

**IDENTIFYING BRIDGE MAINTENANCE
AND PRESERVATION ACTIONS
WHICH MINIMIZE ENVIRONMENTAL IMPACT**

FINAL GUIDELINES

Prepared for:

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Disclaimer

The opinions and conclusions expressed or implied are those of the research agency that performed the research and are not necessarily those of the Transportation Research Board or its sponsoring agencies. This report has not been reviewed or accepted by the Transportation Research Board Executive Committee or the Governing Board of the National Research Council.

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Abstract

Environmental guidelines for bridge maintenance and preservation activities across the range of environmental concerns under a variety of threshold conditions have been developed through literature survey, survey, interview, and expert consensus. Additional detail on impacts, permitting, mitigation, and state by state practices is arrayed in a Decision Aid Table (DAT) summary spreadsheet featuring links to source documents and contact information. The guidelines recommend incorporation of environmental factors into staff training, asset management, operational planning, and quality assurance together with real time access to environmental expertise as needed. Bridge owners are encouraged to review these guidelines to identify opportunities for improvement, and to use the DAT for benchmarking. Others, including managers, field supervisors, and environmental professionals can use the Guidelines, DAT, and the separate Final Research Report as a compendium of best practices.

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Executive Summary

As detailed in the *NCHRP Project No. 20-07/Task 399 Final Report on Identifying Bridge Maintenance and Preservation Actions Which Minimize Environmental Impact*, environmental guidelines for bridge maintenance and preservation have been developed for the activity categories listed below. The guidelines are offered as a point of departure for improving environmental performance under the unique environmental, regulatory, and institutional factors at play in each locality for the range of specific maintenance and preservation activities under consideration.

Environmental guidelines for specific individual bridge maintenance and preservation activities for a range of environmental concerns under a variety of threshold conditions are broken out in tabular format and discussed under category headings. Additional detail on practices, impacts, and mitigation is contained in [Chapter 3: Decision Aid Table \(DAT\)](#) / summary tab; and state-by-state specifics are offered under their respective DAT / state tabs.

The DAT is offered as a tool for bridge owners, maintenance engineers, and their immediate staff for benchmarking their environmental practices for their bridge maintenance and preservation activities - while also providing managers, field supervisors, and environmental professionals with a useful reference/guide.

Bridge owners are encouraged to review these guidelines to identify opportunities for improvement and to use the DAT to benchmark their processes against those employed by others.

Bridge maintenance and preservation activity categories, as classified:

- **Approach and Embankment Work** including bridge and approach rail repair, repairing paved slope protection, attenuator upgrade, leveling/lifting/stabilization in approach pavement or slabs, cut relief joints in approach pavement, site vegetation control, soil stabilization
- **Channel Work** including scour protection and repair of existing riprap or stone and relocation of woody material or sediment removal
- **Culverts** including liners and invert installation, repair, and installation of fish weirs
- **Deck Work** including pavement and deck maintenance including joint repair along with practices such as sealing, deck pavement overlay
- **Bridge Cleaning** including sweeping, vacuuming, using compressed air or water, and with all the complexities associated with bridge cleaning and washing activities for decks, beam/girders and substructures
- **Substructure Work** including temporary support, concrete surface repairs, shotcrete repairs, sealing, general repair, epoxy injection, foundation repair, Bonded Fiber Reinforced Polymer (FRP), bird netting and other deterrent devices
- **Superstructure Work** including painting and paint removal, general repair and member replacement, bearing and anchor bolt work, utilities, signs, mechanical / electrical repairs

Environmental performance for all these categories hinge on the appropriate application of the following general practices:

- Provide field staff with environmental training including information on regulations and permitting requirements that have a bearing on their work.
- Equip staff with information on sensitive resource locations including protected species habitat, wetlands, sensitive waters, historic designations, etc.
- Incorporate environmental / regulatory factors in operational planning so that potentially disruptive operations do not unwittingly occur in environmentally sensitive locations during sensitive time periods.
- Include environmental / regulatory factors in quality assurance procedures.
- Be sure that field staff have ready access to environmental professionals and are prepared to use the chain of command as questions arise.

Chapter 1: Practice Specific Environmental Guidance for Bridge Maintenance and Preservation Activities

With established procedures in place and some fifty different examples from which to benchmark, bridge practitioners are encouraged to “shop widely” in considering how to improve the effectiveness and efficiency of their bridge maintenance and preservation environmental practices. In most cases it should be possible for individual states to review the practices employed by similar and neighboring states - and ideally to discuss these with the peers listed as contacts. That said, the following guidelines are offered to the industry as a point of departure for improving environmental performance under the unique environmental, regulatory, and institutional factors at play in each locality for the range of specific maintenance and preservation activities under consideration.

1.1 General Bridge Maintenance Environmental Practices

Environmental orientation and training of bridge staff so that they can appreciate the whys and wherefores of environmental protection and stewardship is essential for the development of a culture of environmental responsibility, and the avoidance of impacts due to simple ignorance.

An array of selected general training and orientation examples is shown in Table 1. The Decision Aid Table (DAT) summary tab in Chapter 3 goes on to present leading examples of Training; Goals and Policies; Management Systems, Reporting, and Q/A; Enhancement/Stewardship; and General Guidance and Support for adoption and modification as needed.

Staff training and orientation are considered essential for successful application of all the recommended consensus guidelines.

Consensus Recommendations for General Bridge Maintenance Environmental Practices:

1. Provide field staff with environmental training including information on regulations and permitting requirements that have a bearing on their work.
2. Equip staff with information on sensitive resource locations including protected species habitat, wetlands, sensitive waters, historic designations, etc.
3. Incorporate environmental/regulatory factors in operational planning so that potentially disruptive operations do not unwittingly occur in environmentally sensitive locations during sensitive time periods.
4. Include environmental/regulatory factors in quality assurance procedures.
5. Be sure that field staff have ready access to environmental professionals and are prepared to use the chain of command as questions arise.

Table 1. The General Bridge Maintenance Environmental Area of the DAT, with Bullets Indicating Links to Data
[\(Press Ctrl+Click here to access full DAT\)](#)

| | Environmental and Regulatory Factors | | | | | | Information | | | | | | Additional | |
|---|--|-----------------------|--------------------|---------------------------|-------------------|-------------------------------------|-------------------------|--------------------|------------------|------------------------|-------------------|----------------------|-----------------------|-----------------------------|
| | Environmental impacts of maintenance measure (typical) [assumed trigger for impact] | | | | | | Typical Env. measures** | Federal Permitting | State Permitting | Procedures by location | Specs by location | Training by location | Additional References | Additional Notes & Contacts |
| | Air [none] | Noise [people nearby] | Water [near water] | Habitat [species present] | Waste [generated] | Human env. with historic [eligible] | | | | | | | | |
| General Bridge Maintenance Environmental | | | | | | | | | | | | | | |
| Training | • | | • | • | • | | • | • | • | • | • | • | | |
| Goals and Policies | • | • | • | • | • | • | • | • | • | | | • | | |
| Management Systems, Reporting, and Q/A | • | | | • | | | | • | • | | | • | • | |
| Enhancement/Stewardship | | | • | • | • | • | • | • | • | | | • | | |
| General Guidance and Support | • | • | • | • | • | • | • | • | • | • | • | • | • | |

Goals and policies such as those linked above can aid in the delivery of efficient bridge maintenance and preservation by not only mitigating environmental impacts, but also by reducing the administration and approval processing that might otherwise be required by permitting authorities. To quote a former NYSDOT bridge maintenance manager,

“... NYSDOT has a Memo of Understanding with DEC for common activities. The MOU would list or reference specifications outlining the dos and don’ts that may be involved in those actions. Common BM actions included are bridge washing, paint removal, and scour remediation. The MOU allows NYSDOT to proceed with this type of work without getting a site-specific permit. In many other states however, the DOT is required to have a permit for each action and each site. ”

Again, further details may be found in Chapter 3: Decision Aid Table.

To illustrate how the DAT functions, clicking on row “Goals and Policies” and column “Procedures by location” will hyperlink to a source document; while “mouse over” this same cell will display more abbreviated commentary. In this case:

Maintenance of Structures Chapter 5, WSDOT Maintenance Manual M 51-01.06 Page 5-5

“Environmental Aspects”

WSDOT environmental staff will provide Maintenance Engineers, Area Superintendents and Maintenance Supervisors with training and education on which regulations apply to specific maintenance activities and what is the appropriate response to the regulatory process. In addition to federal regulations, state environmental agencies, tribes and city or county health ordinances may have environmental restrictions on work done on or near bridges. Before initiating bridge repair activities, the Maintenance Engineer, Superintendent, or Supervisor will confirm if environmental permits are required. They will also review the proposed repair method with the environmental staff to determine whether it is both appropriate and/or environmentally sound. The following list provides some of the environmental concern factors that impact bridge maintenance in some localities. This list is not comprehensive or current because the list of environmental factors to be considered continues to change. However, it does provide some insight into the degree to which maintenance is being held to an increasing level of environmental accountability.

- *State or federal list of threatened or endangered species*
- *Species of high interest to state or federal agencies*
- *Migratory waterfowl habitat*
- *Anadromous fish habitat*
- *Trout and other cold water fish habitat*
- *Habitat for birds of prey (Must have Bridge and Structures approval to attach platform, boxes or any other structure to any part of a bridge)*
- *Wetlands and wetland habitat*
- *Riparian habitat*
- *Migratory corridors*
- *Wintering areas and other critical feeding areas of wildlife*

- *Important wildlife reproductive habitat*
- *Public water supplies, including important aquifers*
- *Islands and other coastal barriers*
- *Hazardous waste*
- *Regulatory flood ways and other flood plain areas*
- *Commercial fish and shellfish production areas*
- *Important sport fishing areas*
- *Highly erosional soils*
- *Listed or proposed wild and scenic rivers*
- *Navigable waterways*
- *Significant historic resources*
- *Natural resource agency holdings or interests (refuges, parks, habitat areas, etc.)*

The Bridge and Structures Office is concerned with the placement of temporary or permanent wildlife habitat structures (peregrine falcon platforms, bat boxes, etc.) on state bridges due to their potential negative impact to inspections of all bridges in accordance with the federally-mandated National Bridge Inspection Standards and the potential negative affects to maintain the bridge structure itself. The Bridge and Structures Office discourages the practice of placing these habitat structures on state bridges.

Therefore, all plans to place temporary or permanent wildlife habitat structures on state bridges are to be reviewed by the Bridge Preservation Engineer. This is consistent with the review process for all other attachments to bridges. Maintenance agreements established with any regulatory agency that includes bridges must have approval from the Bridge and Structures Office. Agreements that define or limit access to a bridge due to the Endangered Species Act, affect inspections and repairs.”

1.2 Approach and Embankment Work

Approach and Embankment Work includes pavement and approach roadway maintenance along with practices such as sealing, pavement overlay, truing and leveling of approach slabs, and guardrail repairs. These practices tend to be of relatively minor environmental concern under normal conditions; however, they can impact protected species through vegetation removal, present a public hazard from improper use of herbicides, and/or cause water pollution from soil stabilization, careless use of wedging foam, or mud jacking during truing and leveling operations.

As described in Table 2 and further detailed in the DAT, environmental guidelines for approach and embankment work are recommended based on the following general findings:

1. Air
 - Generally, not a serious concern, unless the activity is particularly likely to generate dust or involve the use of volatile sealants. Air quality permitting is not typically required, and mitigation limited to dust control.

2. Noise

- Field crews should be sensitive to the presence of residences, schools, community centers, and sensitive wildlife habitat if noisy operations like demolition, stump grinding/brush clearing, or pavement grinding/milling are anticipated. High-pitched noises generated by drilling, chipping and chain saw use are of particular concern near bird nesting areas. Otherwise, these practices tend to have only minor, temporary impacts on ambient noise. Noise regulations are generally not an issue and mitigation a matter of timing and equipment selection.

3. Water

- If the activities are taking place over or near water bodies the potential for impacts from discharge of sediment or waste should be assessed. Waste discharge into waterbodies generally triggers permit requirements and “best practices” are required to mitigate impacts.

4. Habitat

- Unless there are sensitive habitat locations in the immediate vicinity, or accidental discharge to sensitive water courses, impacts to terrestrial or aquatic flora and fauna should not be of concern for activities on paved surfaces. However, vegetation maintenance and removal, particularly during the spring and early summer, can disrupt protected wildlife. Presence of wildlife can trigger permit requirements and the need for consultation with environmental experts on appropriate mitigation.

5. Waste

- Activities such as pavement grinding/milling, sweeping and washing can generate significant volumes of waste that require appropriate permitting, handling, recycling, and/or disposal if significant impacts are to be avoided. Similarly, potentially hazardous or toxic materials used in sealing applications must also be handled in accordance with approved procedures.

6. Human Environment including Historic

- Standard safety and access controls can generally ensure public safety and access during deck and approach work. For structures eligible for state and national historic registers, normal bridge preservation activities tend to be allowed albeit with prior notification, but activities such as upgrading guide rail may require site specific consultation and approval from the State Historic Preservation Officer (SHPO).

A leading example of effective and efficient environmental measures is found in [Chapter 7 Maintaining the Bridges, from *Water Quality and Habitat Protection Manual for County Road Maintenance from the Five Counties Salmonid Conservation Program of Northern California*](#). Links to detail on other leading examples are provided in Table 2 and the DAT Summary Tab.

Consensus Guidelines for General Approach and Embankment Work follow:

1. Provide field staff with environmental training so that accidental spills are properly handled and inadvertent misuse of hazardous materials is prevented.
2. Screen work locations including access facilities for the presence of sensitive resources such as rare or endangered species, wetlands and water bodies, or significant cultural resources.
3. Include environmental factors in quality assurance procedures and reviews.
4. Be sure that field staff have ready access to environmental professionals as questions arise and use the chain of command as questions arise.

Color coded detail on the impacts of specific approach and embankment work practices, keyed to mitigation measures, is contained in Table 2. Further detail on impacts and mitigation along with state-by-state specifics may be found in the DAT itself.

NCHRP Project 20-07/Task 399
 Identifying Bridge Maintenance and Preservation Actions Which Minimize Environmental Impact
 Task 6. Final Guidelines

Table 2. Summary of Impacts and Mitigation Recommendations for Approach and Embankment Work
[\(Press Ctrl+Click here to access full DAT\)](#)

| | | | Environmental and Regulatory Factors | | | | | | Information | | | | | | Additional | |
|--|--|--------------------------------------|--|-------------------|-------------------------------------|---|---|---|-------------------------|--------------------|------------------|------------------------|-------------------|----------------------|-----------------------|-----------------------------|
| | | | Environmental impacts of maintenance measure (typical) [assumed trigger for impact] | | | | | | Typical Env. measures** | Federal Permitting | State Permitting | Procedures by location | Specs by location | Training by location | Additional References | Additional Notes & Contacts |
| Air [none] | Noise [people nearby] | Water [near water] | Habitat [species present] | Waste [generated] | Human env. with historic [reliable] | | | | | | | | | | | |
| Bridge Maintenance Practice Specific Information | | | Environmental impact rank (typical) Rank 1-5 in order of increasing severity (see table below) | | | | | | | | | | | | | |
| Activity | Benefit | Sub category (if any) | | | | | | | | | | | | | | |
| Bridge and Approach Rail repair | Restore traffic safety | Patch spall | 1 | 2 | 1 | 2 | 2 | 2 | a,b | | | • | | | • | |
| | | Replace corroded metal rail elements | 1 | 2 | 1 | 2 | 2 | 2 | a,b | | | | | | | |
| | | Impact damage repair | 1 | 2 | 1 | 2 | 2 | 2 | a,b | | | | | | | |
| Repairing Paved Slope Protection | Restore slope embankment protection and stability | See Repairing Erosion or Scour | | | | | | | | | • | | | • | | |
| Attenuator Upgrade | Replace non-standard attenuator for traffic safety | | 1 | 2 | 2 | 2 | 2 | 4 | a,b | | | | | | | |

| | | | | | | | | | | | | | | | | |
|--|---|------------------|---|---|---|---|---|---|---------------------------|--|----------|----------|----------|----------|----------|--|
| Leveling/Lifting/Stabilization (e.g., wedging, foam or mudjacking) in Approach Pavement or Slabs | Restore traffic safety | | 1 | 2 | 4 | 3 | 4 | 1 | a,b,c | | | <u>•</u> | | | | |
| Cut Relief Joints in Approach Pavement | Reduce potential for approach pavement, bridge joint, and bridge deck overstress | | 2 | 2 | 2 | 2 | 2 | 1 | a,b | | | | | | | |
| Site vegetation control | Prevent root growth damage to nearby bridge components. Depending on roadway geometry may maintain proper sight distances for traffic safety. | Mowing | 2 | 2 | 2 | 4 | 2 | 2 | a,b,c | | | <u>•</u> | | <u>•</u> | | |
| | | Pruning | 1 | 2 | 3 | 3 | 2 | 2 | a,b,c | | | <u>•</u> | | <u>•</u> | | |
| | | Physical removal | 1 | 2 | 3 | 4 | 2 | 4 | a,b,c | | <u>•</u> | <u>•</u> | <u>•</u> | <u>•</u> | <u>•</u> | |
| | | Herbicide | 1 | 1 | 5 | 5 | 5 | 3 | a,b,c,d,e | | <u>•</u> | <u>•</u> | <u>•</u> | <u>•</u> | | |
| Soil Stabilization (e.g., polyurethane grout injection) | Restore or maintain pavement stabilization for traffic safety | | 2 | 2 | 4 | 3 | 4 | 1 | a,b,c | | | <u>•</u> | | | | |

1.3 Channel Work

Clearly any work in or near a stream channel brings with it the potential for environmental impacts to water and aquatic habitat. As described in Table 3 and further detailed in the DAT, the following general recommendations are suggested based on the following general findings:

1. Air quality
 - Impacts do not generally constitute a major concern barring the impacts of dust generated by major demolition activities. Air permits and mitigation are usually not a major concern.
2. Noise
 - Impacts do not generally constitute a major concern barring the impacts of major demolition activities near sensitive receptors. Still, field crews should be sensitive to the presence of residences, schools, community centers, and sensitive wildlife habitat if noisy operations like demolition, stump grinding/brush clearing, or pavement grinding/milling are anticipated. High-pitched noises generated by drilling, chipping and chain saw use are of particular concern near bird nesting areas. Otherwise, noise regulations are generally not an issue and mitigation is a matter of timing and equipment selection.
3. Water
 - Impacts are of concern for work over, in, or near waterbodies or wetlands. Consultation with environmental staff, field staff training, resource screening, and avoidance and minimization practices are highly recommended for impact reduction. Note that in water/wetland work or discharge often, if not always, requires an individual or general permit from state and/or federal authorities. More detail on both these concerns may be found in the DAT links.
4. Habitat
 - While not as common as water impacts, work in or near water bodies can easily disrupt local flora and fauna, promote the spread of invasive species, affect fish spawning, or even impact endangered species. Attention should be given to potential impacts to aquatic bed and bank habitat for fish and macroinvertebrates. Consultation with environmental staff, field staff training, resource screening, and avoidance and minimization practices are highly recommended for impact reduction and regulatory compliance.
5. Waste
 - Normal safeguards tend to prevent waste impacts from stream channel work. However, since these activities can involve excavation and/or spoil material; caution for the avoidance of fill placement in waters or wetlands is recommended.
6. Human Environment including Historic

- Standard safety and access controls can generally ensure public safety and access for substructure work. However, if the bridge is eligible for the state or National Register of Historic Places, normal repairs and preservation activities tend to be allowed albeit with prior notification, but activities such as replacement of structural members usually require site specific consultation and approval from the State Historic Preservation Officer (SHPO).

A leading example of effective and efficient environmental measures may be found in [A Programmatic Approach to Long-Term Bridge Preventive Maintenance Kentucky Transportation Center](#), Wells, D., Meade, B., Hopwood II, P.E. Theodore, and Pale, S., KTC-16-22/SPR15-504-aF, 2017. Among the recommendations in this reference, the reader will be advised to:

- Obtain necessary approvals prior to beginning work.
- Work only during no-flow or low flow periods unless it is an emergency.
- If possible, work from the roadway and avoid using equipment in the stream.
- Access the stream at one location and use the one-step method if equipment is placed in the stream.
- Use channel lining around bridge elements and culvert footings to minimize erosion.
- Excavate as needed, then use concrete to supplement existing footing.
- Use geotextile fabric for erosion control in the trench and on the embankment slope.
- Use A-Jacks to encourage sediment deposition in scour holes.
- Do not bring equipment into the stream unless it is necessary.
- Do not use bulldozers in the stream without approval from the USACE or KDOW.
- Do not remove streambank vegetation unless necessary.
- If equipment is placed in the waterbody, use one access point to the stream.
- If needed, revegetate disturbed streambanks following guidelines in the *Kentucky Erosion Prevention and Sediment Control Field Guide*.
- If there is the potential for sediment entrainment from disturbed soils, use sediment barriers.

Links to detail on specifications and state specific procedures for avoidance of stream impacts may also be found in the individual state DAT tabs.

Consensus Guidelines for Channel Work in general follow:

1. Provide field staff with environmental training so that in and near water work employs best practices and in no instance, takes place without proper approval.
2. Screen work locations including access facilities for the presence of sensitive resources such as rare or endangered species, wetlands and water bodies, or significant cultural resources.
3. Ensure that equipment and materials are suited to environmental circumstances.

4. Include environmental factors in quality assurance procedures and reviews.
5. Be sure that field staff have ready access to environmental professionals as questions arise and use the chain of command as questions arise.

Color coded detail on the impacts of specific channel practices, keyed to mitigation measures, is contained in Table 3. Further detail on impacts and mitigation along with state-by-state specifics may be found in the DAT.

Table 3. Summary of Impacts and Mitigation Recommendations for Channel Work

[\(Press Ctrl+Click here to access full DAT\)](#)

| Bridge Maintenance Practice Specific Information | | | Environmental and Regulatory Factors | | | | | | Information | | | | | Additional | | |
|---|--|--|--|-----------------------|--------------------|---------------------------|-------------------|-------------------------------------|-------------------------|--------------------|------------------|------------------------|-------------------|----------------------|-----------------------|-----------------------------|
| | | | Environmental impacts of maintenance measure (typical) [assumed trigger for impact] | | | | | | Typical Env. measures** | Federal Permitting | State Permitting | Procedures by location | Specs by location | Training by location | Additional References | Additional Notes & Contacts |
| | | | Air [none] | Noise [people nearby] | Water [near water] | Habitat [species present] | Waste [generated] | Human env. with historic [eligible] | | | | | | | | |
| Activity | Benefit | Sub category (if any) | Environmental impact rank (typical) Rank 1-5 in order of increasing severity (see table below) | | | | | | | | | | | | | |
| Scour Protection Repair (e.g., repair existing riprap or stone) | Restore or maintain streambed and bank stabilization for protecting stability of bridge and traffic safety | | 1 | 2 | 5 | 5 | 3 | 3 | a,b,c,d,e | | | • | | | • | |
| Native Streambed Material Erosion or Scour Repair, including relocation of Large Woody Material and/or Sediment Removal | Restore or maintain streambed and bank stabilization for protecting stability of bridge and traffic safety, as well as maintain aquatic habitat conditions | Erosion control | 1 | 2 | 4 | 3 | 3 | 2 | a,b,c | | • | • | • | | • | |
| | | Build site access | 2 | 4 | 4 | 5 | 3 | 4 | a,b,c,d,e | | | | | | | |
| | | Cofferdam, turbidity curtain, etc. | 1 | 2 | 4 | 5 | 3 | 4 | a,b,c,d,e | | | | | | | |
| | | Debris, nuisance fauna (e.g., beaver) removal, grading, excavation, fill, etc. | 2 | 3 | 4 | 5 | 3 | 4 | a,b,c,d | | • | • | • | | • | |
| | | Repair/Install countermeasures | 2 | 2 | 4 | 5 | 3 | 4 | a,b,c,d | | | • | | | • | • |
| | | Restore site | 2 | 4 | 3 | 5 | 3 | 4 | a,b,c,d,e | | | | | | | |

1.4 Culvert Work

Since culverts are typically designed to pass water, all the safeguards and impacts associated with substructure work in water apply. In addition to these concerns, access to the culvert and the potential for fish and other wildlife passage and habitat issues require diligence if impacts are to be avoided. As described in Table 4 and further detailed in the DAT, the following general recommendations are suggested based on the following general findings:

1. Air
 - Impacts tend not to be a concern. Air quality permitting is not typically required, and mitigation limited to dust control.
2. Noise
 - Impacts do not generally constitute a major concern barring the impacts of major demolition activities near sensitive receptors. Still, field crews should be sensitive to the presence of residences, schools, community centers, and sensitive wildlife habitat if noisy operations like demolition, stump grinding/brush clearing, or pavement grinding/milling are anticipated. High-pitched noises generated by drilling, chipping and chain saw use are of particular concern near bird nesting areas. Otherwise, noise regulations are generally not an issue and mitigation a matter of timing and equipment selection.
3. Water
 - Impacts can be of significance especially for sensitive streams. Screening, training, and avoidance and minimization practices are highly recommended for impact reduction. By its nature culvert work tends to be “in water” work requiring the application of best practices for mitigation. In most states, permits - some of them general, and others site specific - are generally required for any in water work.
4. Habitat
 - Culverts are important conduits and habitats for both aquatic and terrestrial wildlife. They can be barriers to fish passage and/or critical portals for the movement of herptiles (i.e., reptiles and amphibians). Thus, culvert retrofits are often viewed as opportunities for habitat improvement, and permit conditions often reflect this potential. In addition to direct impacts from culverts and culvert work, construction of access to culverts can also have significant impacts to both terrestrial and aquatic habitats. In any event, culvert use by wildlife can trigger permitting requirements and the need for consultation with environmental experts on appropriate planning and mitigation.
5. Waste
 - Culvert work can generate waste material requiring approved handling as with other practices.

6. Human Environment including Historic

- With notable exceptions, access and safety tend not to be unusually difficult for culvert work. While few culverts have been nominated for historic registers, hand constructed stone culvert headwalls may be considered eligible and maintenance staff should consult with experts as questions arise.

A leading example of effective and efficient environmental measures may be found in the Georgia Department of Transportation Bridge *Structure Maintenance And Rehabilitation Repair Manual*, <http://www.dot.ga.gov/drivesmart/safetyoperation/Documents/BridgeRepairManual.pdf>. Among the recommendations in this reference, as step 1, the reader will be advised to:

“Coordinate all work in the stream with the District Environmentalist”

Consensus Guidelines for Culvert Work in general follow:

1. Provide field staff with environmental training so that the environmental impacts and opportunities related to culvert work are appreciated and best practices understood.
2. Screen work locations including access facilities for the presence of sensitive resources such as rare or endangered species, wetlands and water bodies, or significant cultural resources.
3. Secure proper approvals as needed and abide by conditions.
4. Ensure that equipment and materials are suited to environmental circumstances.
5. Include environmental factors in quality assurance procedures and reviews.
6. Be sure that field staff have ready access to environmental professionals as questions arise and use the chain of command as questions arise.
7. Ensure that aquatic organism passage needs are satisfied, and other regulatory requirements met when replacing or installing new culverts.

Color coded detail on the impacts of specific culvert work practices, keyed to mitigation measures, is contained in Table 4. Further detail on impacts and mitigation along with state-by-state specifics may be found in the DAT.

Table 4. Summary of Impacts and Mitigation Recommendations for Culvert Work

[\(Press Ctrl+Click here to access full DAT\)](#)

| | | | Environmental and Regulatory Factors | | | | | | Information | | | | | Additional | | |
|--|--|--|--|-----------------------|--------------------|---------------------------|-------------------|-------------------------------------|-------------------------|--------------------|------------------|------------------------|-------------------|----------------------|-----------------------|-----------------------------|
| | | | Environmental impacts of maintenance measure (typical) [assumed trigger for impact] | | | | | | Typical Env. measures** | Federal Permitting | State Permitting | Procedures by location | Specs by location | Training by location | Additional References | Additional Notes & Contacts |
| Bridge Maintenance Practice Specific Information | | | Air [none] | Noise [people nearby] | Water [near water] | Habitat [species present] | Waste [generated] | Human env. with historic [eligible] | | | | | | | | |
| Activity | Benefit | Sub category (if any) | | | | | | | | | | | | | | |
| Culverts | Achieve or extend the service life of the culvert. | Culvert Liners (sprayed) or Culvert paved inverts (concrete) | 1 | 1 | 4 | 4 | 3 | 2 | a,b,c | | | | | | | |
| | | Repairing bridge culverts | 1 | 2 | 4 | 4 | 3 | 2 | a,b,c,e | | | • | | | | • |
| | | Installing concrete inverts in steel multi-plate pipes | 1 | 2 | 4 | 4 | 3 | 2 | a,b,c,d | | | | | | | |
| | | Installing fish weirs | 1 | 2 | 4 | 5 | 3 | 2 | a,b,c,d,e | | | | | | | |

1.5 Deck Work

While not generally seen as a source of environmental impacts, without proper screening, planning and training, bridge deck work can generate significant impacts. Excess application or accidental discharge of sealant materials can produce water quality and waste impacts, and “heavy” repairs can generate noise, water, waste, historic, and even habitat impacts to birds and bats living under the structure. As described in Table 5 and further detailed in the DAT, the following general recommendations are suggested based on the following findings:

1. Air
 - With proper controls for the use of volatile sealants and dust generation, air quality impacts tend to be minor, if not insignificant. Air quality permitting is not typically required, and mitigation limited to dust control.
2. Noise
 - Except for noise generated by demolition activities and deck pours, noise impacts tend to be minor. Noise regulations are generally not an issue and mitigation is a matter of timing and equipment selection.
3. Water
 - Activities over water can result in accidental discharges. Placing thin polymer overlays, hydro-milling, concrete repairs, crack filling, epoxy injection, and wet-saw cutting are common deck work. Crews need to spend time ensuring the materials and debris do not enter the drainage system. Waste discharge into waterbodies generally triggers permit requirements and “best practices” to mitigate impacts.
4. Habitat
 - Work on the deck may disturb birds or bats living on or under the bridge. Screening procedures such as those cited in the DAT are recommended for impact avoidance. Presence of wildlife can trigger permit requirements and the need for consultation with environmental experts on appropriate mitigation. Disturbance of migratory birds and endangered bat species is one of the more serious, but poorly understood environmental impacts of bridge deck work and practitioners are advised to routinely screen for their presence. More information may be found in *Chapter 7: Bridge Maintenance of NCHRP 25-25(04): Compendium of Environmental Stewardship Practices in Construction and Maintenance*
[http://onlinepubs.trb.org/onlinepubs/archive/NotesDocs/25-25\(4\)_FR.pdf](http://onlinepubs.trb.org/onlinepubs/archive/NotesDocs/25-25(4)_FR.pdf).
5. Waste
 - Pavement work tends to generate high volumes of industrial waste and can trigger permitting thresholds, but proper disposal/recycling options are readily available for impact avoidance. Bridge deck work should include spill abatement preparedness.

6. Human Environment including Historic

- Standard safety and access controls can generally ensure public safety and access for structural activities. However, if the bridge is eligible for the state or national historic register of historic places, normal repairs and preservation activities tend to be allowed - albeit with prior notification. Major activities such as deck replacement usually require site specific consultation and approval from the State Historic Preservation Officer (SHPO).

Consensus Guidelines for General for Deck Work include:

1. Screen work locations for the presence of rare or endangered species, and high classification streams, or listing of the structure as eligible for the National Register of Historic Places.
2. Screen work locations including access facilities for the presence of sensitive resources such as rare or endangered species, wetlands and water bodies, or significant cultural resources.
3. Provide field staff with environmental training so that they can react properly to the unexpected presence of birds and bats.
4. Include environmental factors in quality assurance procedures and reviews
5. Be sure that field staff have ready access to environmental professionals as questions arise and use the chain of command as questions arise.

Color coded detail on the impacts of specific deck work practices, keyed to mitigation measures is contained in Table 5. Further detail on impacts and mitigation along with state-by-state specifics may be found in the DAT.

Table 5. Summary of Impacts and Mitigation Recommendations for Deck Work

[\(Press Ctrl+Click here to access full DAT\)](#)

| | | | Environmental and Regulatory Factors | | | | | | Information | | | | | Additional | | | | |
|---|--|-------------------------------------|--|-------------------|--------------------------------------|----------|---|---|-------------------------|--------------------|------------------|------------------------|-------------------|----------------------|-----------------------|-----------------------------|--|--|
| | | | Environmental impacts of maintenance measure (typical) [assumed trigger for impact] | | | | | | Typical Env. measures** | Federal Permitting | State Permitting | Procedures by location | Specs by location | Training by location | Additional References | Additional Notes & Contacts | | |
| Air [none] | Noise [people nearby] | Water [near water] | Habitat [species present] | Waste [generated] | Human env. with historic [relatable] | | | | | | | | | | | | | |
| Bridge Maintenance Practice Specific Information | | | Environmental impact rank (typical) Rank 1-5 in order of increasing severity (see table below) | | | | | | | | | | | | | | | |
| Activity | Benefit | Sub category (if any) | | | | | | | | | | | | | | | | |
| Sealing Cracks and Joints in Bituminous Wearing Surface | Achieve or extend the service life of the wearing surface. | Tar sealing | 2 | 1 | 3 | 2 | 4 | 2 | a,b,c | | | | | | | | | |
| | | Membrane and asphalt wearing course | 1 | 1 | 2 | 2 | 4 | 2 | a,b,c | | | | | | | | | |
| | | Chip seal | 2 | 1 | 4 | 2 | 4 | 2 | a,b,c | | | | | | | | | |
| Crack Sealing in Portland Cement Concrete Decks | Achieve or extend the service life of the concrete deck. | Penetrating Sealer | 2 | 1 | 4 | 2 | 4 | 2 | a,b,c | | | | | | | | | |
| | | Surface Sealer | 2 | 1 | 4 | 2 | 4 | 2 | a,b,c | | | | | | | | | |
| | | Bridge deck waterproofing | 2 | 1 | 2 | 2 | 4 | 2 | a,b,c | | | | | | | | | |
| | | Injection Filler | 2 | 1 | 3 | 2 | 4 | 2 | a,b,c | | | | | | | | | |
| | | Thin Epoxy Overlay | 2 | 1 | 4 | 2 | 4 | 2 | a,b,c | | | | | | | | | |
| Sealing Concrete | Achieve or extend the service life of | Penetrating Sealer | 3 | 1 | 4 | <u>2</u> | 4 | 2 | a,b,c | | | | | | | | | |
| | | Surface Sealer | 3 | 1 | 4 | <u>2</u> | 4 | 2 | a,b,c | | | | | | | | | |
| | | Waterproofing membrane installation | 3 | 1 | 2 | <u>2</u> | 2 | 2 | a,b,c | | | | | | | | | |

| Bridge Maintenance Practice Specific Information | | | Environmental and Regulatory Factors | | | | | | Information | | | | | Additional | | |
|--|---|--|--|-----------------------|--------------------|---------------------------|-------------------|---------------------------------------|-------------------------|--------------------|------------------|------------------------|-------------------|----------------------|-----------------------|-----------------------------|
| | | | Environmental impacts of maintenance measure (typical) [assumed trigger for impact] | | | | | | Typical Env. measures** | Federal Permitting | State Permitting | Procedures by location | Specs by location | Training by location | Additional References | Additional Notes & Contacts |
| | | | Air [none] | Noise [people nearby] | Water [near water] | Habitat [species present] | Waste [generated] | Human env. with historic [activities] | | | | | | | | |
| Activity | Benefit | Sub category (if any) | Environmental impact rank (typical) Rank 1-5 in order of increasing severity (see table below) | | | | | | | | | | | | | |
| Decks | the concrete deck | Installing barrier membrane to concrete bridge decks | 3 | 1 | 2 | <u>2</u> | 2 | 2 | a,b,c | | | | | | | |
| Sealing Concrete Decks (con't) | Achieve or extend the service life of the concrete deck. | Concrete Overlays | 3 | 1 | 2 | <u>2</u> | 2 | 2 | a,b,c | | | | | | | |
| | | Thin Epoxy Overlay | 3 | 1 | 4 | <u>2</u> | 2 | 2 | a,b,c | . | . | | | | | |
| | | PPC Deck Sealing | 3 | 1 | 2 | <u>2</u> | 2 | 2 | a,b,c | | | | | | | |
| Install or Replace Concrete Deck Overlay | Achieve or extend the service life of the concrete deck. | Installing low slump concrete overlays (by contract) | 3 | 1 | 2 | <u>2</u> | 2 | 3 | a,b,c | | | | | | | |
| | | Placing concrete LMC and PPC) | 3 | 1 | 2 | <u>2</u> | 2 | 3 | a,b,c | | | | | | | |
| | | Overlays by Contract | 3 | 1 | 2 | <u>2</u> | 2 | 3 | a,b,c | | | | | | | |
| Replacing Asphalt Wearing Surface | Achieve or extend the service life of the concrete deck. Maintain or improve the bridge roadway surface drainage. | Milling | 3 | 3 | 2 | <u>2</u> | 3 | 3 | a,b,c | | | | | | | |
| | | Install sheet or spray membrane | 3 | 1 | 3 | <u>2</u> | 3 | 3 | a,b,c | | | | | | | |
| | | Tack Coat | 3 | 1 | 4 | <u>2</u> | 4 | 3 | a,b,c | | | | | | | |
| | | Asphalt wearing surface install | 3 | 2 | 3 | <u>2</u> | 3 | 4 | a,b,c | | | | | | | |
| Repairing | Achieve or extend | Concrete removal - hydro | 3 | 3 | 5 | 4 | 4 | 4 | a,b,c | | | | | | | |

| Bridge Maintenance Practice Specific Information | | | Environmental and Regulatory Factors | | | | | | Information | | | | | Additional | | | |
|---|--|--|--|-----------------------|--------------------|---------------------------|-------------------|---------------------------------------|-------------------------|--------------------|------------------|------------------------|-------------------|----------------------|-----------------------|-----------------------------|--|
| | | | Environmental impacts of maintenance measure (typical) [assumed trigger for impact] | | | | | | Typical Env. measures** | Federal Permitting | State Permitting | Procedures by location | Specs by location | Training by location | Additional References | Additional Notes & Contacts | |
| | | | Air [none] | Noise [people nearby] | Water [near water] | Habitat [species present] | Waste [generated] | Human env. with historic [activities] | | | | | | | | | |
| Activity | Benefit | Sub category (if any) | Environmental impact rank (typical) Rank 1-5 in order of increasing severity (see table below) | | | | | | | | | | | | | | |
| Concrete Decks | the service life of the concrete deck. | Reinforcement corrosion removal | 3 | 3 | 4 | 3 | 4 | 4 | a,b,c | | | | | | | | |
| Repairing Concrete Decks (con't) | Achieve or extend the service life of the concrete deck. | Formwork | 1 | 2 | 2 | 2 | 2 | 4 | a,b,c | | | | | | | | |
| | | Concrete install | 1 | 1 | 4 | 4 | 3 | 4 | a,b,c | | • | • | | | | | |
| | | Repairing/Replacing/Sealing Bridge barrier (and curb and sidewalk) | 1 | 2 | 2 | 3 | 2 | 2 | a,b,c | | | | | | | | |
| Timber Deck Repair or Replacement including wood treatments | Achieve or extend the service life of the concrete deck. | Timber Deck Repair or Replacement | 1 | 2 | 4 | 3 | 2 | 2 | a,b,c | | | | | | | | |
| Placing Thin Polymer Overlays | | Deck preparation | 3 | 3 | 3 | 3 | 4 | 3 | a,b,c | | • | • | | | | | |
| | | Install | 2 | 1 | 4 | 3 | 4 | 2 | a,b,c | | • | • | | | | | |
| False Decking | | False Decking | 1 | 1 | 2 | 2 | 2 | 4 | a,b,c | | | | | | | | |
| Full Depth Bridge Deck Repairs | | See Repairing Concrete Decks | | | | | | | | | | | | | | | |

| | | | Environmental and Regulatory Factors | | | | | | Information | | | | | Additional | | |
|--|---|---------------------------------------|--|-----------------------|--------------------|---------------------------|-------------------|-------------------------------------|-------------------------|--------------------|------------------|------------------------|-------------------|----------------------|-----------------------|-----------------------------|
| | | | Environmental impacts of maintenance measure (typical) [assumed trigger for impact] | | | | | | Typical Env. measures** | Federal Permitting | State Permitting | Procedures by location | Specs by location | Training by location | Additional References | Additional Notes & Contacts |
| | | | Air [none] | Noise [people nearby] | Water [near water] | Habitat [species present] | Waste [generated] | Human env. with historic [location] | | | | | | | | |
| Bridge Maintenance Practice Specific Information | | | Environmental impact rank (typical) Rank 1-5 in order of increasing severity (see table below) | | | | | | | | | | | | | |
| Activity | Benefit | Sub category (if any) | | | | | | | | | | | | | | |
| Repairing/Replacing Joints | Restore the proper sealing, if applicable of damage to bridge components below, and expansion and contraction of superstructure. | Remove seal &/or hardware | 2 | 3 | 3 | 3 | 3 | 3 | a,b,c | | | • | | | • | |
| | | Prepare install area | 3 | 3 | 4 | 3 | 4 | 3 | a,b,c | | | • | | | • | |
| | | Install seal or hardware | 2 | 1 | 2 | 3 | 2 | 3 | a,b,c | | | • | | | • | • |
| | | Repairing/replacing strip seal glands | 1 | 2 | 1 | 3 | 2 | 2 | a,b,c | | | • | | | • | |
| | | Sealing poured joints | 1 | 2 | 2 | 3 | 2 | 2 | a,b,c | | | • | | | • | |
| | | Joint elimination | 1 | 2 | 2 | 3 | 2 | 2 | a,b,c | | | • | | | • | |
| Drain/Scupper Repair/Replacement | Drainage systems cleaning, and repair will reduce likelihood of excess water on deck potentially creating a traffic safety issue. | | 1 | 1 | 4 | 3 | 3 | 4 | a,b,c,d | | | | | | | |
| Cathodic Protection | Achieve or extend the service life of the concrete component being protected | | 1 | 1 | 1 | 2 | 2 | 2 | a,b | | | | | | | |

1.6 Bridge Cleaning

Bridge cleaning and washing is perhaps the most discussed and interesting of bridge maintenance and preservation activities as they relate to the environment. Washing is eminently sensible from a maintenance and preservation perspective for the removal of corrosive and moisture retaining materials from sensitive bridge components including joints and bearings, and almost indispensable to the proper inspection of critical components. However, the flushing or sweeping of soil and other materials containing salt, metals and other contaminants is also an obvious threat to water quality. This threat to water quality is of concern to sensitive waters during low flow/high temperature conditions as typically occur during the summer months – when bridge washing activities are most easily done.

Virtually every state has its own bridge cleaning/washing protocol based on bridge needs, practicality, and regulatory restrictions. Study of this range of practices suggests a convergence of the practical and the pragmatic wherein:

1. Bridges are screened for presence of birds and bats.
2. Debris are swept or vacuumed before any washing or rinsing.
3. Tarps and other containment are deployed to prevent wash water from entering streams.
4. Particular care is taken to avoid sensitive waters during sensitive periods.
5. Strict QA practices are followed.
6. Water quality monitoring is employed on an exception basis.
7. Approvals are granted on a blanket basis subject to monitoring and oversight based on performance.

However, many states have a long way to go in this regard and consensus between the Bridge and Environmental communities at some national level is not only elusive, but probably of limited utility even if it could be gained because permitting of discharges to “waters of the US” generally require individual water quality certifications to be issued by the individual state environmental agencies.

States are encouraged to review the DAT information as arrayed to benchmark their practices and inform their regulatory agencies. As described in Table 6 and further detailed in the DAT, the following general recommendations are suggested based on the following findings:

1. Air
 - With proper controls for dust generation, air quality impacts tend to be minor, if not insignificant. Air quality permitting is not typically required, and mitigation limited to dust control.
2. Noise
 - Noise impacts tend to be minor. Noise regulations are generally not an issue and mitigation a matter of timing and equipment selection.

3. Water

- Bridge washing can generate significant discharges of contaminated and/or oxygen demanding materials capable of disrupting aquatic life. In most states, permits - some of them general and others site specific - are required for bridge washing and prior approval with monitoring is sometimes required. In some states including California environmental concerns are such that water is not used for bridge washing.

4. Habitat

- Work on substructures or decks may be disturbing to birds or bats living or nesting on or under the bridge. Discharges to receiving waters can compromise aquatic habitat. Screening procedures such as those cited in the DAT are strongly recommended for impact avoidance. Presence of wildlife can trigger permit requirements and the need for consultation with environmental experts on appropriate mitigation.

5. Waste

- Bridge cleaning by its nature generates significant volumes of waste, but proper disposal/recycling options are readily available for impact avoidance. Local permitting thresholds should be consulted, and best practices followed.

6. Human Environment including Historic

- If a bridge is eligible for the state or national register of historic places, normal repair and preservation activities tend to be allowed if not encouraged

States including Pennsylvania, Washington, and Ohio feature informative examples on how bridge washing and related activities can be conducted in concert with environmental concerns. For example, Washington State DOT,

“ ... restarted the bridge washing program three years ago after an almost 30-year hiatus. We used to wash all steel truss bridges once a year. A 160-foot-long truss took about a day with high pressure hoses. Because of the clean water act, washing bridges required containment. This extended the time to wash a bridge to two weeks. This was changed about 7 years ago to allow us to thoroughly hand clean a truss without containment and then flush the bridge. We now have a pilot program to annually flush bridges without first hand cleaning. Tests of the waters above and below the bridge show only a slight rise in contamination, well within the minimum allowable. We have gone through two cycles of bridge cleaning to date.”

Consensus Guidelines for General Bridge Cleaning Activities follow:

1. Employ best practices in consultation with environmental agencies.
2. Bridges should be inspected for flaking paint and loose paint properly removed before cleaning begins.
3. Screen work locations including access facilities for the presence of sensitive resources such as rare or endangered species, wetlands and water bodies, or significant cultural resources.
4. Sweep and remove loose material and then avoid washing activities during low flow conditions.

5. Provide field staff with environmental training so that they understand the impacts of waste material on stream ecology.
6. Include environmental factors in quality assurance procedures and reviews.
7. Be sure that field staff have ready access to environmental professionals as questions arise and use the chain of command as questions arise.

Color coded detail on the impacts of specific bridge cleaning practices, keyed to mitigation measures is contained in Table 6. Further detail on impacts and mitigation along with state by state specifics may be found in the DAT.

Table 6. Summary of Impacts and Mitigation Recommendations for Bridge Cleaning Work
 (Press Ctrl+Click here to access full DAT)

| | | | Environmental and Regulatory Factors | | | | | | Information | | | | | Additional | | |
|--|---|-----------------------|--|-------------------|-------------------------------------|----------|---|----------|-------------------------|--------------------|------------------|------------------------|-------------------|----------------------|-----------------------|-----------------------------|
| | | | Environmental impacts of maintenance measure (typical) [assumed trigger for impact] | | | | | | Typical Env. measures** | Federal Permitting | State Permitting | Procedures by location | Specs by location | Training by location | Additional References | Additional Notes & Contacts |
| Air [none] | Noise [people nearby] | Water [near water] | Habitat [species present] | Waste [generated] | Human env. with historic [eligible] | | | | | | | | | | | |
| Bridge Maintenance Practice Specific Information | | | Environmental impact rank (typical) Rank 1-5 in order of increasing severity (see table below) | | | | | | | | | | | | | |
| Activity | Benefit | Sub category (if any) | | | | | | | | | | | | | | |
| Bridge Cleaning, includes cleaning drainage | Achieve or extend the service life of the deck, bridge joints, and other surfaces by removing grit, debris, etc. buildup. If rinsed with water, chlorides within concrete or on metal surfaces will be reduced. Drainage systems cleaning will reduce likelihood of excess water on deck potentially creating a traffic safety issue. | Sweeping | 3 | 1 | 3 | 3 | 4 | 2 | a,b,c | | • | • | • | • | • | • |
| | | Vacuuming | 2 | 2 | 1 | 4 | 3 | 2 | a,b,c | | | | | • | | |
| | | Compressed Air | 4 | 3 | <u>3</u> | 4 | 3 | <u>3</u> | a,b,c | | | | | | | |
| | | Water | 1 | 2 | <u>4</u> | <u>4</u> | 4 | 2 | a,b,c,d | • | • | • | • | • | • | • |

1.7 Substructure Work

Substructures, with their requirements for cleaning, inspection, and repair in proximity to streams and habitat, make these bridge maintenance and preservation activities subject to environmental concern.

As described in Table 7 and further detailed in the DAT, the following general recommendations are suggested based on the following general findings:

1. Air
 - With proper controls for the use of volatile sealants and dust generation, air quality impacts tend to be minor, if not insignificant. Air quality permitting is not typically required, and mitigation limited to dust control.
2. Noise
 - Except for noise generated by demolition activities, noise impacts tend to be minor. Noise regulations are generally not an issue and mitigation a matter of timing and equipment selection.
3. Water
 - Activities over water can generate significant discharges of contaminated and/or oxygen demanding materials capable of disrupting aquatic life. By their nature these activities can require “in water” work with its attendant concerns and strictures. In most states, permits - some general, and others site specific - are generally required for any in water work.
4. Habitat
 - Work on substructures may disturb birds or bats living or nesting on or under the bridge. Discharges to receiving waters can compromise aquatic habitat. Screening procedures such as those cited in the DAT are recommended for impact avoidance. Presence of wildlife can trigger permit requirements and the need for consultation with environmental experts on appropriate mitigation.
5. Waste
 - Substructure work can generate significant volumes of industrial waste, but proper disposal/recycling options are readily available for impact avoidance. Local permitting thresholds should be consulted, and best practices followed.
6. Human Environment including Historic
 - If a bridge is eligible for the state or national register of historic places, normal repair and preservation activities tend to be allowed albeit with prior notification. However, major rehabilitation and repair activities usually require site specific consultation and approval from the State Historic Preservation Officer (SHPO).

Consensus Guidelines for Substructure Work in General include:

1. Screen work locations including access facilities for the presence of sensitive resources such as rare or endangered species, wetlands and water bodies, or significant cultural resources.
2. As practicable, avoid the need for in stream work using proper planning and equipment.
3. Provide field staff with environmental training so that they understand the impacts of waste material on stream ecology and understand proper handling procedures.
4. Include environmental factors in quality assurance procedures and reviews.
5. Be sure that field staff have ready access to environmental professionals as questions arise and use the chain of command as questions arise.

Color coded detail on the impacts of specific substructure practices, keyed to mitigation measures, is contained in Table 7. Further detail on impacts and mitigation along with state by state specifics may be found in the DAT.

Table 7. Summary of Impacts and Mitigation Recommendations for Substructure

[\(Press Ctrl+Click here to access full DAT\)](#)

| | | | Environmental and Regulatory Factors | | | | | | Information | | | | | Additional | | | |
|--|---|--------------------------------------|--|-----------------------|--------------------|---------------------------|-------------------|-------------------------------------|-------------------------|--------------------|------------------|------------------------|-------------------|----------------------|-----------------------|-----------------------------|--|
| | | | Environmental impacts of maintenance measure (typical) [assumed trigger for impact] | | | | | | Typical Env. measures** | Federal Permitting | State Permitting | Procedures by location | Specs by location | Training by location | Additional References | Additional Notes & Contacts | |
| | | | Air [none] | Noise [people nearby] | Water [near water] | Habitat [species present] | Waste [generated] | Human env. with historic [eligible] | | | | | | | | | |
| Bridge Maintenance Practice Specific Information | | | Environmental impact rank (typical) Rank 1-5 in order of increasing severity (see table below) | | | | | | | | | | | | | | |
| Activity | Benefit | Sub category (if any) | | | | | | | | | | | | | | | |
| Temporary Support | Provide bridge stability and traffic safety. | | 1 | 2 | 2 | 2 | 1 | 2 | a,b | | • | • | | | | • | |
| Shotcrete Repairs | Achieve or extend the service life of the concrete being repaired | See Repairing Concrete Substructures | | | | | | | | | | | | | | | |
| Sealing Concrete Substructures | Achieve or extend the service life of the concrete component being protected | Penetrating Sealer | 2 | 1 | 4 | 2 | 4 | 3 | a,b,c | | | | | | | | |
| | | Surface Sealer | 2 | 1 | 4 | 2 | 4 | 3 | a,b,c | | | | | | | | |
| Repairing Concrete Substructures | Achieve or extend the service life of the concrete substructure being repaired. | Concrete removal - manual | 3 | 3 | 2 | 3 | 2 | 4 | a,b,c | | | | | | | | |
| | | Concrete removal - hydro | 2 | 3 | 5 | 4 | 4 | 4 | a,b,c,d,e | | | | | | | | |
| | | Reinforcement corrosion removal | 3 | 3 | 4 | 3 | 4 | 4 | a,b,c,d | | | | | | | | |
| | | Formwork | 1 | 2 | 2 | 2 | 2 | 4 | a,b,c | | | | | | | | |
| | | Concrete install, place or shotcrete | 2 | 2 | 4 | 3 | 3 | 4 | a,b,c | | | | | | | | |

| Bridge Maintenance Practice Specific Information | | | Environmental and Regulatory Factors | | | | | Information | | | | | Additional | | | | |
|---|---|--|--|-----------------------|--------------------|---------------------------|-------------------|-------------------------|--------------------|------------------|------------------------|-------------------|----------------------|-----------------------|-----------------------------|-------------------------------------|--|
| | | | Environmental impacts of maintenance measure (typical) [assumed trigger for impact] | | | | | Typical Env. measures** | Federal Permitting | State Permitting | Procedures by location | Specs by location | Training by location | Additional References | Additional Notes & Contacts | | |
| Activity | Benefit | Sub category (if any) | Air [none] | Noise [people nearby] | Water [near water] | Habitat [species present] | Waste [generated] | | | | | | | | | Human env. with historic [eligible] | |
| | | Install Fiber Reinforced Polymer | 3 | 2 | 3 | 2 | 4 | 3 | a,b,c | | | | | | | | |
| Epoxy Inject Substructure Cracks | Achieve or extend the service life of the concrete substructure being repaired. | Similar to Crack Sealing in Portland Cement Concrete Decks | | | | | | | | | | | | | | | |
| Epoxy Inject Substructure Cracks | | Similar to Crack Sealing in Portland Cement Concrete Decks | | | | | | | | | . | . | . | | | | |
| Foundation Repairs (e.g., spread footing, grout bag, tremie concrete, pile caps, piles, steel sheeting) | | | | 1 | 3 | 4 | 4 | 3 | 3 | a,b,c,d | | | | | | | |
| Bonded Fiber Reinforced Polymer (FRP) Repairs to Concrete | | See Repairing Concrete Substructures | | | | | | | | | | | | | | | |
| Install/Replace Bird Netting and other Deterrent Devices | Prevent bird roosting or nesting debris & animal waste accumulation damage to the underlying and adjacent components. | | 1 | 1 | 2 | 5 | 2 | 2 | a,b,c,d,e | | | . | | . | | | |

1.8 Superstructure Work

Superstructure work, especially paint removal, is one of the most common and most serious sources of bridge maintenance impacts on the environment, though other activities such as repair/replacement of asbestos conduit and general structural repairs can also generate impacts that should be avoided. As described in Table 8 and further detailed in the DAT, the following general recommendations are suggested based on the following general findings:

1. Air
 - Sand blasting of lead paint, or for that matter any paint, is something that must be done under closely controlled conditions involving specialized vacuum shrouded equipment or containment to avoid the release of potentially hazardous dust irrespective of the presence of potential receptors. Most states have strict guidelines and specifications for paint and paint removal and monitoring activities. Due to the prospect of toxic lead emissions, permitting on a general or site-specific nature is generally required before large scale painting can begin.
 2. Noise
 - Tends to be less of a concern than air quality impacts, though sandblasting operations and structural repairs can be noisy and have the potential to affect nearby receptors. Noise regulations are generally not an issue and mitigation a matter of timing and equipment selection.
 3. Water
 - Presuming precautions are taken to prevent air borne releases of paint materials and proper handling and disposal of waste materials, water quality impacts from painting and another superstructure work tend to be rare. Waste discharge into waterbodies generally trigger permit requirements and “best practices” used to mitigate impacts.
 4. Habitat
 - Since superstructure preservation and repair, including painting activities tend to occur where birds or bats may be living or nesting on the structural members or under the bridge deck, screening for their presence should take place before superstructure work is initiated. If they are present, consultation with environmental experts should be completed in accordance with site specific regulatory requirements and agency stewardship policies.
 5. Waste
 - Bridge paint removal waste is typically characterized as industrial, if not hazardous, and waste must be handled in accordance with state specific permitting procedures. Recycling of steel from structural repairs is both responsible and cost effective.
 6. Human Environment including Historic
 - Standard safety and access controls can generally ensure public safety and access for superstructure work. Again, the exception being for structures eligible for state or national historic registers of historic places. If this is the case normal spot
-

painting/preservation activities tend to be allowed albeit with prior notification, but activities such as changing structural details, bridge color or appearance may require site specific consultation and approval from the State Historic Preservation Officer (SHPO).

Even with the complexities of lead paint removal and the varying requirements among the states, sources such as *SSPC: The Society for Protective Coatings, Technology Guide No. 18: Specifier's Guide for Determining Containment Class and Environmental Monitoring Strategies for Lead-Paint Removal Projects* provide excellent detailed specifications and instructions well understood by the industry and should be seriously considered for application whenever lead paint removal is undertaken. Guidance on other superstructure repair work may be found in the DAT and in Georgia DOT's *Bridge Structure Maintenance and Rehabilitation Repair Manual*:

<http://www.dot.ga.gov/drivesmart/safetyoperation/Documents/BridgeRepairManual.pdf>

Consensus Guidelines for Superstructure Work in general include:

1. Employ specialized crews, contractors, and equipment for any paint removal involving non-vacuum sandblasting.
2. Screen work locations including access facilities for the presence of sensitive resources, such as rare or endangered species, wetlands and water bodies, or significant cultural resources.
3. Provide field staff with environmental training so that they understand the impacts of dangers of lead paint and employ proper handling procedures for waste materials.
4. Include environmental factors in quality assurance procedures and reviews to ensure that field staff have ready access to environmental professionals as questions arise on lead paint, presence of protected species, and other sources of concern.

Color coded detail on the impacts of specific superstructure practices, keyed to mitigation measures, is contained in Table 8. Further detail on impacts and mitigation along with state by state specifics may be found in the DAT.

Table 8. Summary of Impacts and Mitigation Recommendations for Superstructure Work
[\(Press Ctrl+Click here to access full DAT\)](#)

| Bridge Maintenance Practice Specific Information | | | Environmental and Regulatory Factors | | | | | | Information | | | | | | Additional | |
|--|---|--|--|-----------------------|--------------------|---------------------------|-------------------|-------------------------------------|----------------------------------|--------------------|------------------|------------------------|-------------------|----------------------|-----------------------|-----------------------------|
| | | | Environmental impacts of maintenance measure (typical) [assumed trigger for impact] | | | | | | Typical Environmental Measures** | Federal Permitting | State Permitting | Procedures by location | Specs by location | Training by location | Additional References | Additional Notes & Contacts |
| | | | Air [none] | Noise [people nearby] | Water [near water] | Habitat [species present] | Waste [generated] | Human env. with historic [eligible] | | | | | | | | |
| Activity | Benefit | Sub category (if any) | Environmental impact rank (typical) Rank 1-5 in order of increasing severity (see table below) | | | | | | | | | | | | | |
| Painting Bridge Steel | Achieve or extend the service life of the metal components painted | Containment | 5 | 3 | 2 | 3 | 4 | 3 | a,b,c,d,e | • | • | • | • | • | • | • |
| | | Removal/Disposal | 5 | 3 | 4 | 3 | 5 | 2 | a,b,c,d,e | • | • | • | • | • | • | • |
| | | Application | 2 | 2 | 5 | 3 | 3 | 4 | a,b,c,d,e | • | • | • | • | • | • | • |
| Spot Painting Bridge Steel | | See Painting Bridge Steel | | | | | | | | • | • | • | • | • | • | |
| Repairing/Replacing Steel Members | Restore structural capacity of steel member to restore structure stability and traffic safety | Repair via mechanical fasteners or welding | 2 | 2 | 2 | 3 | 3 | 3 | a,b,c | | | • | | | | |
| | | Replace - remove portion | 2 | 3 | 2 | 3 | 3 | 5 | a,b,c | | | • | | | | |
| | | Replace - Prep area | 3 | 2 | 4 | 3 | 4 | 4 | a,b,c | | | • | | | | |

| Environmental and Regulatory Factors | | | | | | Information | | | | | | Additional | |
|--|-----------------------|--------------------|---------------------------|-------------------|-------------------------------------|----------------------------------|--------------------|------------------|------------------------|-------------------|----------------------|-----------------------|-----------------------------|
| Environmental impacts of maintenance measure (typical) [assumed trigger for impact] | | | | | | Typical Environmental Measures** | Federal Permitting | State Permitting | Procedures by location | Specs by location | Training by location | Additional References | Additional Notes & Contacts |
| Air [none] | Noise [people nearby] | Water [near water] | Habitat [species present] | Waste [generated] | Human env. with historic [eligible] | | | | | | | | |

| Bridge Maintenance Practice Specific Information | | | Environmental impact rank (typical) Rank 1-5 in order of increasing severity (see table below) | | | | | | | | | | | | | |
|---|--|----------------------------|--|---|---|----------|----------|---|-------|--|--|---|---|--|--|--|
| Activity | Benefit | Sub category (if any) | | | | | | | | | | | | | | |
| | | Replace - Install new | 2 | 1 | 2 | <u>2</u> | 2 | 5 | a,b,c | | | • | | | | |
| Lubricating Bearings | Maintain functionality of bearing reducing risk of overstressing superstructure or substructure | Spray application | 2 | 1 | 4 | 2 | 4 | 2 | a,b,c | | | • | | | | |
| | | Brush application | 1 | 1 | 4 | 2 | 4 | 2 | a,b,c | | | • | | | | |
| | | Grease fitting application | 1 | 1 | 2 | 2 | <u>4</u> | 2 | a,b,c | | | • | | | | |
| Repairing Sheared Anchor Bolts/Replacing Bearings | Maintain stability and proper position of bearing. Replaced bearing restores proper load transfer and expansion of superstructure. | Removal | 2 | 3 | 2 | 2 | 2 | 4 | a,b,c | | | | | | | |
| | | Drill Pedestal | 2 | 3 | 2 | 2 | 2 | 4 | a,b,c | | | | | | | |
| | | Installation | 2 | 1 | 2 | 2 | 2 | 3 | a,b,c | | | • | • | | | |

| Bridge Maintenance Practice Specific Information | | | Environmental and Regulatory Factors | | | | | | Information | | | | | | Additional | |
|--|--|-----------------------|--|-----------------------|--------------------|---------------------------|-------------------|-------------------------------------|----------------------------------|--------------------|------------------|------------------------|-------------------|----------------------|-----------------------|-----------------------------|
| | | | Environmental impacts of maintenance measure (typical) [assumed trigger for impact] | | | | | | Typical Environmental Measures** | Federal Permitting | State Permitting | Procedures by location | Specs by location | Training by location | Additional References | Additional Notes & Contacts |
| | | | Air [none] | Noise [people nearby] | Water [near water] | Habitat [species present] | Waste [generated] | Human env. with historic [eligible] | | | | | | | | |
| Activity | Benefit | Sub category (if any) | Environmental impact rank (typical) Rank 1-5 in order of increasing severity (see table below) | | | | | | | | | | | | | |
| Repair/Replace Utilities & Signs | Restore proper support of utility or traffic information for overall traffic safety. | | 2 | 1 | 1 | 2 | 2 | 2 | a,b | | | | | | | |
| Mechanical/Electrical Replacement | Restore proper function or mechanical/electrical components or the proper functions of bridge components they power or move. | | 2 | 2 | 2 | 2 | 4 | 4 | a,b,c | | | | | | | |

| | | | Environmental and Regulatory Factors | | | | | | Information | | | | | | Additional | | |
|--|--|-----------------------|--|-------------------|-------------------------------------|---|---|---|----------------------------------|--------------------|------------------|------------------------|-------------------|----------------------|-----------------------|-----------------------------|--|
| | | | Environmental impacts of maintenance measure (typical) [assumed trigger for impact] | | | | | | Typical Environmental Measures** | Federal Permitting | State Permitting | Procedures by location | Specs by location | Training by location | Additional References | Additional Notes & Contacts | |
| Air [none] | Noise [people nearby] | Water [near water] | Habitat [species present] | Waste [generated] | Human env. with historic [eligible] | | | | | | | | | | | | |
| Bridge Maintenance Practice Specific Information | | | Environmental impact rank (typical) Rank 1-5 in order of increasing severity (see table below) | | | | | | | | | | | | | | |
| Activity | Benefit | Sub category (if any) | | | | | | | | | | | | | | | |
| Mechanical/Electrical Repairs | Restore proper function or mechanical/electrical components or the proper functions of bridge components they power or move. | | 2 | 2 | 2 | 2 | 4 | 3 | a,b,c | | | | | | | | |

Chapter 2: Decision Aid Table (DAT)

Guidelines for improving environmental performance of bridge maintenance and preservation activities are presented in Chapter 1 of this document. The guidelines are offered as a point of departure for performance improvement by bridge owners who each operate under their own set of geographic, environmental, regulatory, asset, and institutional drivers. Having used the guidelines to identify opportunities for improvement, bridge owners are encouraged to employ the specifics presented in the DAT to benchmark their processes against those employed by others. The following sections explain how to use the DAT.

The DAT is intended as a tool, “For use by bridge owners, maintenance engineers, and their immediate staff in their role as activity planners responsible for specifying (deciding upon) the environmental practices to be followed during field application of the subject bridge maintenance or preservation activity given the expected site-specific conditions - while also providing managers, field supervisors, construction inspectors, and environmental professionals with a useful reference/guide. Decision to be aided, ‘is there a better way to protect the environment?’”

2.1 Overview, Intent, Limitations

The DAT is the product of extensive outreach and interaction with bridge maintenance and preservation practitioners, but even with that, the inclusion of every practice in every state has not been possible. However, with Excel as a platform, the opportunity to expand on the information provided is open to any who wish to expand and customize the tool for their own purposes.

The full Decision Aid Table, as populated with specifics from the literature review, may be found in [Chapter 3: Decision Aid Table \(DAT\) Download](#). Understanding that owners have been conducting bridge maintenance under environmental review for some years and that each state, if not each region, has their own structural, environmental, and regulatory constraints; users are encouraged to:

1. Consult the notes and instructions in “Tab 1”.
2. Review summary information in “Tab 2” to gain a general appreciation for which practices may require the most attention from an environmental perspective.
3. Query adjacent and similar states at their tabs for information that could help improve environmental performance and facilitate bridge preservation and maintenance.

The DAT is organized by tab. An overview of the contents of each tab are outlined in Sections 2.2 to 2.4 of this document.

2.2 Notes and Instructions Tab

The Notes and Instructions Tab provides the user with an overview of the DAT and column definitions, as shown in Figure 1 below.

NCHRP Project 20-07/Task 399: Identifying Bridge Maintenance and Preservation Actions which Minimize Environmental Impact*

DECISION AID TABLE

**For use by bridge owners, maintenance engineers, and their immediate staff in their role as activity planners responsible for specifying (deciding upon) the environmental practices to be followed during field application of the subject bridge maintenance activity given the expected site specific conditions - while also providing managers, field supervisors, and environmental professionals with a useful reference/guide. Decision to be aided, "is there a better way to protect the environment?" Information is keyed to cell location and accessed through "mouse over" in comment format.*

| | | | | | | | | | | | | | | | | | |
|--|----------|---------|-----------------------|---|-----------------------|--------------------|---------------------------|-------------------|-------------------------------------|---|--------------------|------------------|------------------------|-------------------|----------------------|--|-----------------------------|
| <u>Bridge Maintenance Activity</u> Vertical (column) listing of activities - Decision Aid information is keyed to each of these on a summary and state specific basis. Users begin with a practice and access the summary and state specific information in the corresponding row on separate tabs. | | | | <u>Environmental Impact and Regulatory Factors</u> <i>Environmental impacts</i> of specific maintenance measures are rated in terms of potential importance on a 1-5 scale of increasing severity. Assumptions behind the rating scale are explained in the Environmental Impact Rubric table. Expanded definitions for the various subcategories are also provided in "mouse over" comments, as are hyperlinks to available information. Thresholds are for these same categories and environmental measures are those typically employed to reduce potential impacts per assumptions. | | | | | | <u>Environmental Measures and Information Links</u> This is where detailed information may be found for specific practices in "mouse over" comment. Activities typically requiring permits are flagged accordingly. Practitioners may find practices in similar and adjoining states of particular interest. | | | | | | <u>Reference Information</u> Additional information may be found for specific practices by cell - again, in "mouse over" comment. | |
| Bridge Maintenance Practice Specific Information | | | | Environmental impacts of maintenance measure (typical) Importance (1-5) in increasing severity (see table below) | | | | | | | | | | | | | |
| Components per NCHRP Report 668 | Activity | Benefit | Sub category (if any) | Air [none] | Noise [people nearby] | Water [near water] | Habitat [species present] | Waste [generated] | Human env. with historic [eligible] | Typical Env. measures** | Federal Permitting | State Permitting | Procedures by location | Specs by location | Training by location | References | Additional Notes & Contacts |

Figure 1. Screenshot of DAT Notes and Instructions Tab Showing Column Headers for: Bridge Maintenance Activities (Blue), and Environmental and Regulatory Factors (Green), Environmental Information (Light Red), and Reference Information (Gray).

2.3 Summary Tab

The summary page of the DAT shown in Figure 2 with its keyword “search” feature is especially useful for:

1. General assessment of which bridge maintenance and preservation practices are most likely to generate which environmental impacts and to what degree.
2. What specific environmental measures are being used among leading states to mitigate these impacts, and where might additional information on these measures be found.
3. Searching the entire DAT for specific topics by keyword using the search icon located in the upper right corner of the array.
4. Identifying individual bridge maintenance and preservation practices for subsequent research according to DAT conventions.

To provide context for the guidelines, the DAT ranks potential environmental impacts on a 1-5 scale to each of the bridge maintenance and preservation practices. Environmental and Regulatory columns cover the range of environmental factors including: air, noise, water, habitat, waste, and the human environment. These are generalized assessments of potential impacts that *could* occur if field staff lack the means to employ the recommended guidelines. Explanations for each of the ratings may be found in the cell-by-cell comment fields.

Generally recommended environmental mitigation measures for each of the bridge maintenance and preservation practices per guidelines are rated by letter (a-e, see Figure 2 in the “Typical Env. Measures” column and corresponding rating definitions in Figure 3).

Again, while these impact ratings and recommended mitigation measures represent the best generalizations available based on literature review, expert opinion, and vetting through survey, they are only intended as a starting point for review of existing practice and procedure.

NCHRP Project 20-07/Task 399
 Identifying Bridge Maintenance and Preservation Actions Which Minimize Environmental Impact
 Task 6. Final Guidelines

NCHRP Project 20-07/Task 399: Identifying Bridge Maintenance and Preservation Actions which Minimize Environmental Impact DECISION AID TABLE *

| *For use by bridge owners, maintenance engineers, and their immediate staff in their role as activity planners responsible for specifying (deciding upon) the environmental practices to be followed during field application of the subject bridge maintenance activity given the expected site specific conditions - while also providing managers, field supervisors, and environmental professionals with a useful reference/guide. Decision to be aided: "Is there a better way to protect the environment?" | | | | | Environmental and Regulatory Factors | | | | | | Information | | | | | | Additional | |
|--|---|--|--------------------------------------|--------------------------|--|-----------------------|--------------------|---------------------------|-------------------|-------------------------------------|------------------------|--------------------|------------------|------------------------|-------------------|----------------------|-----------------------|-----------------------------|
| | | | | | Environmental impacts of maintenance measure (typical) [assumed trigger for impact] | | | | | | Typical Env. measures* | Federal Permitting | State Permitting | Procedures by location | Specs by location | Training by location | Additional References | Additional Notes & Contacts |
| | | | | | Air [none] | Noise [people nearby] | Water [near water] | Habitat [species present] | Waste [generated] | Human env. with historic [eligible] | | | | | | | | |
| Click here to SEARCH General Bridge Maintenance Environmental Training Goals and Policies Management Systems, Reporting, and Q/A Enhancement / Stewardship General Guidance and Support | | | | | General Bridge Maintenance Environmental | | | | | | | | | | | | | |
| | | | | | Training | | | | | | | | | | | | | |
| | | | | | Goals and Policies | | | | | | | | | | | | | |
| | | | | | Management Systems, Reporting, and Q/A | | | | | | | | | | | | | |
| | | | | | Enhancement / Stewardship | | | | | | | | | | | | | |
| General Guidance and Support | | | | | | | | | | | | | | | | | | |
| Bridge Maintenance Practice Specific Information | | | | | Environmental impact rank (typical) Rank 1-5 in order of increasing severity (see table below) | | | | | | | | | | | | | |
| Components per NCHRP Report 668 | Activity | Benefit | Sub category (if any) | Infra structure Benefits | | | | | | | | | | | | | | |
| Approach / Embankments | Bridge and Approach Rail repair | Restore traffic safety | Patch spall | • | 1 | 2 | 1 | 2 | 2 | 2 | a,b | | | | | • | | |
| | | | Replace corroded metal rail elements | | 1 | 2 | 1 | 2 | 2 | 2 | a,b | | | | | | | |
| | | | Impact damage repair | | 1 | 2 | 1 | 2 | 2 | 2 | a,b | | | | | | | |
| | Repairing Paved Slope Protection | Restore slope embankment protection and stability | See Repairing Erosion or Scour | • | | | | | | | | | | | | • | | |
| | Attenuator Upgrade | Replace non-standard attenuator for traffic safety | | | | 1 | 2 | 2 | 2 | 2 | 4 | a,b | | | | | | |
| | Leveling/Lifting/Stabilization (e.g., wedging, foam or mudjacking) in Approach Pavement or Slabs. | Restore traffic safety | | | 1 | 2 | 4 | 3 | 4 | 1 | a,b,c | | | | • | | | |
| | Cut Relief Joints in Approach Pavement | Reduce potential for approach pavement, bridge joint, and bridge deck overstress | | | 2 | 2 | 2 | 2 | 2 | 1 | a,b | | | | | | | |

Figure 2. Screenshot of Summary Tab

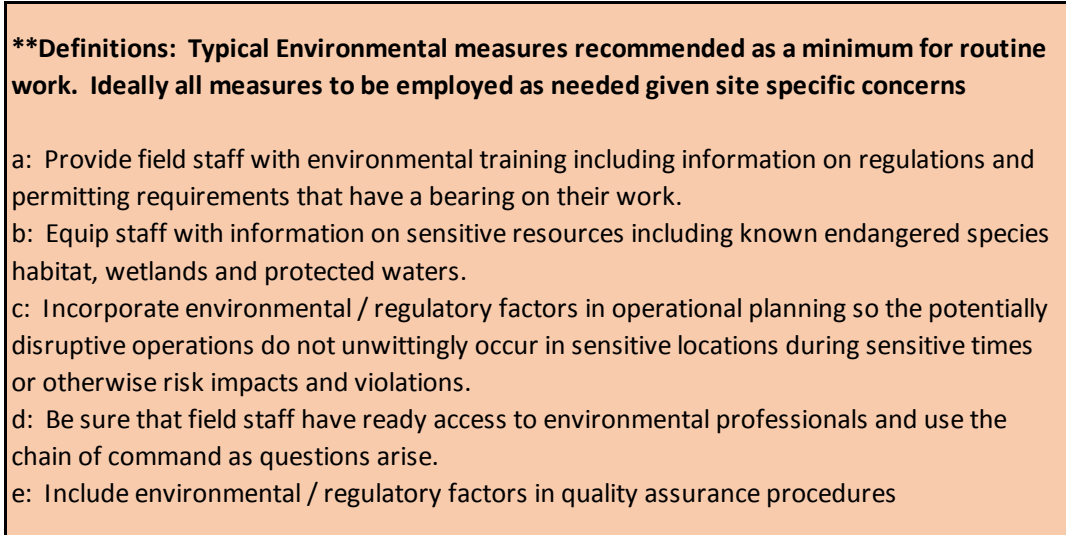


Figure 3. Screenshot of Generally Recommended Environmental Mitigation Measures Key

2.4 State Specific Tabs

The state specific tabs are the heart of the DAT and states are encouraged to “flesh out”/customize their tabs using Excel as well as review corresponding entries from other states to benchmark their operations. Contact information for a large number of states has been included and peer to peer discussions are strongly encouraged. A screenshot of a state summary tab example is shown in Figure 4.

NCHRP Project 20-07/Task 399
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 Task 6. Final Guidelines

| NCHRP Project 20-07/Task 399: Identifying Bridge Maintenance and Preservation Actions which Minimize Environmental Impact | | | | | | | | | | | | | | | | | |
|---|-----------------------|--|-------|-------|---------|-------|------------------------------|-----------------------|------------------------|------------------|------------------------|-------------------|-----------------------|---------------------------|-----------------------|----------|-----------------------------|
| Maintenance Activity Description | | Environmental and Regulatory Factors | | | | | | | Environmental Practice | | | | Reference Information | | | | |
| Bridge Maintenance Activity | Sub Category (if any) | Site specific environmental thresholds | | | | | | Typical Env. measures | Federal Permitting | State Permitting | Procedures by location | Specs by location | Training by location | Metrics including \$/unit | Additional References | Contacts | Additional Notes & Guidance |
| | | Air | Noise | Water | Habitat | Waste | Human env including historic | | | | | | | | | | |
| General | | | | | | | | | | | | | | | | | |
| Env. Training | | | • | • | | | | | • | | | • | | • | | • | |
| Env. Goals | | | | | | | | | | | | | | • | | | |
| Env. Reporting | | | | | | | | | | | | | | • | | | |
| Env. Enhancement | | | | | | | | | | | | | | • | | | |
| General Maintenance | | | • | • | • | | • | • | • | • | • | • | | • | • | • | |
| Specific | | | | | | | | | | | | | | | | | |
| Bridge Cleaning, includes cleaning drainage | Cyclical | | • | • | • | | • | | • | • | • | • | | • | • | • | |
| | On demand | | | | | | | | | | | | | | | | |
| Site vegetation control | | | | • | | | • | | | • | | | | | | | |
| Sealing Cracks and Joints in Bituminous Wearing Surface | | | | | | | • | | | | | | | | | | |
| Crack Sealing in Portland Cement Concrete Decks | | | | | | | | | | | | | | | | | |
| Sealing Concrete Decks | | | | | | | | | | | | | | | | | |
| Replacing Asphalt Wearing Surface | | | • | • | | | | | • | • | | | | • | | | |
| Lubricating Bearings | | | | | | | | | | | | | | | | | |

Figure 4. Screenshot of DAT State Specific Tab for Washington State

2.5 DAT Example

A Western state DOT has experienced problems with protected species and wishes to avoid future problems in a cost-effective manner. To accomplish this, they might employ the following steps:

- a. Consult DAT Summary Page for general information, as shown in Figure 5. The “habitat” cells are highlighted yellow for this example. “Mouse over” will show the relevant information in the cell comment.

| | | | | | | |
|---|---|--------------------------|-----------------------|------------------------------|----------------------|---|
| <p>*For use by bridge owners, maintenance engineers, and their immediate staff in their role as activity planners responsible for specifying (deciding upon) the environmental practices to be followed during field application of the subject bridge maintenance activity given the expected site specific conditions - while also providing managers, field supervisors, and environmental professionals with a useful reference/guide. Decision to be aided: "Is there a better way to protect the environment?"</p> | <p align="center">Environmental Impact and Regulatory Factors</p> | | | | | |
| | <p align="center">Environmental impacts of maintenance measure (typical) [assumed trigger for impact]</p> | | | | | |
| | Air [none] | Noise [people nearby] | Water [near water] | Habitat [species present] | Waste [generated] | Human env. with historic [eligible] |
| <p>Click here to SEARCH</p> | <p>General Bridge Maintenance</p> | | | | | |
| | Training | | | | | |
| | Goals and Policies | | | | | |
| | Management Systems, Reporting, and Q/A | | | | | |
| | Enhancement / Stewardship | | | | | |
| General Guidance and Support | | | | | | |
| | • | • | • | • | • | • |
| | • | • | • | • | • | • |
| | • | • | • | • | • | • |
| | • | • | • | • | • | • |
| | • | • | • | • | • | • |

Figure 5. Screenshot of General Information for General Bridge Maintenance/Habitat

- b. Review other states in the region for examples, e.g.,
 - On the WA sheet in the DAT:
 - i. “Mouse over” comment in the “General Guidance and Support row/Habitat column” cell quoting “Page 5-5 of WSDOT Chapter 5 Maintenance of Structures”, as shown in Figure 6. The cell is highlighted yellow for this example.
 - ii. “Click Link” to view the full publication at:
<http://www.wsdot.wa.gov/publications/manuals/fulltext/M51-01/Chapter5.pdf>
 - iii. Contact information for the WSDOT expert on these matters is included in the “Contacts” Column of the “Additional References” section (see Figure 7), and is again visible by “mouse over”. The cell is highlighted yellow for this example.

| Maintenance Activity Description | | Environmental and Regulatory Factors | | | | | | | Environmental Practice | | | | | |
|---|-----------------------|--|-------|-------|---------|----|-----------|--------------|------------------------|-------|------------|----------|-------------|---------------------------|
| Bridge Maintenance Activity | Sub Category (if any) | Site specific environmental thresholds | | | | | Human env | Typical Env. | Federal | State | Procedures | Specs by | Training by | Metrics including \$/unit |
| | | Air | Noise | Water | Habitat | Wa | | | | | | | | |
| General | | | | | | | | | | | | | | |
| Env. Training | | | | | | | | | | | | | | |
| Env. Goals | | | | | | | | | | | | | | |
| Env. Reporting | | | | | | | | | | | | | | |
| Env. Enhancement | | | | | | | | | | | | | | |
| General Maintenance | | | | | | | | | | | | | | |
| Specific | | | | | | | | | | | | | | |
| Bridge Cleaning, includes cleaning drainage | Cyclical | | | | | | | | | | | | | |
| | On demand | | | | | | | | | | | | | |
| Site vegetation control | | | | | | | | | | | | | | |
| Sealing Cracks and Joints in Bituminous Wearing Surface | | | | | | | | | | | | | | |
| Crack Sealing in Portland Cement Concrete Decks | | | | | | | | | | | | | | |
| Sealing Concrete Decks | | | | | | | | | | | | | | |
| Replacing Asphalt Wearing Surface | | | | | | | | | | | | | | |

Page 5-5 of WSDOT Chapter 5 Maintenance of Structures
<http://www.wsdot.wa.gov/publications/manuals/fulltet/M51-01/Chapter5.pdf>

Generic list of environmental thresholds that the state adheres to:

- State or Federal list of threatened or endangered species.
- Species of high interest to state or federal agencies.
- Migratory waterfowl habitat.
- Anadromous fish habitat.
- Trout and other cold water fish habitat.
- Habitat for birds of prey (Must have Bridge and Structures approval to attach platform, boxes or any other structure to any part of a bridge).
- Wetlands and wetland habitat.
- Riparian habitat.
- Important sport fishing areas.
- Highly erosional soils.
- Listed or proposed wild and scenic rivers.
- Navigable waterways.
- Significant historic resources.
- Natural resource agency holdings or interests (refuges, parks, habitat areas, etc.).
- Migratory corridors.
- Wintering areas and other critical feeding areas of wildlife.
- Important wildlife reproductive habitat.
- Public water supplies, including important aquifers.
- Islands and other coastal barriers.
- Hazardous waste.
- Regulatory flood ways and other flood plain areas.
- Commercial fish and shellfish production areas.

Figure 6. Screenshot of WSDOT Example showing General Maintenance/Habitat Information

| Maintenance Activity Description | | Environmental Practice | | | | Reference Information | | |
|----------------------------------|-----------------------|------------------------|-------------------|----------------------|---------------------------|-----------------------|----------|-----------------------------|
| Bridge Maintenance Activity | Sub Category (if any) | Procedures by location | Specs by location | Training by location | Metrics including \$/unit | Additional References | Contacts | Additional Notes & Guidance |
| | | | | | | | | |
| Env. Training | | | | | | | | |
| Env. Goals | | | | | | | | |
| Env. Reporting | | | | | | | | |
| Env. Enhancement | | | | | | | | |
| General Maintenance | | | | | | | | |

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Figure 7. Screenshot of WSDOT Example Showing Contact Information

Chapter 3: Decision Aid Table (DAT) Download

Until the DAT can be hosted on the TRB or other Website, users may access the information by following these steps:

1. Clicking on the link below or copying and pasting the link into an internet browser

https://www.dropbox.com/s/bnbiel18vrnhpa6/DECISION%20AID%20TABLE_NCHRP%20Project%2020-07_Task%20399_022118%20Final.zip?dl=0

2. Downloading the working zip file to the c:\directory

(Note the compressed folder cannot be directly opened on Dropbox.com; the compressed folder must first be downloaded)

3. Opening the Excel DAT spreadsheet

Chapter 4: References

1. AASHTO Center for Environmental Excellence. *Compendium of Environmental Stewardship Practices for Highway Construction and Maintenance, Chapter 7 Bridge Maintenance*. http://environment.transportation.org/environmental_issues/construct_maint_prac/compendium/manual/7_4.aspx
2. AASHTO Center for Environmental Excellence. *Transportation and Sustainability Best Practices Background*, Sustainability Peer Exchange Center for Environmental Excellence. May 27-29, 2009 <https://www.dot.ny.gov/programs/greenlites/repository/AASHTO%20Sustainability%20Briefing%20Paper.pdf>
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