

# EXCAVATION FOR STRUCTURES AND PIPE – THICK LIFT BACKFILL (REV 8-10-22)

SUBARTICLE 125-8.1.6 is deleted and the following substituted:

**125-8.1.6 Placement and Compaction:** Place the material in horizontal layers not exceeding 6 inches compacted thickness, in depth above water level, behind abutments, wingwalls and end bents or end rest piers, under the haunches of the pipes and around box culverts and all structures including pipe culverts. When the backfill material is deposited in water, compact as specified in 125-8.2.5 and 125-8.3.4.

**125-8.1.6.1 Thick Lift Requirements:** The Contractor may elect to place material in thicker lifts of no more than 12 inches compacted thickness above the Spring Line if the embankment material is classified as Group 1 in the table below. For thick lifts above the Spring Line, the Contractor must demonstrate with a successful test section that density can be achieved. For thick lifts of no more than 12 inches compacted thickness above the Soil Envelope, a control test section is not required if the embankment material is classified as Group 1 in the table below.

If the embankment material is classified as Group 2 in the table below and the Contractor chooses to place material in thicker lifts of no more than 12 inches compacted thickness above the Soil Envelope then the Contractor must demonstrate with a successful test section that density can be achieved. Thick lift around structures is only allowed above the soil envelope of the connecting pipe. Notify the Engineer in writing prior to beginning construction of a test section. Construct a test section of the length of one LOT. Perform five quality control (QC) tests at random locations within the test section. All five tests must meet the density required by 125-9.2 and be verified by the Department. Identify the test section with the compaction effort and soil classification in the Earthwork Records System (ERS) section of the Department's database. In case of a change in compaction effort or soil classification, construct a new test section. When a QC test fails the requirements of 125-9.2 or when the QC tests cannot be verified, construct a new test section. The Contractor may elect to place material in 6 inches compacted thickness at any time.

Table 125-1				
Group	AASHTO Soil Class	Maximum Lift Thickness/Thick Lift Control Test Section Requirements		
		Within Cover Zone	Above Soil Envelope	Above Spring Line
1	A-3	Maximum 6 inches without control test section	Maximum 12 inches without control test section	Maximum 12 inches with control test section
	A-2-4 (No. 200 Sieve $\leq$ 15%)			
2	A-1		Maximum 12 inches with control test section	Not Allowed
	A-2-4 (No. 200 Sieve $>$ 15%)			
	A-2-5, A-2-6, A-2-7, A-4, A-5, A-6			
	A-7 (Liquid Limit $<$ 50)			

\* Thick lift must meet the requirements of 120-8.2.1.2

**125-8.1.6.2 Thick Lift Above the Spring Line:** Meet the following requirements for the use of thick lift compaction above the Spring Line:

1. Notify the Engineer in writing prior to the use of thick lift compaction above the Spring Line.
2. Submit a process control plan consisting of the following:
  - a. Locations of drainage pipe where thick lift compaction above the Spring Line will be used. Include stationing and drainage structure numbers. The use of thick lift compaction above the Spring Line must be limited to no more than ten pipe runs.
  - b. Proposed measures to prevent damage to the pipe.
3. The Engineer will coordinate the review of the process control plan with State Construction Office, State Materials Office, and District Materials Office.
4. Upon the Engineer's review of the process control plan, submit two 50-lb soil samples used for thick lift backfill to the Engineer. The Engineer will coordinate review with the State Materials Office to verify that the proposed materials meet Specification requirements prior to use.

5. Meet the following backfilling, compaction, and acceptance requirements:

- a. Each pipe run that utilizes thick lift compaction above the Spring Line must have an equal or greater number of comparative pipe runs that utilize 6-inch lift compaction.
- b. For odd-numbered LOT's, in addition to the density requirements of 125-9.2, perform QC density testing at random locations within the LOT. Perform this testing for the entire lift thickness and a dig down test of the bottom 6 inches of each lift. Excavate materials as needed to allow testing of the bottom 6 inches, at no expense to the Department. Maintain the exposed surface as close to undisturbed as possible; no further compaction will be permitted during the test preparation. The Department will perform verification testing of density for the bottom 6 inches and the entire lift thickness at the frequency indicated in 125-9.3.1. All QC tests and a Department Verification test must meet the density required by 125-9.2.1.
- c. Any pipe runs that are outside 1:2 control line must meet the density requirements of 125-9.2.

6. Perform post installation inspection in accordance with Section 430. Post installation videos must identify whether the drainage pipe utilized thick lift or standard 6-inch lift compaction. All remedial work must be approved by the Department and completed at no cost to the Department.

SUBARTICLE 125-8.2 is deleted and the following substituted:

**125-8.2 Additional Requirements for Structures Other than Pipe:**

**125-8.2.1 Density:** Where the backfill material is deposited in water, obtain a 12 inch layer of comparatively dry material, thoroughly compacted by tamping, before verifying the layer and density requirements. Meet the requirements of 125-9.2.

**125-8.2.2 Box Culverts:** For box culverts over which pavement is to be constructed, compact around the structure to an elevation not less than 12 inches above the top of the structure, using rapid-striking mechanical tampers.

**125-8.2.3 Other Limited Areas:** Compact in other limited areas using mechanical tampers or approved hand tampers, until the cover over the structure is at least 12 inches thick. When hand tampers are used, deposit the materials in layers not more than 4 inches thick using hand tampers suitable for this purpose with a face area of not more than 100 square inches. Take special precautions to prevent any wedging action against the masonry, and step or terrace the slope bounding the excavation for abutments and wingwalls if required by the Engineer.

**125-8.2.4 Culverts and Piers:** Backfill around culverts and piers on both sides simultaneously to approximately the same elevation.

**125-8.2.5 Compaction Under Wet Conditions:** Where wet conditions do not permit the use of mechanical tampers, compact using hand tampers. Use only A-3 material for the hand tamped portions of the backfill. When the backfill has reached an elevation and condition such as to make the use of the mechanical tampers practical, perform mechanical tamping in such manner and to such extent as to transfer the compaction force into the sections previously tamped by hand.

**125-8.3 Additional Requirements for Pipe Greater than 12 Inches Inside Diameter:**

**125-8.3.1 General:** Trenches for pipe may have up to four zones that must be backfilled.

**Lowest Zone:** The lowest zone is backfilled for deep undercuts up to within 4 inches of the bottom of the pipe.

**Bedding Zone:** The zone above the lowest zone is the bedding zone. Usually it will be the backfill which is the 4 inches of soil below the bottom of the pipe. When rock or other hard material has been removed to place the pipe, the bedding zone will be the 12 inches of soil below the bottom of the pipe.

**Cover Zone:** The next zone is backfill that is placed after the pipe has been laid and will be called the cover zone. This zone extends to 12 inches above the top of the pipe. The cover zone and the bedding zone are considered the Soil Envelope for the pipe.

**Spring Line:** Horizontal mid-height line of the pipe with the circular cross section, or horizontal line at half the height of the minor axis for a pipe with a non-linear cross section.

**Top Zone:** The top zone extends from 12 inches above the top of the pipe to the base or final grade.

**125-8.3.2 Material:**

**125-8.3.2.1 Lowest Zone:** Backfill areas undercut below the bedding zone of a pipe with coarse sand, or other suitable granular material, obtained from the grading operations on the project, or a commercial material if no suitable material is available.

**125-8.3.2.2 Soil Envelope:** In both the bedding zone and the cover zone of the pipe, backfill with materials classified as A-1, A-2, or A-3. Material classified as A-4 may be used if the pipe is concrete pipe. If using thick lift compaction above the Spring Line, backfill with materials classified as Group 1 of Table 125-1.

**125-8.3.2.3 Top Zone:** Backfill the area of the trench above the soil envelope of the pipe with materials allowed on Standard Plans, Index 120-001.

**125-8.3.3 Compaction:**

**125-8.3.3.1 Lowest Zone:** Compact the soil in the lowest zone to approximately match the density of the soil in which the trench was cut.

**125-8.3.3.2 Bedding Zone:** If the trench was not undercut below the bottom of the pipe, loosen the soil in the bottom of the trench immediately below the approximate middle third of the outside diameter of the pipe.

If the trench was undercut, place the bedding material and leave it in a loose condition below the middle third of the outside diameter of the pipe. Compact the outer portions to meet the density requirements of the acceptance criteria. Place the material in lifts no greater than 6 inches (compacted thickness).

**125-8.3.3.3 Cover Zone:** Before placing the cover zone material, lay pipe according to Section 430. Excavate for pipe bells before laying pipe. Place the material in 6 inch layers (compacted thickness), evenly deposited on both sides of the pipe, and compact with mechanical tampers suitable for this purpose. For thick lift compaction above the Spring Line, place the material in successive layers of not more than 12 inches (compacted thickness), evenly deposited on both sides of the pipe, and compact with mechanical tampers suitable for this purpose. Hand tamp material below the pipe haunch that cannot be reached by mechanical tampers. Meet the requirements of in 125-9.2.

**125-8.3.3.4 Top Zone:** Place the material in layers not to exceed 12 inches in compacted thickness. Meet the requirements of the density acceptance criteria.

**125-8.3.4 Backfill Under Wet Conditions:** Where wet conditions are such that dewatering by normal pumping methods would not be effective, the procedure outlined below may be used when specifically authorized by the Engineer in writing. The Department will pay for any select material which is not available from the grading as Unforeseeable Work. The Department will not pay for select material that might be used by the Contractor for his own convenience instead of dewatering.

The Department will permit the use of granular material below the elevation at which mechanical tampers would be effective, but only material classified as A-3. Place and compact the material using timbers or hand tampers until the backfill reaches an elevation such that its moisture content will permit the use of mechanical tampers. When the backfill has reached such elevation, use normally acceptable backfill material. Compact the material using mechanical tampers in such manner and to such extent as to transfer the compacting force into the material previously tamped by hand.

The Department will permit the use of coarse aggregate below the elevation at which mechanical tampers would be effective. Use coarse aggregate as specified in Section 901 for Aggregate Size Number 89, 8, 78, 7, 68, 6, or 57. Place the coarse aggregate such that it will be stable and firm. Fully wrap the aggregate with a layer of Type D-4 filter fabric, as specified in Section 985. Do not place coarse aggregate within 4 feet of the ends of the trench or ditch. Use normally accepted backfill material at the ends.

ARTICLE 125-9 is deleted and the following substituted:

## **125-9 Acceptance Program.**

**125-9.1 General Requirements:** Meet the requirements of 120-10, except replace the requirements of 120-10.1.6 with 125-9.1.1, 120-10.2 with 125-9.2, and 120-10.3 with 125-9.3.

**125-9.1.1 Reduced Testing Frequency:** Obtain the Engineer's approval in writing for the option to reduce density testing frequency to one test every two LOTs or one every four LOTs for trench box operations if the following requirements are met:

1. Resolution testing was not required for six consecutive verified LOTs.
2. Resolution testing was required for any of the six consecutive verified LOTs, but QC test data was upheld.

Identify the substantiating tests in the ERS section of the Department's database and notify the Engineer in writing prior to starting reduced frequency of testing. Generate random numbers for selecting test locations for the LOTs under consideration. When QC test frequency is reduced, obtain the Engineer's approval in writing to place more than one LOT over an untested LOT. Do not apply reduced testing frequency for the first and last lift of pipe or for the pipe installed using thick lift compaction above the Spring Line. Assure similar compaction efforts for the untested sections. If the Verification test fails, and QC test data is not upheld by Resolution testing the QC testing will revert to the original frequency.

### **125-9.2 Acceptance Criteria:**

**125-9.2.1 Density:** Obtain a minimum QC density in any LOT of 100% of the Standard Proctor maximum density as determined by FM 1-T099 or the requirements of 125-8.3.3.1 when applicable. When the cover height below the bottom of base under asphalt pavement, below concrete pavement, or below unpaved ground, exceeds 15 inches, compact the pipe backfill in the cover zone to a density of at least 95% of the Standard Proctor maximum density as determined by FM1-T099. For thick lift compaction above the Spring Line of backfill, compact to a density of at least 98% of the Standard Proctor maximum density for the entire lift thickness and a dig down test of the bottom 6 inches meeting compaction density of at least 95% of the Standard Proctor as determined by FM 1-T099.

For density requirements around drainage structures, obtain a minimum QC density in any LOT of 100% of the Standard Proctor maximum density as determined by FM 1-T099 for a distance of one pipe diameter but not less than 3 feet from the outside face of the structure. For pipe runs constructed using thick lift compaction above the Spring Line, this density requirement extends to a distance of one pipe diameter but not less than 6 feet from the outside face of the structure.

**125-9.2.2 Exceptions to Structures and Pipe Density Requirements:** Compact the backfill to a firmness approximately equal to that of the soil next to the pipe trench in locations outside the plane described by a one (vertical) to two (horizontal) slope downward from the roadway shoulder point or the gutter line in accordance with Standard Plans, Index 120-001 or 120-002. Apply 125-9.2.1 when compacting side-drain pipe backfill under driveways serving a property that is not a single residential lot.

### **125-9.3 Additional Requirements:**

**125-9.3.1 Frequency:** Conduct Standard Proctor maximum density sampling and testing at a minimum frequency of one test per soil type. The summary of tests and frequency is shown in Table 125-2 below.

Table 125-2		
Test Name	Quality Control	Verification
Standard Proctor Maximum Density	One per soil type	One per soil type
Density	One per LOT	One per four consecutive LOTs and for wet conditions, the first lift not affected by water
Soil Classification and Organic Content	One per Standard Proctor Maximum density	One per Standard Proctor Maximum density