



**SPECIAL PROVISION
FOR
LEEVE CONSTRUCTION**

**Pottawattamie County
IM-NHS-029-3(86)52--03-78**

**Effective Date
June 21, 2011**

THE STANDARD SPECIFICATIONS, SERIES 2009, ARE AMENDED BY THE FOLLOWING MODIFICATIONS AND ADDITIONS. THESE ARE SPECIAL PROVISIONS AND THEY SHALL PREVAIL OVER THOSE PUBLISHED IN THE STANDARD SPECIFICATIONS.

090123.01 DESCRIPTION.

The work covered by this Special Provision consists of furnishing all labor and materials, and performing all operations in connection with the foundation preparation and the construction of relocated portions of existing levee embankments, and other incidental earthwork as may be necessary to complete the relocated levees and modifications, as shown on the Contract Documents.

The geotechnical information for the levee construction is provided in the document entitled "FINAL REPORT - Relocation of Council Bluffs Levee Unit and Agricultural Levee L627 – Section 1, Council Bluffs Interstate System, Segment 2, Interstate 80 and 29 Interchange, Pottawattamie County, Iowa," prepared by HDR, Inc., dated November, 2010. Subsurface profiles for the South Levee and the Ramp C Levee are provided at the end of this Special Provision.

090123.02 MATERIALS.

A. General.

The levee embankments shall be constructed of impervious fill and random fill which shall be obtained from on site excavation and approved borrow areas. Earth used in construction of embankments shall be free of unsuitable materials.

See Article 090123.03, C, 2 for zoning requirements in the impervious fill and random fill.

B. Impervious Fill, Lean Clay.

Impervious fill shall consist of cohesive materials having at least 50% passing the U.S. Standard 200 mesh sieve size. Cohesive materials include materials classifying as lean (CL), having a Plasticity Index of 10 or greater, and falling between the "U" line and the "A" line on Figure 3 in ASTM D 2487 – Standard Tests for Classifications of Soils for Engineering Purposes.

The Pay Item for Impervious Fill, Lean Clay will be Embankment-In-Place. This material will be furnished by the Contractor.

C. Impervious Fill, Fat Clay.

Impervious fill shall consist of cohesive materials having at least 50% passing the U.S. Standard 200 mesh sieve size. Cohesive materials include materials classifying as fat (or lean) clay (CL, CH), having a Plasticity Index of 10 or greater, and falling between the "U" line and the "A" line on Figure 3 in ASTM D 2487 – Standard Tests for Classifications of Soils for Engineering Purposes. The Pay Item for Impervious Fill, Fat Clay will be Class 10 Excavation, Roadway and Borrow. This material is available from the project site.

D. Random Fill.

Material for random fill shall consist of clays, silts, and sands that are obtained from the project site or approved borrow areas. The maximum particle size for the random fill shall be 3 inches in diameter.

Sands and non-plastic silts are considered non-cohesive materials.

The Pay Item for Random Fill will be Class 10 Excavation, Roadway and Borrow.

E. Unsuitable Materials.

Unsuitable materials are materials containing debris, brush, roots, sod, organic matter or stones with dimensions greater than one-half the loose layer thickness. Under no circumstances shall frozen earth, snow, or ice be placed in the embankments.

F. Suitable Materials.

Suitable materials for construction of the levee embankment will include materials described in Articles A, B, C and D of this section. A material will not be classified as unsuitable based on its moisture content. See Article 090123.03, E.

Materials for Relief Well Berm Fills for the relief well berm shall consist of random fill from approved borrow areas.

G. Pre-Construction Testing of Proposed Borrow Materials.

The Contractor shall submit to the Engineer for approval the results of grain size tests (ASTM D 422) and plasticity tests (ASTM D 423 and D 424) for impervious and non-cohesive materials. The estimated quantity and location of non-cohesive materials proposed for use in the levee embankment shall also be submitted. These submittals must be approved by the Engineer prior to the placement of non-cohesive materials within the levee section.

If it is desired to incorporate non-cohesive materials in the levee embankment, they shall be placed in the random fill zone as shown on the plans and shall meet the requirements of this Special Provision.

The results of CU triaxial compression testing (with pore pressure measurements) shall be submitted on all cohesive (clay) borrow materials proposed for use in the levee construction. The tests shall be 3-point tests performed in accordance with ASTM D 5311. The results of direct shear testing shall be submitted on all cohesionless (sand) borrow materials proposed for use in the levee construction. The tests shall be performed in accordance with ASTM D 3080. The

strengths of the borrow materials shall be equal to or greater than the minimum required values presented below.

Design Shear Strengths – Levee Fill					
Material	Unit Weight	CU Strengths		CD Strengths	
	γ_{total}	c	Φ	c'	Φ'
	(pcf)	(psf)	(psf)	(psf)	(degrees)
new fill – clay	120	500	14	50	28
new fill – sand	117	0	30	0	30

090123.03 CONSTRUCTION.

A. Subgrade Preparation.

1. General.

After stripping and removal of unsuitable foundation material, cavities or other depressions shall be broken down to flatten out the slopes. Immediately prior to the placement of fill material for the relocated levee, the entire earth surface on or against which fill is to be placed, shall be thoroughly broken to a depth of 6 inches and the area to be occupied by the embankments shall be compacted in accordance with the provisions specified in Article 090123.03, B, Embankment Construction and Testing. If for any cause, this foundation surface or other fill surface that is to receive fill becomes compacted in such a manner that, in the opinion of the Engineer, a plane of seepage or weakness might be induced, it shall be scarified to a depth of 6 inches before the depositing of material thereon.

2. Requirements.

The depth of stripping on the existing slopes of levees and roadway embankments shall not exceed 6 inches. All slopes upon which fill is to be placed shall be notched and broken up so that the fill material will bond with the existing material. Water shall be added as needed to achieve compaction requirements. All notching, scarifying, and breaking of ground surface shall be done parallel to the centerline of the embankment being constructed. All foundation preparation shall be approved by the Engineer prior to placement of embankment. No fill shall be placed upon frozen ground.

3. Existing Embankments.

At locations where the levee or other embankments tie to existing earth embankments to complete the line of protection, such embankment surface slopes shall be notched, scarified and compacted as specified herein. When directed by the Engineer, such operations shall be accomplished parallel to the axis of the existing embankment.

B. Embankment Construction and Testing.

1. General.

Apply Section 2107 of the Standard Specifications, except when amended by requirements of this specification. Verify embankment placed with moisture and density control meets the requirements of Article 2107.03, I of the Standard Specifications.

Fill material for the relocated levee, as specified in Article 090123.02, shall be placed in successive horizontal layers not more than 8 inches in depth prior to compaction. Each layer shall be spread uniformly on the previously compacted surface; plowed, disked, or otherwise broke up; moistened or aerated as necessary; thoroughly mixed and compacted to produce embankments having the following moisture and density requirements. If in the opinion of the Engineer, the surface of any compacted layer is too smooth to bond properly with the succeeding layer, it shall be scarified to the satisfaction of the Engineer before the

succeeding layer is placed thereon. The Contractor must use equipment which achieves the compaction specified below and which will not create seams between embankment lifts.

2. Quality Control Program (Embankment Construction).

Provide and maintain a Quality Control Program (Embankment Construction), defined as all activities of sampling, testing, process control inspection, and necessary adjustments for construction of embankments to meet the requirements of this Special Provision.

As part of the Quality Control Program (Embankment Construction), provide a Quality Control Technician to perform testing on all embankment soils placed with Compaction with Moisture and Density Control. As a minimum, the Quality Control Technician shall have a high school education. The Technician shall obtain 'Soils Technician Lab Certification' through a two day course held at Des Moines Area Community College (DMACC) in Boone through the Technical Training and Certification Program (TTCP) of the Department. Arrange training through the Iowa DOT's Office of Construction (telephone 515.239.1280). TTCP Requirements of Materials I.M. 213 apply.

Ensure the Quality Control Technician is present on the project when embankment is being placed with 'Compaction with Moisture and Density Control.'

Provide a laboratory facility and all the necessary calibrated equipment to perform the required tests.

3. Test Procedures.

Use test procedures and equipment complying with applicable Materials I.M.'s, Iowa DOT Materials Laboratory Test Methods, or equivalent standards of AASHTO or ASTM.

Allow the Engineer to review equivalent standards. Use equivalent standards only if approved by the Engineer.

Acceptable test methods for determining moisture content and density are:

- Oven drying - AASHTO T 265
- Pan drying - ASHTO T 265 (modified to use an open burner)
- Microwave - ASTM D 4643
- Nuclear gauge - Materials I.M. 334
- Density of soil cores - Materials I.M. 326
- Sand Cone Test - ASTM D 1556

Use AASHTO T 265 oven drying method for the reference method for calibration.

Atterberg Limits (ASTM D 4318) and grain size analysis (ASTM D 422) shall also be determined for each of the representative materials. Copies of all test results made for and used as a basis for moisture and density control shall be furnished to the Engineer in advance of the time that materials are to be placed in the embankments.

4. Moisture and Density Control.

Moisture and density control of the embankments shall be based on the standard Proctor compaction test (Materials I.M. 309). Cohesive materials placed in embankments shall be compacted to a density of at least 95 percent of the maximum dry density and be within -1 to +4 percent of the optimum moisture content at the time the compactive effort is applied which may require the addition of water or aeration of materials. Non-cohesive materials used in the embankments will be placed in a moist condition and compacted with approved equipment to a density of at least 95 percent of the maximum dry density.

Determine the optimum moisture content and maximum density by Proctor testing of soil being placed. Determine optimum moisture and maximum density for each type of excavated

or mixed soil which varies as to change the expected AASHTO classification, or if directed by the Engineer.

With the Engineer's approval, and for soils that can be identified during excavation, the Contractor may use the optimum moisture content and maximum density as shown on the soils 'Q' sheets in the contract documents. In lieu of using values from the 'Q' sheets, the Contractor may choose to determine optimum moisture and maximum density from a field sample.

If the Engineer deems the optimum moisture and maximum density of material being excavated and/or mixed is not represented by that shown on the 'Q' sheets, determine optimum moisture and maximum density from a field sample. When determined from a field sample at the option of the Contractor or at the Engineer's request, the optimum moisture and maximum density values from the field sample prevails over that shown on the 'Q' sheets.

Test and verify that moisture content and density of material placed under the item 'Compaction with Moisture and Density Control' is within the optimum moisture content range for the soil being placed and greater than or equal to the required density.

Disk to reduce moisture if, after initial disking to break down lumps greater than 12 inches as required by Article 2107.03, D, 2, d, of the Standard Specifications, the deposited soil material contains moisture in excess of the specified moisture limits.

If, after initial disking as required by Article 2107.03, D, 2, d, of the Standard Specifications, the material is dry to the extent that it is not within the range of the optimum moisture of the soil to allow satisfactory compaction by rolling, uniformly moisten the material to the required limits before it is compacted.

Proceed with aeration, watering, and compaction operations in an orderly fashion without unreasonable and unnecessary delay. Compensation will not be allowed for delays resulting from the ordering of moistening or disking.

Verify all soil accepted for final placement is within the specified moisture control limits and meets the in-place density requirements.

5. Compaction.

Apply Article 2107.03, E, of the Standard Specifications.

6. Equipment.

Apply Article 2107.03, B of the Standard Specifications, except that for compaction of granular sand soils classified as AASHTO A-1, A-2, or A-3 and having 15% or less combined silt/clay content (percent passing the No. 200 (75 µm sieve) use:

- Pneumatic tired rollers as described in Articles 2001.05, C and 2001.05, D of the Standard Specifications, or
- Self-propelled vibratory rollers as described in Article 2001.05, F of the Standard Specifications.

7. Test Frequency during Embankment Construction.

Test for proctor optimum moisture content and maximum density and embankment moisture content and density at the minimum frequencies in Materials I.M. 204. Samples will be randomly selected.

8. Field Records.

Document all observations, records and inspection, changes in soil type, soil moisture, fill placement procedures, and test results on a weekly basis. Note the results of the observations and records of inspection in a permanent field record as they occur. Submit copies of field moisture and density tests to the Engineer on a weekly basis. Submit the original testing records (raw field and lab data sheets) and control charts to the Engineer in a neat and orderly manner within five calendar days after completion of the project.

9. Corrective Action.

Notify the Engineer when a moisture content falls outside the specified control limits or density falls below the required minimum. If a single moisture content falls outside of the control limits, the fill material in this area will be considered unacceptable for compaction. Perform corrective action(s) to bring the uncompacted fill material, after a retest, within the specified moisture control limits. If material has been compacted, disk it, bring it to within moisture control limits, and recompact it. Also, if a single density does not meet the requirements, the compacted fill material in this area will be considered unacceptable. Perform corrective action(s) to the material to meet density requirements.

10. Quality Assurance.

a. Required Testing.

The Contractor's Quality Control Technician shall perform all field testing and data analysis. The Quality Control Technician shall retain split samples of Materials I.M. 309 testing when requested by the Engineer. The Engineer may select any or all of the Contractor-retained split samples for independent assurance and verification testing.

The Engineer will determine the random location of verification tests and will test at the minimum frequencies in Materials I.M. 204. The Contractor Quality Control Technician shall obtain a sample at the same location as directed by the Engineer and provide the results to the Engineer. Verification test results will be provided to the Contractor within one working day after the Contractor's quality control test results have been reported.

The Engineer will periodically witness field testing being performed by the Contractor. If the Engineer observes the quality control field tests are not being performed according to the applicable test procedures, the Engineer may stop production until corrective action is taken. The Engineer will notify the Contractor of observed deficiencies, promptly, both verbally and in writing. The Engineer will document all witnessed testing.

All quality control test-results become part of the project files.

b. Verification and Independent Assurance Testing.

The Contractor's quality control test results will be validated by the Engineer's verification test results using the criteria in Materials I.M. 216. If the Engineer's verification test results validate the Contractor's test results, the Contractor's results will be used for material acceptance.

In the event that the Contractor's results can't be validated, the Engineer will investigate the reason immediately. The Engineer's investigation may include:

- Testing of other locations,
- Observations of the Contractor's testing procedures and equipment, and
- Comparison of test results of the Contractor with those of the Engineer.

Personnel and laboratories performing tests used in the acceptance of material shall participate in the independent assurance program covered in Materials I.M. 205.

c. Referee Testing.

If a difference in procedures for sampling and testing and/or test results exists between the Contractor and the Engineer which they cannot resolve, the Iowa DOT's Central Materials Laboratory will provide referee testing. The Engineer and the Contractor will abide by the results of the referee testing.

11. Acceptance.

The Engineer will base final acceptance of tests and materials on the results of the Contractor's quality control testing as verified by the Engineer's quality assurance.

C. Levee Section and Zoning**1. Levee Section**

South Levee: The South Levee shall be constructed of impervious fill meeting the requirements of Article 090123.02, B, placed and compacted as specified in Article 090123.03. The upper layer will consist of lean clay (CL) soils placed a minimum of 3 feet in thickness measured normal to the slope.

Ramp C Levee: For the Ramp C Levee, the embankment shall be comprised of a facing of impervious fill meeting the requirements of Article 090123.02, B, and random fill meeting the requirements of Article 090123.02, D. The facing shall consist of lean clay (CL) soils placed a minimum of 5 feet in thickness on the riverside slope. The impervious fill and the random fill shall be placed and compacted as specified in Article 090123.03.

North Access Dike: For the North Access Dike, the entire embankment shall be comprised of impervious fill meeting the requirements of Article 090123.02, B, placed and compacted as specified in Article 090123.03. This facing shall consist of lean clay (CL) soils placed a minimum of 5 feet in thickness on the riverside slope and 3 feet in thickness on the crest and landside slope measured normal to the slope.

Detour 293: For Detour 293, the entire embankment shall be comprised of impervious fill meeting the requirements of Article 090123.02, B, placed and compacted as specified in Article 090123.03. This facing will consist of lean clay (CL) soils placed a minimum of 5 feet in thickness on the riverside slope measured normal to the slope.

2. Zoning of Materials

In general, the levee section shall be relatively homogeneous except for the impervious facing. Where materials of varying permeability are encountered in the borrow areas, the more impervious material shall be placed toward the riverside slope and the more pervious material toward the landside.

The use of fat clay (CH) soils shall not be used in the facing described in Article 090123.03, C, 1.

090123.04 METHOD OF MEASUREMENT

Measurement will be made as follows for the quantity as specified or as directed by the Engineer:

- A.** The quantity of Class 10 Excavation, Roadway and Borrow requiring excavation and placement of impervious fill (fat clay) and random fill will be measured in cubic yards for which payment made will be the quantity shown in the contract documents.
- B.** The quantity of Embankment-In-Place for Contractor furnished Impervious Fill (Lean Clay), will be measured in cubic yards placed.

- C. The quantity of embankment requiring Compaction with Moisture and Density Control, in cubic yards, will be the quantity shown in the contract documents as determined by the template fill volume. Shrinkage will not be included in moisture and density control quantity.
- D. All excavation in preparation for and construction of embankment with moisture and density control will be included in Class 10 Excavation according to Article 2102.04 of the Standard Specifications.

090123.05 BASIS OF PAYMENT.

- A. The quantities accepted for payment will be paid for at the contract unit price for the following items:

Pay Item	Unit
Class 10 Excavation, Roadway and Borrow	cubic yard
Embankment-In-Place	cubic yard

The contract unit prices for the above items will be full and complete payment for providing all design, materials, labor, equipment, and incidentals to complete the work.

- B. Payment for Compaction with Moisture and Density Control will be the contract unit price in cubic yards for the quantity of embankment placed with moisture and density control.

Payment is full compensation for furnishing a Quality Control Technician, sampling and testing, process control inspection, working of drying material, furnishing and applying water, controlling moisture content of the materials, and compacting the materials to the required density, as specified.



