Bridge Guidance Related to Environmental Consultation & Permitting

4/27/2021
Revision 2.2
Atlanta, GA 30308

GDOT
Georgia Department of Transportation

This document was developed as part of the continuing effort to provide guidance within the Georgia Department of Transportation in fulfilling its mission to provide a safe, efficient, and sustainable transportation system through dedicated teamwork and responsible leadership supporting economic development, environmental sensitivity and improved quality of life. This document is not intended to establish policy within the Department, but to provide guidance in adhering to the policies of the Department.

Your comments, suggestions, and ideas for improvements are welcomed.

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The Georgia Department of Transportation maintains this printable document and is solely responsible for ensuring that it is equivalent to the approved Department guidelines.

Revision Summary

Revision Number	Revision Date	Revision Summary
Original	N/A	Original Release Date
2.0	3/18/19	Converted to standard template. The Work Bridges subsection of the manual was revised to clarify how environmental permitting should address the potential use of mat foundations for work bridges
2.1	6/4/20	Updated template to comply with new branding guidelines
2.2	4/27/21	Riprap Jetties cross section parameters were modified from 2 year storm to base flow

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List of Effective Chapters

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Chapter 1. Environmental Consultation & Permitting - Contents

Chapter 1. Environmental Consultation & Permitting

1.1 Overview

Bridges crossing waterways (e.g., Waters of the U.S. and State Waters) may require environmental consultation, permitting or variances through the U.S. Army Corps of Engineers (USACE), Federal Emergency Management Agency (FEMA), Georgia Environmental Protection Division (EPD), U.S. Fish & Wildlife Service (USFWS) and/or National Marine Fisheries Service (NMFS).

In order to receive regulatory concurrence, a permit, or variance, certain information regarding the permanent construction of the bridge, demolition of existing bridge, if necessary, and the way in which the new bridge is constructed are incorporated in the environmental permit application.

This document serves to clarify the evaluation of environmental impacts and provides guidance regarding timeline and information needed for the environmental permit application.

These impacts are divided into two categories: Permanent Impacts and Temporary Impacts.

Impacts to Waters of the U.S. are measured in two different ways for obtaining a Section 404 permit (USACE):

- Linear Impacts – in linear feet, measured along a stream centerline; and
- Area Impacts – acreage of impact within the resource boundary.
- Non-exempt impacts to state buffers are measured in square feet for obtaining a buffer variance (EPD).

Exempt Impact areas are areas at bridge structures bounded by 100 feet (50 feet each side of the centerline and 50 feet before begin structure and 50 feet beyond end of structure).

Discussions among the environmental specialists, bridge and roadway engineers, and construction disciplines are recommended to accurately understand the process and quantify temporary and/or permanent impacts for the Assessment of Effects documentation.

1.2 Permanent Impacts

General

Permanent Impacts are those environmental impacts that are defined as the permanent placement of structures or fill within Waters of the U.S. and other areas [such as Environmentally Sensitive Areas (ESA), including historic resources] protected by environmental legislation. These areas are permanently disturbed and will not recover over time. Permanent impacts also refers to any impacts to a resource that will not recover within 7 years. An example of this would be clearing a forested wetland, which would be a permanent impact since it would not recover within 7 years.

Permanent impacts could include: bridge bents, rip-rap, placement or removal of embankment, etc.

Potential items that need to be provided to the ecologist preparing environmental documentation include but may not be limited to:

1. Type, size and location of pile bents (including size of any encasements), concrete foundations including pile footing sizes, drilled caissons, spread footings and/or cofferdam seals;

Note: Driven piles are not deemed to be a permanent impact unless encased in concrete.

2. Layout of roadway, including bridge structure;
3. Type, size and location of pipes, culverts, and/or box culverts;
4. Limits of riprap and/or rock embankment;
5. Pilot holes (Pilot holes within Waters of the US would cause a driven pile to become a permanent impact because of the displacement of fill);
6. Justification for impacts and explanation of avoidance and minimization measures. (The Engineer may assist the ecologist in understanding the permanent impacts caused by a project and the decision making involved in the alternative selected.)
7. Cofferdams that require a concrete seal along the base would be considered a permanent impact.

Quantifying Permanent Impacts

Permanent impacts are assessed by their measurement. These measurements are considered in two distinct categories: Linear Impacts and Area Impacts.

Linear Impacts are distance measurements along the longitudinal axis of the resource. For example, when the resource is a stream or river, the linear impact measured is along the centerline of the stream or river.

These measurements are taken to the nearest foot.

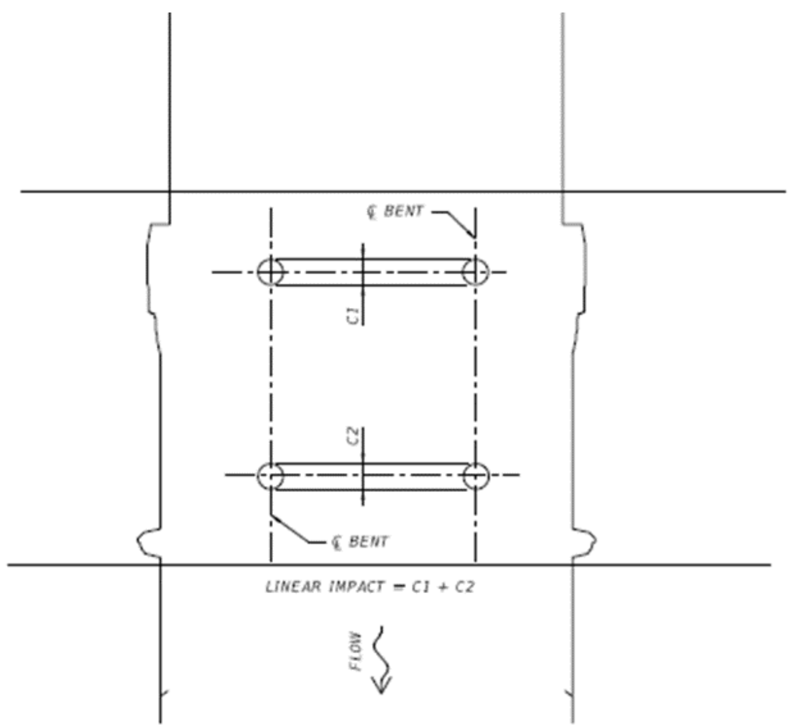


Figure 1 - Linear Impacts for a Bridge perpendicular to flow

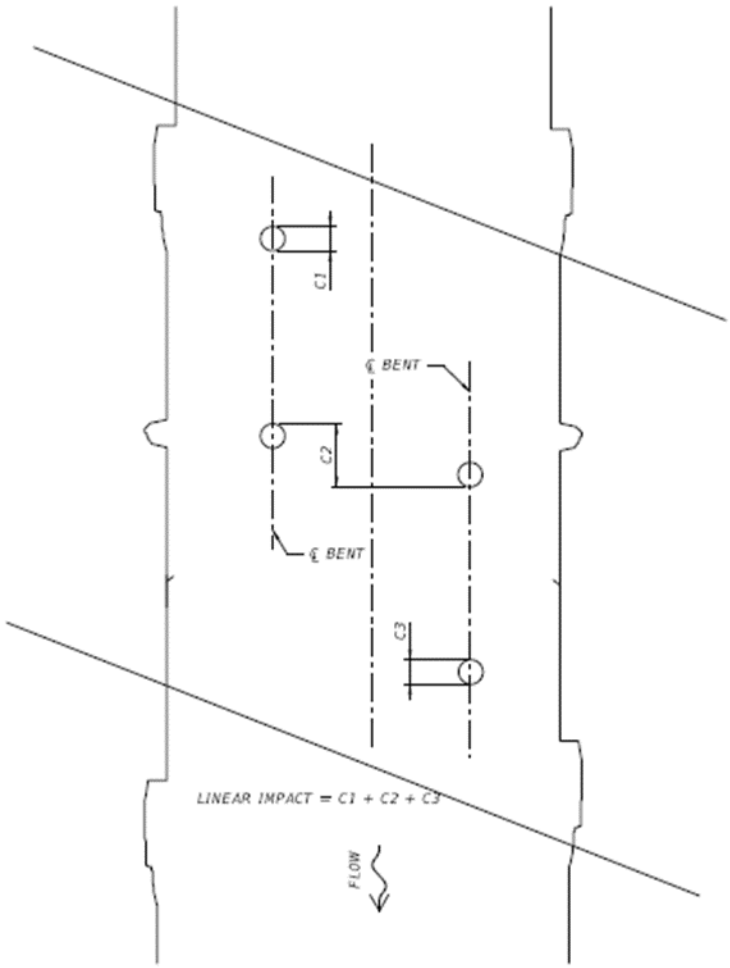


Figure 2 - Linear Impacts for a Bridge skewed to flow

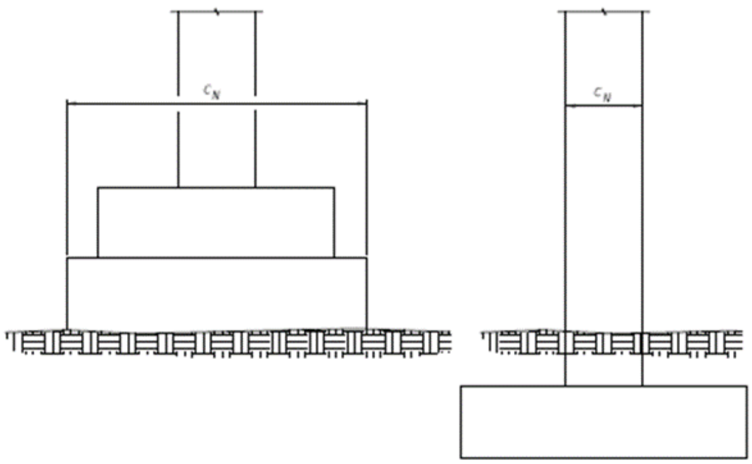


Figure 3 - Impact widths for column configurations

Area Impacts are measurements of impact to a particular resource. For example, an area impact to a wetland area that is created by a newly constructed bridge would be the area of the caissons at the ground surface. These impacts are measured in acres (rounded up to the nearest .01 AC).

In addition to the physical impacts to waters, a permanent area impact can occur when the bridge deck blocks all sunlight from reaching below the structure. This should be considered for bridges where minimum freeboard is the normal condition. This impact will be considered on a case by case basis.

Foundations typically used on GDOT projects will have BOTH Linear Impacts AND Area Impacts. For example, Drilled Caissons in a stream will have linear impacts along the stream associated with their diameter and area impacts created by the plan area of the caisson.

The following list provides some commonly asked questions during discussions of permanent impacts for the proposed bridge:

- Is clear spanning the resource/resources an option? If not, why can this not be achieved?
- If bents are necessary in streams/wetlands/open waters, please provide the answers to the following:
  - How many and which bents would be placed in what resources?
  - How many piles would be constructed per bent? How will the piles be installed (i.e. driven, spread concrete footing, etc.)?
  - If applicable, what are the dimensions of the concrete footprint for each pile footing or each caisson?

1.3 Temporary Impacts

General

Temporary Impacts are those environmental impacts defined as “temporary” (not permanent) in nature and that will allow the Water of the U.S. to regain full function within seven (7) years of placement. Temporary impacts are typically those caused by *during construction* activities.

These temporary impacts include but are not limited to:

- Cofferdams and other pile driving operations. (Additional considerations may be required where re endangered species are present). Cofferdams with only sheet piles used to contain debris are considered a temporary impact (no seal concrete).
  - For estimating impacts, add 5 feet to the footing or seal dimensions to calculate the area and linear impacts (this accounts for the offset to formed concrete and the thickness of the cofferdam).
- temporary fills (including haul roads and jetties);
- temporary structures (temporary detour bridge, work bridges, and bulkheads);
- clearing and grubbing limits;
- temporary diversion channels, items requiring demolition;
- Other temporary disturbances for construction of the permanent work and/or demolition of the existing structure, as necessary.
- Justification for impacts and explanation of avoidance and minimization measures. (The Engineer may assist the ecologist in understanding the temporary impacts caused by a project and the decision making involved in the alternative selected.)

Quantifying Temporary Impacts

The Engineer can identify temporary impacts and provide supporting information regarding type, size, limits or other information necessary to allow the preparer to adequately describe the temporary impacts in the environmental permit application and assessment of effects documentation. This information is included in a Construction Staging for Access (Section 20) plan. Constructability reviews, PFPR and FFPR are opportunities for discussion between Design, Construction and Environmental as well as Consultant resources involved in the meetings.

The preparer will also need the approximate durations (weeks or months) of the temporary impacts created by constructing the project.

The following list provides some commonly asked questions during discussions of temporary impacts for:

1) Existing bridge removal:
   - How will the existing bridge be removed? Are there existing bents within the stream/wetland/open water areas that need to be removed? If so, can a commitment be made to cut off existing bents at the substrate elevation?
     a. Regardless of if existing bents will be cut off or fully removed, please provide a footprint for temporary de-watering activities via cofferdams or other methods to be used for this work.
   - Please provide dimensions for de-watering structures, if applicable.
     a. The footprint for these methods, whether they will be used for bridge demolition and/or reconstruction, need to be shown on Series 20 plans. Stages for this work (if applicable – say for jetties), need to be clearly indicated and durations of each state provided. For projects proposing the use of jetties, a hydrologic modeling analysis regarding potential scour will need to be performed and available upon request.
2) Construction/access:
   - Series 20 plans need to be available for discussion at the constructability review meeting.

- It is preferred for bridges to be constructed from any available upland areas adjacent to the bridge.
- If construction from upland areas is not feasible, regarding methods for temporary access to the bridge site, the contractor will be limited to the areas on the plans within orange barrier fence.
- What access will be needed for the construction methods proposed (e.g. temporary access roads, slip ramps, etc.)? What will the footprint of these access areas entail? If applicable, these may need to be shown on the Series 20 plans as well.
- What are the dimensions for temporary de-watering activities via cofferdams or other methods, if applicable and different than those used for bridge demolition?

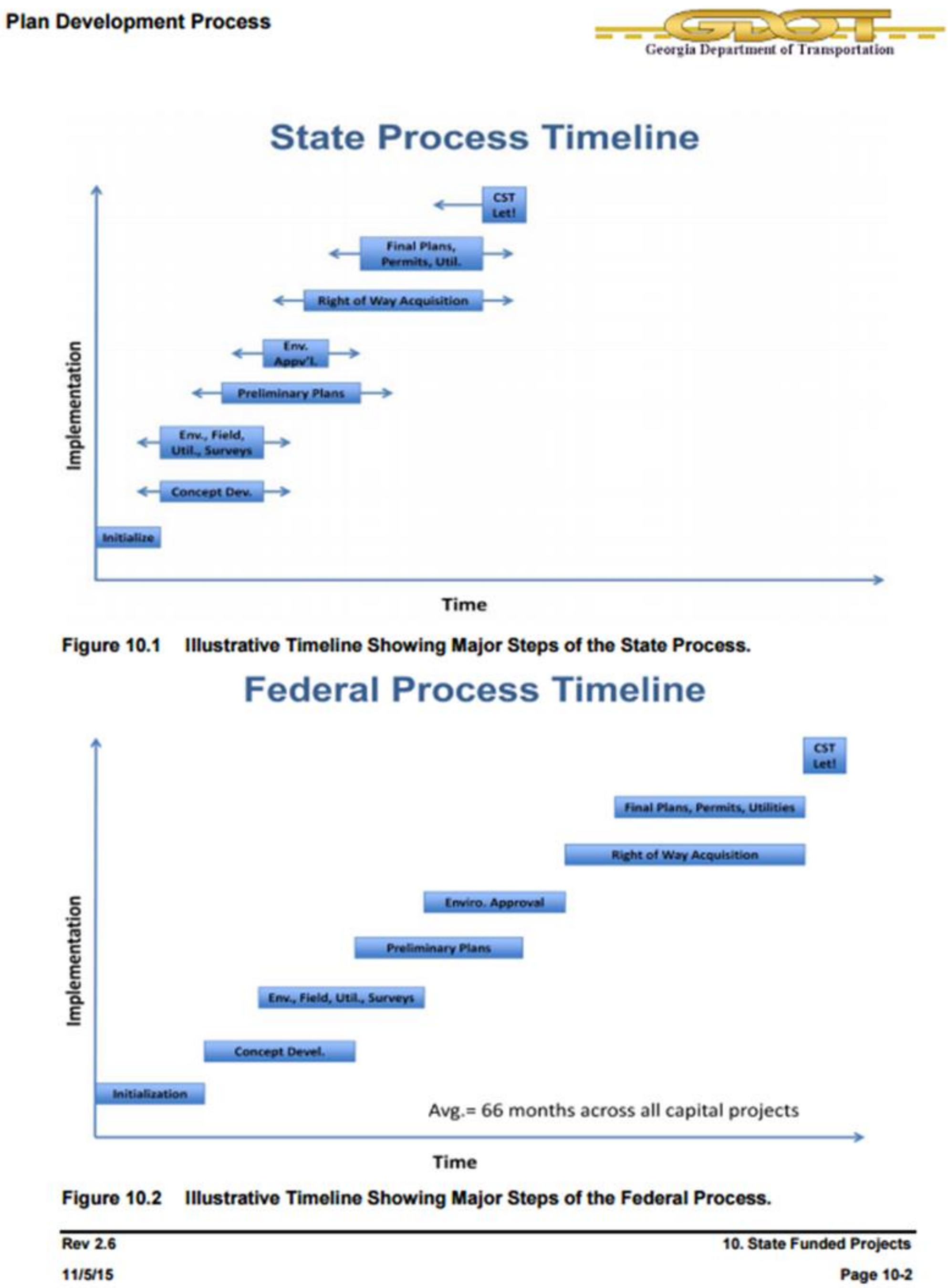
3) Other Considerations
   - Are there any seasonal restrictions due to aquatic species/migratory birds that could influence the constructability discussion?
   - Are there any best management practices included to maintain water quality during construction?

1.4 Environmental Timeline

The following section details the timeline for the environmental approval and permitting process with respect to the GDOT Plan Development Process (PDP).

The relationship between the timing of bridge design with respect to the environmental permitting activities will provide insight into the actual level of accuracy in design and the expectations of the permitting documents at a given time in the project delivery process.

Below is an excerpt from the GDOT Project Development Plan Manual.



Plan Development Process

Figure 10.1 Illustrative Timeline Showing Major Steps of the State Process.

Figure 10.2 Illustrative Timeline Showing Major Steps of the Federal Process.

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From these graphs, there is considerable overlap of the Preliminary Plans and Environmental Approval Phases.

From a bridge design perspective, there is little or no actual design that occurs at the Preliminary Plan Phase which leads to the uncertainty in providing definitive answers to questions regarding sizes of bridge elements.

1.5 Level of Accuracy

One of the challenging tasks in providing answers to the preparer regarding foundation sizes and the need for or lack of the need for cofferdams at the preliminary plans phase is the uncertainty because no detailed design or Bridge Foundation Investigation has been performed.

In order to respond, the engineer has to provide a "best guess" based on intuition and previous experience.

The challenge occurs due to the engineer's general nature to be conservative. Conservatism is prudent, but being overly conservative leads to problems in the environmental permitting. These discussions are not focused on identifying the most conservative approach, rather discuss the localized considerations and develop a plan that is attainable and demonstrates the team looked at avoidance and minimization options. Preparers have been warned by regulatory agencies not to "over permit" as Environmental Services is tasked with demonstrating avoidance and minimization of ESAs.

The best advice on responding is to "be conservative, but not too conservative". This is best achieved by testing the "best guesses" against similar projects or by soliciting the opinions of peers if there is no previous work to use as a basis for an educated guess.

In addition, the early discussions regarding the Section 20 plans may define a particular approach, but this approach can be modified as the project development process continues. The objective of the "best guess" early on is to document for the environmental process that the discussion has occurred and a plan has been developed with the available information. As the Final Plans phase of project and the bridge design advance, more details may come to light that influence the constructability discussion. At this point, the constructability approach can be revisited and any changes can be documented in the environmental reevaluation in advance of permitting.

It should be noted that GDOT is not intending to specify means and methods that could limit the contractor. However, the constructability discussion allows for an in depth multi-disciplinary approach that documents the project has taken into account the resource impacts and is constructible in at least one way.

Chapter 2. Construction Access Methods - Contents

Chapter 2. Construction Access Methods

Guidance for determining the best selection of construction access methods

The following sections provide guidance regarding typical features that are needed in order to construct bridges but are not necessarily included in the bridge plans. These features have environmental impacts and must be considered in the environmental consultation and permitting.

There are many considerations in selecting the appropriate construction access methods. Often times it is not practical for the engineer to consider all the factors involved, including preferred methods by individual contractors. However, it is important for the engineer to select a method that is constructible, even if the contractor should pursue an alternative after the project is awarded. If the contractor decided to pursue a construction method outside the permitted method and if impacts change, they are required to modify the permit.

The Engineer should consider the effect on the environment and the environmental permitting implications when selecting the construction access methods for the project.

From a broad perspective, the following order of construction access selection generally provides an approach that disturbs the environment from least to most.

1. Work Barges and their associated Bulkhead Walls/Docks;
2. Work Bridges;
3. Jetties;
4. Haul Roads.

Guidance provided for these construction access methods include:

- Work Barges;
- Bulkhead Walls;
- Work Bridges;
- Jetties;
- Haul Roads.

Additional Guidance provided for miscellaneous items include:

- Temporary Casings for Drilled Shafts;
- Bridge Demolition.

2.1 Work Barges

Work barges are large floating platforms. In bridge construction, work barges are used to support lifting equipment (cranes) in deep water. Work barges are a viable option for bridge construction when the water is at least 7 feet deep and the current is not very strong. Waters that change elevation frequently (downstream of a dam) might reduce the viability of using a work barge.

Work barges are usually comprised of discreet sections of steel rectangular elements that are connected together with latching devices. By combining these sections together, sufficient load carrying capacity for material and equipment can be achieved. For smaller projects, crawler cranes are loaded onto barges.

In order to load equipment on a barge, a loading dock is required. If a suitable existing dock is not nearby the project, a temporary loading dock (or bulkhead) is required. This temporary dock is included in the temporary impacts created by a project. See Guidance for use of Bulkhead walls.

Figure 1 - Use of a Barge for Drilled Shaft Construction

2.2 Bulkhead Walls

Bulkhead walls are walls constructed by driving steel sheet piling or steel H piling with a panel element between driven piles. These walls are designed as cantilever retaining walls. The walls may require a tied back anchor if the exposed height becomes too tall.

The wall required to establish a loading dock for a work barge is a bulkhead wall. Loading docks shall be 20 feet wide behind the bulk head and have the same construction as a haul road roadbed. The bulkhead shall be placed far enough from shore so that there is 7 feet of water depth at the face.

Figure 2 - Bulkhead wall for foundation installation

2.3 Work Bridges

Work bridges are temporary bridges constructed adjacent to new or replacement bridges to facilitate construction of the proposed structure and demolition of existing structures. These are generally composed of prefabricated elements and are unique to each contractor performing the construction.

Figure 3 - Typical Work Bridge

Figure 4 - Typical Work Bridge

The superstructure for these work bridges is usually composed of steel beams with wooden mats of oak timbers that serve as an equipment platform and walking surface for workers. These mats are often called “crane mats”. Work Bridges are typically 20 feet wide.

The substructure for temporary bridges varies depending on subsurface conditions. Steel H-pile or steel pipe pile are often used in combination with prefabricated steel or concrete bent caps. When recommending a work bridge with driving piles, designer should take into account the location of rock below the stream and stability of piles due to insufficient pile embedment. Generally, 10 feet of pile embedment in suitable material is the minimum for considering the use of a pile supported work bridge. Where water levels are low and rock level is shallow enough to prevent the use of driven piles, the use of stack mats to create cribbing for a work bridge to rest on is an option. This type of foundation would be very susceptible to damage from a flood event. If this type of foundation is to be allowed, it is important to make the sure it is stated in the environmental permitting application as it has a larger area impact than the pile foundation and may require additional environmental permitting. The environmental permitting application should not preclude the use of a pile foundation.

Work bridges should be offset 10-15 feet from an existing bridges and may require offshoots (“fingers”) to access foundations of the existing or new bridge.

Figure 5 - Typical work bridge "finger"

2.4 Riprap Jetties

Jetties are riprap embankments that project into waterways to allow construction access. These embankments have flat surfaces on top to allow for the construction of a 30 foot wide haul road. The cross section can be built with 1:1 slopes and should project 1 foot above the normal water level or base flood elevation.

Figure 6 - Riprap Jetty

Figure 7 - Riprap Jetty

The rationale for using a jetty verses other construction access methods such as temporary work bridges or construction using work barges is usually determined by several conditions.

These include:

- Absence of endangered species in the vicinity of the proposed jetty;
- Absence of the need for waterway navigation or an identified recreational area in the vicinity of the proposed jetty;
- Presence of rock near the surface at the proposed jetty location that would make driving pile for a work bridge cost prohibitive;
- Shallow water depth that would prevent the use of work barges.

GDOT's experience with the use of continuous jetties (bank to bank) has been that they are not hydraulically efficient. Pipes through these jetties are not effective and the overall use of continuous jetties should be avoided. There is a concern with the constriction of the waterway created by finger jetties and their potential for scour. However, the increased velocities are generally not larger than flood events. In flows greater than typical typical base flow, the water surface generally overtops the jetty which can be a negative for a contractor because of the potential increase in jetty maintenance during construction.

2.5 Haul Roads

Haul roads are often necessary for construction of both new and replacement bridges. These haul roads are routinely constructed for access adjacent to the bridge for the delivery of bridge beams and other bridge construction materials as well as to facilitate the movement of construction cranes and other machinery.

Figure 8 - Haul Road beside new bridge construction

Haul roads are constructed using fill material. The cross section of haul roads is generally shaped to provide 30 feet of roadbed width and roadway side slopes of 1.5:1. The roadbed for the haul road is routinely constructed of an open graded granular material.

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Chapter 3. Additional Guidance on Miscellaneous Items - Contents

Chapter 3. Additional Guidance on Miscellaneous Items

3.1 Temporary Casings for Drilled Shafts

Temporary Casings for Drilled Shafts may be used by the contractor when caisson construction in the water required collection of debris or spoils. They may also be required when adjacent soils are susceptible to collapse.

Temporary shaft diameter = Diameter of the permanent shaft + 2 feet

3.2 Number of Pile hammer strikes

Due to the presence of protected aquatic species that travel upstream to spawn, there is environmental concern regarding the sound and vibrations caused by pile (impact) driving operations for installing piles in bridge footings as well as vibratory hammers that are often used to install and remove steel sheet piling for cofferdams.

Environmental staff as part of regulatory agency consultation are regularly asking for the number of hammer strikes to install these piles. Calculating this number with a reasonable degree of certainty is difficult.

3.3 Bridge Demolition

Bridge demolition can be a temporary environmental impact and must be considered in environmental consultation and permitting. Existing bridges are demolished and removed from the project by various methods that include but are not limited to:

- Cutting by saw or torch;
- Power activated mechanical rams;
- Pushover;
- Blasting.

The access for equipment for the deconstruction activities would be accounted for in the temporary impacts analysis.

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Chapter 4. Plan Presentation of Information Related to Environmental Permitting - Contents

Chapter 4. Plan Presentation of Information Related to Environmental Permitting

While information that is relative to environmental permitting is located in various sections of the construction plan set, including but not limited to:

Section 13 – Roadway Plans
Section 19 – Construction Staging…
Section 54 – Erosion control plans
Section 35 – Bridge Plans
Section 31 – Wall Plans

The primary source of information related to environmental permitting from a plans presentation standpoint is Section 20 – Construction Staging Details. Requirements for items to be included in these Details are found in the GDOT Plans Presentation Guide (20.002).

This section contains drawings specifically related to the constructability approach considered by the design team in order to receive an environmental permit from the appropriate regulatory agencies.

The goal of the information provided in this section is to depict this construction approach to the contractor so that if this approach is followed in construction activities, no further environmental permitting coordination is required.

Should the contractor's construction means and methods require a different approach, the contractor will need to seek a revised environmental permitting.

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