

IOWA DEPARTMENT OF TRANSPORTATION

To Office: Bridges & Structures

Date: February 5, 2002

Attention: All Employees

Ref. No.: 521.2

From: Gary Novey

Office: Bridges and Structures

Subject: Bridge Substructure Design - MM No. 21 (Use of "Excavate and Dewater" Bid Item)

There has been some confusion on the use of the bid item "Excavate and Dewater". The following issues have been raised in regard to the item.

- When is the bid item "Excavate and Dewater" used?
- Who determines when to use the bid item?
- Is the "Excavation, Class 21" bid item required also?
- What design criteria are used for seal coats?

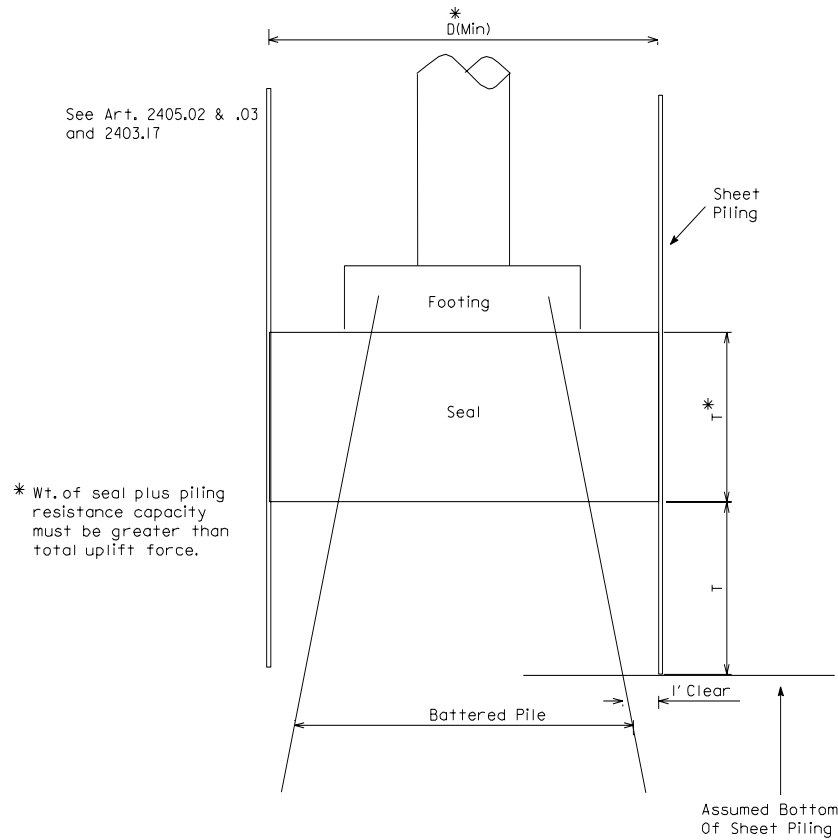
A. When is the bid item "Excavate and Dewater" used?

The "Excavate and Dewater" bid item was developed for use in the construction of piers for the large Iowa Rivers where the soil, at and below the footing excavation, is predominantly sand. When a footing is located below the water table in these soil conditions, the bottom of the sheet pile cofferdam may be difficult to seal or the length of sheet pile required to seal the cofferdam would not be economical. A concrete seal coat (See Detail A) can be used in these situations. . By using the seal coat, it allows the construction of the footing in the dry. A seal coat may also be required in situations where underlying soft rock may be porous.

General procedure for installation of a seal coat is as follows:

1. Drive sheet piles to form cofferdam.
2. Drive H-piles for bridge footing.
3. Place concrete seal coat.
4. Pump cofferdam dry.
5. Place bridge footing in the dry.

Anytime a cofferdam is required to construct a footing and the permeability of the soil is in question, the design engineer should check with their section leader and consult with Design's Soils Section.



Detail A

B. Who determines when to use the bid item?

If the permeability of the soil is in question, the design engineer should check with his/her section leader and the Soils Section to see if "Excavate and Dewater" is required. This bid item should generally not be used for bridges over small or medium sized streams.

C. Is the "Excavation, Class 21" bid item required also.

When "Excavate and Dewater" is used, the Standard Specification 2405.14 states that both Class 20 and 21 along with the cost of cofferdams, seal coats, pumps and all other equipment required are included. Therefore, the "Class 20" bid item, "Class 21" bid item and the "Excavation Classification Line" are not required.

D. What design criteria are used for seal coats?

Design guidelines for the seal coat are as follows:

February 5, 2002

1. Design bond between the seal coat and pile = 5 psi (The lower allowable bond is due to the uncertainty of the bond strength of steel to concrete when the placement is in water.
2. Include the weight of the seal coat in the design of the piling.
3. When designing the size of the cofferdam, assume the tip of the sheet pile cofferdam extends 1 ft from the edge of the piling (See Detail "A").
4. Base the elevation of the top of the cofferdam and the thickness of the seal coat on a  $Q_{25}$  flow.
5. Base the design on the weight of the seal coat and bond strength between the piling and seal coat to counteract the water pressure at the bottom of the seal coat. Assume a factor of safety of 1.1.
6. Because of the uncertainty of whether the seal coat is going to be used, the pier needs to be designed for both situations (with or without the seal coat).

When using the "Excavate and Dewater" bid item, seal coat details shall be provided on the plans and standard note E832 or M832 shall be placed on the pier sheet.

As described in the Attachment "A" below, the bid item was developed to:

1. Provide a method of bidding that is fair to the contractor.
2. Allow the designer to specify certain conditions (cofferdam size, elevation, and length) to insure the structural integrity of the bridge.
3. Eliminates as much negotiating as possible to reduce the work orders and paper work required by the field to complete the project.

#### Attachment "A" (Development of "Excavate and Dewater" Bid Item)

The following is some background information on the development of the "Excavate and Dewater" bid item taken from a memo from Bill Lundquist to his design section (12-3-80).

The question arises as to how best to specify and bid the excavation and dewatering necessary to construct a pier in a large inland Iowa river where the soil, at and below the footing excavation, is predominantly sand. It has been our understanding that a seal coat is necessary to allow the pier footing to be placed in the dry. Our practice has been to design the seal thickness, specify it on the plans, and bid it and the excavation necessary to place it as definite bid quantities. If the contractor chooses to try to construct the pier without the seal coat, permission must be obtained from the central office. If he is successful in this construction, a work order results, deleting the cost of a seal coat concrete and the Class 21 Excavation that was saved. However, the contractor is paid an adjusted price for these two items that would reflect the fixed costs he might have included in the cost of the seal and excavation. These fixed costs he might have included cofferdam, overhead, profit, bid bond and insurance, etc. The determining of this adjusted price is a negotiated item and can be hard to agree upon.

The new bridge across the Cedar River at Vinton (878 Benton) is a good example of the above. The pier footings sit in medium sand, about 50 feet deep, overlying firm glacial clay. The footings are about 10 feet below streambed, to protect against scour, and the seal coats that were specified on the plans were designed for a head of the seal coat specified for each. The contractor worked inside a steel sheet pile cofferdam at each pier and was able to pump the cofferdams dry. Seepage was controlled by the use of a sump and a pump. All piles and footings were driven and constructed in the dry. A work order was processed for the elimination of the seal and excavation, and after finally negotiating an adjusted price to cover fixed costs; a savings was realized by the State of Iowa.

Several problem areas arise in specifying and bidding dewatering costs in the above manner. First, of course, is negotiating the adjusted price for the materials deleted. Second, is the possibility of the contractor unbalancing his bid. Bidding the seal coat low and adjusting other items upward on the assumption, he will not place the seal, but will place the adjusted items. His loss in total dollars then is less than if he were to bid the cost of the seal coat more accurately.

It appears that a better way to bid the costs required to dewater is by an all-inclusive lump sum bid "Excavate and Dewater." Included in this would be all costs of labor and materials required to allow the pier footing to be constructed in the dry. This could include cofferdams, concrete seal coats and the excavation required to place the seal coat, well points, earth dikes, or any approved method of dewatering plus all pumping, bailing, or drainage required. The size and thickness of seal coat, if used, would be shown on the plans. The pier would be designed to be stable if the seal coat was not used and the footing piling designed to carry the weight of the seal coat if used.

An example of the above type of bidding is designs 577 and 677 Black Hawk, I-380 over Cedar River. On this project, the contractor again chose to construct the piers without seal coat, again by the use of steel piles, pumping, and a sump and pump. In this instance, though, no work order and negotiation will be required due to the elimination of the seal coats. The burden of bidding, gambling on the necessary use of seal coats, is placed upon the contractor. He is required by specification to do whatever is approved or required by the Engineer to insure that the footings can be placed in the dry.

We want to provide, on the plans, a method of bidding that is fair to the contractor, but yet specifies certain conditions to insure the structural integrity of the bridge. We also want to eliminate as much negotiating as possible to reduce the work orders and paper work required to complete a project. It seems that bidding by the "Excavate and Dewater" method would best satisfy these criteria.

The designer should review carefully the situation at hand before deciding to follow this bidding method. There may be instances where bidding in the present manner than by "Excavate and Dewater" is the best method to follow. Also, the usual bridge over a small or medium sized stream should not require any special mention of dewatering or means to do so.