

MODIFIED BY EC 13-020 EFFECTIVE 1/9/14		<i>New York State Department of Transportation</i> ENGINEERING INSTRUCTION	EI 12-014
Title: STANDARD SPECIFICATION SECTION 204 – FLOWABLE FILL AND REVISION TO §552-2.05 C.2. GROUT BACKFILL			
SUPERSEDED BY EB 15-031 EFFECTIVE 9/28/15	ors (33) stants (34) ctors (39) ()	Approved: <u>Anthony J. Torre</u> <u>05-03-2012</u> Anthony Torre, P.E. Date Acting Deputy Chief Engineer (Research)	

ADMINISTRATIVE INFORMATION:

- This Engineering Instruction (EI) is effective beginning with projects submitted for the letting of Sept. 6, 2012.
- This EI supersedes EI 08-034 and modifies EI 10-038.
- The revisions issued with this EI will be incorporated into the next update of the Standard Specifications.

PURPOSE: The purpose of this EI is to issue revised Standard Specification Section 204 *Flowable Fill*.

TECHNICAL INFORMATION:

- Section 204 in the Standard Specifications is deleted and replaced with the revised Section 204 transmitted by this issuance.
- A revised Standard Specification §733-01 *Controlled Low Strength Material*, the title of which is being changed to §733-01 *Flowable Fill*, is being issued concurrently via EI 12-015.
- An update regarding a revision to the *Controlled Low Strength Material Design Guidance* and addition of *Lightweight Concrete Fill Design Guidance* to Chapter 9 of the Highway Design Manual is being issued concurrently via EB 12-018.
- Guidelines for the use of Controlled Low Strength Material are contained in Chapter 9 of the Highway Design Manual. Standard Details for the installation of Controlled Low Strength Material are contained in Standard Sheet M204-1.
- The revisions to the Standard Specifications include the following:
 1. The title of Section 204 has been changed to "Section 204 *Flowable Fill*" and the title of §733-01 has been changed to "§733-01 *Flowable Fill*".
 2. Use and installation requirements for Lightweight Concrete Fill have been added to Section 204 *Flowable Fill*. Material requirements for Lightweight Concrete Fill have been added to §733-01 *Flowable Fill*.
 3. Material requirements for grout backfill identified in §552-2.05 C.2. *Grout Backfill*, issued by EI 10-038, have been revised to correspond with the subsection title change.

IMPLEMENTATION:

- The Main Office Design Quality Assurance Bureau will insert these standard specification revisions into contract proposals beginning with projects submitted for the letting of Sept. 6, 2012.
- The following special specifications are disapproved:

Metric	Item 203.0308--17:	Lightweight Concrete Fill (Type A)
Metric	Item 203.0309--17:	Lightweight Concrete Fill (Type B)
Metric	Item 555.10----10:	Flowable Fill

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US Cust.	Item 203.03080017:	Lightweight Concrete Fill (Type A)
US Cust.	Item 203.03090017:	Lightweight Concrete Fill (Type B)
US Cust.	Item 555.10000010:	Flowable Fill

TRANSMITTED MATERIALS: Revisions to Standard Specification Section 204 *Flowable Fill* and §552-2.05 C.2. *Grout Backfill*. Both metric and US Customary revisions are attached.

BACKGROUND:

- **Controlled Low Strength Material.** To achieve the Department's goal of completing construction projects in a timely manner, it is essential to use products which decrease installation time and effort over conventional materials. CLSM is used primarily as a self-leveling backfill material and does not require compaction. It is much lower in strength than concrete, making future excavation possible. Due to the self-compacting properties of the material, construction personnel and equipment are not required in confined spaces for compaction operations. As a result, the width of excavations can be decreased, laid back slopes eliminated and flagging operations reduced.
- **Lightweight Concrete Fill.** Lightweight Concrete Fill is an engineered geotechnical material with a unique strength / density relationship which can be used to reduce loads on soft foundation soils, buried structures, or against retaining walls. Lightweight Concrete Fill consists of a Portland cement matrix containing uniformly distributed, non-interconnected air voids introduced by a foaming agent. The flowability and cementitious properties of this material provide a product that is self leveling and does not require compaction. Additives can be introduced to achieve grades of as much as 3% $\pm$ from the horizontal. The Geotechnical Engineering Bureau (GEB) provides earthwork and foundation engineering services for the design and construction of Departmental projects statewide. When subsurface explorations reveal that a project's underlying soils are soft or unstable, the GEB may utilize specialized treatment options to allow completion of the desired final product. Lightweight Concrete Fill is one such option. It is a lightweight fill used to reduce vertical stresses beneath embankments, or to reduce lateral stresses on retaining walls, abutments or foundations.

CONTACT: Questions or comments regarding this issuance should be directed to Randall J. Romer, P.E., of the Geotechnical Engineering Bureau at (518) 457-4714, or via e-mail at rromer@dot.state.ny.us. Questions or comments regarding the technical aspects of the revision to the Standard Specification should be directed to Don Dwyer, P.E., of the Geotechnical Engineering Bureau at (518) 457-4724, ddwyer@dot.state.ny.us.

FLOWABLE FILL

Make the following changes to the Standard Specifications dated May 1, 2008:

Page 176-178, **Delete** SECTION 204 *Controlled Low Strength Material (CLSM)* entirely and **Replace** it with the following:

SECTION 204 – FLOWABLE FILL

204-1 DESCRIPTION. The work shall consist of mixing and placing flowable fill at the locations shown in the contract documents.

204-1.01. Controlled Low Strength Material. Controlled Low Strength Material (CLSM) is an acceptable alternative to compacted soil backfill in confined spaces. CLSM consists of cement, water and, at the Contractor's option, fly ash, aggregate or chemical admixtures in any proportions such that the final product meets the strength and flow consistency requirements included in the specification. The mix is proportioned to be self leveling and does not require compaction. It is much lower in strength than concrete, making future excavation possible.

204-1.02. Lightweight Concrete Fill. Lightweight Concrete Fill is an engineered geotechnical material with a unique strength / density relationship which can be used to reduce loads on soft foundation soils, buried structures, or against retaining walls. Lightweight Concrete Fill consists of a Portland cement matrix containing uniformly distributed, non-interconnected air voids introduced by a foaming agent. The flowability and cementitious properties provide a product that is self leveling and does not require compaction.

204-2 MATERIALS.

204-2.01 Controlled Low Strength Material. Provide backfill material meeting the requirements for CLSM as stated in §733-01 *Flowable Fill*.

204-2.02 Lightweight Concrete Fill. Provide backfill material meeting the requirements for Lightweight Concrete Fill as stated in §733-01 *Flowable Fill*.

204-3 CONSTRUCTION DETAILS.

204-3.01 Controlled Low Strength Material.

A. CLSM Submittal. Submit to the Engineer (1) a mix design, with certified test results supplied by a qualified independent testing laboratory for the CLSM verifying the unconfined compressive strength meets the requirements of the specification, and (2) the methods of installation to be employed. Include in the CLSM placement sequence, a procedure to account for subsidence during the settling and curing process.

B. CLSM Production. Mix the materials at a stationary mixing plant which is either a continuous or a batch type plant. A batch is defined as the amount of material that can be mixed at one time. Design the mix of materials to accurate proportions, either by volume or by weight, so that when the materials are incorporated in the mix a thorough and uniform mix will result.

If the CLSM can be placed within 30 minutes of the end of mixing, then open haul units may be used for transport. If it cannot be placed within 30 minutes after the end of mixing, it must be transported by a rotating drum unit capable of 2-6 rpm.

FLOWABLE FILL

For work involving quantities of CLSM less than 2.5 yd³, the Contractor may use a small portable mixer. Provide a mixer capable of mixing CLSM that has the specified unconfined compressive strength and flow consistency. Mix all components so as to produce a uniform product.

C. CLSM Placement - General. Do not place CLSM that is frozen, or place CLSM on frozen ground. Do not expose CLSM to freezing temperatures until after it has gained its requisite strength, abiding by the *Provisions for Curing in Cold Weather* in Section 555 *Structural Concrete*.

If the CLSM is to be placed via pumps, the placement sequence shall be such that the equipment is able to access the entire volume to be filled without separating the mixture.

Keep CLSM encapsulated with soil or protected by other means so as to prevent erosion and environmental degradation.

D. CLSM Placement – at Structures, Culverts, Pipes, Conduits and Direct Burial Cables. Place the CLSM in accordance with the installation details shown on the Standard Sheet.

When placing CLSM for pipe backfill, discharge the material onto the top and at the center of the pipe.

Do not place CLSM in contact with aluminum pipe, including connections, fixtures, etc., unless the aluminum has been thoroughly coated with Zinc Chromate Primer, §708-04 *Zinc Chromate Primer*, or an equivalent alternative as approved by the Materials Bureau.

Do not place CLSM containing fly ash in direct contact with cast iron or ductile iron pipes, fittings or appurtenances.

In situations where CLSM is used as backfill around pipe, take precautions to counteract the pipe's buoyancy.

E. CLSM – QA Testing. The Department maintains a Quality Assurance (QA) program for CLSM. The Department will sample and test specimens of the CLSM during placement to compare its properties to the specification requirements and verifying the spread diameter and unconfined compressive strength of the in-place material. The QA program provides oversight of the Contractors Quality Control (QC) process, to reveal changes which may occur in the approved mix design.

Several scenarios may develop as a result of the QA testing.

1. The properties are shown to meet the requirements of the specification for the type(s) identified in the contract documents. No action will be taken.
2. The properties are shown to be outside the requirements of the specification for the type(s) identified in the contract documents.
 - a. If the results are within an acceptable margin as determined by the Department through an independent analysis of the site specific conditions, the material may remain in-place contingent upon an agreed credit. If a credit cannot be agreed upon, the scenario reverts to 2.b.
 - b. If the results are not within an acceptable margin as determined by the Department through an independent analysis of the site specific conditions, the entire lift (and all overlying lifts) of material will be removed and replaced at the Contractor's expense.

204-3.02 Lightweight Concrete Fill.

A. Lightweight Concrete Fill Submittal. Submit to the Engineer (1) a mix design, with certified test results supplied by a qualified independent testing laboratory for the Lightweight Concrete Fill verifying the wet cast density and unconfined compressive strength meets the requirements of the specification for the type(s) identified in the contract documents, and (2) the methods of installation to be employed.

FLOWABLE FILL

B. Lightweight Concrete Fill Production. Generate foam in accordance with the manufacturer's recommendations for inclusion into the mix.

Mix the materials at a stationary mixing plant which is either a continuous or a batch type plant. A batch is defined as the amount of material that can be mixed at one time. Design the mix of materials to accurate proportions, either by volume or by weight, so that when the materials are incorporated in the mix, a thorough and uniform mix will result.

Locate equipment such that the mixed product is capable of being pumped into place properly.

C. Lightweight Concrete Fill - Placement. A representative of the supplier of the foaming agent shall be on site during the initial placement and at such times as requested by the Engineer to advise the Contractor on his operation. The lightweight concrete fill shall be placed in lifts not to exceed 24 in. unless otherwise approved by the Engineer. Subsequent lifts shall be placed only after a minimum 12 hour waiting period has been observed.

At the end of each pour, exposed surfaces shall be roughened with a stiff broom or scored with a tool. The Lightweight Concrete Fill shall be placed on supporting surfaces which have been cleaned of loose debris, sand, dust, or other foreign materials to the satisfaction of the Engineer.

Do not place Lightweight Concrete Fill that is frozen, or place Lightweight Concrete Fill on frozen ground. Do not expose Lightweight Concrete Fill to freezing temperatures until after it has gained its requisite strength, abiding by the *Provisions for Curing in Cold Weather* in Section 555 *Structural Concrete*.

D. Lightweight Concrete Fill - QA Testing. The Department maintains a Quality Assurance (QA) program for Lightweight Concrete Fill. The Department will sample and test specimens of the Lightweight Concrete Fill material during placement to compare its properties to the specification requirements and verifying the wet cast density and unconfined compressive strength of the in-place material. The QA program provides oversight of the Contractors Quality Control (QC) process, to reveal changes which may occur in the approved mix design.

Several scenarios may develop as a result of the QA testing.

1. The properties are shown to meet the requirements of the specification for the type(s) identified in the contract documents. No action will be taken.
2. The properties are shown to be outside the requirements of the specification for the type(s) identified in the contract documents.
 - a. If the results are within an acceptable margin as determined by the Department through an independent analysis of the site specific conditions, the material may remain in-place contingent upon an agreed credit. If a credit cannot be agreed upon, the scenario reverts to 2.b.
 - b. If the results are not within an acceptable margin as determined by the Department through an independent analysis of the site specific conditions, the entire lift (and all overlying lifts) of material will be removed and replaced at the Contractor's expense.

204-4 METHOD OF MEASUREMENT.

204-4.01. Controlled Low Strength Material. CLSM will be measured for payment in cubic yards measured to the nearest 0.1 cubic yard computed from the payment lines shown on the contract documents.

A deduction will be made for pipes (based on nominal diameters) and other features when the combined cross-sectional area exceeds 1 ft².

No additional quantity shall be measured for payment to make up losses due to foundation settlement, compaction, erosion or any other cause.

FLOWABLE FILL

Cross sectioning, for the purpose of determining quantities for payment, will be employed only where payment lines are not shown on the contract documents or Standard Sheets, and cannot be reasonably established by the Engineer.

204-4.02. Lightweight Concrete Fill. Lightweight Concrete Fill will be measured for payment in cubic yards measured to the nearest 0.1 cubic yard computed from the payment lines shown on the contract documents.

204-5 BASIS OF PAYMENT.

204-5.01 Controlled Low Strength Material. The unit price bid shall include the costs of all labor, material, and equipment necessary to satisfactorily complete the work.

204-5.02. Lightweight Concrete Fill. The unit bid price shall include the cost of all labor, materials, and equipment necessary to satisfactorily complete the work.

Payment will be made under:

Item No.	Item	Pay Unit
204.01	Controlled Low Strength Material (CLSM)	Cubic Yard
204.02	Controlled Low Strength Material (CLSM) (No Fly Ash)	Cubic Yard
204.03	Lightweight Concrete Fill (Type A)	Cubic Yard
204.04	Lightweight Concrete Fill (Type B)	Cubic Yard

FLOWABLE FILL

Make the following changes to the Standard Specifications dated May 1, 2008, as modified by EI 10-038:

Delete §552-2.05 C.2. *Grout Backfill* entirely and **Replace** it with the following:

2. Grout Backfill. Grout backfill shall be a workable mixture capable of stabilizing the hole being excavated. The Contractor shall use either:

i. Controlled Low Strength Material. Material meeting the requirements for Controlled Low Strength Material as stated in §733-01 *Flowable Fill*.

ii. Controlled Low Strength Material (No Fly Ash). Material meeting the requirements for Controlled Low Strength Material (No Fly Ash) as stated in §733-01 *Flowable Fill*.

iii. Grout. Cement, concrete sand and water conforming to Table 552-1 *Grout Backfill Requirements*.

TABLE 552-1 GROUT BACKFILL REQUIREMENTS	
Material	Subsection
Portland Cement Type 2	§701-01
Concrete Sand	§703-07
Water	§712-01

FLOWABLE FILL

Make the following changes to the Standard Specifications dated May 4, 2006:

Page 176-178, Delete SECTION 204 *Controlled Low Strength Material (CLSM)* entirely and Replace it with the following:

SECTION 204 – FLOWABLE FILL

204-1 DESCRIPTION. The work shall consist of mixing and placing flowable fill at the locations shown in the contract documents.

204-1.01. Controlled Low Strength Material. Controlled Low Strength Material (CLSM) is an acceptable alternative to compacted soil backfill in confined spaces. CLSM consists of cement, water and, at the Contractor's option, fly ash, aggregate or chemical admixtures in any proportions such that the final product meets the strength and flow consistency requirements included in the specification. The mix is proportioned to be self leveling and does not require compaction. It is much lower in strength than concrete, making future excavation possible.

204-1.02. Lightweight Concrete Fill. Lightweight Concrete Fill is an engineered geotechnical material with a unique strength / density relationship which can be used to reduce loads on soft foundation soils, buried structures, or against retaining walls. Lightweight Concrete Fill consists of a Portland cement matrix containing uniformly distributed, non-interconnected air voids introduced by a foaming agent. The flowability and cementitious properties provide a product that is self leveling and does not require compaction.

204-2 MATERIALS.

204-2.01 Controlled Low Strength Material. Provide backfill material meeting the requirements for CLSM as stated in §733-01 *Flowable Fill*.

204-2.02 Lightweight Concrete Fill. Provide backfill material meeting the requirements for Lightweight Concrete Fill as stated in §733-01 *Flowable Fill*.

204-3 CONSTRUCTION DETAILS.

204-3.01 Controlled Low Strength Material.

A. CLSM Submittal. Submit to the Engineer (1) a mix design, with certified test results supplied by a qualified independent testing laboratory for the CLSM verifying the unconfined compressive strength meets the requirements of the specification, and (2) the methods of installation to be employed. Include in the CLSM placement sequence, a procedure to account for subsidence during the settling and curing process.

B. CLSM Production. Mix the materials at a stationary mixing plant which is either a continuous or a batch type plant. A batch is defined as the amount of material that can be mixed at one time. Design the mix of materials to accurate proportions, either by volume or by weight, so that when the materials are incorporated in the mix a thorough and uniform mix will result.

If the CLSM can be placed within 30 minutes of the end of mixing, then open haul units may be used for transport. If it cannot be placed within 30 minutes after the end of mixing, it must be transported by a rotating drum unit capable of 2-6 rpm.

FLOWABLE FILL

For work involving quantities of CLSM less than 2.0 m³, the Contractor may use a small portable mixer. Provide a mixer capable of mixing CLSM that has the specified unconfined compressive strength and flow consistency. Mix all components so as to produce a uniform product.

C. CLSM Placement - General. Do not place CLSM that is frozen, or place CLSM on frozen ground. Do not expose CLSM to freezing temperatures until after it has gained its requisite strength, abiding by the *Provisions for Curing in Cold Weather* in Section 555 *Structural Concrete*.

If the CLSM is to be placed via pumps, the placement sequence shall be such that the equipment is able to access the entire volume to be filled without separating the mixture.

Keep CLSM encapsulated with soil or protected by other means so as to prevent erosion and environmental degradation.

D. CLSM Placement – at Structures, Culverts, Pipes, Conduits and Direct Burial Cables. Place the CLSM in accordance with the installation details shown on the Standard Sheet.

When placing CLSM for pipe backfill, discharge the material onto the top and at the center of the pipe.

Do not place CLSM in contact with aluminum pipe, including connections, fixtures, etc., unless the aluminum has been thoroughly coated with Zinc Chromate Primer, §708-04 *Zinc Chromate Primer*, or an equivalent alternative as approved by the Materials Bureau.

Do not place CLSM containing fly ash in direct contact with cast iron or ductile iron pipes, fittings or appurtenances.

In situations where CLSM is used as backfill around pipe, take precautions to counteract the pipe's buoyancy.

E. CLSM – QA Testing. The Department maintains a Quality Assurance (QA) program for CLSM. The Department will sample and test specimens of the CLSM during placement to compare its properties to the specification requirements and verifying the spread diameter and unconfined compressive strength of the in-place material. The QA program provides oversight of the Contractors Quality Control (QC) process, to reveal changes which may occur in the approved mix design.

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 - b. If the results are not within an acceptable margin as determined by the Department through an independent analysis of the site specific conditions, the entire lift (and all overlying lifts) of material will be removed and replaced at the Contractor's expense.

204-3.02 Lightweight Concrete Fill.

A. Lightweight Concrete Fill Submittal. Submit to the Engineer (1) a mix design, with certified test results supplied by a qualified independent testing laboratory for the Lightweight Concrete Fill verifying the wet cast density and unconfined compressive strength meets the requirements of the specification for the type(s) identified in the contract documents, and (2) the methods of installation to be employed.

FLOWABLE FILL

B. Lightweight Concrete Fill Production. Generate foam in accordance with the manufacturer's recommendations for inclusion into the mix.

Mix the materials at a stationary mixing plant which is either a continuous or a batch type plant. A batch is defined as the amount of material that can be mixed at one time. Design the mix of materials to accurate proportions, either by volume or by weight, so that when the materials are incorporated in the mix, a thorough and uniform mix will result.

Locate equipment such that the mixed product is capable of being pumped into place properly.

C. Lightweight Concrete Fill - Placement. A representative of the supplier of the foaming agent shall be on site during the initial placement and at such times as requested by the Engineer to advise the Contractor on his operation. The lightweight concrete fill shall be placed in lifts not to exceed 600 mm unless otherwise approved by the Engineer. Subsequent lifts shall be placed only after a minimum 12 hour waiting period has been observed.

At the end of each pour, exposed surfaces shall be roughened with a stiff broom or scored with a tool. The Lightweight Concrete Fill shall be placed on supporting surfaces which have been cleaned of loose debris, sand, dust, or other foreign materials to the satisfaction of the Engineer.

Do not place Lightweight Concrete Fill that is frozen, or place Lightweight Concrete Fill on frozen ground. Do not expose Lightweight Concrete Fill to freezing temperatures until after it has gained its requisite strength, abiding by the *Provisions for Curing in Cold Weather* in Section 555 *Structural Concrete*.

D. Lightweight Concrete Fill – QA Testing. The Department maintains a Quality Assurance (QA) program for Lightweight Concrete Fill. The Department will sample and test specimens of the Lightweight Concrete Fill material during placement to compare its properties to the specification requirements and verifying the wet cast density and unconfined compressive strength of the in-place material. The QA program provides oversight of the Contractors Quality Control (QC) process, to reveal changes which may occur in the approved mix design.

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204-4 METHOD OF MEASUREMENT.

204-4.01. Controlled Low Strength Material. CLSM will be measured for payment in cubic meters measured to the nearest 0.1 cubic meter computed from the payment lines shown on the contract documents.

A deduction will be made for pipes (based on nominal diameters) and other features when the combined cross-sectional area exceeds 0.1 m^2 .

No additional quantity shall be measured for payment to make up losses due to foundation settlement, compaction, erosion or any other cause.

FLOWABLE FILL

Cross sectioning, for the purpose of determining quantities for payment, will be employed only where payment lines are not shown on the contract documents or Standard Sheets, and cannot be reasonably established by the Engineer.

204-4.02. Lightweight Concrete Fill. Lightweight Concrete Fill will be measured for payment in cubic yards measured to the nearest 0.1 cubic meter computed from the payment lines shown on the contract documents.

204-5 BASIS OF PAYMENT.

204-5.01 Controlled Low Strength Material. The unit price bid shall include the costs of all labor, material, and equipment necessary to satisfactorily complete the work.

204-5.02. Lightweight Concrete Fill. The unit bid price shall include the cost of all labor, materials, and equipment necessary to satisfactorily complete the work.

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Item No.	Item	Pay Unit
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204.03	Lightweight Concrete Fill (Type A)	Cubic Meter
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FLOWABLE FILL

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2. Grout Backfill. Grout backfill shall be a workable mixture capable of stabilizing the hole being excavated. The Contractor shall use either:

i. Controlled Low Strength Material. Material meeting the requirements for Controlled Low Strength Material as stated in §733-01 *Flowable Fill*.

ii. Controlled Low Strength Material (No Fly Ash). Material meeting the requirements for Controlled Low Strength Material (No Fly Ash) as stated in §733-01 *Flowable Fill*.

iii. Grout. Cement, concrete sand and water conforming to Table 552-1 *Grout Backfill Requirements*.

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