

## SECTION LS 452

### FIBER-REINFORCED CONCRETE PAVEMENT

#### PART 1 – GENERAL

##### 1.1 SUMMARY

- A. The extent of high-early strength Portland cement concrete is shown on the drawings and includes pavement, pavement base, crosswalks, curbs, aprons and sidewalk blocks behind aprons. Concrete will be provided with accelerated strength development that allows residential, non-truck vehicular traffic 24 hours after placement.
- B. Normal strength concrete, ODOT CMS 499 Class QC 1 or QC MS will be used for the walkways, beddings and encasements.
- C. The Contractor is responsible for designing the concrete mix to meet the performance requirements specified herein. Submittals of the mix design, test lab reports, samples, manufacturer's product data and material certifications will be made to The City of Lakewood for approval. The same approved materials will be used throughout the entire duration of the project.

##### 1.2 QUALITY ASSURANCE

The contractor is responsible for obtaining and examining Federal, State and Local Building Codes as they pertain to the contracted work. All such Codes that are more stringent than the contract documents shall be followed.

#### PART 2 – PRODUCTS

##### 2.1 CONCRETE MIX PROPORTIONING, PERFORMANCE AND PRODUCTS

- A. Requirements of ODOT Items 451, 452, 499, 511, 608 and 609 shall apply except as modified herein. The Contractor is responsible for products that comply with the specifications.
- B. Aggregates and Sands: Only natural earth materials shall be used in the concrete mix for aggregates and sand. **No recycled materials, slag, cinders, or non-natural materials shall be permitted in the concrete mix.**

- C. Properties: The following high-early strength mix shall be used for roadway pavement, pavement base, crosswalks, curbs, aprons and sidewalk blocks behind aprons. Design the mix for normal-weight concrete consisting of portland cement, aggregates, water-reducing admixture, air-entraining admixture, accelerating admixture and water to produce the following properties:
1. Compressive Strength: 4,000 psi at 28 days (minimum).
  2. Air Content: 4 to 8 percent.
  3. Water/Cement Ratio: Maximum 0.40.
  4. Cement Content: Maximum 660 lbs/CY.
  5. Normal strength concrete shall be used for sidewalk blocks not behind driveway aprons, foundations, beddings and encasements in accordance with ODOT Class QC 1 or QC MS concrete.
- D. Proportioning Options: Portland cement replacement with fly ash shall not be permitted in high-early concrete.
- E. Water Reducers: Conventional, normal and mid-range water reducing admixtures shall be chloride-free (contribute no more than 0.005% chloride content by weight of cement) and meet the requirements of ASTM C94. High range water reducers will not be permitted. Admixtures shall be used with expressed approval of the manufacturer for the intended application and recommended dosage to achieve mix performance requirements.
- F. Accelerators: Accelerating admixtures shall be chloride-free (contribute no more than 0.005% chloride content by weight of cement). An accelerator may be necessary to meet performance requirements based on the mix design and/or lower ambient soil and concrete temperatures.

## 2.2 STEEL REINFORCEMENT

Steel welded wire fabric pavement reinforcement shall not be used unless specifically detailed herein or as directed by the City.

## 2.3 FIBER-REINFORCING

All cast in place concrete shall contain polypropylene fiber reinforcing

with a fiber length of 0.75 inches minimum and mixed at a rate of 1.5 pounds per cubic yard of concrete. The Contractor will submit documentation to The City of Lakewood and obtain approval of the fiber material prior to use on the job.

### **PART 3 – EXECUTION**

#### **3.1 OPENING TO TRAFFIC**

- A. Requirements of ODOT Items 451, 452, 499, 511, 608, 609 and the standard drawings shall apply except as modified herein.
- B. Approval to open the concrete paving, curbs and aprons to traffic will be granted by The City of Lakewood's representative upon receipt of the compression test report demonstrating that 3000 psi or test beam at 600 psi has been achieved for that placement. No truck traffic will be permitted for at least seven days, unless permission is expressly granted by The City of Lakewood allowing truck traffic earlier than seven days.

#### **3.2 WARRANTY**

Payment for High-Early Strength concrete used in the pavement, curbs and aprons will be made if 3000 psi is achieved within 24 hours. If the initial design mix does not meet 3000 psi within 24 hours but does so within three (3) days, full payment will be withheld until such time as the concrete consistently achieves the 3000 psi 24-hour strength. The allowed time period for mix adjustment is three (3) days; so the mix must be immediately adjusted to compensate. Otherwise, concrete work will be paid at a reduced contract rate.

#### **3.3 PAVEMENT**

- A. Unless otherwise approved in advance by the City, all Fiber-Reinforced Concrete pavements shall be constructed using self-propelled paving machines.
- B. The requirements specified in CMS 451.12, Surface Smoothness, shall apply.
- C. Contraction joint spacing shall be 12 feet.
- D. Expansion joints shall be installed at a maximum spacing of 500 feet, or as shown on the plans.

#### **3.4 SAMPLING AND TESTING**

- A. Sampling and testing services shall be provided by the Contractor at the direction of The City of Lakewood. The testing agency shall be approved prior to commencing construction. The field testing shall be done to determine conformance with reference specifications and for quality control.
- B. Laboratory testing shall consist of running compressive strength tests on concrete cylinders prepared in the field according to ASTM C39.
- C. Concrete shall be sampled and tested at the direction of The City of Lakewood's representative and as follows:

Requirement	Test Method	Number of Tests
Sampling	ASTM 172	As required for each test
Slump	ASTM C143	<p><u>Pavement and Curbs</u>: One for each of the first two (2) trucks of each continuous placement and for every 5<sup>th</sup> truck thereafter. One for each load where compressive strength test cylinders are made. Additional tests as required by The City of Lakewood's representative.</p> <p><u>Aprons and Walks</u>: One for first truck of each continuous placement and one for every 3<sup>rd</sup> truck thereafter. One for each load where compressive strength test cylinders are made. Additional tests as required by The City of Lakewood's representative.</p>
Air Content	ASTM C231	<p><u>Pavement and Curbs</u>: One for each of the first two (2) trucks of each continuous placement and one for every 5<sup>th</sup> truck thereafter. One for each load where compressive strength test cylinders are made. Additional tests as required by The City of Lakewood's representative.</p> <p><u>Aprons and Walks</u>: One for first truck of each continuous placement and one for every 3<sup>rd</sup> truck thereafter. One for each load where compressive strength test cylinders are made. Additional tests as required by The City of Lakewood's representative.</p>
Compression Tests	ASTM C31	<p><u>Pavement and Curbs</u>: One set of three (3) standard cylinders for each compressive strength test. Cast cylinders for the first truck of each continuous placement and on every 60 cubic yards thereafter. Cylinder specimens shall be tested at 24 hours, three (3) days and 28 days or as directed by The City of Lakewood. At least one set of cylinders for the first and last truck of each day's placement.</p> <p><u>Aprons and Walks</u>: One set of three (3) standard cylinders for each compressive strength test. Cast cylinders for the</p>

Requirement	Test Method	Number of Tests
		first truck of each continuous placement and on every 30 cubic yards thereafter. Cylinder specimens shall be tested at 24 hours, three (3) days and 28 days or as directed by The City of Lakewood. At least one set of cylinders for the first and last truck of each day's placement.

- D. The City shall be informed of all test results immediately upon completion of the test. All test reports shall be forwarded to the City's representative in writing within three (3) working days.
- F. No flexural beam tests per ODOT 451 will be required but are permissible.

3.5 CONCRETE TICKETS / WATER-CEMENT RATIO

- A. Each load of concrete delivered shall have a separate ticket listing the amount of coarse aggregate, fine aggregate, cement, water-reducing admixtures, accelerating admixtures (if used), air-entraining admixture and water. The time the truck left the plant and time of arrival on the job site shall be clearly illustrated. Concrete load tickets will be given to The City of Lakewood's representative. Concrete must be placed within ninety (90) minutes of mixing. Loads delivered after this time will be rejected.
- B. The City of Lakewood's representative on the job must have sufficient information from the tickets to accurately calculate the water-cement ratio to determine that this performance requirement (maximum 0.40) is not exceeded. The Contractor may add water on the job provided: that the concrete is mixed at least 70 revolutions at normal mixing speed per ASTM C94; that the water added is recorded on the ticket; that the water-cement ratio when calculated with additional water does not exceed the specifications; and that nominal slump requirements are not exceeded.

3.6 CAST-IN-PLACE CURB

- A. Cast-in-place curb shall be installed in accordance with this specification, Item 609 and the cast-in-place curb detail shown on the drawings. Washed #8 limestone aggregate shall be used as drainage fill around the underdrain as detailed on the plans.
- B. All existing curb to be replaced shall be removed and is the responsibility of the Contractor. Butt joint with existing curb to remain shall be saw cut neat and true.

- C. Pay item for curb shall include all removal of curb, backfill behind curb, removal of old underdrains, furnishing and installing new underdrain with stone, furnishing and installing fill, topsoil and new curb with preformed expansion material and joint filler, all sealing and curing work, complete.
- D. Contractor shall excavate and cast all curbs and aprons on one side of the street before any work commences on the opposite side of the street.
- E. Curbs shall be slip-formed and integral with the concrete pavement if possible. On concrete paved street with tight clearances, an integral curb and gutter is acceptable.

### 3.7 DRIVE APRON AND SIDEWALK CONSTRUCTION

- A. Pay items for aprons and sidewalks include all removal of aprons and sidewalks, excavation, disposal, furnishing and installing all stone, concrete and expansion joint material, all saw-cut and curing compound application, complete. **Aprons shall be placed no later than three (3) days after excavation.**

- B. Driveway Apron Removed and Replaced

This item shall conform to LS 2300, ODOT CMS Item 202 and 452 and the other provisions of this section, with the following additions:

1. Concrete shall have a minimum thickness of six inches (6") and shall be placed on a four-inch (4") layer of approved limestone aggregate base and shall extend from back of curb to back of walk.
2. Full depth expansion material shall be placed between new apron and existing driveways where existing driveways are concrete.
3. Surface shall be broom finished perpendicular to traffic flow with tooled control joints. The sidewalk section shall be broom finished perpendicular to pedestrian traffic flow and shall include tooled joints. All tooled joints shall result in the Lakewood standard "picture frame" pattern.
4. Curb boxes and cleanout cover fixtures in aprons or walks: All such fixtures shall be installed/adjusted so that no part protrudes above the sloped surface of the apron. Concrete shall be shaped and molded around the fixtures so that no sharp edges or vertical surfaces result. Under no circumstances shall concrete be placed on top of the fixtures. All concrete shall be immediately removed from the top of the fixtures.

C. Concrete Walk:

1. Concrete shall be of a minimum four-inch (4") thickness placed on a two-inch (2") minimum approved limestone aggregate base.
2. Sidewalk contraction joints shall be tooled and a minimum ¼" depth, not sawed.
3. The new walk shall be measured through the handicap curb ramp area unless a separate curb ramp pay item appears in the bid tabulation.
4. Sidewalk surface shall be broom finished perpendicular to pedestrian traffic flow with tooled joints and edges. All tooled joints shall result in the Lakewood standard "picture frame" pattern.

D. Curb Ramp:

1. Ramps shall be constructed per the referenced specifications and the details shown on the plans and extend from the back of curb to the edge of sidewalk.
2. Ramp joints shall be tooled, not sawed. All tooled joints shall result in the Lakewood standard "picture frame" pattern.
3. There shall be a zero (0) elevation difference between the toe of the ramp and the pavement.
4. Curb ramp concrete materials shall be in accordance with this specification.
5. Truncated dome treatments shall be installed according to the details shown on the plans and the manufacturer's specifications. The truncated dome treatments shall be completely bedded and flush with the surrounding concrete on all contact sides.
6. The contractor shall submit the proposed truncated dome treatment and bedding products for City approval prior to ordering.

### 3.8 SEWER CLEANING AND DOCUMENTATION

- A. The Contractor shall provide a final cleaning of all manholes, catch basins and sewers that were exposed during, or subject to, pavement construction. This final cleaning shall take place following the completion of all other construction activities.

- B. All sewer system structures and piping shall be kept clear of all construction debris and materials on a daily basis. The Contractor is financially liable for all expenses incurred as a result of construction debris, materials or other damage caused by his activities that restricted or blocked the functioning of any part of the sewer system.
- C. All catch basins exposed to construction activities, including those adjacent to the construction area, shall be opened and inspected down to the bottom of the sumps at the conclusion of construction. This item shall include removal of standing water.
- D. All debris identified by the video taping and the manhole and catch basin inspections shall be removed by the Contractor.
- E. All cleaning and documentation costs shall be included in the tabulated items for storm sewer, storm manhole, lateral and catch basin installation or pavement installation. All video tapes shall be turned over to the City.

## **PART 4 – PAYMENT**

### **4.1 METHOD OF MEASUREMENT**

- A. The City of Lakewood will measure and pay for Sidewalk and Driveway Aprons by the actual square foot installed. Payment for these items shall be considered full compensation for all labor and material for the removal and disposal of existing sidewalk, apron, aggregate base, temporary backfill, and subgrade including the installation of finished concrete, aggregate base, saw cutting, expansion joint material, and curing compound application.
- B. The City of Lakewood will measure and pay for Curb Ramps by the actual square foot installed. Payment for this item shall be considered full compensation for all labor and material for the saw cutting, removal and disposal of existing sidewalk, aggregate base, temporary backfill, and subgrade, and for the installation of finished concrete, aggregate base, expansion joint material, and curing compound application.
- C. The City of Lakewood will measure and pay for detectable warning plates by the actual number installed.
- D. The City of Lakewood will measure and pay for non-integral Curb (e.g. Type 6) by the actual linear foot installed. Payment for this item shall be considered full compensation for all labor and material and shall include removal of all existing curb, backfill and underdrains, furnishing and

installing new curb, underdrain, fill, topsoil, preformed expansion joint material, joint filler, all sealing and curing work, complete.

- F. The City of Lakewood will measure and pay for Concrete Pavement by the actual Square Yards installed. Payment for this item shall be considered full compensation for all labor and material to install finished concrete pavement, integral curbs (e.g. Type 2-A or Type 4-A), all joint materials (expansion, contraction and construction joints) and curing compound application.

4.2 BASIS OF PAYMENT

- A. Payment for accepted quantities, complete in place, will be made at the contract price for:

<u>Item</u>	<u>Unit</u>	<u>Description</u>
LS 452	Square Foot	___” Sidewalk
LS 452	Square Foot	___” Driveway Apron, as per plan
LS 452	Square Foot	Curb Ramp, as per plan
LS 452	Each	Detectable Warning Plate
LS 452	Linear Foot	Curb
LS 452	Square Yard	___” Fiber-Reinforced Concrete Pavement
LS 452	Square Foot	9” Colorized and Stamped Concrete Crosswalk
LS 452	Square Foot	4” Colorized and Stamped Concrete Tree lawn

**END OF SECTION LS 452**