

Chapter 11

Sample Specifications

11.1 Specification for We Energies Cast-in-Place Concrete

Part 1 - General

1.01 Section Includes

- A. Furnish and install all cast-in-place concrete.

1.02 References

- A. American Concrete Institute (ACI):
 1. *ACI 301 - Specifications for Structural Concrete for Buildings.*
 2. *ACI 305 - Hot Weather Concreting.*
 3. *ACI 306 - Cold Weather Concreting.*
 4. *ACI 309 - Recommended Practice for Consolidation of Concrete.*

1.03 Submittals

- A. Submit Portland cement and fly ash test reports at least 14 days prior to placement of concrete.
- B. Submit manufacturer's data for concrete admixtures, liquid curing material, floor joint filler, finishing compounds, and bonding agents.
- C. Submit concrete aggregate test reports and concrete mix designs at least 14 days prior to placement of concrete.
- D. Submit results of concrete strength tests.

1.04 Quality Assurance

- A. Comply with ACI 301, except as modified in this Section.
- B. Hire an independent testing laboratory, approved by the Engineer, to perform the work listed below. All costs for this testing shall be paid by the Contractor.
 1. *Test proposed aggregate.*
 2. *Test proposed fly ash.*

3. *Design concrete mixes for each type of concrete specified*
4. *Cast concrete cylinders for strength tests.*
5. *Test concrete cylinders.*

C. *Aggregate Tests:*

1. *Test aggregates for compliance with ASTM C33.*

D. *Concrete Mix Design:*

1. *Prepare mix designs for each type of concrete specified.*
2. *Design concrete mixes in accordance with ACI 301.*

E. *Concrete Strength Tests:*

1. *Mold and cure three specimens from each sample in accordance with ASTM C31. Any deviations from the requirements of ASTM C31 shall be recorded in the test report.*
2. *Test specimens in accordance with ASTM C39. Two specimens shall be tested at 28 days for acceptance and one shall be tested at seven days for information. The acceptance test results shall be the average of the strengths of the two specimens tested at 28 days.*
3. *Make at least one strength test for each 100 cu. yds., or fraction thereof, of each mixture design of concrete placed in any one day.*
4. *A copy of the test results shall be furnished to the Engineer as soon as available.*
5. *All costs of concrete cylinder testing shall be paid by the Contractor.*
6. *Mold and field cure additional specimens for early form removal.*

F. *Concrete Slump Tests:*

1. *The Independent Testing Laboratory will determine slump of concrete from each truck in accordance with ASTM C143.*
2. *If the slump does not meet specifications, remove batch from work and return to supplier.*

G. *Concrete Air Content Tests:*

1. *The Independent Testing Laboratory will determine air content of concrete from each truck in accordance with ASTM C231.*
2. *If air content does not meet specifications, remove batch from work and return to supplier.*
3. *Air content will be tested prior to and after adding superplasticizer.*

H. *Concrete Temperature:*

1. *The Independent Testing Laboratory will determine temperature of concrete from each truck.*

1.05 *Product Handling*

- A. *Do not store forms, shores, reinforcing, equipment or other material on finished slab surfaces.*

Part 2 – Products

2.01 Concrete Materials

- A. Cement: Conform to ASTM C150, Type I. Provide cement from one source of supply.
- B. Fly ash: Conform to ASTM C618, Class C from We Energies Pleasant Prairie or Presque Isle Power Plants.
- C. Aggregate: Conform to ASTM C33. Provide aggregate from one source of supply.
- D. Water: Clean, potable, and free from deleterious amounts of oil, acid, alkali or other foreign matter.

2.02 Admixtures

- A. Air Entraining Admixture: Conform to ASTM C260.
- B. Water Reducing Admixture: Conform to ASTM C494, Type A.
- C. High Range Water-Reducing Admixtures (Superplasticizer): Conform to ASTM C494, Type F and contain no chlorides.

2.03 Miscellaneous Material

- A. Burlap-Polyethylene Sheet: Burlap polyethylene sheeting shall consist of burlap weighing not less than 10 oz./linear yard, 40 in. wide impregnated on one side with white opaque polyethylene 0.006 in. thick. Sheeting shall conform to ASTM C171.
- B. Liquid Curing Compound: Conform to ASTM C309, Type 1-D, Class B clear or translucent with fugitive dye. Not to be applied to floor slabs.
- C. Expansion Joint Material: Bituminous fiber type conforming to ASTM D1751 with bituminous or paraffin binder.
- D. Interior Joint Filler: One part, self leveling, polymer reinforced joint filler, Everjoint manufactured by L&M Construction Chemicals, Inc., or approved equal.
- E. Exterior Joint Sealant: Two part, self leveling, polyurethane sealant, Sonolastic SL2 manufactured by Sonneborn, or approved equal.
- F. Concrete Finishing Compound: Thoroseal cement based coating manufactured by Thoro System Products, or approved equal.
- G. Bonding Agent: Acryl 60 manufactured by Thoro System Products, or approved equal.

2.04 Concrete Mix Proportions

- A. 3000 PSI Concrete - 40% fly ash @ 1:1.25, cement to fly ash replacement ratio.

Coarse Aggregate Size	ASTM C33 No. 67
Minimum Compressive Strength at 28 days	3000 psi
Minimum Cement Content	255 lbs/cu. yd.
Minimum Class C Fly ash Content	208 lbs/cu. yd.

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|----------------------|---|
| Air Entraining Agent | Compatible with cement and as needed for air content to provide required air for exposure condition |
|----------------------|---|
- B. 4000 PSI Concrete - 40% fly ash @ 1:1.25, cement to fly ash replacement ratio.
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|---|---|
| Coarse Aggregate Size | ASTM C33 Size No. 67 |
| Minimum Compressive Strength at 28 days | 4000 psi |
| Minimum Cement Content | 310 lbs/cu. yd. |
| Minimum Class C Fly ash Content | 251 lbs/cu. yd. |
| Air Entraining Agent | Compatible with cement and as needed for air content to provide required air for exposure condition |
- C. 5000 PSI Concrete - 40% fly ash @ 1:1.25, cement to fly ash replacement ratio
- | | |
|---|---|
| Coarse Aggregate Size | ASTM C33 No. 67 |
| Minimum Compressive Strength at 28 days | 5000 psi |
| Minimum Cement Content | 367 lbs/cu. yd. |
| Minimum Class C Fly Ash | 265 lbs/cu. yd. |
| Air Entraining Agent | Compatible with cement and as needed for air content to provide required air for exposure condition |
- D. 6000 PSI Concrete - 40% fly ash @ 1:1.25 cement to fly ash replacement ratio.
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|--|---|
| Coarse Aggregate Size | ASTM C33 No. 67 |
| Minimum Compressive Strength @ 28 days | 6000 psi |
| Minimum Cement Content | 445 lbs/cu. yd. |
| Minimum Flyash Content | 239 lbs/cu. yd. |
| Slump | 6½ in. |
| Superplasticizer | Compatible with cement and as needed for workability |
| Air Entraining Agent | Compatible with cement and as needed for air content to provide required air for exposure condition |

Part 3 – Execution

3.01 Concrete Production

- A. Batch, mix, and transport ready-mixed concrete in accordance with ASTM C94.
- B. Mix concrete only in quantities for immediate use. Discard concrete which has set. Do not retemper.
- C. Discharge concrete from truck within 60 minutes after cement is added to the mix.
- D. Do not add water at the site without the permission of the Engineer.
- E. Add superplasticizer to the concrete at the project site. Add superplasticizer and mix concrete in accordance with manufacturer's recommendations.

3.02 *Embedded Items*

- A. All sleeves, inserts, anchors, and embedded items required for adjoining work or for its support shall be placed prior to placing concrete.
- B. All embedded items shall be positioned accurately and supported against displacement.
- C. Voids in sleeves, inserts and anchor slots shall be filled temporarily with readily removable material to prevent the entry of concrete into the voids.

3.03 *Preparation Before Placing*

- A. Formwork shall be completed and all reinforcement and embedded items shall be secured in place.
- B. All snow, ice, and mud shall be removed prior to placing concrete.
- C. Do not place concrete on frozen ground.
- D. Do not place concrete on ground with standing water or when upper 2" of ground is saturated.
- E. Do not place concrete during rain, sleet, or snow.

3.04 *Concrete Conveying*

- A. Handle concrete from the mixer to the place of final deposit as rapidly as practical by methods, which will prevent segregation or loss of ingredients.

3.05 *Concrete Depositing*

- A. Deposit concrete continuously or in layers of such thickness that no concrete will be deposited on concrete which has hardened sufficiently to cause the formation of seams or planes or weakness within the section.
- B. Place concrete at such a rate that the concrete which is being integrated with fresh concrete is still plastic.
- C. Concrete, which has partially hardened or has been contaminated by hardened materials, shall not be deposited.
- D. Remove rejected concrete from the site.
- E. Deposit concrete as nearly as practicable in its final position to avoid segregation due to handling or flowing.
- F. Free fall of concrete shall not exceed five feet. Use chutes equipped with hopper heads for placing where a drop of more than five feet is required.

3.06 *Placing Concrete Slabs*

- A. Deposit and consolidate concrete slabs in a continuous operation.
- B. Consolidate concrete placed in slabs by vibrating bridge screeds, roller pipe screeds or other methods acceptable to the Engineer. Bring slab surfaces to the correct level with a straight edge and then strike off. Use bullfloats or darbies to smooth the surface, leaving it free from bumps and hollows.
- C. Do not leave screed stakes in concrete.

- D. Do not sprinkle water on the plastic surface. Do not disturb the slab surfaces prior to start of finishing operations.

3.07 Cold Weather Placing

- A. Do not place concrete when the air temperature is less than 40°F without the specific approval of the Engineer.
- B. Comply with ACI 306 to protect all concrete work from physical damage and reduced strength caused by frost or low temperatures.
- C. The temperature of the concrete delivered at the site shall conform to the following limitations.

<u>Air Temperature</u>	<u>Minimum Concrete Temperature</u>
30 ⁰ to 45 ⁰ F	60 ⁰ F
0 ⁰ to 30 ⁰ F	65 ⁰ F
Below 0 ⁰ F	70 ⁰ F

- D. If water or aggregate is heated above 100°F, the water shall be combined with the aggregate in the mixer before cement is added. Cement shall not be mixed with water or with mixtures of water and aggregate having a temperature greater than 100°F.
- E. When the mean daily temperature is less than 40°F, the temperature of the concrete shall be maintained between 50⁰and 70⁰F for the required curing period.
- F. Arrangements for heating, covering, insulation, or housing the concrete work shall be made in advance of placement and shall be adequate to maintain the required temperature without injury due to concentration of heat.
- G. Combustion heaters shall not be used during the first 24 hours unless precautions are taken to prevent exposure of the concrete to exhaust gases.

3.08 Hot Weather Placing

- A. Comply with ACI 305 when hot weather conditions exist.
- B. Maintain concrete temperature at time of placement below 90°F.
- C. When the temperature of the steel is greater than 120°F, steel forms and reinforcement shall be sprayed with water prior to placing concrete.
- D. Keep all surfaces protected from rapid drying. Provide windbreaks, shading, fog spraying, sprinkling, ponding, or wet covering in advance of placement.

3.09 Consolidation

- A. Consolidate all concrete in accordance with provisions of ACI 309.
- B. Consolidate each layer of concrete immediately after placing, by use of internal concrete vibrators. Maintain a frequency of not less than 8,000 vibrations per minute for each internal vibrator.

- C. Provide adequate number of units and power source at all times. Use a minimum of two vibrators for all work and maintain spare units to ensure adequacy.
- D. Insert the vibrator so as to penetrate the lift immediately below the one being placed. Do not insert the vibrator into lower courses, which have begun to set.
- E. Spacing between insertions of the vibrator shall generally be from 12" to 18" and shall not exceed twice the radius of action as shown in ACI 309 or eighteen (18) inches.
- F. Do not use vibrators to transport concrete inside the forms.
- G. Vibration shall be adequate and properly carried out to minimize entrapped air and surface voids on formed surfaces.

3.10 Concrete Slab Finishing

A. Float Finish:

1. *Apply float finish to all slab surfaces.*
2. *After placing and screeding concrete slabs, do not work the surface until ready for floating. Begin floating when the surface water has disappeared and when the concrete has stiffened sufficiently to permit operation of a power-driven float.*
3. *Consolidate the surface with power-driven float, or by handfloating if the area is small or inaccessible to power units.*
4. *Check and level the surface plane to a tolerance not exceeding ¼ inch in ten (10) feet when tested with a ten-foot straight-edge placed on the surface at not less than two different angles.*
5. *Immediately after leveling, refloat the surfaces to a smooth, uniform, granular texture.*

B. Trowel Finish:

1. *Apply steel trowel finish to all interior floor slabs, topping, and stair treads.*
2. *Apply float finish to slabs as described above in part 3.10.A.*
3. *After floating, begin the first trowel finish operation using a power-driven trowel. Begin final troweling when the surface produces a ringing sound as the trowel is moved over the surface.*
4. *Consolidate the concrete surface by the final hand troweling operation, free from trowel marks, uniform in texture and appearance, and with a surface plane tolerance not exceeding ⅛ inch in 10 feet when tested with a ten foot straight-edge.*

C. Broom Finish:

1. *Apply non-slip broom finish to all exterior sidewalks and aprons.*
2. *Apply float to slabs as described above in part 3.10A.*
3. *Immediately after floating, slightly roughen the concrete surface by sweeping in the direction perpendicular to the main traffic route. Use a fiber-bristle broom.*

3.11 *Finishing Formed Surfaces*

- A. Smooth Form Finish: Provide a smooth formed surface to all formed surfaces not exposed to view unless otherwise noted in paragraph B. Smooth formed finish shall consist of the following:
 - 1. *Construct formwork in exact dimension of the concrete member poured.*
 - 2. *Patch all tie holes and defects.*
 - 3. *Remove all fins, concrete "buttons", and protrusions completely.*
- B. Special Wall Finish: Provide a special wall finish to all formed surfaces exposed to view.
 - 1. *Provide a smooth form finish in accordance with paragraph 3.11.A.*
 - 2. *Thoroughly clean wall surface and remove all dirt, loose mortar particles, paint, films, protective coatings, efflorescence and other foreign material.*
 - 3. *Dampen surface with clean water just prior to application of finishing compound.*
 - 4. *Mix one part bonding agent to three parts clean water for mixing liquid.*
 - 5. *Mix concrete finish compound with mixing liquid as specified by the manufacturer.*
 - 6. *Apply first coat to concrete with brush at 2 lbs. per square yard.*
 - 7. *Apply second coat to concrete with brush at 2 lbs. per square yard after the first coat has set.*
 - 8. *When the second coat has set, float it to a uniform texture with a sponge float.*
 - 9. *Prepare three test samples of various textures for approval by the Engineer. Each sample shall be approximately 6' x 6' in size and located on an unexposed wall surface as directed by the Engineer.*

3.12 *Curing*

- A. Immediately after placement, all concrete shall be damp cured for a minimum of seven days.
- B. All slabs shall be covered with approved burlap-polyethylene film and kept in place throughout the curing period.
- C. Walls, beams, columns, and other formed surfaces shall be covered with burlap-polyethylene film or sprayed with an approved curing compound.
- D. All burlap-polyethylene film shall be adequately anchored at the edges to prevent moisture loss.
- E. Rewet all slab surfaces at least once a day during the curing period.

3.13 *Patching*

- A. Repair honeycomb and other defective areas, fill surface voids and fill form tie holes and similar defects in accordance with Chapter 9 of ACI 301.

- B. Reinforce or replace deficient work as directed by the Engineer and at no additional cost to the Owner.

3.14 *Cleaning*

- A. Upon completion and prior to any painting, all exposed or painted concrete surfaces shall be thoroughly cleaned of all concrete spatters, from oil or other foreign material detrimental to appearance or painting.

END OF SECTION

11.2 Specification for We Energies Bottom Ash Structural Backfill

Part 1 – General

1.01 Section Includes

- A. Furnish bottom ash structural fill material and backfill excavation (for bridges, culverts, retaining walls, structural plate pipes, pipe anchors, and/or around building basements).

1.02 References

- A. WDOT - Standard Specifications for Highway and Structure Construction Section 210.
- B. ASTM E1861 - Standard Guide for Use of Coal Combustion By-Products in Structural Fills.

1.03 Submittals

- A. Submit Sieve Analysis Test and Reports.

1.04 Quality Assurance

- A. Chapter NR 538 - Beneficial Use of Industrial By-Products - Department of Natural Resources (Wisconsin Administrative Code).
- B. Comply with ASTM E1861, except as modified in this section.
- C. Hire an independent testing laboratory, approved by the Engineer to perform the work listed below. All costs for the testing shall be paid by the Contractor.
 - 1. Perform Sieve Analysis Test on the bottom ash.
 - 2. Measure field density of the bottom ash.

Part 2 – Products

2.01 Bottom Ash Structural Fill

- A. Bottom Ash: Meet ASTM E1861 requirements.
- B. Water: Clean, potable, and free from deleterious amounts of oil, acid, alkali or other foreign matter.

Part 3 – Execution

3.01 Bottom Ash Material

- A. Bottom ash used for backfill shall be of a quality acceptable to the Engineer and free from frozen lumps, wood or other extraneous or deleterious material.

3.02 Limitations on Placing Backfill

- A. Bottom ash shall not be placed against concrete masonry retaining wall or abutment until the masonry has been in place 14 days or until tests

show the strength of masonry strong enough to take lateral pressure from the fill.

- B. Structural backfill shall not be placed against any portion of any substructure until the required curing and protection, surface finishing, damp proofing and waterproofing of the work to be covered by structural fill has been completed.
- C. When backfilling against retaining walls, fill uniformly and simultaneously on both sides to the elevations of the front ground surface immediately after removal of the forms.
- D. Abutments for rigid frame structures and abutments not designed as self-sustaining shall not be backfilled until concrete in the superstructure has been poured and cured.
- E. Backfill only after the area has been cleared of all false work, sheet piling, cribbing, shoring, bracing, forms and rubbish.

3.03 *Bottom Ash Transporting and Placing*

- A. Bottom ash shall be transported in a truck or other vehicle and shall be so unloaded such that contents of each vehicle are gradually deposited instead of simultaneously emptying the entire content as one mass.
- B. Backfill shall be placed in continuous horizontal layers not more than eight inches thick and brought up uniformly. Compact each layer to at least 95% of proctor density or 90% of modified proctor density (ASTM D1557) before the next layer is placed, by means of approved rollers or portable mechanical or pneumatic tampers or vibrators.
- C. Backfilling along front face of abutments, retaining walls and wing walls shall extend to within six inches of weep holes, unless otherwise specified.

3.04 *Cleaning*

- A. Upon completion of placing structural fill, the area shall be thoroughly cleaned of all foreign material.

END OF SECTION

11.3 Specification for We Energies Bottom Ash as Granular Backfill

Part 1 – General

1.01 *Section Includes*

- A. Furnish bottom ash granular material and backfill trenches for pipe culverts, storm sewers, underdrains and similar structures.

1.02 *References*

- A. WDOT - Standard Specifications for Highway and Structure Construction-Section 209.
- B. ASTM D422 - Test Method for Particle Size Analysis of Soils
- C. Chapter NR 538 - Beneficial Use of Industrial By-Products - Department of Natural Resources (Wisconsin Administrative Code).

1.03 *Submittals*

- A. Submit Sieve Analysis Test results.

1.04 *Quality Assurance*

- A. Comply with WDOT - Standard Specification for Highway and Structure Construction Section 209.2 for particle size distribution, except as modified in this section.
- B. Hire an independent testing laboratory, approved by the Engineer to perform the work listed below. All costs for the testing shall be paid by the Contractor.
 - 1. *Perform Sieve Analysis Test on the aggregate.*
 - 2. *Measure field density of the backfill.*

Part 2 – Products

2.01 *Bottom Ash Granular Fill*

- A. Bottom Ash: Particle size distribution shall meet job requirements.
- B. Water: Clean potable and free from deleterious amounts of oil, acid, alkali or other foreign matter.

Part 3 – Execution

3.01 *Bottom Ash Material*

- A. Bottom ash used for backfill shall be of a quality acceptable to the Engineer and free from frozen lumps, wood or other extraneous or perishable material.

3.02 *Bottom Ash Placing and Compacting*

- A. Bottom ash shall be unloaded from the truck or other vehicles so that the contents of each vehicle are gradually deposited instead of emptying the entire contents as one mass.
- B. The bottom ash shall be spread and leveled in layers generally not exceeding eight inches in thickness before compaction.
- C. Compact each layer to the degree that no further appreciable consolidation is evident under the actions of the compaction equipment. The required compaction shall be attained before any material for a succeeding layer is placed thereon.
- D. Compaction shall be performed by specialized compaction equipment in addition to hauling and leveling equipment routed and distributed over each layer of the fill.
- E. The fill material shall be compacted to at least 90% of modified proctor maximum density (ASTM D1557) for their full depth.

3.04 *Cleaning*

- A. Upon completion of placing granular fill, the area shall be thoroughly cleaned of all foreign material. The compaction area shall be free from bottom ash debris and suitable for placement of topsoil or next course of road construction.

END OF SECTION

11.4 Specification for We Energies Flowable Fly Ash Slurry Controlled Low Strength Material (CLSM)

Part 1 - General

1.01 Section Includes

- A. Furnish and place controlled low strength material as backfill in trenches for culverts, conduit, storm sewers, utilities or similar structures, as a backfill behind bridge abutments or as a fill for retirement of sewers, tunnels, tanks, culverts or pipes.

1.02 References

- A. ACI 229R-94 Report: Controlled Low Strength Materials (CLSM)
- B. ACI 304 - Guide for measuring, mixing, transporting and placing concrete.
- C. Chapter NR 538 - Beneficial use of industrial by-products - Department of Natural Resources (Wisconsin Administrative Code).

1.03 Submittals

- A. Submit fly ash test results.
- B. Submit CLSM flow and compressive strength test results.
- C. Submit documentation that the fly ash used in this mixture meets the requirements of Industrial By-Products Categories 1, 2, 3 or 4 in NR 538 of the Wisconsin Administrative Code for use as a confined geotechnical fill.

1.04 Quality Assurance

- A. Comply with ACI 229R, except as modified in this section.
- B. Hire an independent testing laboratory, approved by the Engineer, to perform the work listed below. All costs for testing shall be paid by the Contractor.
 - 1. *Design CLSM mixes for each type of CLSM specified.*
 - 2. *Cast CLSM cylinder for compressive strength test.*
 - 3. *Measure flow of CLSM.*
 - 4. *Test CLSM cylinders.*
- C. CLSM Mix Design
 - 1. *CLSM shall consist of a designed mixture of cement and We Energies' Valley Power Plant or Port Washington Power Plant bituminous coal fly ash and sometimes aggregate.*
 - 2. *The designed mixture shall be self-leveling and shall be essentially free from shrinkage after hardening. The mixture shall be designed to reach a state of hardening such that it can support the weight of a person in no more than 24 hours.*

3. *The CLSM shall meet the following criteria:*

<u>Test</u>	<u>Method</u>	<u>Valve</u>
Flow	ASTM D6103	10" (250 mm) ± 3"
Compressive Strength	ASTM D4832	20-200psi @ 28 days (140 - 1400 kPa)

(The compressive strength values shown are guideline targets and actual cylinder breaks may vary considerably while still providing an acceptable and re-excavatable fill material. 100psi is 14,400 psf in soil terms, which is comparable to very compacted gravel to hard pan material.)

D. CLSM Strength Tests

1. *Mold and cure three specimens from each sample in accordance with ASTM D4832. Any deviations from the requirements of ASTM D4832 shall be recorded in the test report.*
2. *Test specimens in accordance with ASTM D4832. Two specimens shall be tested at 28 days for acceptance and one shall be tested at seven days for information. The acceptance test results shall be the average of the strength of the two specimens tested at 28 days.*
3. *Make at least one strength test for each 100 cu. yd., or fraction thereof, of each mixture design of CLSM placed in any one day.*
4. *A copy of the test results shall be furnished to the Engineer as soon as possible.*
5. *The Contractor shall pay all costs of CLSM cylinder testing.*

F. CLSM Flow Tests

1. *The testing laboratory will determine the flow of CLSM from each truck in accordance with ASTM D6103.*
2. *If flow does not meet specifications, remove batch from work and dispose of off site.*
3. *The Contractor will pay all costs of flow testing.*

G. Hardening Time

1. *On projects where hardening time is critical, the Owner/Engineer may at his/her discretion measure the hardening time in accordance with ASTM C403.*
2. *When measured in accordance with ASTM C403, the CLSM shall give a penetration number in the range of 500 to 1500.*
3. *All costs for measuring hardening time shall be paid by the Contractor.*

Part 2 – Products

2.01 CLSM Material

- A. *Cement: Conform to ASTM C150, Type 1. Provide cement from one source.*
- B. *Aggregate: Conform to ASTM C33 unless approved by the Engineer.*

- C. We Energies Class F Fly Ash: Not necessarily conforming to ASTM C 618.
- D. Water: Clean, potable, and free from deleterious amounts of oil, acid, alkali or other matter.

2.02 CLSM Mixture Proportions

- A. CLSM mixtures shall be proportioned to meet project requirements. The following mixture proportions shall be considered as a guideline for CLSM mixtures. The mixture proportion shall be modified to meet specific project requirements.

1. Flo-Pac 1 – (Excavatable) trench backfill applications:

Portland Cement	:	100 lb/cu. yd.
Class F Fly ash	:	1450 lb/cu. yd.
Water	:	950 lb/cu. yd.
Total Weight	:	2500 lb/cu. yd.

2. Flo-Pac 2 (Excavatable)

Portland Cement	:	70 lb/cu. yd.
Class F Fly ash	:	925 lb/cu. yd.
Sand (SSD)	:	1175 lb/cu. yd.
Added Water	:	785 lb/cu. yd.
Total Weight	:	3002 lb/cu. yd.

3. Flo-Pac 5 (Not easily excavatable)

Portland Cement	:	200 lb/cu. yd.
Class F Fly ash	:	700 lb/cu. yd.
Stone (SSD)	:	1500 lb/cu. yd.
Sand (SSD)	:	750 lb/cu. yd.
Added Water	:	480 lb/cu. yd.
Total Weight	:	3683 lb/cu. yd.

4. Flo-Pac 6 (Excavatable)

Portland Cement	:	50 lb/cu. yd.
Class C Fly Ash	:	50 lb/cu. yd.
Sand (SSD)	:	3100 lb/cu. yd.
Added Water	:	500 lb/cu. yd.
Total Weight	:	3700 lb/cu. yd.

Part 3 – Execution

3.01 CLSM Production and Conveyance

- A. CLSM shall be batched, mixed and transported in accordance with ACI 229.
- B. CLSM shall be mixed only in quantities for immediate use. CLSM, that has set, shall be discarded and shall not be retempered.
- C. Discharge CLSM from truck within 90 minutes after cement and fly ash is added to the mix.
- D. CLSM shall be handled from the mixer to the place of final deposit as rapidly as practical by methods, which will prevent segregation or loss of ingredients.

3.02 *CLSM Depositing*

- A. CLSM shall be placed to the lines and grades as shown on the plans.
- B. Materials shall be proportioned in accordance with the specified mix design. The product shall be of consistent texture and flow characteristics. The Engineer may reject any materials exhibiting a substantial change in properties, appearance or composition.
- C. CLSM, which has partially hardened or has been contaminated by hardened material, shall not be deposited.
- D. Deposit CLSM as soon as practical, so it can flow to any irregular area and fill completely.
- E. CLSM shall be placed in accordance with Wisconsin DNR Chapter NR538 and no CLSM material shall be allowed to enter any stream, lake, or storm sewer system.
- F. If the official Weather Bureau forecast for the construction site predicts temperatures at or below freezing within the next 24 hours after placement of CLSM, the Contractor shall protect the material placed from freezing during that time period. If the temperature is not forecast to rise above 40°F (4°C) for 72 hours after placement, the Engineer may require protection from freezing for up to 72 hours.
- G. When CLSM is used for pipe bedding, it shall be placed in lifts to prevent floating the pipe.
- H. When backfilling existing basement walls, or walls not designed for full lateral pressure from CLSM, CLSM shall be placed in lifts to prevent overstressing.
- I. Allow CLSM to self-level. Barricade the site or protect by other means, till CLSM hardens to avoid accidental entry.

3.03 *Construction Cautions*

- A. CLSM is placed as a liquid. Hence, it exerts fluid pressure. If CLSM is placed against basement walls or other structures, verify that the structure is capable of taking this lateral pressure. If the structure is not capable of handling this pressure, it can be braced externally until the CLSM slurry solidifies, or the CLSM slurry may be poured in multiple lifts so that one lift hardens before the next is poured.
- B. Fresh CLSM flowable fly ash slurry that is placed in deep excavations behaves like “quick-sand” and must be protected from accidental entry until it hardens.
- C. Low strength CLSM material (where re-excavation may be required at a later age) should be specified with a maximum strength (or a range of strength) that will allow for easy re-excavation with normal equipment. The addition of coarse aggregate to the mixture generally makes re-excavation more difficult.
- D. When transporting CLSM flowable slurry in a ready-mix truck, the driver should be aware of the liquid nature of the material being transported. CLSM may spill out of the back of a ready mix truck with quick stops or

traveling up hills. It is better to transport CLSM stiff and add water at the job site for high flow requirements.

3.04 *Cleaning*

- A. Upon completion of placing CLSM, clean the surrounding area of all CLSM spatters, or other foreign material detrimental to appearance.

END OF SECTION

11.5 Sample Specification for We Energies Class C Fly Ash Stabilized Cold In-place Recycled (CIR) Asphaltic Concrete Pavement

Part 1 - General

1.01 Section Includes

- A. Pulverize and relay the existing asphaltic surface and stabilize the recycled materials with Class C fly ash.

1.02 References

- A. WisDOT – Standard Specifications for Highway and Structure Construction-Section 325.
- B. ASTM C-618 – Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete
- C. Chapter NR 538 – Beneficial Use of Industrial By-Products - Department of Natural Resources (Wisconsin Administrative Code)
- D. ASTM D-698 – Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort
- E. ASTM D-5239 – Standard Practice for Characterizing Fly Ash for Use in Soil Stabilization

1.03 Submittals

- A. Submit fly ash test results.

1.04 Quality Assurance

- A. Comply with WisDOT - Standard Specification for Highway and Structure Construction Section 325 for particle size distribution, except as modified in this section.
- B. Required moisture contents will be established by the Engineer based on laboratory tests with the site materials and specific fly ash to be used for the treatment.

Part 2 – Products

2.01 Materials

- A. Fly Ash

Fly ash shall comply with the physical requirements of ASTM D-5239 6.4 maintaining a minimum compressive strength of 3.45 MPa (500 psi) at 7 days and the chemical requirements of ASTM C-618, Table 1, for Class "C" fly ash. Self-cementing ashes not meeting the above requirements can be used provided that the sulfur trioxide content does not exceed 10% and the self-cementing properties have been demonstrated to provide the required degree of stabilization. The source of the ash shall

be identified and approved in advance of stabilization operations so that laboratory tests can be completed prior to commencing work.

B. Water

The water used in the stabilized mixture shall be clean, clear, free of sewage, vegetable matter, oil, acid and alkali. Water known to be potable may be used without testing. All other sources shall be tested in accordance with A.A.S.H.T.O. T-26 and approved by the Engineer.

Part 3 – Execution

3.01 *Reprocessed Asphaltic Base*

A. Description

The work under this item shall consist of cutting out, grading and windrowing the existing gravel shoulders and pulverizing and relaying the existing asphaltic surface as shown on the plans and as hereinafter provided.

B. Construction Methods

The milling machine used shall be capable of pulverizing the existing asphaltic surface to a width of 12'6". The milling machine shall be equipped with a spray bar capable of adding 8% by volume of water to the pulverized material. The amount of water added shall be determined by the Engineer.

The existing asphaltic surface shall be pulverized to a depth as shown on the plans and to a maximum size of 1½ inches. A milling machine intended for this pulverizing operation shall be utilized. The milling machine shall be self propelled and equipped with electronic devices which will provide accurate depth, grade and slope control. Contractor shall furnish necessary extra trucks, loaders and graders to transfer reprocessed material where needed and to balance the material. Surplus reprocessed material from the project shall remain the property of the Owner.

Contractor shall grade the pulverized material to a width and slope as shown on the plans.

The grader used to distribute the reprocessed material shall be equipped with an approved automatic control system capable of automatically controlling the elevation and slope of the blade.

Crown slope shown in the typical section is after compaction. Slope at lay down or rolling technique shall be adjusted to achieve desired final cross slope.

C. Method of Measurement

This item will be measured as provided in the contract by the area in square yards. The quantity to be measured for payment shall be the area of the pavement before being removed and then redistributed, graded and compacted. Crushed Aggregate Base Course added shall be measured by the ton, delivered and spread prior to the reprocessing operation.

D. Basis of Payment

This item, measured as provided above, will be paid for at the contract unit price per square yard, which price shall be full compensation for removing, redistributing, adding moisture and blending aggregate, shaping and compacting the materials and for furnishing all labor, equipment, water, tools and incidentals necessary to complete the work.

3.02 *Specifications for Stabilization of Pavement Subgrades with Self-Cementing Coal Fly Ash*

A. Description

This item shall consist of the addition of self-cementing fly ash to the reprocessed asphaltic base, mixing, and compacting the material to the required density to develop a stabilized subgrade section. This item shall be constructed as specified herein and in conformity with the typical sections, lines, and grades as shown on the plans or as established by the Engineer.

B. Equipment

1. The machinery, tools and equipment necessary for proper execution of the work shall be on the project and approved by the Engineer prior to beginning construction operations. Blending of the reprocessed asphaltic base-fly ash mixture shall be accomplished by a Bomag MPH 100 pulvamixer or equivalent. Compaction shall be achieved using a **vibratory padfoot roller**. Rubber-tired rollers will not be permitted except for finish rolling of the stabilized section.

All machinery, tools and equipment used shall be maintained in a satisfactory and workmanlike manner.

2. Fly ash shall be stored and handled in closed weatherproof containers until immediately before distribution.
3. Fly ash is furnished in trucks, each truck shall have the weight of fly ash certified on public scales or the Contractor shall place a set of standard platform truck scales or hopper scales at a location approved by the Engineer.

C. Construction Methods

1. General

It is the primary purpose of this specification to secure a completed section of treated material which contains a uniform fly ash/reprocess asphaltic base mixture with no loose or segregated areas; which has a uniform density and moisture content; and which is well bound for its full depth. It shall be the responsibility of the Contractor to regulate the sequence of work; to process a sufficient quantity of material to provide a completed section as shown on plans; to use the proper amounts of fly ash; to achieve final compaction within the specified time; to maintain the work; and to rework the lifts as necessary to meet the above requirements. Soil temperature shall be at or above 35°F. at the time ash is incorporated.

2. Preparation of Subgrade

Before other construction operations are begun, the area where the fly ash stabilized material will be placed shall be cut and shaped in conformance with the lines and grades shown on the plans.

All areas shall be firm and able to support, without displacement, the construction equipment and the compaction hereinafter specified. Soft or yielding subgrade shall be corrected and made stable by scarifying, adding fly ash, and compacting until it is of uniform stability.

Where the stabilized section is to extend below the cut surface, the ash shall be distributed uniformly across the surface in a quantity sufficient to provide the specified ash content. The ash shall be incorporated with a pulvamixer with water being added to achieve the specified moisture content.

3. Moisture Control

Moisture control shall be achieved through use of a pulvamixer equipped with a spray bar in the mixing drum capable of applying sufficient quantities of water to achieve the required moisture content for the soil-fly ash mixture. The system shall be capable of being regulated to the degree necessary to maintain moisture contents within the specified range.

Required moisture contents will be established by the Engineer based on laboratory tests with the site reprocessed asphaltic base and specific fly ash to be used for the treatment. Final moisture content of the mix immediately prior to compaction shall not exceed the specified range of moisture contents. If moisture contents exceed the specified limits, additional fly ash may be added to lower moisture contents to the required limits. Lowering moisture contents by aeration following addition of fly ash will not be allowed.

4. Application of Fly Ash

Immediately prior to application of fly ash, the area shall be bladed to provide uniform distribution of fly ash.

The fly ash shall be spread in an approved manner at the rates shown on the plans or as directed by the Engineer.

The fly ash shall be distributed at a uniform rate and in such manner to reduce the scattering of fly ash by wind to a minimum. Fly ash shall not be applied when wind conditions, in the opinion of Engineer, are such that blowing fly ash will become objectionable to adjacent property owners.

Mixing operations shall commence within one hour after distribution of the fly ash.

5. Mixing

The RAB and fly ash shall be thoroughly mixed by approved mixers or other approved equipment, and the mixing continued until, in the opinion of the Engineer, a homogeneous, friable mixture of reprocessed asphaltic base and fly ash, free from all clods or lumps, is obtained.

If the reprocessed asphaltic base-fly ash mixture contains clods, they shall be reduced in size by additional pulverization.

6. Compaction

Compaction of the mixture shall begin immediately after mixing of the fly ash and be completed within two hours, (one or two hours depending upon the degree of stabilization required and experience level of the stabilization contractor), following incorporation of fly ash. Compaction of the mixture shall begin at the bottom and shall continue until the entire depth of mixture is uniformly compacted to the specified density using padfoot or similar rollers.

All non-uniform (too wet, too dry or insufficiently treated) areas which appear shall be corrected immediately by scarifying the areas affected, adding or removing material as required and remixing and recompacting.

The stabilized section shall be compacted to a minimum of 95% of the material's maximum dry density as determined by ASTM D-698 (Standard proctor compaction). Moisture content of the reprocessed asphaltic base fly ash mixture shall be in the range developed from the laboratory compaction and strength tests.

In addition to the requirements specified for density, the full depth of the material shown on the plans shall be compacted to the extent necessary to remain firm and stable under construction equipment. After each section is completed, tests will be made by the Engineer. If the material fails to meet the density or moisture content requirements, the Engineer may require it be reworked as necessary to meet those requirements or require the Contractor to change his construction methods to obtain required density on the next section. Additional fly ash will be added to areas that are reworked and amount required will be established by the Engineer. Should the material, due to any reason or cause, lose the required stability, density and finish before the work is accepted, it shall be reprocessed, recompacted and refinished at the sole expense of the Contractor. Reprocessing shall follow the same pattern as the initial stabilization including the addition of fly ash.

7. Finishing and Curing

After the stabilized layer has been compacted, it shall be brought to the required lines and grades in accordance with the typical sections.

- a. After the fly ash treated course has been finished as specified herein, the surface shall be protected against rapid drying by either of the following curing methods for a period of not less than three (3) days or until the pavement is placed :
 - 1) Maintain in a thorough and continuously moist condition by sprinkling.
 - 2) Binder course shall be applied within **three to seven calendar days**.

D. Measurement

FLY ASH will be measured by the ton (2,000 pounds), dry weight.
MIXING reprocessed asphaltic base and FLY ASH will be measured by the square yard in place.

E. Payment

Work performed and materials furnished as prescribed by this item and measured as provided under "Measurement" will be paid for as follows:

FLY ASH will be paid for at the unit price bid per ton (2,000 pounds) which price shall be full compensation for furnishing all fly ash.

MIXING reprocessed asphaltic base and FLY ASH will be paid for at the unit price per square yard in place, which shall include placing of fly ash, mixing reprocessed asphaltic base, fly ash, and water, compacting the mixture, grading to required cross slope, and final compaction. Contractor shall supply water necessary to achieve optimal density and the cost shall be incidental to this item.

3.03. *Temporary Pavement Marking, 4 inch, Removable Tape*

This work shall be in accordance with the pertinent requirements of Section 649 of the Standard Specifications and as hereinafter provided.

A. General

This item of work shall consist of furnishing and application of temporary pavement marking to all intermediate courses or layers and final surfaces of asphaltic pavement on the same day that such course, layers, or surfaces are placed, in order to delineate the traffic centerline.

B. Basis of Payment

The item of Temporary Pavement Marking, 4 inch removable tape will be considered incidental to the item Asphaltic Concrete Pavement.