Use of the screening process as a vehicle for establishing communities of practices among practitioners, all towards an end of sharing Best practices and lessons learned among departments of transportation,
- Ø Creation of input forms on the Compendium website for users to offer suggestions and candidate Best practices, and to volunteer as Working Group members, and
- Ø Compiling and having the opportunity of communicating within the AASHTO members’ construction and maintenance staffs a distilled list of Best practices drawn from the Compendium.

Technical experts can effectively and efficiently evaluate and select Best practices from the Compendium. In this study, the Steering Group, comprised of members of AASHTO’s relevant committees and subcommittees, identified and engaged technical experts to participate on Working Groups to evaluate the practices. Supported by

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<sup>2</sup> See Appendix A.2 for names of Steering Group members

<sup>3</sup> See Appendix A.3 for names of the Working Group Members

administrative staff, two Working Groups of four to six motivated, geographically diverse, experienced, and decisive subject practitioners were provided with matrices of the practices from Compendium Section 4.4 (Construction in *and around* Drainage Areas and Streams, Wetlands, and Other Environmentally Sensitive Areas<sup>4</sup>) and Section 8.3 (Strategic Planning for Reduced Salt Usage).

Initial evaluation criteria of environmentally beneficial, practical, and cost-effective, were offered to the Working Groups who were afforded the latitude to develop additional evaluation criteria tailored to the areas of practice under review. Working Group members individually evaluated the practices; the administrative staff collated and redistributed the individual assessments. The Working Group members then reviewed and discussed the assessments from all members and came to a consensus on those practices deemed Best. The Steering Group reviewed the Best practice selections of the Working Group and the research team edited the online Compendium to reflect the findings.

## **2.1 STEERING GROUP**

A Steering Group was created to oversee and guide the process, serving as the coordinating and decision-making body for this effort. Members of the Steering Group were selected from the stakeholder AASHTO committees and sub-committees. The AASHTO organizational elements represented were:

- Ø Standing Committee on Highways, sub-committees of Maintenance and Construction,
- Ø Standing Committee on the Environment, and
- Ø Center for Environmental Excellence

Also included were representatives from the Federal Highway Administration.

The members of the Steering Group were chosen as key participants by virtue of their areas of responsibility and expertise. The Steering Group reviewed and approved the proposed screening process, the selection of practice area peer reviewers, and the incorporation of resulting Best practices into the Compendium.

After reviewing and approving the proposed process for identifying Best practices, (in effect, screening the screening process) the Steering Group also approved two topic areas that would be the subjects of pilot tests of the proposed process.

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<sup>4</sup> The Steering Group added the italicized text so that the Working Group would consider practices in a broader context.

## **2.2 WORKING GROUPS**

For each topic area, the Steering Group nominated a group of four to six practitioners to serve as the Working Group. The members of each Working Group were selected because of their expertise in the field. To provide professional experience across a broad range of climates and conditions an effort was made to ensure that each Working Group represented a diversity of geographic areas from across the United States.

The Working Groups were tasked with applying the screening process to practices in their assigned topic areas, and selecting those practices they deemed to be Best practices. The Steering Group agreed that Working Groups could engage topic area experts as additional resources if they chose. It was anticipated that Working Groups might seek expert advice from AASHTO member departments, FHWA, and people from their own departments of transportation.

## **2.3 EVALUATION CRITERIA**

The initial tasks of the Working Groups were to familiarize themselves with the respective topic areas that the Steering Group selected for review and to select the appropriate evaluation criteria for their topic. The Working Groups were provided with three criteria: environmentally beneficial, practical, and cost-effective. The Working Groups were asked to consider if these three criteria were appropriate and sufficient to effectively evaluate the practices. The Working Groups were afforded latitude to develop criteria they believed would be most helpful for their evaluation by modifying, replacing, eliminating, or adding to the three provided.

## **2.4 RATING SCALES**

After reaching consensus on the criteria, the Working Group members were tasked with reviewing all of the practices within the section of the chapter selected by the Steering Group. The Working Groups selected a rating scale to use in evaluating the practices and, using a matrix, rated each practice against the selected criteria. The initial review was done individually, and then the group convened by conference call and compared and discussed their evaluations. Through discussion, the Working Groups reached consensus on each practice and made a determination on whether it was a Best practice or not.

## **2.5 FEEDBACK**

The Working Groups provided feedback and recommendations to the Steering Group on the effectiveness of the peer review process. The Steering Group reviewed the Working Group recommendations via conference call. The research team reviewed the

effectiveness of the evaluation process among its members and with the Working Groups, and prepared a draft report to the Steering Group with findings and recommendations. The research team and Steering Group discussed the draft report and the research team addressed appropriate elements in the final report.

## **2.6 PROJECTSOLVE<sup>2</sup>**

The research team used an online file sharing website (ProjectSolve<sup>2</sup>) to facilitate communication and document sharing by the participants of the project. ProjectSolve<sup>2</sup> is a secure internet-based collaboration tool that allows project teams of all sizes to communicate easily regardless of their location. ProjectSolve<sup>2</sup> was intended to provide both the Steering Group and the Working Groups with a forum for accessing project materials.

### 3. FINDINGS AND APPLICATIONS

The screening process as proposed by the research team was implemented by two Working Groups. The research team was pleased to observe that the process worked well and that the Working Groups were able to complete their assignments within the allotted time. The findings of this trial run of the process are presented below.

#### 3.1 GENERAL FINDINGS

- Ø Working Groups comprised of four to six, motivated, geographically diverse, experienced, and decisive subject practitioners were highly successful.
- Ø The subsections within each chapter proved to be an appropriate scope for Working Group reviews. For example, Chapter 4, Construction Practices for Environmental Stewardship, has twelve subsections ranging from stewardship practices at work areas to roadside vegetation management. DOTs typically have staff responsible for issues pertaining to a variety of these sections.
- Ø The Steering Group should review the Compendium in its entirety to determine priorities for selecting Best practice topics using the process established in Task 29. The nine subject chapters of the Compendium present 88 separate subsections. Many of the subsections are in related topic areas and Working Group members invariably possess expertise in more than a single topic area. By capitalizing on the breadth of expertise of Working Group members to review more than one subsection, it is anticipated that the number of Working Groups required to vet all 88 topic areas would be only a fraction of that number.
- Ø The Working Group comprised of members who had previously worked together accomplished its objective more quickly than the Working Group that had not.
- Ø The Working Group comprised of members who had previously worked together was comfortable conducting all meetings via conference calls. The Working Group comprised of members who had not previously worked together believed that a face-to-face kickoff meeting would have built team effectiveness faster.
- Ø Both Working Groups appreciated that the Steering Group had provided initial evaluation criteria.
- Ø The initial evaluation criteria of environmentally beneficial, practical, and cost-effective, were appropriate.

- Ø It is valuable to afford Working Groups the latitude to develop additional evaluation criteria that are tailored to the subject areas under review.
- Ø A Working Group summary reporting tool for ratings (matrix) saved time and facilitated decision-making for the Working Group.
- Ø The review process can create opportunities for Working Groups to engage colleagues for their insights and contributions, which enhances the quality of the review while expanding awareness and use of the Compendium.
- Ø There is value in the Working Groups having the discretion to fine tune and edit the descriptions of practices that are “nearly eligible” as Best practices such that they can then qualify as Best practices.
- Ø The roles of facilitator and administrative support are pivotal to the success of the process.
- Ø Members of both Working Groups deemed the screening process itself a Best practice and recommend its inclusion in the Compendium as a Best practice.

### **3.2 WORKING GROUP COMPOSITION AND SIZE**

The high caliber of the Working Group members was a critical success factor, which points to the importance of selecting appropriately equipped staff for this key role. The Steering Group recruited the Working Group members for this study, selecting a mixed staff having backgrounds as current practitioners, supervisors, and managers, with a higher percentage of managers. Equally as important as staff experience is the need for Working Group members to be decisive, fully engaged, articulate, and knowledgeable. To the extent practicable, a mix of members having environmental, construction and maintenance backgrounds is desirable. A recommended source for potential Working Group candidates is the AASHTO subcommittees (on the Environment, on Construction, and on Maintenance).

The research team had originally posited that a Working Group should have a minimum of six or seven members so that it could still function well even if one or two members were unavailable. Working Group size proved more elastic than originally assumed: one Working Group worked quite well with only four members, while the other had six members. One advantage of a lesser number of people is that it was considerably easier to schedule a meeting that everyone could attend. A second advantage of a small group is that the importance of an individual’s role is increased, and therefore the members tend to make attendance a higher priority. For the long-term sustainability of a Working Group, however, a larger membership is more appropriate. In addition to



sustainability, it is important to have a diverse geographic representation on the Working Group so that the practices are considered for their effectiveness in a variety of conditions, and this is more easily achieved with a larger Working Group. Both Working Groups, however, concluded that the size of their groups worked well.

The research team recommends that the size of the Working Groups be between five and seven members. With fewer than five members there might not be enough diversity of opinion, experience, and geographic range. As group size grows beyond seven members, it is likely to be too large and cumbersome to effectively implement the mission.

Both Working Groups took to their assigned tasks with enthusiasm. They reviewed the suggested criteria, made thoughtful modifications for their topic areas, and applied them consistently while evaluating their practices. The three criteria proposed by the research team (environmentally beneficial, practical, and cost effective) proved to be a good basis for the evaluations and a logical starting place for developing topic-specific criteria. Both groups chose to add at least one criterion. One Working Group added “used with success”; and the other added “operational sustainability”. Also, one group chose to replace “cost effective” with “cost to implement”. The Working Groups made wise use of the latitude to develop criteria that were tailored to the areas of practice they were reviewing.

The two groups used what initially appeared to be different approaches to ratings and yet both worked well. One Working Group used a simple yes/no rating while the other used a numerical rating of 1 to 5. Ultimately, the Working Group that used the numerical rating recommended a 1 to 4 rating scale, rather than 1 to 5, to prevent evaluators from “straddling the fence.” While the 1 to 4 rating system allowed more nuanced assessments than the yes/no rating system, the inevitable necessity to determine “yes” or “no” in identifying Best practices at the conclusion of the process effectively moved this rating system closer to that of the Working Group that used the yes/no system. Group discussion was essential in deciding whether a practice was a Best practice or not.

Both groups used a matrix (Appendices B.1 and B.2), which had not been prescribed by the research team. Both matrices listed in columns the practice, and then each evaluation criterion, followed by a column for comments. This tool worked well. Compendium practices can often be broken down into subcategories, and each Working Group decided how to break down their practice. For future evaluations, the research team recommends that one person prepare the matrix and break down the practices to establish common terminology and scope for the practice elements, which will ensure consistency in evaluating the practices. Creating a draft matrix of the practices and

selection criteria in advance of the deliberations should reduce the required time for Working Groups to complete their tasks.

The Working Group members completed their individual evaluations and submitted them to the research team. The research team consolidated the evaluations into one document, allowing the Working Group members to see one another's evaluations. The Working Group then convened by conference call to discuss and reach consensus on the evaluations. Where there were many practices, this was a lengthy process; in one case requiring two conference calls exceeding 90 minutes each. Working Group members stressed that the level of effort was appropriate for the value delivered.

In some cases, Working Group members concluded that the practices as described in the Compendium, while close to being a Best practice, did not fully qualify without some refinement in language. Where they thought it would be appropriate, the Working Groups had license to edit the text or refine the practice language. One of the Working Groups spent considerable time editing and rewriting practices to make them truly Best practices. This was a valuable exercise in making the most of the information originally provided. Both Working Groups recommended removing from the Compendium certain practices which did not meet their threshold of acceptability.

Members of one Working Group confined their review to group members. The other Working Group shared the practices with peers in their departments to gain additional input. By engaging peers in the review, the latter Working Group created three additional benefits: they raised awareness of the Compendium, identified potential future Working Group members, and received suggestions of additional practices for inclusion in the Compendium. The research team recommends that future Working Groups be encouraged to reach out to others in their field whenever they believe that it would enhance the process of evaluating practices.

While both Working Groups agreed that the conference calls worked well, one of the groups would have preferred to meet face-to-face. The members of this Working Group did not know one another prior to this project and they felt that there would have been value in building rapport through a kickoff meeting. This is compelling; especially in light of the goal to create sustained Working Groups that grow into communities of practice. This Working Group also concluded that the group evaluation process would have been easier if done face-to-face.

In contrast, the members of the other Working Group, all of whom knew each other from prior professional activities, concluded that traveling to and from face-to-face meetings would have required more time than they would like to have committed. Their

established working relationships facilitated dialogue and decision-making, rendering unnecessary a face-to-face meeting to build rapport.

Accordingly, the two groups had different recommendations regarding the idea of face-to-face meetings. For members who are unacquainted, an initial face-to-face meeting would build rapport and strengthen the long-term sustainability of the project by supporting the development of ongoing communities of practice. If the majority of the members of a Working Group do not know one another, then an initial face-to-face meeting would be valuable. Having such a face-to-face meeting in conjunction with other meetings which the Working Group members are attending could save on costs and reduce the travel time commitment. The recommendation is that future Working groups should hold a face-to-face kickoff meeting if half or more of the members do not know one another.

### **3.3 A WORD ABOUT THE COST OF BEST PRACTICES**

The question arose whether or not Best practices should include cost information. The research team deliberated and recommended against including cost information. Relevant cost data would be a challenge to include because of regional, definitional, and scope differences; and the effect of escalation, all of which can be quite significant. Practitioners using the Compendium should be encouraged to estimate costs based on their experience and knowledge or to obtain estimates from within their agencies or to follow up with the agency that initially recommended the Compendium practice. A benefit to this last approach is that Compendium users would interact directly with the agency that initiated the practice to obtain specific information on costs, which could trigger a more in-depth assessment of costs, clarify the definitional and scope issues involved, and generate broader dialogue relevant to communities of practice. It is important that users gain an understanding of estimated costs of practices before specifying them in their programs.

### **3.4 MANAGING PROJECT DOCUMENTATION**

Everyone was able to access the ProjectSolve<sup>2</sup> website, though some experienced initial difficulty. Neither Working Group however, used ProjectSolve<sup>2</sup> extensively. For example, most of the Working Group members preferred to obtain documents via email rather than downloading them from the ProjectSolve<sup>2</sup> website. Some members would have liked to fill out the evaluation matrix online. In fact, even those who preferred to read a hard copy said that they could have filled in the evaluation matrix online after having worked with a hard copy. The research team recommends using a web-based tool that Working Groups would use to complete evaluations online.

### **3.5 THE “THIRD PERSON” OR SUPPORT STAFF**

There was clearly an important need for administrative support. Tasks identified by the Steering Group and Working Groups included scheduling meetings; creating agenda; facilitating conference calls; taking notes during the telephone conferences and preparing minutes; preparing evaluation matrices; combining, organizing and formatting individual evaluations (or managing an online solution); and posting results.

In this pilot project the “third person” contributed facilitation and support, rather than technical expertise. It is clear that if the Compendium is to be transformed to a Best practices tool and sustained over time, and dozens of Compendium sections may be addressed each year by dozens of Working Groups, a program facilitator will be essential to support the effort.

### **3.6 CHAPTER LEADERS**

At such time as the process of evaluating and updating the Compendium goes into full swing, the sheer volume and diversity of practices and the need to examine them on a cycle indicates the likely need for an additional level of leadership and oversight between Working Groups and the Steering Group. The review cycle could range from annual for those practices that are changing very rapidly to perhaps once every five years for practices that are very stable. A small group (three to five) of Chapter Leaders could be delegated many of the functions of the Steering Group in terms of setting priorities, establishing Working Groups, recruiting members, overseeing their work and concurring in their results.

### **3.7 INCORPORATING RESULTS IN THE COMPENDIUM WEBSITE**

A key question is, “What to do with the results of the screening process?” The initial concept was that the practices would be divided into two groups; Best practices (which would be uniquely identified in the Compendium) and those not selected as Best practices (which would remain in the Compendium as currently listed). After the review by the Working Groups it became clear that there were really three categories:

1. Best Practices
2. Acceptable Practices, which should stay in the Compendium
3. Unacceptable Practices, which should be removed from the Compendium

The Working Groups noted that the Acceptable Practices should remain in the Compendium because they may be useful in some situations or geographic areas even though they did not earn the Best practices designation.

### **3.8 COST OF EVALUATING AND SELECTING BEST PRACTICES**

The need for facilitative and administrative support noted in Section 3.4 would have some costs. The costs incurred for screening practices include the cost of the facilitator and the research assistant. This effort would cost up to \$10,000, depending upon the compensation of those filling these positions, the volume of information in the topic area(s) addressed, the time that the Working Group deliberates, and the extent that the Working Group elects to edit, rather than simply screen, practices.

It was generally agreed that Working Groups comprised of technical experts who were not familiar with one another would greatly benefit from a face-to-face meeting. The long term commitment of the members, the sense of community of practice, and their ability to communicate effectively over time would all be enhanced by this activity. It is estimated that the cost of a face-to-face meeting (including airfare, accommodations, food and other incidental costs) of five to seven Working Group members, plus a facilitator would cost between \$5,000 and \$10,000.

## 4. CONCLUSIONS AND RECOMMENDATIONS

The research conducted under Task 29 established a successful process for creating a Best practices library from the Compendium and for keeping it up-to-date with new stewardship practices. This process can be replicated and applied to the entire Compendium to develop a comprehensive library of Best practices, which would enhance the value and use of the Compendium, leading to heightened awareness and continual improvements in environmental stewardship practices. The most important elements for success are the caliber of the Working Group members, their willingness to put in the effort required, and their ability to coalesce into a collaborative team.

The research also identified opportunities for establishing communities of practice stemming from the Working Groups established for the two topic areas in the Compendium selected for Best practices screening. These communities of practice could well evolve into stewards of the Compendium to further foster the exchange of lessons learned and communication of Best practices among practitioners.

### 4.1 RECOMMENDATIONS

The research team recommends that the AASHTO Center for Environmental Excellence transition from this pilot test to implementation. The following are recommendations based on the experiences of the Task 29 research.

#### Steering Group

A Steering Group comprised of representatives of AASHTO's organizational elements, should be retained under the Center for Environmental Excellence (Center) on a permanent basis.

The Steering Group should review the Compendium in its entirety to determine priorities for selecting Best practice topics using the process established in Task 29.

The Steering Group's responsibilities would include prioritizing and selecting the practices to be evaluated, establishing Working Groups and recruiting members to perform the selection of Best practices, concurring in changes to selection criteria, and reviewing and accepting their findings and recommendations for Best practices. The Steering Group would guide the overall process and adjust the process when necessary.

#### Program Facilitator

There is clearly an important need for facilitative and administrative support. The Center should designate a program facilitator to sustain the overall process by providing

administrative and facilitation support. The facilitator would provide professional support to the Steering Group and Working Groups so that the results of their work are included in an updated Compendium and communicated widely and effectively to practitioners.

The facilitator's role would be to energize and implement the transformation and updating of the Compendium into a Best practices document.

The program facilitator would work closely with and support the Steering Group as well as Working Groups. Specific responsibilities, with resource requirements clearly identified, may include:

- Ø Creating a general schedule and budget for selecting and conducting reviews of Best practice topic areas,
- Ø Working with the Steering Group in designating Working Groups for selected topics,
- Ø Facilitate Working Group evaluations during conference calls and meetings,
- Ø Update the Compendium as Working Groups select Best practices, and
- Ø Review and direct to appropriate Working Groups the comments, suggestions and volunteer resources that users offer through the Compendium's newly created website links.

There is a need for an administrative assistant to support of the program facilitator. The Steering Group and Working Groups identified a number of necessary administrative tasks during this study. These include:

- Ø Scheduling meetings,
- Ø Creating agenda,
- Ø Facilitating conference calls,
- Ø Taking notes during the telephone conferences and preparing minutes,
- Ø Preparing evaluation matrices,
- Ø Combining, organizing and formatting individual evaluations (or managing an online solution) and
- Ø Posting results.

## Working Groups

The research team recommends that Working Groups be established to review one or more topic areas of the Compendium. The primary responsibility of the Working Groups is to screen practices presented in the Compendium according to evaluation criteria that they and the Steering Group agree upon; to identify Best, Acceptable and Unacceptable practices (the latter to be deleted from the compendium); and to suggest new practices for consideration. Note that there was considerable dialogue within and between the Steering Group and the research team concerning the term, “Best Practice”. We discussed many terms as potential substitutes for “Best” and offer two more for consideration: noteworthy and meritorious. It is recommended that the Steering Group and the Center consider these two alternatives before launching future Compendium evaluations.

The high caliber of the Working Group members was a critical success factor. The research team recommends that future Working Groups be composed of members of similar quality and background to the Task 29 Working Groups. The Working Group members were decisive, fully engaged, articulate, and knowledgeable. In performing the review, one of the Working Groups affirmed the imperative for practitioners, rather than consultants, to screen practices.

Initially the research team had some concern that reaching consensus on Best practices would be a challenge. However, the level of experience of the Working Group members and their willingness to make a decision is evident in the successful outcome of the pilot practices. Dialogue was central to a quality outcome.

Working Groups should be comprised of at least five and typically not more than seven members.

For Working Groups that do not have a previous history of working together, it is recommended that members meet in person for a kickoff meeting. (To the extent possible this should occur in conjunction with scheduled AASHTO activities, particularly meetings of the subcommittees on Construction and Maintenance.) Subsequent meetings can be via telephone conferences.

Working Groups should be provided the evaluation criteria (environmentally beneficial, practical, and cost-effective) and afforded the flexibility to make modifications, subject to the concurrence of the Steering Group. Evaluation matrices proved to be an effective tool.

Working Groups should be encouraged to reach out to peers beyond their Working Group, including contractor and external environmental agency personnel, for



additional information and insights, and to generate broader awareness and use of the Compendium.

It is recommended that each Working Group have a provisional chairperson to help the Steering Group identify topic area expert practitioners for membership on the Working Group, and that a permanent chair be selected once the group is established. The longevity, size, and possible rotation of membership and leadership of Working Groups would be determined by the Steering Group.

#### Level of Evaluation within each Chapter

The research team recommends that, generally, chapters would be evaluated in elements using the first level below the chapter level. For example, sections 4.1, 4.2, 4.3, and so forth of Chapter 4 would be evaluated separately, perhaps by different Working Groups (this would depend on the topics in the sections). This rule of thumb would vary depending upon the size and complexity of the chapters and the sections. Preferably the Working Groups would be comprised such that they included members who were qualified to evaluate more than one section of a chapter, so as to minimize the overall number of Working Groups.

#### Chapter Leaders

As the workload expands, consideration should be given to recruiting from within AASHTO members volunteer Chapter Leaders recognized for their knowledge in the individual Chapter topic areas. It is suggested that a Chapter Leader could oversee one or more complete chapter(s).

At such time as the number of Working Groups grows to the point where an additional level of leadership is required, the Chapter Leader function could expand to take on most of the responsibilities of the Steering Group, and the composition of Chapter Leadership would expand from one person to a suggested minimum of three and maximum of five. Chapter Leaders would assist in designating and reviewing the work of multiple Working Groups; addressing multiple topics that may be too numerous for the Steering Group to address.

#### ***Recommended Process:***

Once established by the Center, the Steering Group would convene via teleconference to choose the topic areas to be screened and to suggest members and chairs of the Working Groups. The research team recommends that Working Groups be comprised of five to seven members.

After identifying the Working Group members, the Center, on behalf of the Steering Group, contacts each proposed member, inviting them to join the Working Group and explaining the roles and responsibilities of the Working Group members.

An initial conference call would be scheduled and each Working Group member would be sent a packet of information prior to the first conference call. The information packets would include:

- Ø an overview of the Compendium;
- Ø an introduction to the Steering Group members;
- Ø the Steering Group roles and responsibilities, which include selecting a chair, selecting a program facilitator; providing guidance to and setting priorities for the program facilitator for conducting Compendium section reviews; identifying potential chapter leaders, Working Group members and Working Group chairs; monitoring program progress, and reviewing and accepting proposed Compendium revisions before they are posted;
- Ø a description of the screening process;
- Ø the Working Group roles and responsibilities, which include selecting a chair, establishing evaluation criteria, selecting one member to break down the practices into appropriate elements for review, ensuring that all Working Groups members evaluate the practice elements, engaging outside experts for input as appropriate, negotiating to a consensus on Best practices, Acceptable practices and Unacceptable practices; editing practices that are nearly eligible as Best practices such that they can then qualify as Best practices, and reporting final evaluations to the Steering Group.
- Ø list of Working Group members and contact information;
- Ø a matrix template<sup>5</sup> of the practice(s) from the Compendium section(s) that he/she is being asked to evaluate;
- Ø draft evaluation criteria - environmentally beneficial, practical, and cost effective;
- Ø the 1 to 4 ranking system;
- Ø a schedule; and
- Ø instructions for calling into the first conference call<sup>6</sup>.

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<sup>5</sup> See Appendix B.4 as an example.

<sup>6</sup> Working groups that meet face-to-face for a kickoff meeting would receive instructions for attending their meeting rather than instructions for a conference call.

The agenda for the initial conference call would include reviewing the information packet, determining the evaluation criteria, and discussing the ranking system.

Each Working Group should start with the originally proposed criteria for the evaluation of the practices: environmentally beneficial, practical, and cost effective. The Working Groups will have the latitude to develop criteria tailored to the practices they are reviewing, with the flexibility to add, delete, replace, or modify evaluation criteria.

The required outcome is that future Working Groups identify Best practices, Acceptable Practices (which should stay in the Compendium), and Unacceptable Practices (which should be removed from the Compendium).

The research team recommends that future Working Groups use a matrix to evaluate practices and screen practices based upon scoring as a Best Practice, Acceptable Practice, or Unacceptable Practice. With direction from each Working Group regarding how far to break down the practices and the level of detail needed to evaluate a stand-alone practice, the program facilitator will prepare the matrix and the Working Group would review, revise, and accept it before conducting evaluations. By providing the Working Group with a draft matrix of the practices and selection criteria in advance, the Working Group members can focus their attention on evaluating practices. The matrix (Appendix C) would list the practice in the first column and then each of the evaluation criteria in a separate column, followed by three columns entitled, Best Practice, Acceptable Practice, and Unacceptable Practice, and a final column for comments. Future Working Groups may benefit by reviewing examples of completed matrices from this study (Appendix B) to help guide their reviews.

The program facilitator will distribute the agreed upon matrix to the Working Groups members who will be given a limited time (in the pilot, two weeks was provided) to conduct their individual evaluations and send their completed matrices back to the facilitator. It is important to carry out the process with efficiency and a reasonable pace to ensure it does not languish. During the evaluation period, Working Group members should be encouraged to suggest new practices for inclusion in the Compendium, edit existing practices where appropriate to qualify them as a Best practice, and engage their knowledgeable colleagues and other topic experts for input on evaluations. This last recommendation is a very valuable aspect of the project, both for raising awareness of the Compendium and for eliciting suggestions for Best practices.

Within no more than a week, the program facilitator prepares a combined and collated matrix showing all of the ratings so that the Working Group can easily discuss the evaluations. The collated rankings are redistributed to the Working Group members

and a second conference call is convened to discuss the rankings of each practice and any refinements or new practices suggested. Working Groups should evaluate practices when at least four members participate. If there are fewer than four members, Working Groups should not evaluate practices, but should reschedule their meeting when four or more members are available.

The program facilitator and the Steering Group review the Working Groups' final consensus on the screened practices, including all edits and additions, and upon their concurrence, the results are submitted for posting in the online Compendium. The Best practices will be indicated within the Compendium by a unique check mark next to the practices, so that they can be easily identified by Compendium users. Any recommended editorial changes will be made to the text on line.

From time to time, the Center will publicize updates to the Compendium to ensure broad awareness.

Consistent with the objective of keeping the Compendium up-to-date and reflective of the experience of practitioners, a link has been added to the Compendium where users can suggest new practices or comment on the existing practices. The link to these comment forms will be visible from the chapter pages, so that it will be easy to submit a comment. See the sample comment form in Appendix D.

### ***Recommendations on Face-to-Face Meetings***

The research team observed that there is a significant benefit for Working Group members to know one another before starting their evaluations. This could be accomplished by creating a Working Group from a community of practitioners who are acquainted or it could be created by conducting a face-to-face kickoff meeting.

The recommendation is that a face-to-face kickoff Working Group meeting should be part of the effort when fewer than half of the members know each other in order to strengthen the long-term sustainability of the project by supporting the development of a community of practice.

### ***Recommendations on Review Frequency***

The research team recommends that reviews would generally be performed at least every five years, with the recognition that there must be flexibility to adjust to the pace of change in issues, processes, and technologies in a particular topic area. It is recommended that the chapters be monitored for the need for review.

## 4.2 CONCLUDING STATEMENT

Under the guidance of the Steering Group, the research team and Working Groups successfully developed a process to identify and post Best Environmental Stewardship Practices. More importantly, this undertaking resulted in program recommendations to replicate this process and apply it to the entire Compendium as an investment that will deliver far reaching benefits to practitioners, agencies, constructors, the public, and the environment. Through a disciplined approach to Compendium reviews and updates, there is an exciting opportunity to dramatically expand the awareness, knowledge, creation, and use of best environmental stewardship practices in the construction and maintenance of our nation's highways.

# APPENDIX A PARTICIPANTS IN THE TASK 29 STUDY

## A.1 RESEARCH TEAM

The Task 29 research team was made up of Parsons Brinckerhoff staff. Jim Ruddell, Principal Investigator, was supported in his research by Monica Meade. Hal Kassoff, Principal in Charge for the NCHRP 25-25 projects provided expert advice. Lisa Zeimer is project manager for the NCHRP 25-25 projects.

Christopher Hedges, NCHRP Senior Program Officer, oversaw the project for the Transportation Research Board.

## A.2 STEERING GROUP

A Steering Group provided expert guidance and oversight of the research. Steering Group members included:

Carlos Braceras, Utah DOT - Chair  
David Carlson, Federal Highway Administration  
Shannon Eggleston, AASHTO Center for Environmental Excellence  
Kate Kurgan, AASHTO Center for Environmental Excellence  
Jim McDonnell, AASHTO  
Gary McVoy, New York State DOT  
Chris Newman, Federal Highway Administration  
Ruth Rentch, Federal Highway Administration  
Len Sanderson, North Carolina DOT

The Steering Group chose two sections of the Compendium as the pilot projects to test the proposed screening process; Section 4.4, Construction in and around Drainage Areas and Streams, Wetlands, and Other Environmentally Sensitive Areas, and Section 8.3, Strategic Planning for Reduced Salt Usage. The Steering Group nominated practitioners from around the country to serve on these Working Groups.

## A.3 WORKING GROUPS

Members of the Working Group for Compendium Section 4.4, Construction in and around Drainage Areas and Streams, Wetlands, and Other Environmentally Sensitive Areas were:

Kyle Williams, New York State DOT - Chair  
Frannie Brindle, Oregon DOT  
Jake Goettle, Montana DOT  
Frank Pafko, Minnesota DOT

Members of the Working Group for Compendium Section 8.3, Strategic Planning for Reduced Salt Usage were:

Lee Wilkinson, Iowa DOT - Chair  
Lynn Bernhard, Utah DOT  
Dennis Burkheimer, Iowa DOT  
Mike Lashmet, New York DOT  
Wayne Lupton, Colorado DOT  
Don Miller, Colorado DOT  
Lee Smithson, Iowa DOT

# APPENDIX B PILOT STUDIES

## B.1 SUMMARY OF THE PROCESS

The research team implemented the proposed evaluation process with working groups on two sections of the Compendium. The following is a description of this experience.

### *Steering Group*

Working with Chris Hedges of NCHRP the research team identified candidates for the Steering Group. These people were invited to join the Steering Group by Chris Hedges. After they agreed to serve on the Steering Group they were sent an advance package of materials on the project. The packet contained the following information:

- Ø Project background
- Ø Goal of the Steering Group kickoff meeting
- Ø Process
- Ø Project schedule
- Ø Research team
- Ø ProjectSolve2
- Ø Suggested pilot practices
- Ø Contact list – NCHRP, Steering Group, and research team
- Ø Research problem statement

The research team convened the first meeting of the Steering Group by conference call on October 4, 2006. The purpose of this meeting was to introduce the Steering Group and research team members, review the overarching elements of the Task 29 mission, approve the proposed plan and evaluation criteria, and select the candidate pilot practices.

*Review of the proposed process.* The Steering Group was in general agreement on the proposed process. The Steering Group approved the proposed plan and evaluation criteria, and agreed to allow the Working Groups the latitude to expand the topic area



within the confines of the allowed time and to recommend alternate or additional evaluation criteria.

*Selection of the pilot practices.* The Steering Group was tasked with selecting two topics from the six topics proposed by the research team, or from others that were of interest to the Steering Group members. With the understanding that there is flexibility for the Working Groups to explore related topics, the Steering Group selected the following two pilot processes for study:

- Ø Section 4.4, Construction in and around Drainage Areas and Streams, Wetlands, and Other Environmentally Sensitive Areas
- Ø Section 8.3, Strategic Planning for Reduced Salt Usage

The Steering Group was asked to identify Working Group candidates. Members of the Steering group identified and contacted the Working Group members.

***Working Group on Construction in and Around Drainage Areas, Streams, Wetlands, and other Environmentally Sensitive Areas***

The Working Group for the evaluation of practices for Construction in and around Drainage Areas, Streams, Wetlands, and other Environmentally Sensitive Areas (the Wetlands Working Group) met on November 22, 2006. The history and purpose of the NCHRP research projects and particularly Task 4, the compilation of the Compendium, was explained to the Working Groups.

At the initial meeting the Working Group reviewed the assigned topics and came to an agreement on the evaluation criteria. The group committed to completing their individual evaluations in three weeks and submitting them to the research team, and then reconvening for the group evaluation several weeks after that.

*Conference Call on Group Evaluation and Review of the Process.* The Wetlands Working Group met by conference call on January 9 and again on January 25, 2007. The selected section of Chapter 4 was particularly large and so required two calls to cover the agenda, which included a review of individual rankings, decisions on what practices would be Best practices, and an evaluation of the process.

***Working Group on Strategic Planning for Reduced Salt Usage***

The Reduced Salt Working Group convened by conference call on November 29, 2006. As with the Wetlands Working Group, the history, goals, and objectives of the project were explained to the group. The research team reviewed the goals of this meeting, which were to review the assigned topics and reach agreement on the evaluation criteria that the Working Group will use.

*Conference Call on Group Evaluation and Review of the Process.* The next conference call was January 4, 2007. Four of the group members participated. The Working Group reviewed all of the evaluations.

***Steering Group***

*Conference Call to Review Screening Process.* The Steering Group, the research team, and the chairs of the two working Groups met via conference call on February 14, 2007 to review the experiences of the Working Groups. The two Chairs presented summaries of their experiences and the Steering Group worked together to develop a series of recommendations on the process.

**B.2 FINDINGS OF THE WETLANDS WORKING GROUP**

The results of the evaluation process are presented below. Text in italics and struck-through text reflect changes made by the Working Group.

<b>Practice</b>		<b>Final Evaluation</b>
<b>Wetlands and Riparian Areas</b>		
4.4.1 – 1	Travel on wetlands shall be avoided wherever <i>possible practical</i> . Access roads shall avoid all important wetlands where possible.	Best Practice
4.4.1 – 2	Activities will be timed to coincide with low water or frozen conditions, where <i>possible practical</i> .	Best Practice
4.4.1 – 3	Crossing will be restricted to a single location and will occur perpendicular to and at a narrow point on the wetland. Brush matting, swamp matting, ice bridges and floatation tires on vehicles shall be used when crossing as dictated by site conditions and the Project Engineer.	Best Practice
4.4.1 – 4	Equipment shall be in good working order and free of leaks. No equipment maintenance including fueling shall be carried out within 30 m of a wetland.	Best Practice
4.4.1 – 5	Excavation in wetlands <del>shall</del> <i>should</i> be carried out <del>by an excavator operating</del> from a dry stable surface to minimize <del>sediment generation</del> <i>environmental impacts</i> .	Best Practice
4.4.1 – 6	Excavate only what is absolutely necessary to meet engineering requirements. Excavated material shall not be side cast in the wetland <i>unless permitted, or for beneficial environmental purposes</i> .	Best Practice

<b>Practice</b>		<b>Final Evaluation</b>
4.4.1 – 7	In wetlands associated with sensitive water crossings, grubbing shall be minimized by the placement of geogrid and geotextile prior to the placement of fill.	Best Practice.
4.4.1 – 8	<i>Vegetation will be retained where possible to provide wildlife habitat. Where applicable, no work near wetlands will be scheduled during the wildlife's breeding season.</i>	Best Practice
4.4.1 – 9	Excavated wetland material shall be retained for placement in the median or along the ROW to improve seeding success. Material may be stored at locations specified by the Project Engineer or applied directly to designated areas to a minimum thickness of 100 mm. Note that wetlands material typically has a very high organic matter content that may require further mixing with inorganic soils prior to spreading.	Not a Best Practice
4.4.1 – 10	Excavated material shall be replaced with approved fill material as soon as possible to minimize sloughing, over excavation and generation of sediment.	Best Practice
4.4.1 – 11	The fill material shall be clean, coarse fill material with less than 10 percent fines to minimize the generation of sediment and to promote drainage.	Not a Best Practice
4.4.1 – 12	Water control shall be maintained at all times. Water removed from the excavation shall be pumped to an approved sediment control measure (e.g., settling pond, adjacent vegetated area or filter bag). <i>The contractor shall ensure that no discharge to adjacent watercourses will occur when total suspended sediment (TSS) concentrations exceed 25 mg/L, other level noted by permits with the state or provincial resource agency and letters of advice.</i>	Best Practice
4.4.1 – 13	Ditches shall not drain directly to wetlands. Flows must be direct away from wetlands by take-off ditches for dissipation through adjacent vegetated areas.	Not a Best Practice
<b>Vegetation Protection</b>		
4.4.2 – 14	Avoid native vegetation removal and disturbance on stream banks unless absolutely necessary.	Best Practice
4.4.2 – 15	Maintain a vegetated buffer strip between the work site and water course except at the actual crossing location.	Best Practice

Practice		Final Evaluation
4.4.2 – 16a	Mark large trees, where present, with colored and labeled flagging to ensure that the field crew understands what is to be cut and what is to remain and be protected from damage.	Best Practice
4.4.2 – 16b	Temporary barriers to protect existing trees, plants, and root zone should be provided, if necessary.	Best Practice
4.4.2 – 16c	Trees and other vegetation should not be removed, injured, or destroyed without prior written approval.	Not a Best Practice
4.4.2 – 16d	Ropes, cables, or fencing should not be fastened to trees.	Not a Best Practice
4.4.2 – 17	Clear vegetation from unstable or erodible banks by hand instead of using heavy machinery.	Not a Best Practice
4.4.2 – 18	Remove undesirable plant species such as nonnative and invasive species that might threaten the survival of <i>native targeted</i> species.	Best Practice
4.4.2 – 19	Retain as much under story brush and as many trees as feasible, emphasizing shade producing and bank stabilizing vegetation.	Not a Best Practice
4.4.2 – 20	Minimize soil compaction by using equipment <i>types such as wide track or rubber tired</i> with a greater reach or that exerts less pressure per square inch on the ground, resulting in less overall area disturbed or less compaction of disturbed areas.	Best Practice
4.4.2 – 21a	Decompact disturbed soils <i>where needed prior to revegetation at project completion as the heavy equipment exits the construction area.</i>	Best Practice
4.4.2 – 21b	Heavy equipment may use various routes to reduce severe compaction in any one area.	Not a Best Practice
4.4.2 – 21c	Conversely, using fewer haul routes may result in less overall compaction.	Not a Best Practice
4.4.2 – 21d	After use, haul routes may be ripped or sub soiled to reduce compaction and promote infiltration.	Not a Best Practice
4.4.2 – 22	If riparian vegetation is to be removed with chainsaws, consider using saws currently available that operate with vegetable-based bar oil.	Not a Best Practice
4.4.2 – 23	Revegetate disturbed and decompacted areas with <i>locally adapted native species specific to the project location</i> that comprise a diverse community of woody and herbaceous species, <i>where practical and appropriate. Use of species that grow extensive root networks quickly should be emphasized. Sterile, non-native hybrids may be used for erosion control in the short term if planted in conjunction with native species.</i>	Best Practice  The final sentence was originally two other practices 4.4.3-33b and c. These were relocated to be part of this practice.

<b>Practice</b>		<b>Final Evaluation</b>
4.4.2 – 24	Allow at least four weeks of growing season when using seeding to stabilize erodible soils.	Not a Best Practice
<b>Fish &amp; Wildlife Protection</b>		
4.4.3 – 25	DOT employees and Contractor employees and agents shall not interfere with wildlife and shall not carry firearms within the ROW.	Not a Best Practice
4.4.3 – 26	Where important wildlife species are encountered impacts shall be minimized by avoiding noisy, disruptive activities during sensitive wildlife periods (e.g., March to June for Bald Eagles) <i>or as specified in permit conditions.</i>	Best Practice
4.4.3 – 27	All refuse shall be disposed of at an approved landfill facility. Refuse stored on site prior to removal shall be stored in closed containers.	Not a Best Practice
4.4.3 – 28	Report any nuisance wildlife to the Project Engineer or directly to the environmental specialist or the local DNR office	Not a Best Practice
4.4.3 – 29	The Contractor shall consult with the Regional Wildlife Biologist to determine appropriate measures for removing beaver dams and/or nuisance beavers.	Not a Best Practice
4.4.3 – 30a	Disturbance of the bed and banks should be limited to disturbance necessary to place the culvert, embankment protection and any required channel modification associated with the installation.	Best Practice
4.4.3 – 30b	All disturbed areas should be protected from erosion within seven (7) calendar days of completion of the project using vegetation or other means.	Not a Best Practice
4.4.3 – 30c	The banks should be revegetated within one year with native or other approved woody plant species.	Not a Best Practice
4.4.3 – 30d	Live stakes should be planted at a maximum interval of three feet (on center) and maintained as necessary to ensure 80 percent survival.	Not a Best Practice

Practice		Final Evaluation
4.4.3 – 31	<p><del>Approved structures should be constructed in the dry whenever possible.</del></p> <p><del>31a Where significant live flow exists, isolation of the construction site from stream flow should be accomplished by techniques appropriate to local and site conditions such as jersey barriers, sheet piles, etc. such as the installation of a bypass channel, a flume, or culvert.</del></p> <p><del>31b Where significant live flow exists, isolation of the construction site from stream flow should be accomplished by techniques such as the installations of a sheet pile or sandbag wall.</del></p> <p><del>31c Where significant live flow exists, isolation of the construction site from stream flow should be accomplished by techniques such as the use of a water-filled cofferdam.</del></p> <p><del>31d Where significant live flow exists, isolation of the construction site from stream flow should be accomplished by techniques such as by pumping the stream flow around the site if situation or turbidity cannot be reduced to acceptable levels by other means.</del></p> <p>New text:  <i>Approved structures should be constructed in the dry whenever possible. Where significant live flow exists, isolation of the construction site from stream flow should be accomplished by techniques appropriate to local and site conditions such as jersey barriers, sheet piles, cofferdams, etc.</i></p>	Best Practice 31a, b, c, and d were combined into one practice.
4.4.3 – 32	Any wastewater from project activities and dewatering should be routed to an area outside the ordinary high water line in a location that will not drain directly into any stream channel, to allow settling of fine sediments and other contaminants prior to being discharged back into the subject stream.	Best Practice
4.4.3 – 33a	The work area should be fully restored upon completion with a mix of native, locally adapted, riparian vegetation.	Remove from Compendium
4.4.3 – 33b	<i>Use of species that grow extensive root networks quickly should be emphasized.</i>	Best Practice, but relocate to be part of 4.4.2-23
4.4.3 – 33c	<i>Sterile, non-native hybrids may be used for erosion control in the short term if planted in conjunction with native species.</i>	Best Practice, but relocate to be part of 4.4.2-23

Practice		Final Evaluation
4.4.3 – 34a	If target species are likely to be present, fish clearing or salvage operations should be conducted by qualified personnel prior to construction. <i>If these fish are listed as threatened or endangered under the federal or state Endangered Species Act, consult with FWS, NMFS, and/or state biologists to gain authorization for these activities. Care should be taken to ensure fish are not chased up under banks or logs that will be removed or dislocated by construction. Return any stranded fish to a suitable location in a nearby live stream by a method that does not require handling of the fish.</i>	Best Practice  Practices 34a-34d were combined into one practice.
4.4.3 – 34b	<del><i>If these fish are listed as threatened or endangered under the federal or state Endangered Species Act, consult with FWS, NMFS, and/or state biologists to gain authorization for these activities.</i></del>	Combine with 34a.
4.4.3 – 34c	<del><i>Care should be taken to ensure fish are not chased up under banks or logs that will be removed or dislocated by construction.</i></del>	Combine with 34a.
4.4.3 – 34d	<del><i>Return any stranded fish to a suitable location in a nearby live stream by a method that does not require handling of the fish</i></del>	Combine with 34a.
4.4.3 – 35	If pumps are used to temporarily divert a stream to facilitate construction, an acceptable fish screen should be used to prevent entrainment or impingement of small fish.	Best Practice
4.4.3 – 36	No one shall disturb, move or destroy migratory bird nests. If a nest or young birds are encountered, the Contractor shall cease work in the immediate area of the nest and contact the environmental specialist and the Project Engineer.	Best Practice
4.4.3 – 37a	Should a bald eagle nest be identified, the following approach shall be followed: within 200 m of a nest, avoid activities that result in significant landscape changes.	Not a Best Practice
4.4.3 – 37b	Within 400 m of a nest, activity is permitted except during the most critical period, usually between March and mid-May.	Not a Best Practice
4.4.3 – 38a	Where bald eagle nests have been identified prior to construction communication will be undertaken with the contractor to promote awareness of nest locations and protection requirements	Best Practice

<b>Practice</b>		<b>Final Evaluation</b>
4.4.3 – 38b	Where bald eagle nests have been identified prior to construction avoidance of noise disturbance in this area during the breeding period from March to June.	Not a Best Practice
4.4.3 – 38c	Where bald eagle nests have been identified prior to construction blasting will be avoided adjacent to this habitat between March and June.	Not a Best Practice
4.4.3 – 38d	Where bald eagle nests have been identified prior to construction setbacks from the area restricting machinery access will be established and clearly marked in the field.	Not a Best Practice
4.4.3 – 38e	Where bald eagle nests have been identified prior to construction the amount of trees cleared in this area will be minimized.	Not a Best Practice
4.4.3 – 39	Prior to proceeding with removal or modification of beaver dams and associated activities (e.g. dewatering, excavation, sediment removal, debris disposal, installation of water control structure or culvert guard, trapping, etc.) Contact DOT environmental specialist or local office of DNR for assistance and/or permit for advice if watercourses will be affected, prior to proceeding with this work.	Not a Best Practice
4.4.3 – 40	<i>The removal of the beaver dam or culvert should be limited to the debris of in the structure. The original watercourse bed and bank material may not be removed or disturbed unless permitted.</i>	Best Practice, but it will be moved to be part of 4.4.3-39
4.4.3 – 41	<i>Drainage of the ponds should, if possible, take place between June 1 and September 15, when water is at lower flow levels.</i>	Best Practice, but it will be moved to be part of 4.4.3-39
4.4.3 – 42	Impounded water will be released over an extended period so as to minimize silt flushing from the impounded area and reduce channel erosion downstream due to the increased discharge and water velocities.	Not a Best Practice
4.4.3 – 43	The pond can be drained by pumping down or siphoning to reduce potential for resuspension of sediment.	Not a Best Practice
4.4.3 – 44	A good maximum allowable depth of water spilling over the structure at the drainage point is 10 cm (4 inches). The width of the opening should be no greater than the width of the watercourse downstream of the dam until the pond has been drained.	Not a Best Practice



<b>Practice</b>		<b>Final Evaluation</b>
4.4.3 – 45	When dismantling beaver dams, the majority of the work should be performed using hand tools; remove only enough debris to start running the flow of water under controlled discharge.	Not a Best Practice
4.4.3 – 46	If using machinery, only diesel powered cable winches (not electrical) should be used to remove debris from dams and pipes.	Not a Best Practice
4.4.3 – 47	All debris removed from the beaver dam will be placed at a location above the high water mark so as not to re-enter the stream.	Not a Best Practice
4.4.3 – 48	If it is intended to remove accumulated sediment or organic material from a beaver pond area after a dam has been breached, this material should be allowed sufficient time to completely dry before it is removed. All appropriate permits for fill removal and working near a watercourse must be obtained for such a removal project.	Not a Best Practice
4.4.3 – 49	In a location where it is impossible to eliminate dams, control the level of water by constructing and installing a temporary structure using water level control pipes.	Not a Best Practice
4.4.3 – 50	For a small to medium sized culvert in locations where dams are totally dismantled, install culvert protectors which can be easily removed if the beaver rebuilds his dam.	Not a Best Practice
4.4.3 – 51	In situations where a culvert must remain open to prevent road washouts during flood condition, but a beaver pond is acceptable, a culvert guard can be constructed.	Not a Best Practice
4.4.3 – 52	The excavation of sediment from the former pond site should be conducted in a manner to ensure that suspended sediment and organic matter do not re-enter the watercourse.	Not a Best Practice
4.4.3 – 53	If possible, defer the removal of the nuisance beaver until a beaver trapping season is in effect.	Not a Best Practice
<b>Stewardship Considerations to Avoid Watercourse Contamination</b>		
4.4.4 – 54	Prevent vehicle fuels and fluids from contaminating the watercourse.	Best Practice
4.4.4 – 55	Refuel machinery at locations well removed from the watercourse (recommended minimum 100m or 300 ft separation).	Best Practice
4.4.4 – 56	Wash and service vehicles and machinery at locations well removed from the watercourse.	Not a Best Practice

<b>Practice</b>		<b>Final Evaluation</b>
4.4.4 – 57	Use bio-friendly hydraulic fluids in equipment operating in or adjacent to watercourse.	Not a Best Practice
4.4.4 – 58	Store fuel, lubricants, hydraulic fluid and other potentially toxic materials at locations well removed from the watercourse.	Best Practice
4.4.4 – 59	Isolate storage areas so that spilled fluids cannot enter the watercourse.	Best Practice
4.4.4 – 60	Prepare a spill contingency plan	Best Practice
4.4.4 – 61	Ensure operators have spill clean up supplies on site and are knowledgeable in their proper use and deployment.	Best Practice
4.4.4 – 62	Report all spills. In the event of a spill, operators must immediately cease work, start cleanup and notify the appropriate authorities.	Not a Best Practice
4.4.4 – 63	Perform in-stream work in low flow conditions, to the maximum extent practicable.	Not a Best Practice
4.4.4 – 64	Prevent any construction debris from falling into the stream channel. Any material that does fall into a stream during construction should be immediately removed in a manner that has minimal impact to the streambed and water quality.	Best Practice
4.4.4 – 65	<i>Where feasible, As appropriate</i> the construction should occur from the bank, or on a temporary pad underlain with filter fabric.	Best Practice
4.4.4 – 66	Temporary fill must be removed in its entirety prior to close of work-window.	Best Practice
4.4.4 – 67	Begin reclamation and site cleanup as soon as construction has been completed. Remove all waste material from the active floodplain as well as all temporary facilities and structures.	Best Practice
4.4.4 – 68	Recontour, stabilize, and revegetate disturbed areas to suit original conditions; it is especially important to stabilize all slopes leading directly to the watercourse.	Best Practice
<b>State Resources and Fact Sheets for Stream Crossings</b>		
4.4.5	Facts sheets from various states on environmental stewardship	Not a Best Practice
Erosion Control in Environmentally Sensitive Areas – insert referral to erosion section of Compendium (Chapter 4.5 Erosion and Sedimentation Control).		
4.4.6 – 69	Use environmentally sensitive bank and erosion control measures or bioengineered designs.	Best Practice
4.4.6 – 70	Develop <i>erosion and</i> sediment control plans and install sediment control measures before starting work.	Best Practice

Practice		Final Evaluation
4.4.6 – 71	Minimize the length of time that unstable erodible soils are exposed.	Best Practice
4.4.6 – 72a	Isolate the construction area from flowing water until project materials are installed and erosion protection is in place.	Best Practice
4.4.6 – 72b	Erosion control measures should be in place at all times during construction.	Not a Best Practice
4.4.6 – 72c	Do not start construction until all temporary control devices are in place down slope or downstream of project site.	Not a Best Practice
4.4.6 – 73	Stockpile topsoil removed from the right-of-way outside of the active floodplain and use measures <i>such as silt fences and holding ponds</i> to prevent stockpile runoff from entering the watercourse.	Combine 73 and 74, Best Practice
4.4.6 – 74	Use erosion control to protect and stabilize stockpiles and exposed soils to prevent movement of materials. <del><i>Use devices such as plastic sheeting held down with rocks or sandbags over stockpiles, silt fences, or berms of hay bales to minimize movement of exposed or stockpiled soils.</i></del>	See above
4.4.6 – 75	Direct runoff containing sediment away from the stream into a vegetated area.	Not a Best Practice
4.4.6 – 76	Construct suitably sized settling ponds to precipitate suspended sediment before water is discharged into the watercourse. <b><i>See Chapter 4.5, Erosion and Sediment Control for more information.</i></b>	Best Practice
4.4.6 – 77	Stabilize erodible soils as soon as practical by seeding, spreading mulch, or installing erosion control blankets.	Best Practice
4.4.6 – 78	Inspect <i>erosion and</i> sediment control measures regularly and make necessary repairs immediately after damage has been discovered.	Best Practice
4.4.6 – 79	Maintain a supply of erosion control materials onsite, to facilitate a quick response to unanticipated storm events or emergencies.	Best Practice
4.4.6 – 80	When needed, utilize in-stream grade control structures to control channel scour, sediment routing, and headwall cutting.	Not a Best Practice

<b>Additional Practices proposed by NYDOT</b>		
4.4.6 – 81	To divert flowing water away from in-stream or streambank construction activity, where equipment access is available, place jersey barrier wrapped in plastic and reinforced with woven geotextile gravel-filled bags to prevent seepage at base.	Best Practice
4.4.6 – 82	To prevent the unintentional introduction of aquatic invasive animal species, such as zebra mussel, all water used for bridge washing shall be from the same stream or a public water supply source. See NYSDOT EPM Chapter 4.8.4- Invasive Species Control Practices for Maintenance and Construction: <a href="http://www.dot.state.ny.us/eab/epm/4-8atta4.pdf">http://www.dot.state.ny.us/eab/epm/4-8atta4.pdf</a>	Best Practice
4.4.6 – 83	To divert flowing water away from in-stream or streambank construction activity, where equipment access is not available, erect a temporary dam using prefabricated steel frame covered with waterproof fabric material reinforced with woven geotextile gravel-filled bags along base to prevent seepage.	Not a Best Practice
4.4.6 – 84	Whenever working in or near streams, wetlands, <i>storm drains</i> , or ditches; require vehicles and heavy equipment to carry a “ <i>Petropae</i> ” spill kit to contain and clean-up petroleum product spills. <i>Petropaes are custom spill kits that contain absorbent materials, booms, culvert plugs and putty, etc. and prominently display the state spill report hotline phone number on the outside. Each kit is about the size of a small suitcase and costs about \$75.00 depending on materials selected.</i>	Best Practice
4.4.6 – 85	Whenever working in or near streams, to prevent the unintentional introduction of invasive plant species through contaminated soil, all heavy construction equipment shall be cleaned to remove soil and plant parts from the bucket and tracks prior to arrival on-site. See USDA’s ‘Vehicle Cleaning Technology for Controlling the Spread of Noxious Weeds and Invasive Species’ and Chapter 4.1 of the NYSDOT Environmental Handbook for Transportation Operations.	Not a Best Practice

<b>Additional Practices proposed by NYDOT</b>		
4.4.6 – 86	Whenever working in or near streams, to prevent the unintentional introduction of invasive plant species, when restoring disturbed areas, do not use hay mulch. Use mulch from straw, wood fiber or paper.	Best Practice
4.4.6 – 87	To protect sensitive aquatic habitats, when removing small stands of invasive Japanese knotweed or phragmites, cut the stems by hand and inject herbicide into basil stem with hand syringe. Cut plant stems should be composted or disposed by burial or landfilling. See NYSDOT EPM Chapter 4.8.4- Invasive Species Control Practices for Maintenance and Construction: <a href="http://www.dot.state.ny.us/eab/epm/4-8atta4.pdf">http://www.dot.state.ny.us/eab/epm/4-8atta4.pdf</a>	Not a Best Practice
4.4.6 – 88	<del><i>Migratory bird nests typically may be found with eggs or unfledged chicks from April 15th to August 15th.</i></del> Bridges scheduled for rehabilitation or removal <del><i>during this time period</i></del> should be inspected for bird nesting activity prior to commencing any washing, painting, rehabilitation or construction activity. If the nest(s) is determined to be occupied, avoid disturbing, damaging or removing the nest until the young are fledged (leave the nest.) At no time should large nests of hawks, falcons or eagles be destroyed, as these species return to the same nest site year after year and reuse the same nest. Methods of preventing migratory bird nest construction, such as the use of tarpaulins installed before the beginning of nesting activity, should be considered in order to avoid construction or contract delays. If this method is used, tarps must be secured tightly so as to prevent entry into the underside of the bridge, and must not have any gaps, holes, or tears that would allow entry.	Best Practice

<b>Additional Practices proposed by NYDOT</b>		
4.4.6 – 89	To reduce potential flood damage to culvert and roadways due to beaver activities, installing bypass pipes (Water Level Control Devices, a.k.a. ‘WLCD’s’) through existing beaver dams and deep water fencing offer potential solutions. If persistent damage continues, trapping may be required in conjunction with the above mentioned practices. See Appendix S: Beaver Damage of the NYSDOT Guidance for the Adirondack Park: <a href="http://www.dot.state.ny.us/eab/greenbook.html">http://www.dot.state.ny.us/eab/greenbook.html</a>	Best Practice
4.4.6 – 90	Work with adjacent property owners along project sites which have a manageable invasive plant infestation beyond the ROW. Allowing access for removal of invasive species beyond the ROW will eliminate or reduce reoccurrence of infestation within the project area.	Remove from the Compendium
4.4.6 – 91	Driving live stakes deep into saturated soil in stream bank stabilization material (i.e.: riprap armor) increases the survivability and root development of the live stake vegetation, further stabilizing the slope in conjunction with mechanical means. Providing a spud hole, driving stake with a soft-blow hammer and cleanly trimming off top portion of the stake will increase the live stake survival.	Best Practice
4.4.6 – 92	Removing/ treating <i>priority</i> invasives and <i>noxious species</i> prior to stream access construction will reduce fragments entering water and aid in reducing the spread of invasives downstream.	Best Practice
4.4.6 – 93	<i>Where other practices are not appropriate</i> careful planning should be considered in the placement of filtration bags used to treat turbid water, in regards to ease of disposal and minimizing risk of impacts from accidental breakage. The filtration bags could either be placed in a location where they can be buried in place when full or they can be placed within a harness or on a platform, dump truck, flatbed trailer, etc. that can be easily picked up later without puncturing the bag. Filtration bags shouldn't be placed in/near stream channels where a bag failure would discharge lots of sediment.	Best Practice

<b>Additional Practices proposed by NYDOT</b>		
4.4.6 – 94	(Recommend for Chapter 2) With more efficient equipment, agencies and contractors face a greater risk of causing inadvertent environmental damage. Work practice training for streams and wetlands is a high priority. It consumes time and funding, yet such costs are reasonable compared to time and funding consumed if an agency violates mandates. The New York State Department of Transportation has a corps of Equipment Operator Instructors who instruct equipment users on proper operation and may address environmental considerations while working near streams. The Department partners with regulatory agencies, universities, environmental groups and nationally known experts (i.e.: Dave Derrick for stream restoration) for instruction on minimizing environmental impacts to wetlands and streams - - and enhancing such resources.	Best Practice

### **B.3 FINDINGS OF THE REDUCED SALT WORKING GROUP**

The results of the evaluation process are presented below. Because this section of the Compendium was on Strategic Planning, the Working Group decided that the practices should not be evaluated individually, but as part of a plan.

<b>Practice</b>		<b>Final Evaluation</b>
<b>Caltrans Salt Reduction Policy and Implementation</b>		Not a Best Practice
A.1	Requires transportation districts to develop specific route-by-route plans.	
A.2	In some areas salt is applied separately from abrasives in order to better control the location and application rate. This has proven to significantly reduce the amount of salt used.	
A.3	Through operator training and usage logs, the Department has significantly reduced the amount of applied deicing salt.	

<b>NYSDOT's Salt Reduction Strategy</b>		Not a Best Practice
B.1	NYSDOT has employed thorough management controls, keeping track of amount of salt delivered to sheds and the salt used on each beat, and doing calculations afterward to see if the agency is within established guidelines. If not, the first thing they check is the truck; if calibrations are on target, a supervisor has a discussion with the operator. With this system, NYSDOT does not have a problem with operator over-application.	
B. 2	Computerized on-board systems allow application at any rate, and take into account weather information.	
<b><u>PENNDOT District 10 Salt Management "After Action Reviews" and Annual Update of Salt Management Plan</u></b>		Best Practice
C. 1	All trucks are equipped with thermometers for informed decisions on application rates; equipment operators can make informed decisions on when to spread material because each truck has a thermometer that displays both air and road surface temperature.	
C. 2	<p><i>"After Action Reviews"</i></p> <p>The district has established application rate goals for different types of storms and different temperature ranges. PENNDOT's universal database from each snow event used to evaluate and compare application rates by district and by truck. Information from spreader controllers can be downloaded to a computer or output directly to a printer through a data port on the controller at the end of each shift. This information includes:</p> <ul style="list-style-type: none"> <li>Ø Types and amount of material spread</li> <li>Ø Miles spread</li> </ul> <p>Each operator keeps a written log of:</p> <ul style="list-style-type: none"> <li>Ø Routes spread at what time</li> <li>Ø Air and road temperatures</li> <li>Ø Type of storm</li> </ul>	
C. 3	<p>Update Salt Management Plan annually:</p> <ul style="list-style-type: none"> <li>Ø Analysis of prior year data</li> <li>Ø Revision of materials application charts and tracking sheets</li> <li>Ø Update of target application rates by snow lane miles per truck and charts to collect actual results</li> <li>Ø Equipment evaluation, calibration, repair, and purchasing plan</li> <li>Ø Update winter training plan</li> <li>Ø Training of equipment operators on application rates</li> </ul>	



<b>Ohio DOT Pretreatment, Weather, Decision-making and Routing System</b>		Not a Best Practice
D.1	Ohio DOT has a statewide initiative to reduce the amount of salt used to treat snow and ice conditions expanding anti-icing pre-treatment to a statewide level starting in 2002. Listed below are steps in the plan	
D.2	<ul style="list-style-type: none"> <li>Ø Create material matrix expressing relationship between pavement temperature and precipitation</li> <li>Ø Determine critical information for operational decisions, including surface condition, material freeze point, precipitation type and amount, wind direction and speed, and air temperature.</li> <li>Ø Perform research to determine most appropriate pavement sensors to measure freeze points</li> <li>Ø Optimize truck routing to reduce “dead-head time” where a truck must return empty to a yard to refill</li> <li>Ø Establish base line parameters for application rates, travel speed, and cycle time evaluation</li> <li>Ø Develop process for long-range planning from the computer truck routing parameters</li> </ul>	
	<ul style="list-style-type: none"> <li>Ø Include snow and ice procedures the Maintenance Manual</li> <li>Ø Develop equipment evaluation forms and process</li> <li>Ø Develop an equipment matrix listing basic units and auxiliary equipment</li> <li>Ø Evaluate use of friction device to monitor surface conditions</li> <li>Ø Use salinity device mounted on truck to determine surface freeze conditions</li> <li>Ø Evaluate use of Automated Vehicle Location (AVL) device to track vehicle location, monitor material application and record operational information</li> <li>Ø Validate material matrix and pretreatment plan including research for pre-treatment effectiveness</li> <li>Ø Deploy pavement sensors and weather devices statewide</li> <li>Ø Develop enhanced application to display pavement and weather information</li> <li>Ø Coordinate snow and ice operations through Central Radio Center for weather bulletins and condition alerts</li> <li>Ø Implement computer truck routing process and resource planning procedure for equipment and facility location and staffing</li> </ul>	

<b><u>Transportation Association of Canada Recommended Practices for Developing Salt Management Plan</u></b>		Best Practice
	<b>Current baseline/metrics for salt management practice and progress.</b> A situational analysis may include the following to allow the DOT to measure and track progress in managing the amount of road salt being placed into the environment:	
E.1	<p><b><i>Examination of On-Road Salt Use:</i></b></p> <ul style="list-style-type: none"> <li>Ø Type and amount of chloride freeze point depressant used (all sources including solids, liquids, and abrasive mixes).</li> <li>Ø Type and amount of non-chloride freeze point depressant used (all sources including solids, liquids, and abrasive mixes).</li> <li>Ø Current application rate for each type of material.</li> <li>Ø Percentage of fleet with pre-wetting.</li> <li>Ø Percentage of fleet with liquid only applications.</li> <li>Ø Percentage of fleet with electronic spreader controls.</li> <li>Ø Number of road weather information systems (RWIS) installations.</li> <li>Ø Number of other surface temperature measuring devices (hand-held or vehicle mounted).</li> <li>Ø Use of dedicated pavement and/or atmospheric forecasting</li> </ul>	
E.2	<p><b><i>Identification of Salt Vulnerable Areas:</i></b></p> <ul style="list-style-type: none"> <li>Ø Location of salt vulnerable areas</li> <li>Ø Description of winter maintenance practices in the vicinity of salt vulnerable areas (e.g. alternate treatment). Examples of possible salt vulnerable areas include: <ul style="list-style-type: none"> <li>- Groundwater recharge areas</li> <li>- Areas with exposed or shallow water tables with medium to high permeability soils</li> <li>- Sources of drinking water</li> <li>- Salt-sensitive vegetative communities</li> <li>- Salt-sensitive wetlands</li> <li>- Small ponds and lakes</li> <li>- Rivers with low flows</li> <li>- Salt-sensitive agricultural areas</li> <li>- Salt-sensitive habitats for species at risk</li> </ul> </li> </ul>	

E.3	<p><b><i>Evaluation of Sand and Salt Storage Sites:</i></b></p> <ul style="list-style-type: none"> <li>Ø Number and capacity of storage sites</li> <li>Ø Percentage of sand/salt piles covered and type of cover</li> <li>Ø Percentage of indoor loading</li> <li>Ø Management of drainage from sand/salt mix piles</li> <li>Ø Levels of environmental indicators (e.g. chloride levels)</li> <li>Ø Percentage of salt in winter sand</li> <li>Ø Percentage of sites with washwater treatment</li> <li>Ø Existence of a good housekeeping policy, and adherence to the policy</li> </ul>	
E.4	<p><b><i>Snow Disposal Sites:</i></b>(only necessary in the most snowy regions)</p> <ul style="list-style-type: none"> <li>Ø Number and capacity of disposal sites (permanent and/or temporary)</li> <li>Ø Levels of environmental indicators (e.g. chloride levels)</li> <li>Ø Percentage of disposal sites with water management systems</li> <li>Ø Conformance with existing environmental standards for snow disposal sites</li> <li>Ø Existence of a good housekeeping policy and adherence to the policy</li> </ul>	
E.5	<p><b><i>Training:</i></b></p> <ul style="list-style-type: none"> <li>Ø Training includes such on-the-job elements as preseason “dry runs.” Drainage facilities, wildlife crossing structures and other facilities requiring delineation or special treatment in plowing operations should be noted by foremen and equipment operators during dry runs of routes in the fall along with possible obstructions.</li> <li>Ø Percentage and frequency of staff receiving training in best salt management practices broken down into categories (e.g. managers, supervisors and operators)</li> </ul>	
E.6	<p>Compare current practices to best management practices and document the gaps. The salt management plan should focus on closing any gaps. The plan should include preseason, in-season, and post-season actions to be taken to reduce the adverse impacts of road salts. It should also include consideration of equipment, labor, materials, and the local climate.</p>	

E.7	<p>Clear tasks, schedules with milestones, budget considerations, and assign responsibilities for implementing best salt management practices. The plan will involve prioritizing in many cases. For example, spreaders on the highest salt routes or in proximity to vulnerable areas can be targeted first for replacement, and the most versatile mechanical removal equipment can be stationed where it will help lessen salt loadings.</p>	
E.8	<p><b>Documented policies, procedures, and guidelines</b> to introduce best salt management practices with both in-house and outsourced operations.</p> <ul style="list-style-type: none"> <li>Ø Level of service for each roadway type</li> <li>Ø Salt and sand application rates</li> <li>Ø Managed sand and salt storage</li> <li>Ø Good housekeeping practices for maintenance yards consistent with TAC’s Design and Operation of Road Maintenance Yards Synthesis of Best Practices</li> <li>Ø Equipment calibration &amp; re-calibration</li> <li>Ø Training</li> <li>Ø Snow disposal</li> <li>Ø Incorporation of salt management consideration into road design and construction</li> <li>Ø Salt vulnerable areas</li> </ul>	

E.9	<p><b>Monitoring, Record Keeping, Reporting &amp; Analysis</b></p> <p>Progress on implementation of the salt management plan can only be confirmed by tracking specific indicators and comparing these to the baseline that was benchmarked at the outset of the program.</p> <ul style="list-style-type: none"> <li>Ø Each salt management plan should assign responsibility for monitoring and reporting on implementation of the plan. These results should be reported annually to the senior executive responsible for the salt management plan.</li> <li>Ø The monitoring and record keeping system should document and assess the indicators identified in the situational analysis. Where there are new issues or activities being implemented as part of the salt management plan, new monitoring initiatives may be required. Any changes from the baseline established in the situational analysis need to be analyzed to assess the degree of progress being made. The analysis should also take into account the type of winter experienced to ensure that realistic conclusions are being drawn. For example, an increase in salt use may be due to an unusually severe winter rather than the failure of a plan.</li> <li>Ø Similarly, a reduction in salt use may be due to a milder than normal winter rather than the successful implementation of a plan. Therefore the analysis must be sufficiently in-depth to account for these variances. Where there are known releases to the environment being monitored (e.g. stormwater outfalls, water intakes, water treatment plants, monitoring wells, material storage sites or snow disposal sites), then these data should be included in the annual progress report.</li> </ul>	
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E.10	<p><b>Management Review</b></p> <p>Yearly review by senior management of results of the previous year’s salt management actions. If necessary, adjust the next year’s salt management plan to respond to shortcomings and new opportunities. Policies and procedures should be updated prior to the next snow and ice control season and communicated to management and operational personnel.</p> <p>This review should be integrated into the budgetary process to permit timely acquisitions of new equipment and to identify other funding needs, including:</p> <ul style="list-style-type: none"> <li>Ø Personnel commitments.</li> <li>Ø Review of organizational equipment needs and fleet management strategy, staying current with changes in the business.</li> <li>Ø A transition strategy to shift from the existing fleet to a new fleet that incorporates available technology. To gain experience in new methodology, new equipment may be assigned to preferred “champions” in the organization for demonstrated use on less significant roadways until there is confidence in the new practices.</li> </ul>	
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## B.4 DRAFT MATRIX FOR COMPENDIUM EVALUATION 4.1

### Section 4.1. General Construction Site Stewardship Practices

	<b>Practice</b>	<b>Environmentally Beneficial</b>	<b>Practical</b>	<b>Cost Effective</b>	<b>Best Practice</b>	<b>Acceptable</b>	<b>Unacceptable</b>	<b>Comments</b>
1.	Select the right equipment for the job.							
2.	Establish an emergency notification program.							
3.	Before beginning a project, conduct an on-site meeting [regarding emergency notification program].							
4.	At a minimum, include team members with vegetation, local climate, and soils knowledge.							
5.	Avoid earthwork in saturated soils.							
6.	When possible, schedule heavy equipment work during periods of low precipitation.							

	<b>Practice</b>	<b>Environmentally Beneficial</b>	<b>Practical</b>	<b>Cost Effective</b>	<b>Best Practice</b>	<b>Acceptable</b>	<b>Unacceptable</b>	<b>Comments</b>
7.	Develop and implement BMPs for mobile operations common to the construction of a project as well as the earthwork: include asphalt recycling, concrete mixing, crushing and the storage of materials, as appropriate to control the individual situations these mobile operations can create.							
8.	Inspect project work daily.							
9.	For E&S control: Round the top edge of a slope failure, which is often a vertical face. For project success, it is critical to address this “initiation point” or persistent source of erosion by removing or rounding off the slope overhang.							
10.	For E&S control: Smooth all eroding areas such as rills or gullies. In addition, prepare a seed bed by slightly <a href="#">roughening</a> Do this by raking across the slope face, not downhill.							



	<b>Practice</b>	<b>Environmentally Beneficial</b>	<b>Practical</b>	<b>Cost Effective</b>	<b>Best Practice</b>	<b>Acceptable</b>	<b>Unacceptable</b>	<b>Comments</b>
11.	For E&S control: Create <a href="#">terraces</a> when slopes exceed 35 percent. Dig these terraces 10 to 14 inches deep across the slope face. Horizontal spacing usually varies from 14 to 10 feet depending on conditions. The steeper the slope, the closer the terraces should be to one another. The objective is to accelerate establishment of plants by reducing the slope angle of the planted locations.							

# APPENDIX C NCHRP 25-25 TASK 29 PROBLEM STATEMENT

## RESEARCH PROBLEM STATEMENT NCHRP Project 25-25 Task 29

### BACKGROUND

State DOTs across the nation are improving the ways they protect and improve the environment while fulfilling their transportation missions. The Compendium of Environmental Stewardship Practices for Highway Construction and Maintenance (Compendium), produced under NCHRP 25-25 (4) in September 2004, represented an important step in expanding awareness of environmental stewardship in terms of specific practices and procedures as well as general policies and programs. The Compendium was well received as an encyclopedic compilation of current practice. This proposed project presents a plan to “mine” this encyclopedic compilation of practices to produce a library of vetted “best practices.”

This project will develop and initiate the implementation of a process for vetting the practices in the Compendium by conducting and reporting on the results of peer reviews by expert practitioners. The process will involve identifying leading experts in the wide variety of areas covered by the Compendium who will work with and through appropriate AASHTO committees, subcommittees, technical sections, and task forces as they review the material in the guide and reach their conclusions about which are worthy of designation as a “best practice.”

**Objective:** The objective of this project is to produce a library of best practices from the current volume of “Environmental Stewardship Practices, Procedures, and Policies in Construction and Maintenance” and initiate procedures for updating the Compendium on an ongoing basis.

The objective will be achieved by developing and implementing a process for review and assessment of practices documented in the Compendium by practice area experts working in consultation with appropriate AASHTO committees, subcommittees, and technical sections. Essentially the plan is to “screen” sections of the current Compendium to a best practices library by implementing a continuing process that would link the vetted sections to the AASHTO Center for Environmental Excellence’s (Center) website topic areas while keeping the Compendium current and available as a collection of “all practices”.

A Steering Group is recommended to oversee and guide the process, serving as the AASHTO coordinating and decision-making group for this effort. The Steering Group would have approval authority over the proposed review and vetting process, the identification of practice area peer reviewers, and the incorporation of resulting best practices into the guide. It is recommended that the Steering Group be comprised of leadership from the stakeholder AASHTO Committees and Sub-Committees who would be key participants by virtue of their areas of responsibility and expertise.

Practices included in the Compendium would be organized into major categories established to correlate with the topics of expertise of existing Sub Groups of key AASHTO Committees (such as the Standing Committee on the Environment, the Sub-Committee on Construction, the Sub-Committee on Maintenance, and the Sub-Committee on Materials.) A sample listing of such Sub-Groups is shown in the following table:

<b>AASHTO “Parent” Committee</b>	<b>Section or Task Force to Involve</b>
<i>Standing Committee on Highways</i>	
Sub-Committee on Maintenance	§ Roadside and Environment § Pavement § Snow & Ice § Bridges
Sub-Committee on Construction	§ Environment and Human Resources § Roadway § Structures
Sub-Committee on Materials	§ Pavement Serviceability § Environmental Quality § Quality Assurance
Sub-Committee on Design	§ Aesthetic Design § Design-Build § Environmental Design § Geometric Design § Highway Lighting § Hydrology & Hydraulics § Bike/Ped § Pavements § Facilities
Standing Committee on Environment	§ Natural Resources § Cultural Resources § Air Quality § Process and Streamlining
Standing Committee on Administration	§ Auditing § Information Systems
Standing Committee on Planning	§ Asset Management § Policy Analysis § Institutional Change

The established Sub-Groups, to be called Working Groups for this effort, will have responsibility in their areas of expertise for overseeing and conducting the processes approved by the Steering Group to identify from the myriad candidate practices in the Compendium those deserving the designation as “Best Practices.” Where additional resources and/or technical expertise are needed by a Working Group to properly evaluate and identify those that are “best processes,” they will have the flexibility within

guidelines established by the Steering Group to seek and include such resources and expertise - - typically from, but not necessarily limited to, AASHTO member departments and FHWA.

After reviewing and approving the proposed process for identifying best practices, the Steering Group would initially identify two (2) topic areas that would be the subjects of “pilot tests” of the process (in effect, vetting the vetting process.) Upon conclusion of the pilot tests, and following adjustments to the process as recommended by the affected Working Groups and as directed by the Steering Group, a proposed budget and schedule would be established for vetting additional practices in the compendium according to priorities that they will have set.

## **Tasks**

*Task descriptions are intended to provide a framework for conducting the research. The NCHRP is seeking the insights of proposers on how best to achieve the research objectives. Proposers are expected to describe research plans that can realistically be accomplished within the constraints of available funds and contract time. Proposals must present the proposers’ current thinking in sufficient detail to demonstrate their understanding of the problem and the soundness of their approach*

### **Task 1: Working with the project panel, a identify Steering Group to provide ongoing oversight and implementation of the practice vetting process.**

The Steering Group should be comprised of a manageable group of key AASHTO leaders, ideally around five to seven, including:

- Carlos Braceras, Chair, AASHTO Subcommittee on Maintenance, UDOT (Pavement, Bridge, Snow and Ice, and Environment and Roadsides Chairs of SOM Task Forces may also be necessary)
- Len Sanderson, Chair, AASHTO Subcommittee on Construction, NCDOT (Environment & HR and Roadway & Structures Technical Sections may be particularly relevant to this project)
- Gary McVoy, Chair, AASHTO SCOE Research and NCHRP 25-25 Series, NYSDOT
- Working with AASHTO’s Director of Environmental Programs and an AASHTO Engineer Representative, this initial group would serve as an organizing team and make decisions on others to invite.
- An appropriate SCOE representative
- An appropriate FHWA representative

### **Task 2: Steering Group reviews/modifies basic approach of the research, and identifies pilot practices.**

This proposed plan will be reviewed with the Steering Group and their feedback and modifications will be incorporated. Pilot practices will be identified to be used for testing and refining the approach with the appropriate Working Groups.

### **Task 3: Identify and approve practice area experts.**

The Working Groups will play the key role in identifying experts from within their ranks, from other AASHTO Groups or from member DOTs or FHWA, to participate on small teams of approximately three to five individuals to perform the review of specific practices. The consultant research team will be available to provide suggestions and support for the Working Group upon request.

### **Task 4: Expert Teams will review and rate current practices.**

Practices as presented in the Compendium will be forwarded to the Expert Teams by the consultant team for vetting. They will be asked to rate practices according to two designations indicated below:

Recognizing that a multitude of practices are listed in the Guide, and in an effort to gain maximum efficiency in meeting the objective of identifying best practices, it is recommended that each practice be classified into just one of two categories:

- Those practices which have been implemented by one or more DOTs and are viewed by all of the peer reviewers as likely to be sufficiently beneficial, practical, and cost-effective to warrant a rating as a best practice
- All other practices which for whatever reason fail to earn the rating by peer reviewers as a best practice

The Expert Teams will be asked to offer feedback and recommendations to the Steering Group on the effectiveness of the peer review process.

### **Task 5: Posting Best Practices on the Center for Environmental Excellence Website and Noting Best Practices in the Compendium**

The Working Group will provide Best Practices updates to the AASHTO Center for Environmental Excellence for the website, and for other dissemination as desired. Best Practices should be flagged in the website compendium as “peer reviewed” and designated a “Best Practice/” Category A “Best Practices” will be appropriately identified.

Expert Team members will also be asked to improve on best practice descriptions and identify additional practices in their specialty area that should be reviewed.

### **Task 6: Evaluate the review process and lessons learned.**

Ø Conduct periodic conference calls and meetings as needed with the Steering Group and Working Groups to discuss practices reviewed and lessons learned, and to reaffirm or revise process for future Expert Team reviews.

Provide a final report to Steering Group on the pilot process, including lessons learned, and recommendations for a revised process.

Receive direction from the Steering Group on the overall process and its implementation.

Develop and submit a long term plan for the ongoing maintenance of the Compendium on the AASHTO Center for Environmental Excellence website.

## **SPECIAL NOTES**

A. Proposals shall include a task-by-task breakdown of labor hours for each staff member as shown in Figure 5 in the brochure, "Information and Instructions for Preparing Proposals" (<http://www4.nas.edu/trb/crp.nsf> under "Current RFPs [Requests for Proposals]"). Proposals also shall include a breakdown of all costs (e.g., wages, indirect costs, travel, materials, and total) for each task.

B. Item 5 in the proposal, "Qualifications of the Research Team," must include a section labeled "Disclosure." Information relevant to the NCHRP's need to ensure objectivity and to be aware of possible sources of significant financial or organizational conflict of interest in conducting the research must be presented in this section of the proposal. For example, under certain conditions, ownership of the proposing agency, other organizational relationships, or proprietary rights and interests could be perceived as jeopardizing an objective approach to the research effort, and proposers are asked to disclose any such circumstances and to explain how they will be accounted for in this study. If there are no issues related to objectivity, this should be stated.

**Funds Available:** \$75,000

**Contract time:** 9 months (includes 1 month for the review and revision of the final report).

## APPENDIX D ADDITIONS TO THE ONLINE COMPENDIUM

The online Compendium has been enhanced to provide users with opportunities to contribute to its continued relevance. Four online forms have been created and linked to the Compendium: About Best Practices; Comment on Best Practices, Suggest Best Practices, and to Volunteer to Screen Best Practices. Samples of these forms are presented.

# AASHTO Center for Environmental Excellence

Environmental Stewardship Practices, Procedures, and Policies for Highway Construction and Maintenance

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[About Best Practices](#) | [Comment on Best Practices](#) | [Suggest A Best Practice](#) | [Volunteer to Vet Best Practices](#)



## About Best Practices

The Environmental Stewardship Practices in Construction and Maintenance Compendium includes thousands of individual practices used by DOTs across the country. Through a peer review vetting process, a number of practices in the Compendium have been identified as Best Practices. This vetting process is rigorous and it involves a team made up of a minimum of four, highly qualified and experienced practitioners ("Working Groups") who convene several times over the course of several months, typically via conference calls. A Steering Group provides oversight and guidance to the Working Groups.

The Working Groups are assigned to perform a detailed content review of "first tier" chapter levels (e.g., Section 8.3, Strategic Planning for Reduced Salt Usage). The Working Group members start by considering three evaluation criteria, which are "sufficiently beneficial, practical and cost-effective". Working Groups may modify, delete or add evaluation criteria to best fit their subject. Once the evaluation criteria are agreed upon, each member individually evaluates each practice using the evaluation criteria and a definitive rating system. A facilitator compiles, organizes, and summarizes the individual results. Working Group members then discuss and review the cumulative responses to reach consensus on Best Practices.

In a report to the Steering Group, Working Groups conclude their effort by distinguishing Best Practices from those that are not selected as "Best Practices", and by identifying any practices which they determine should be removed from the Compendium.

You can identify the vetted Best Practices by the [ ✓ ] icon. Look for the number of Best Practices to grow as AASHTO continues its review efforts of additional practices. You are encouraged to assist by providing your thoughts and ideas for Best Practices through the [Comments](#) link. All practitioners are encouraged to suggest additional environmental stewardship practices through the [Suggest a Best Practice](#) link. If you would like to volunteer to vet practices in your area of expertise, select the [Volunteer to Vet](#) link.

✓ = Best Practice

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http://aashtocenterforenvironmentalexcellence.com/onlinecompendium/tables/WJ06010101.htm



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[About Best Practices](#) | [Comment on Best Practices](#) | [Suggest A Best Practice](#) | [Volunteer to Vet Best Practices](#)



## Comment On Best Practices

\* Required Fields

Comment Subject:

Best Practice Section Title:

Compendium Section Number:

Comment: \*

First Name: \*

Last Name: \*

Agency/Organization:

E-mail: \*

Telephone:

Address:

City:

State:

Zip Code:

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### Suggest A Best Practice

\* Required Fields

Comment Subject:

Best Practice Title: \*

Where Practice is/was Used or Implemented: \*

Agency/Organization Responsible For Practice: \*

Related Web Address (if applicable):

First Name: \*

Last Name: \*

Agency/Organization:

E-mail: \*

Telephone:

Address:

City:

State:

Zip Code:

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## Volunteer to Vet Best Practices

\*Required Fields

Best Practice Topic Area :

Other:

First Name \*:

Last Name \*:

Agency/ Organization:

Area of Expertise:

Email\*:

Telephone:

Address:

City:

State:

Zip Code:

( \* ) Denotes Required Field

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http://www.aashtocenterforenvironmentalexcellence.com/compindex.asp?practices=47&DF=8461194

## APPENDIX E COMPENDIUM REVIEW STATUS SUMMARY

<b>NCHRP Compendium - Review Status Summary</b>							
<b>Chapter</b>	<b>Chapter Section</b>	<b>Description</b>	<b>Work Group Chair</b>	<b>Date Assigned for Review</b>	<b>Date Review Due</b>	<b>Date Review Complete</b>	<b>Comments</b>
1	N / A	<a href="#">Introduction and Research Approach</a>					
2	2.1	<a href="#">DOT Environmental Policies and Mission Statements</a>					
	2.2	<a href="#">Environmental Strategic Planning at Transportation Agencies</a>					
	2.3	<a href="#">Setting Objectives and Targets &amp; Tracking Environmental Commitments</a>					
	2.4	<a href="#">Environmental Management Systems - Benefits &amp; Approaches</a>					
	2.5	<a href="#">Operational Controls, Procedures, and Practices</a>					
	2.6	<a href="#">Measuring Environmental Performance</a>					
	2.7	<a href="#">Environmental Staffing, Roles, and Responsibilities</a>					
	2.8	<a href="#">Environmental Training and Certification</a>					
3	3.1	<a href="#">Beyond Mitigation: Projects to Achieve Environmental Goals</a>					
	3.2	<a href="#">Context Sensitive Design/Solutions</a>					
	3.3	<a href="#">Avoiding Impacts to Historic Sites</a>					
	3.4	<a href="#">Designing to Accommodate Wildlife, Habitat Connectivity, and Safe Crossings</a>					
	3.5	<a href="#">Culverts and Fish Passage</a>					
	3.6	<a href="#">Stream Restoration and Bioengineering</a>					
	3.7	<a href="#">Design Guidance for Stormwater and Erosion &amp; Sedimentation Control</a>					
	3.8	<a href="#">Drainage Ditches, Berms, Dikes, and Swales</a>					

## NCHRP Compendium - Review Status Summary

Chapter	Chapter Section	Description	Work Group Chair	Date Assigned for Review	Date Review Due	Date Review Complete	Comments
	3.9	<a href="#">Design for Sustainable, Low Maintenance Roadsides</a>					
	3.10	<a href="#">Designing to Reduce Snow, Ice, and Chemical Accumulation</a>					
	3.11	<a href="#">Designing to Minimize Air Quality Problems</a>					
	3.12	<a href="#">Design and Specification for Recycling</a>					
	3.13	<a href="#">Designing to Minimize Noise</a>					
	3.14	<a href="#">Lighting Control/Minimization</a>					
	3.15	<a href="#">Design for Sustainability and Energy Conservation</a>					
	3.16	<a href="#">Safety Rest Areas, Traveler Services, and Parking Area Design</a>					
4	4.1	<a href="#">General Construction Site Stewardship Practices</a>					
	4.2	<a href="#">Work Area</a>					
	4.3	<a href="#">Construction Involving Historic Properties and/or Other Cultural Resources</a>					
	4.4	<a href="#">Construction in and around Drainage Areas and Streams, Wetlands, and Other Environmentally Sensitive Areas</a>	Kyle Williams	Fall 2006	1/25/2007	1/25/2007	Completed as part of pilot study, NCHRP Task 29
	4.5	<a href="#">Erosion and Sedimentation Control</a>					
	4.6	<a href="#">Vehicle Fluid, Fuel, and Washwater Control</a>					
	4.7	<a href="#">Air Quality Control Practices</a>					
	4.8	<a href="#">Noise Minimization</a>					
	4.9	<a href="#">Materials Storage, Collection and Spill Prevention on Construction Sites</a>					
	4.10	<a href="#">Vegetation Management in Construction</a>					
	4.11	<a href="#">Soil Management in Construction</a>					
	4.12	<a href="#">Establishing Vegetation at Construction Sites</a>					

## NCHRP Compendium - Review Status Summary

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5	5.1	<a href="#">Preventative Maintenance and Pavement Management Systems</a>					
	5.2	<a href="#">Stormwater Management in Paving Operations, Grinding, and Pavement Maintenance</a>					
	5.3	<a href="#">Flexible Pavement/Asphalt</a>					
	5.4	<a href="#">Concrete Installation and Repair</a>					
	5.5	<a href="#">Pavement Marking</a>					
	5.6	<a href="#">Curb and Sidewalk Repair</a>					
	5.7	<a href="#">Recycling in Pavement and Roadside Appurtenances</a>					
	5.8	<a href="#">Maintenance of Dirt and Gravel Roads</a>					
6	6.1	<a href="#">Planning and Prioritizing Environmental Improvements at Maintenance Facilities</a>					
	6.2	<a href="#">Facility Housekeeping Practices</a>					
	6.3	<a href="#">Yard and Floor Drain Management</a>					
	6.4	<a href="#">Energy Conservation</a>					
	6.5	<a href="#">Under and Above-Ground Storage Tanks</a>					
7	7.1	<a href="#">Preventative Bridge Maintenance Practices</a>					
	7.2	<a href="#">Avoiding and Minimizing Impacts to Fish and Wildlife</a>					
	7.3	<a href="#">Enhancements to Bridges and Stream Access</a>					
	7.4	<a href="#">Bridge Painting/Coating/Sealing and Containment Stewardship Practices</a>					
8	8.1	<a href="#">Selecting Snow and Ice Control Materials to Mitigate Environmental Impacts</a>					
	8.2	<a href="#">Reducing Sand Usage and Managing Traction Materials</a>					
	8.3	<a href="#">Strategic Planning for Reduced Salt Usage</a>	Lee Wilkinson	Fall 2006	1/04/2007	1/04/2007	Completed as part of NCHRP Task 29

## NCHRP Compendium - Review Status Summary

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8	8.4	<a href="#">Stewardship Practices for Reducing Salt and Other Chemical Usage</a>					
	8.5	<a href="#">Winter Operations Facilities Management</a>					
	8.6	<a href="#">Training for Salt Management and Winter Operations</a>					
9	9.1	<a href="#">Inventory of and Management for Rare Species and Sensitive Resources in the ROW</a>					
	9.2	<a href="#">Growing Threats Drive Expansion of DOT Invasive Species Practice</a>					
	9.3	<a href="#">Practices for Prevention of Roadside Infestations</a>					
	9.4	<a href="#">Statewide Inventory of Invasive or Noxious Species in the ROW and Update of Databases</a>					
	9.5	<a href="#">Planning for Invasives Control</a>					
	9.6	<a href="#">Roadside Vegetation Control Methods and Resources</a>					
	9.7	<a href="#">Management of Visual Quality of the Roadside</a>					
	9.8	<a href="#">Staffing, Training, &amp; Partnerships</a>					
10	10.1	<a href="#">Environmental Enhancement Practices and Partnership Efforts</a>					
	10.2	<a href="#">Protection of Historic and Other Cultural Resources</a>					
	10.3	<a href="#">Maintenance in Wetlands</a>					
	10.4	<a href="#">Maintenance Near Waterbodies</a>					
	10.5	<a href="#">Maintenance of Structures for Wildlife</a>					
	10.6	<a href="#">Maintenance of Stormwater Facilities</a>					
	10.7	<a href="#">Maintenance of Roadside Public Facilities</a>					
	10.8	<a href="#">Management of Portable Sanitary/Septic Waste Systems</a>					
	10.9	<a href="#">Maintenance of Shoulders and Roadway Appurtenances</a>					
	10.10	<a href="#">Sweeping and Vacuuming of Roads, Decks, Water Quality Facilities, and Bridge Scuppers</a>					

## NCHRP Compendium - Review Status Summary

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10	10.11	<a href="#">Maintenance Stewardship Practices for Slopes, Drainage Ditches, Swales, and Diversions</a>					
	10.12	<a href="#">Erosion and Sediment Control in Maintenance</a>					
	10.13	<a href="#">Recycling in Roadside Maintenance Operations</a>					
	10.14	<a href="#">Preserving Air Quality in Maintenance and Operations</a>					
	10.15	<a href="#">Painting Operation Stormwater BMPs</a>					
	10.16	<a href="#">Road Waste Management</a>					
	10.17	<a href="#">Stockpiling, Spoil Disposal or Placement of Inert Fill</a>					
	10.18	<a href="#">Maintenance of Soils</a>					
	10.19	<a href="#">Emergency Actions</a>					
	10.20	<a href="#">Field Review of Roadside Maintenance Operations</a>					
11	11.1	<a href="#">Florida DOT Environmental Policy</a>					
	11.2	<a href="#">Kentucky Transportation Cabinet Environmental Policy</a>					
	11.3	<a href="#">Maine Dot Environmental Policy</a>					
	11.4	<a href="#">North Carolina DOT Environmental Stewardship Policy</a>					
	11.5	<a href="#">PennDOT's Green Plan Policy Statement</a>					
	11.6	<a href="#">Washington State Dot Environmental Policy</a>					
	11.7	<a href="#">New South Wales Roads and Traffic Authority Environmental Policy</a>					
	11.8	<a href="#">Texas Environmental Commitment Checklist</a>					
	11.9	<a href="#">Maine DOT Environmental and Safety Auditing Policy and Procedure</a>					
	11.10	<a href="#">Maine DOT Corrective Action Request Form</a>					
	11.11	<a href="#">Mass Highway Compliance Tracking Methods</a>					
	11.12	<a href="#">Mass Highway Compliance Tracking Roles and Responsibilities</a>					
	11.13	<a href="#">Mass Highway Self-Audit Procedure</a>					



## NCHRP Compendium - Review Status Summary

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11	11.14	<a href="#">Mass Highway Facility Self-Audit Checklist</a>					
	11.15	<a href="#">Mass Highway Environmental Roles &amp; Responsibilities</a>					
	11.16	<a href="#">Mass Highway Environmental Section EMS Roles and Responsibilities</a>					
	11.17	<a href="#">Mass Highway Operations Division EMS Roles and Responsibilities</a>					
	11.18	<a href="#">Mass Highway District EMS Roles and Responsibilities</a>					
	11.19	<a href="#">Mass Highway Training Expectations By Role</a>					
	11.20	<a href="#">Mass Highway Environmental Training Program Roles and Responsibilities</a>					
	11.21	<a href="#">PennDOT District 10 SEMP Responsibility Table</a>					
	11.22	<a href="#">PennDOT District 10 SEMP Training Table</a>					
	11.23	<a href="#">NYSDOT Construction/Environmental Training Schedule</a>					
	11.24	<a href="#">Environmental Checklist for MoDOT Facilities</a>					
	11.25	<a href="#">PennDOT Stockpile Quality Assurance Responsibilities</a>					
	11.26	<a href="#">PennDOT 15-Minute Stockpile Walkaround</a>					
	11.27	<a href="#">PennDOT Stockpile Snapshot</a>					
	11.28	<a href="#">PennDOT Maintenance Stockpile Activity Protocol</a>					
	11.29	<a href="#">PennDOT Post-Storm Salt Management Tracking Responsibilities</a>					
	11.30	<a href="#">Risk, Compliance Issues, and Management Examples for Highway-Generated Waste - Oregon DOT</a>					
11.31	<a href="#">NYSDOT-DEC Deer Carcass Composting – Practice Guidelines</a>						
11.32	<a href="#">NYSDOT’s Draft Metric for Assessing Performance of Integrated Vegetation Management on ROW</a>						
11.33	<a href="#">NCDOT Roadside Vegetation Management Guidelines in Marked Areas</a>						

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11	11.34	<a href="#">Invasive Species Coordination and Control DOT Resources</a>					