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Remove structural materials carefully without damage.

Do not use explosives to remove concrete floor slabs from steel superstructures that remain the property of the Department.

(C) Requirements for Partial Removal

Perform partial removal to the lines indicated in the plans. Submit a plan for partial removal of bridges for approval before beginning removal. Do not remove concrete by blasting or other method that may cause damage to the concrete or reinforcement that is used in the completed structure.

Use equipment and methods to remove portions of a concrete structure undergoing widening which are sufficient to obtain plan lines and slopes without undue spalling at edges of the concrete. Do not use an iron ball or pile hammer to remove portions of a concrete structure undergoing widening.

402-3 MEASUREMENT AND PAYMENT

The price and payment below will be full compensation for all items required to remove existing structures including, but not limited to, those items contained in Article 402-1.

When the contract includes the item of Removal of Existing Structure at Station _____, the work of removing the structure will be paid at the contract lump sum price for this item.

When the contract includes the item of Removal of Existing Structures at Station _____, the work of removing the structures will be paid at the contract lump sum price for this item.

Payment will be made under:

<table>
<thead>
<tr>
<th>Pay Item</th>
<th>Pay Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Removal of Existing Structure at Station _____</td>
<td>Lump Sum</td>
</tr>
<tr>
<td>Removal of Existing Structures at Station _____</td>
<td>Lump Sum</td>
</tr>
</tbody>
</table>

SECTION 410

FOUNDATION EXCAVATION

410-1 DESCRIPTION

Excavate any material as necessary for the construction of foundations and end bent caps for bridges, retaining walls of reinforced concrete or reinforced masonry, arch culverts and box culverts without floor slabs in accordance with the contract or as directed. Excavate, perform exploratory drilling at footings to a depth not to exceed 5 feet, blast, drain, divert water, bail and pump. Provide and remove bracing, shoring, sheeting, cribbing and cofferdams; substructure scour protection, subsurface drainage and drawings; and backfill including hauling and disposal of materials.

Do not deposit excavated materials or construct earth dikes or other temporary earth structures in rivers, streams or impoundment or so near to such waters that they are carried into any river, stream or impoundment by stream flow or surface runoff. As an exception to the above, obtain written approval for the use of confined earth materials in cofferdams for structure foundations.

410-2 MATERIALS

Refer to Division 10.

<table>
<thead>
<tr>
<th>Item</th>
<th>Section</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subsurface Drainage Materials</td>
<td>1044</td>
</tr>
</tbody>
</table>

410-3 FOUNDATION EXCAVATION

Notify the Engineer a sufficient time before beginning the excavation to allow measurements of the undisturbed ground.
Section 410

Where necessary for safety, slope, shore, brace or protect by cofferdams the foundation
openings in accordance with State and local safety standards. Perform foundation excavation
and related work in such sequence that no portion of the structure is endangered by subsequent
operations. Adequately protect completed portions of a structure during blasting operations.

Consider the dimensions and elevations of footings, as shown in the plans as approximate only.
The Engineer may order, in writing, such changes in dimensions or elevations of footings as
necessary to secure a satisfactory foundation.

Notify the Engineer after excavating each foundation. Do not place concrete before obtaining
approval for the excavation depth, the character of the foundation and permission to proceed.
Perform drilling as may be required by the Engineer to obtain information as to the depth to
which the rock or other hard foundation material extends below the bottom of the footing.

Clean all rock or other hard foundation material of all loose material and cut to a firm surface,
either level, stepped or serrated, as directed. Clean out all seams and fill with concrete, mortar
or grout. Remove all loose and disintegrated rock and thin strata. Leave the rock surface in a
rough condition to form an adequate key against lateral movement of the footing.

When the footing rests on an excavated surface other than rock, take special care not to disturb
the bottom of the excavation until immediately before placing reinforcing steel and concrete.
Remove foundation material softened and weakened by exposure and inundation down to
sound, solid material before placing steel and concrete.

When using piles or drilled piers, complete the excavation of each pit before installing piles or
piers.

When water or other unsuitable material is encountered, pile driving liquefies the soil, or the
bed is otherwise unsuitable as determined by the Engineer, remove the material as required and
backfill to the required elevation with subdrain fine or coarse aggregate. Such work will be
paid as extra work in accordance with Article 104-7.

410-4 COFFERDAMS

(A) General

The term cofferdam designates any temporary or removable structure constructed to hold
the surrounding earth, water or both, out of the excavation. It includes timber cribs, any
type of sheet piling, removable steel shells or similar structures, all necessary bracing and
the use of pumping wells or well points for the same purpose. Ensure cofferdams located
in bodies of water are designed, detailed and sealed by an engineer licensed by the State of
North Carolina when the distance from the water surface to the bottom of the excavation
is 5 feet or greater.

(B) Construction

Design and construct cofferdams to adequate depths and heights, safely and as watertight
as is necessary for the proper performance of the work. Provide interior dimensions of
cofferdams as to give sufficient clearance for the construction and inspection of forms and
to permit pumping outside the forms. Provide at least 5 feet of clearance between the
proposed edge of footing and inside face of cofferdam when a keyed footing is required
and at least 3 feet when a keyed footing is not required. Right, rest or enlarge cofferdams
that are tilted or moved laterally during the process of sinking to provide the necessary
clearance.

Construct cofferdams to protect plastic concrete against damage from a sudden rising of
the stream and to prevent damage to the foundation by erosion. Do not leave timber or
bracing in cofferdams that could extend into the substructure concrete without permission.
(C) Removal

After the completion of the substructure, unless otherwise provided in the contract, remove cofferdams with all sheeting and bracing to the stream bed or one foot below existing ground. Take care not to disturb or damage the finished concrete.

410-5 PUMPING

Perform pumping operations in accordance with Article 414-5.

410-6 PRESERVATION OF CHANNEL

Unless otherwise required by the contract or permitted by the Engineer, do not excavate in stream channels outside of cofferdams. Do not disturb the natural stream bed adjacent to the structure without permission. Backfill any excavation or dredging made at the site of the structure outside of the cofferdam limits to the original ground surface or river bed with approved material.

Remove materials placed within the stream area and leave the stream in its original condition, unless otherwise permitted.

410-7 UTILIZATION OF EXCAVATED MATERIAL

Use suitable excavated material as backfill. Use suitable material that is not required for backfill to form embankments, subgrades or shoulders. Furnish disposal areas for excavated unsuitable materials and suitable materials not required in connection with other work included in the contract. Do not place excavated material in a stream or other body of water or wetland.

Do not deposit excavated material at any time so as to endanger the partly finished structure, either by direct pressure, indirectly by overloading banks adjacent to the operations or in any other manner.

410-8 BACKFILLING AND FILLING

Use approved material for backfill that is free from large or frozen lumps, wood or other undesirable material. Where there is not an adequate quantity of suitable backfill material available from the excavation, provide suitable backfill material compensated in accordance with Article 410-10.

Refill all excavated spaces, not filled with permanent work, with earth up to the ground surface existing before the excavation. Place backfill to provide adequate drainage as soon as concrete surfaces are finished in accordance with Subarticle 420-17(B) and the concrete has been inspected and approved. The Engineer has the authority to suspend all operations until such backfilling is acceptably completed.

Eliminate any slope adjacent to the excavation for abutments, wingwalls and retaining walls by stepping or serrating to prevent wedge action.

Place and compact all portions of the backfill that become a part of roadway typical sections or their foundations in accordance with Subarticles 235-3(B) and 235-3(C). Place all other portions of the backfill in layers not more than 10 inches in depth of loose measure and compact to a density comparable to the adjacent undisturbed material.

Place backfill or embankment material simultaneously to approximately the same elevation on both sides of an abutment, pier or wall. If conditions require placing backfill or embankment higher on one side, do not place the additional material on the higher side until the concrete develops the minimum specified strength for the class of concrete required for the structure as specified in Table 1000-1.

Do not place backfill or embankment behind abutments of rigid frame structures such as arch culverts and box culverts without floor slabs, until the top slab is placed and has developed the minimum compressive strength of the class of concrete required for the structure. Place backfill and embankment simultaneously behind opposite abutments of rigid frames.
Section 410

Place backfill to not cause excess lateral forces against the structure by heavy equipment or
from earth masses transmitting pressures caused by earth moving equipment. Place backfill
immediately adjacent to the structure by hand operated mechanical tampers. Do not operate
heavy earth moving equipment within 10 feet of the structure in backfilling operations.

410-9 BLASTING ADJACENT TO HIGHWAY STRUCTURES

Conduct blasting operations adjacent to highway structures in accordance with the following
requirements.

Submit a blasting plan for approval before conducting any blasting operation.

Do not conduct blasting operations within 60 feet of any structure until the concrete strength
reaches 2,400 psi. After the concrete achieves a strength of 2,400 psi, limit the maximum PPV
to 4 in/sec measured at the closest structure extremity.

For multi-column bents with column heights up to 40 feet and a combined span length for the
2 adjacent spans of 160 feet or less, adhere to the following criteria:

(A) Do not blast within 6 feet without obtaining prior written approval.
(B) At distance of 6 feet to 10 feet, do not use a quantity of explosives more than 0.5 lbs. per
delay period.
(C) From 11 feet to 60 feet, use a maximum charge weight per delay of 0.5 lb. and 0.5 lb. of
explosives per foot of distance over 10 feet.

No vibration measurements are required if the above criteria are met. If unable to meet the
above criteria, monitor the structure for vibrations. If the 4 in/sec limit is exceeded, the
Engineer will evaluate each subsequent blast, and if deemed necessary, will apply more
restrictive controls than those above to prevent damage.

410-10 MEASUREMENT AND PAYMENT

Payment of blasting operations is included in the bid price for Foundation Excavation at the
affected substructure unit.

(A) Foundation Excavation on a Cubic Yard Basis

When the contract calls for payment of Foundation Excavation on a cubic yard basis, it
will be measured and paid as the actual number of cubic yards of materials, measured in
their original position within the limits described below and computed by the average end
area method, that are acceptably excavated.

The upper limits for measurement are the actual ground surface at the time of starting work,
except where the excavation is performed in cut areas excavated under Section 225, the
upper limits are the roadway plan typical section. For keyed footings the upper limits of
the keyed section are as shown in the plans. Define a “keyed footing” as a footing placed
without forms for the keyed depth in an excavation whose sides, as near as practical, are
located at the neat line dimensions of the footing and are vertical.

When the foundation material is other than rock, the lower limits for measurement are the
elevation of the bottom of footing as established by the plans or as directed. When the
foundation material is rock, the lower limits for measurement are the actual rock elevations
after the foundation is approved.

As an exception to the lower limits established above, when in the opinion of the Engineer
excess excavation is performed due to carelessness or negligence on the part of the
Contractor, the Engineer notifies the Contractor of that portion of the excavation which is
not measured for payment.

Horizontal limits for measurement are established by vertical planes located 18 inches
outside of the neat line dimensions of the footing as established by the plans or directed in
writing by the Engineer. For keyed footings the horizontal limits for measurement of the
keyed section are established by vertical planes located at the neat line dimensions of the
footing as established by the plans or directed in writing.

Measurement includes mud, muck or similar semi-solid material within the limits
described above provided such material is present at the time excavation begins and cannot
be drained away or pumped without the use of a jet or nozzle.

(1) No measurement is made of the following excavation, as such excavation is incidental
to the work being performed:

(a) Excavation necessary to construct end bent caps and the berm adjacent to the cap.
(b) Excavation necessary to construct pile encasement.
(c) Excavation outside of the limits described in this subarticle.
(d) Excavation necessary from heaving of a foundation due to the driving of piles.
(e) Excavation necessary from overbreaks or slides.
(f) Mud, muck or similar semi-solid material which can be drained away or pumped
without the use of a jet or nozzle.
(g) Excavation made before the Engineer makes measurements of the undisturbed
ground.
(h) Excavation necessary due to exposure or inundation allowed by the Contractor or
negligence on the part of the Contractor.

(2) Foundation Excavation will be paid at the contract unit price per cubic yard for
Foundation Excavation except where the Engineer directs the Contractor in writing to
excavate below the original plan elevation of the bottom of the footing. Payment for
such excavation will be made as follows:

(a) For excavation made below the original plan elevation of the bottom of the footing
to an elevation 3 feet below such plan elevation, payment will be made at the
contract unit price per cubic yard for Foundation Excavation.
(b) For excavation made below an elevation 3 feet below the original plan elevation
of the bottom of the footing but not more than 6 feet below such plan elevation,
payment will be made at 150% of the contract unit price per cubic yard for
Foundation Excavation.
(c) For excavation made below an elevation 6 feet below the original plan elevation
of the bottom of the footing, payment will be made as extra work in accordance
with Article 104-7.
(d) In areas where piles have been driven, removal of material and backfilling with
subdrain fine or coarse aggregate in accordance with Article 410-3 will be paid as
extra work in accordance with Article 104-7.

(B) Foundation Excavation on a Lump Sum Basis

When the contract calls for payment of Foundation Excavation on a lump sum basis, no
measurement will be made of any foundation excavation made at such locations.

The prices and payments below will be full compensation for all items required to complete
foundation excavation.

(1) When the contract calls for payment on a lump sum basis, payment will be made at
the contract lump sum price for Foundation Excavation for Bent No. ____ at
Station ____ or Foundation Excavation for End Bent No. ____ at Station ____ except
as otherwise provided below.
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(2) Where the Engineer directs the Contractor to excavate below the original plan elevation of the bottom of the footing by a distance which is less than 3 feet the character of the work will not be considered to be materially changed and no additional compensation will be allowed for the foundation excavation at such location.

(3) Where the Engineer directs the Contractor in writing to excavate more than 3 feet below the original plan elevation of the bottom of the footing, payment for such excavation will be made as extra work in accordance with Article 104-7.

(C) Furnishing and Hauling Backfill Material

Where it is necessary to provide backfill material from sources other than excavated areas or borrow sources used in connection with other work in the contract, payment for furnishing and hauling such backfill material will be paid as extra work in accordance with Article 104-7. Placing and compacting such backfill material is not extra work but is incidental to the work being performed.

When the Contractor has been directed by the Engineer to drill in the vicinity of a footing to obtain subsurface information, such drilling in excess of a 5 foot depth will be paid as extra work in accordance with Article 104-7.

When so used, no additional payment will be made for use of the material under other pay items or for stockpiling the material for use under other pay items.

Payment will be made under:

<table>
<thead>
<tr>
<th>Pay Item</th>
<th>Pay Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Foundation Excavation</td>
<td>Cubic Yard</td>
</tr>
<tr>
<td>Foundation Excavation for Bent No. ____ at Station ____</td>
<td>Lump Sum</td>
</tr>
<tr>
<td>Foundation Excavation for End Bent No. ____ at Station ____</td>
<td>Lump Sum</td>
</tr>
</tbody>
</table>

SECTION 411

DRILLED PIERS

411-1 DESCRIPTION

Construct drilled piers consisting of CIP reinforced concrete cylindrical sections in excavated holes typically stabilized with casings or slurry. Provide permanent casings, standard penetration tests, integrity testing and assistance with the shaft inspection device as noted in the plans. Construct drilled piers with the required resistances and dimensions in accordance with the contract and accepted submittals. Use a prequalified Drilled Pier Contractor to construct drilled piers.

Define “excavation” and “hole” as a drilled pier excavation and “pier” as a drilled pier. Define “permanent casing” as a casing that remains in the excavation and acts as a form for Drilled Pier concrete and “temporary casing” as any casing that is not permanent. Define “rock” as a continuous intact natural material with a standard penetration resistance of 0.1 foot or less per 60 blows or a rock auger penetration rate of less than 2 inches per 5 minutes of drilling at full crowd force or as determined by the Engineer when rock is not encountered as expected based on these criteria. This definition excludes discontinuous loose natural materials such as boulders and man-made materials such as concrete, steel, timber, etc. and is not for measurement and payment purposes. See Article 411-7 for measurement and payment of drilled piers.