

Memorandum

Department of Public Works



*Forwarded to PPW for review & recommendation
12/19/2017*

TO: Michael O. Geisel, P.E.
City Administrator

FROM: James A. Eckrich, P.E.
Public Works Dir. / City Engineer

DATE: December 19, 2018

RE: Public Works Policy #23 – Pavement Specifications

As you know, in 2016 and early 2017 the Public Works Department completed a comprehensive review of all Public Works City Council policies. Through this process many policies were revised or deleted, ultimately resulting in 37 policies adopted by City Council.

During this process it was determined that one policy which required further review was Public Works Policy #23 – Pavement Specification and Acceptance Policy. This policy references many other agency specifications (State and County) and well as a number of ASTM standards, which have changed over time. Accordingly, Public Works Staff has performed a detailed analysis of this policy and recommended changes to ensure Policy #23 is comprehensive, appropriate, and references current standards and specifications.

There are two substantive change which merit mentioning. First, the existing Policy #23 contains two separate specifications: one for new development and one for work contracted by the City. Establishing the Policy in this manner caused many of the requirements to be duplicative, creating inconsistencies if one section was updated but the other was not. Instead of maintaining two specifications, the City Staff has recommended one Policy #23 covering all pavement in the City of Chesterfield. The second substantive change is that we have incorporated the specifications for cold weather concrete into Policy #23. Accordingly, there is no longer a need for a separate policy covering cold weather concrete, and we are recommending that City Policy #8 – Winter Paving, be deleted.

Should you have questions or need additional information, please let me know.

Action Recommended

Policy #23 should be presented to the Planning and Public Works Committee for consideration. Should PPW concur with Staff's recommendation, it should vote to authorize Staff to submit Policy #23 to City Council for approval and the elimination of Policy #8.

**CITY OF CHESTERFIELD
POLICY STATEMENT**

*Revised Policy
Recommend Approval*

PUBLIC WORKS

NO. 23

SUBJECT Pavement Specification and Acceptance
Policy

INDEX PW

**DATE
ISSUED** 2/5/2001

**DATE
REVISED** 12/5/2017

POLICY

The attached document will serve as the Pavement Specification and Acceptance Policy.

RECOMMENDED BY:

Department Head/Council Committee (if applicable)

Date

APPROVED BY:

City Administrator

Date

City Council (if applicable)

Date

City of Chesterfield
Concrete Pavement Specification & Acceptance Policy

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SECTION 1. CONCRETE

- A. Concrete shall have a minimum of 6.25 sacks (588 lbs.) of Portland Cement (ASTM C 150, Type I/II) per cubic yard of concrete.

- B. Concrete coarse aggregate shall consist of limestone aggregate for pavement concrete in accordance with Section 1005 of the most current edition of the “Missouri Standard Specifications for Highway Construction”. Coarse aggregates shall be supplied from a MoDOT inspected and approved source. Coarse aggregate containing in excess of 6% total deleterious material is prohibited.

- C. Concrete fine aggregate shall be Class A sand in accordance with Section 1005 of the most current edition of the “Missouri Standard Specifications for Highway Construction.” Note that fine aggregates for concrete to be used in sidewalks and drive approaches shall be free from coal and lignite materials as determined by AASHTO 113.

- D. Approved Class C or F fly ash may be used to replace up to 25 percent of the cement on a pound for pound basis in all concrete except concrete designed for high early strength.

- E. Water to cement ratio shall not exceed 0.43. No water shall be added to the concrete mix once it leaves the batch plant without the City’s approval.

- F. Maximum three-inch (3”) slump when placed with a slip-form paver and maximum four-inch

(4") slump when placed using forms, per ASTM C-143.

G. Concrete shall have a 5% to 8% air content (by volume).

H. Hand mixing of concrete will not be permitted.

I. The use of an approved admixture may be permitted upon written request by the Developer on development or Contractor on City contracted work. The use of any admixture requires approval of the Director of Public Works/City Engineer. Permission to use an admixture may be withdrawn at any time.

J. All streets within a development shall be constructed in accordance with the approved improvement plans for that development. All residential streets shall be constructed to the minimum required thickness of seven inches, unless the approved improvement plans indicate a larger thickness.

K. All City contracted work shall be performed in accordance with the plans and specifications for each project.

SECTION 2. SUBGRADE AND ROCK BASE

A. During excavation for the rock base, the soil subgrade shall be scarified to facilitate drying or moistened as necessary to permit proper compaction. Prior to placement of the rock base, the subgrade shall be uniform, rolled and compacted to not less than ninety percent (90%) of the maximum density as determined by the Modified Proctor Test AASHTO T-99 (ASTM D-1557-78). The City may, at its sole discretion, accept proof rolling of the subgrade as evidence of compactive effort in lieu of in place density tests.

B. Rock base shall be Type 5 Aggregate, per Section 1007 of the most current edition of the "Missouri Standard Specifications for Highway Construction". The rock base shall be placed on the graded and compacted sub-grade then shaped and compacted to not less than ninety percent (95%) of the maximum density as determined by the Modified Proctor Test AASHTO T-99 (ASTM D-1557-78).

C. Soft spots and unstable areas in the subgrade and/or rock base shall be removed and replaced with an approved material.

SECTION 3. FABRIC

A. Prior to the placement of rock base, geotextile fabric shall be rolled out on the compacted subgrade in the direction of the traffic lane with all edges overlapping by at least eighteen inches (18").

B. Fabric must comply with AASHTO M288 for separation purposes. The geotextile shall be non-woven fabrics, with survivability class two (2) and minimum permittivity of 0.02.

Fabrics shall be submitted for approval by the Director of Public Works/City Engineer.

SECTION 4. UNDERDRAINS

- A. Install and connect four-inch (4") diameter, schedule 40 PVC, perforated drains at all inlets to provide a way for water to exit from beneath the pavement. Underdrains help prevent prolonged pavement exposure to water, pumping, deflection cracking, faulting and frost action. The underdrains shall extend across the full width of the roadway. The pipe shall be installed perforations down in a 12" wide excavated trench, top of pipe being minimum 12" below bottom of pavement. The trench shall be wrapped in filter fabric and backfilled with one inch clean rock, with at least two inches of clean rock below the pipe.
- B. Underdrains shall be grouted at the location where the underdrain enters a storm sewer structure. Grout will be required on both the exterior and interior of the structure.

SECTION 5. CONCRETE PLACEMENT

- A. The paving contractor shall be responsible for all layouts and placement work necessary to maintain positive and proper drainage of the finished pavement and to ensure the pavement is placed to the lines and grades in accordance with the project plans and documents.
- B. Concrete shall not be placed until rock base and/or forms have been checked for line and grade. For new streets and complete street reconstructions, vertical control stakes set by a registered land surveyor may be required on each side of the proposed pavement and cut sheets shall be provided to the City.
- C. The rock base shall be moistened, if necessary, to provide a uniform dampened condition at the time concrete is placed. Place concrete on the prepared rock base in a manner to avoid segregation and contamination. Concrete vibrators of an internal type shall be used to consolidate concrete. The vibrators shall be capable of providing a minimum of 4,500 impulses per minute.
- D. A construction joint must be installed if concrete placement is interrupted for more than one-half hour, or if in the opinion of the City's inspector a cold joint has formed.

SECTION 6. JOINTS

- A. All joints shall conform to Drawings C502.01 thru C502.14 of the most current edition of St Louis County Department of Transportation's Standard Drawings. All transverse joints shall be spaced a minimum of 10 feet and maximum 15 feet apart.
- B. Dowel bars shall be installed at all transverse construction joints in pavement. Dowel bars shall be 1" diameter smooth, epoxy coated bars meeting the requirements of ASTM A 615, Grade 40 or 60. Dowel bars shall be 18" long and placed at a spacing of 12" on center.

- C. Tie bars shall be installed at all longitudinal joints in pavement. Tie bars shall be 5/8" diameter deformed epoxy coated bars meeting the requirements of ASTM A 615, Grade 40 or 60. Longitudinal tie bars shall be 30" long and placed at a spacing of 30" on center.
- D. All catch basins and inlet sills shall be separated from the pavement by a one half inch wide pre-molded expansion joint material shall be installed full depth between the curb, catch basin, inlet sill and adjacent pavement slab. If the inlet sump is blocked out and not poured with the adjacent pavement, it must be tied back in to the adjacent pavement slab with tie bars. Dowel bars and tie bars and their placement shall be in accordance with Section 5, paragraphs B and C of this specification.
- E. One inch wide pre-molded expansion joint material shall be installed full depth between the curb and driveway approaches. At locations where street creep is a concern, such as opposite of T-intersections, ends of cul-de-sacs and on outside of curves, the joint width shall be increased to two inches.
- F. To reduce the effects of street creep, A2 expansion joints (See St. Louis County Department of Transportation Standard Drawing C502.13) shall be installed at
- the end of radius on each approach to a "T" intersection,
 - across the throat of cul-de-sacs,
 - at the beginning (PC) and the end (PT) of curved sections of street, and
 - at maximum intervals of 1000 feet.

SECTION 7. CONCRETE FINISHING

- A. Under normal working conditions moisture shall not be applied to the surface of the pavement in any form. Added finishing water shall be applied only as approved by the City Inspector and only in the form of a fine pressure spray by hand methods (small hand pump type sprayer).
- B. After surface irregularities have been removed, the finished concrete surface shall be given a uniformly roughened surface finish by the use of a broom or a fabric drag. The damp fabric drag shall be dragged in a longitudinal direction. Brooms shall be drawn across the surface from the centerline towards each edge with the broom held perpendicular to the surface, with adjacent strokes slightly overlapping. The brooming operation shall be executed so that the corrugations are uniform in appearance and not more than 1/8 of an inch in depth. Brooming and dragging shall be completed before the concrete is in a condition that it will be torn or unduly roughened and before the concrete has attained its initial set. Brooms and fabric shall be cleaned or replaced as often as necessary to attain the required surface texture. Upon completion of brooming or dragging, the surface shall be uniform in appearance and shall be free from surplus water, rough or porous spots, irregularities, depressions, and other objectionable features.

SECTION 8. SAW CUTTING

- A. All transverse contraction joints and all longitudinal joints shall be sawed with powered saws equipped with shatterproof abrasive or diamond-rimmed blades. Joints shall be cut into hardened concrete as soon as the surface will not be torn, abraded, or otherwise damaged by cutting action. Joints shall be cut to a depth equal to at least 1/3 of the concrete thickness at a width of 1/8".
- B. Full depth sawcutting is required at limits of pavement removal. Extreme care shall be exercised to avoid damage to adjacent concrete to remain.

SECTION 9. CURING

Concrete shall be cured with a white pigmented membrane curing material applied at a minimum rate of 150 square feet per gallon. Curing material shall completely cover the concrete surface and shall be applied as soon as possible without damaging or marring the pavement surface.

SECTION 10. JOINT SEALING

- A. Joints shall be sealed with materials that conform to ASTM D3405 for rubberized joint sealer of Federal specification SSS1401C. The sealing material shall be heated to the pouring temperature specified by the manufacturer, and any material which has been heated above the maximum safe heating temperature will be rejected. Prior to the placement of any joint seal material, the Contractor shall provide a bill of material certification that the material meets the appropriate specification.
- B. Prior to sealing, all joints shall be re-sawcut to a 3/8" width by 1" depth. This sawing shall be done wet. The 3/8" cut shall be centered on the original cut. Within one hour of re-sawing, the joints shall be pressure washed to remove all latency and foreign objects from the entire depth of the joint. Following pressure washing, the joint and adjacent pavement shall be completely clean. Any liquid residue resulting from the sawcutting shall be immediately and completely washed from the pavement.
- C. Immediately prior to crack sealing, all joints shall be dry and clean of dust and contaminants for proper adhesion of joint material.
- D. Joints shall be uniformly filled to a level just below the adjacent pavement surface. Care should be taken not to overfill the joints; any excess material shall be removed from the concrete surface.
- E. All joints are to be filled. This includes: 1) transverse joints, 2) longitudinal joints, 3) joints between the drive aprons and back of curb, 3) joints at storm sewers, and 4) joints between sidewalks and curbs.
- F. All joints shall be sealed as soon as practical after completion of a minimum curing period

of 24 hours. Vehicles, including those necessary for sealing, will be allowed on the pavement in accordance with Section 12 of this specification.

SECTION 11. WEATHER CONDITIONS

- A. Concrete shall not be placed: (1) when either the air temperature or the temperature of the surface on which concrete is to be placed is below 40 degrees F, unless authorized by the Director of Public Works/City Engineer (2) on any frozen surface, or (3) when weather conditions prevent the proper handling, finishing, or curing of the concrete.
- B. The placement of concrete in cold weather shall be in accordance with ACI 306R-16. As defined by ACI, cold weather exists when the air temperature has fallen or is expected to fall below 40 degrees Fahrenheit during the protection period. The following requirements supersede ACI 306R-16:

Cement Content - the minimum cement requirement shall be 6.25 sacks per cubic yard with an approved water reducer and a maximum water cement ratio of 0.40.

Plant Certification - shall be provided to the City to verify mix design compliance at time of delivery prior to placement.

Temperature Monitoring - concrete temperature shall be recorded at 100' spacing or less with a minimum of four locations, unless otherwise approved by the City. Temperature shall be recorded by maturity meters with temperature recordings at a maximum frequency of one hour intervals. The temperature recording locations shall be taken near edges and corners of the pavement, as determined by the City. Temperature monitoring reports shall be provided to the City.

Acceptance Period - streets will be eligible for acceptance after 12 months.

Winter Paving Inspection Cost - the developer/contractor will be responsible for costs incurred by the City for the City's inspection monitoring and testing associated with winter street paving that exceed typical inspection monitoring and testing efforts.

The developer/contractor shall be responsible for retaining the services of a qualified materials testing firm to perform temperature monitoring and reporting of the concrete pavement as well as any other materials testing requirements for the cold weather concrete.

Protection - protection of concrete shall remain in place for a minimum of five days after placement. Protection must be capable of maintaining the Concrete temperature at a minimum of 55 degrees Fahrenheit.

Acceptance - all cold weather concrete that does not comply with the above

requirements and ACI 306R-16, will not be accepted by the City.

SECTION 12. OPENING TO TRAFFIC

The pavement shall not be opened to traffic (including construction traffic) until the concrete has attained a minimum compressive strength of 3,000 psi and is at least 72 hours old. Compressive strength will be determined by tests made in accordance with ASTM C-31 and C-39. Pavement shall be thoroughly cleaned prior to opening to traffic.

SECTION 13. TESTING AND ACCEPTANCE.

- A. **Responsibility** – Material testing shall be conducted in accordance with City Policy PDS-001, Material Testing.
- B. **Smoothness** – As soon as practicable, the center of each slab, parallel to the direction of travel, will be thoroughly checked with a straightedge by the City's inspector. All variations exceeding 3/8 in./10 ft. will be plainly marked, and those slabs shall be considered defective. Corrective action shall be accomplished by longitudinally diamond grinding or by use of an approved device designed to improve the profile of the riding surface. The use of a bush hammer or other impact device will not be permitted. All corrective work shall be completed prior to the final determination of the pavement thickness. Removal and replacement will be required, if in the judgement of the Director of Public Works/City Engineer, an inordinate amount of defective slabs are found.
- C. **Concrete Thickness** – For the purpose of determining constructed thickness of the pavement, cores will be taken at random intervals in each traffic lane at a minimum rate of thirteen (13) cores per mile or approximately every 400 lineal feet. In addition, cores will be taken at all locations where thickness measurements taken during construction indicate a thickness deficiency sufficient to justify a penalty, or at any other location as determined by the Engineer.

When the measurement of any core is deficient, additional cores will be taken on all sides of the affected location until the extent of the deficiency has been determined. The thickness of any core taken shall be considered representative of the thickness of the pavement for a distance extending one-half (1/2) the distance to the next core, measured along the centerline, or in the case of a beginning or ending core, the distance will extend to the end of the pavement section. In any case, the distance shall be adjusted to the nearest transverse joint. The Developer/Contractor shall be responsible for all costs associated with additional cores required to determine the extent of thickness deficiencies.

If any core measurement is less than the thickness indicated on the construction plans or Improvement Plans, the Contractor may be required to remove and replace the pavement at the Contractor's expense, or pay the City for the deficiencies in thickness of less than one (1) inch as noted on the following schedule. The choice of removal and replacement or monetary penalty, as detailed below, shall be at the sole discretion of the City.

Category	Thickness Deficiency	Penalty
1	0.1 inch	10%
2	0.2 to 0.4 inch	20%
3	0.5 to 0.9 inch	40%
4	1.0 inch or more	Remove and Replace or 100%

- For new development, penalties will be based on the “Streets” escrow amount for that area of pavement represented by the failing test. The Developer will be required to pay the penalty to the City, via cashier’s check. All penalties must be paid before escrows are released.
- For City contracted work, a deduction will be made to the contract unit price for concrete pavement for that area of pavement represented by the failing test. The amounts due as penalties shall be withheld from any sums due to the Contractor as soon as the extent of the deficiencies is determined.

D. **Compressive Strength** – Sets of concrete test cylinders shall be prepared and tested at regular intervals in conformance with ASTM C172, C31 and C39 and ACI 318 to verify the concrete placed meets the City’s specifications. For the purpose of this section, test cylinders prepared on a Friday and taken to the testing lab on the following Monday will be considered as compliant with the ASTM standards and procedures.

Sets of concrete test cylinders shall be taken at regular intervals and shall be representative of all concrete placed during the interval. If the locations of each set can be identified, the set will represent that area of pavement bounded by one-half (½) the distance to the adjacent sets. If locations of sets are unable to be determined, each set will represent an equivalent percentage of the area poured that day (e.g. if 1,000 S.Y. of pavement are cast and four (4) sets of cylinders are made, each set will represent 250 S.Y. of pavement).

In accordance with ACI 318, the strength level of concrete shall be considered satisfactory only if both of the following requirements are met. For the purpose of this section, a strength test constitutes the average strength of two 6 inch x 12 inch or three 4 inch x 8 inch cylinders tested at 28 days.

- Every arithmetic average of any three consecutive strength tests equal or exceeds the required compressive strength of 4,000 psi; and;
- No individual strength test falls below the specified strength of 4,000 psi by more than 500 psi

Should penalties be required because any of the above criteria are met, the penalties will be imposed on all concrete failing to meet the specifications.

- For new development, penalties will be based on the “Streets” escrow amount for that area of pavement represented by the failing test. The Developer will be required to pay the penalty to the City, via cashier’s check. All penalties must be paid before escrows are released.
- For City contracted work, a deduction will be made to the contract unit price for

concrete pavement for that area of pavement represented by the failing test. The amounts due as penalties shall be withheld from any sums due to the Contractor as soon as the extent of the deficiencies is determined.

The penalty shall be a linear penalty varying from no (0) penalty at 4,000 p.s.i. to seventy-five percent (75%) at 3,000 p.s.i. and a one-hundred percent (100%) penalty or removal and replacement for any test result less than 3,000 p.s.i. The choice of remove and replace or monetary penalty shall be at the sole discretion of the City.

Strength testing of field cores will not be allowed as a substitute for lab specimens.

E. **Inspection/Defects:** Prior to final acceptance of a project or any streets within a development the City of Chesterfield will conduct a thorough inspection of said streets. The following defects will require full slab removal and replacement from joint to joint, at the sole expense of the Developer or Contractor. Half slab replacement, patching or grouting will not be allowed as a form of corrective measure.

- Differential settlement or movement that has occurred at a joint.
- Depressions holding water more than 1/8" deep (the City has the option to permit isolated grinding of small areas of up to 1/4" deep to promote drainage).
- Overbreakage.
- Any damage resulting from negligence on the part of the contractor.
- Rain damage.
- Cracks— a temperature/shrinkage crack that forms in the center of a slab and is perpendicular to the center line of the street may be acceptable. Not more than 5% of the slabs within a street segment may have a temperature/shrinkage crack so long as no differential settlement or movement has occurred at the crack, and the crack is not located over a utility trench. Multiple adjacent cracked slabs, in the direction of travel, are not acceptable, and will not be included in the 5% calculation, and therefore will be required to be removed and replaced. A street segment is defined as a section of street that is between intersections, or a section of street as measured by the change in the characteristics of the street, i.e. width. A street segment may also be identified by the sequence of the paving operation. Slabs which do not meet this threshold must be removed and replaced. No other types of cracks are acceptable, including but not limited to longitudinal and diagonal cracks. Slabs with unacceptable cracks must also be removed and replaced. All acceptable cracks that are to remain shall be sawed with a random crack saw, and shall be sealed in accordance with Section 10 of this specification, at the direction of the City.

F. **Marred Surfaces:** If the Director of Public Works/City Engineer determines marred surfaces of slightly damaged concrete may remain in the completed project, a minimum penalty of twenty percent (20%) will be assessed for the slabs affected.

- For new development, the 20% penalty will be deducted from the escrow amount for "Streets". The Developer will be required to pay the penalty to the City, via cashier's check. All penalties must be paid before escrows are released.

- For City contracted work, the 20% penalty will be deducted from the unit bid price for concrete pavement. The amounts due as penalties shall be withheld from any sums due to the Contractor as soon as the extent of the deficiencies is determined.
- A marred surface is defined as having any of the following characteristics: 1) pavement that has been rained on, 2) pavement that has not reached its initial set and has had water flow on its surface washing away cement, 3) pavement that has had plastic placed on it wherein the plastic has actually caused indentations and random patterns, 4) pavement that has been walked on by humans or animals or driven on by any type of vehicle, 5) pavement that has had curing compound sprayed on it before the initial set, resulting in pitting marks, 6) pavement that has been vandalized in any way. Under no circumstances shall concrete surfaces be re-finished with additional cement or other materials as a method to repair damaged or marred surfaces.

G. **Acceptance:** The City of Chesterfield will not accept streets for maintenance within new subdivisions until all development is completed, or until construction within the subdivision has been substantially completed, as outlined in Public Works City Policy #1 (Acceptance of Streets Within Residential Developments), which is hereby incorporated into this pavement and acceptance policy.

SECTION 14. JUDGEMENT

The Director of Public Works/City Engineer is authorized to use judgement in the application of the provisions of this policy in order to achieve the most beneficial results to the City of Chesterfield. It is recognized that physical conditions may warrant site specific determinations or judgement applications of the guidelines herein specified. The Director of Public Works/City Engineer is hereby instructed to use the pavement acceptance policy as a general directive and to administer the construction, reconstruction or reparation of pavements consistent with this policy.

**CITY OF CHESTERFIELD
POLICY STATEMENT**

EXISTING Policy
Recommend delete -
Covered within new
policy #23

PUBLIC WORKS

NO. 8

SUBJECT Winter Paving

INDEX PW

DATE 2/04/1991

DATE 11/7/2016

ISSUED

REVISED

POLICY

Cold weather concreting shall be in accordance with ACI 306R-10. As defined by ACI, cold weather exists when the air temperature has fallen to or is expected to fall below 40 degrees Fahrenheit during the protection period. The following requirements supersede ACI 306R-10:

Cement Content - the minimum cement requirement shall be 6.25 sacks per cubic yard with an approved water reducer and a maximum water cement ratio of 0.40.

Plant Certification - shall be provided to the City to verify mix design compliance at time of delivery prior to placement.

Temperature Monitoring - concrete temperature shall be recorded at 100' spacing or less with a minimum of four locations, unless otherwise approved by the City. Temperature shall be recorded by maturity meters with temperature recordings at a maximum frequency of one hour intervals. The temperature recording locations shall be taken near edges and corners of the pavement, as determined by the City. Temperature monitoring reports shall be provided to the City.

Acceptance Period - streets will be eligible for acceptance after 12 months.

Winter Paving Inspection Cost - the developer/contractor will be responsible for costs incurred by the City for the City's inspection monitoring and testing associated with winter street paving that exceed typical inspection monitoring and testing efforts.

The developer/contractor shall be responsible for retaining the services of a qualified materials testing firm to perform temperature monitoring and reporting of the concrete pavement as well as any other materials testing requirements for the cold weather concrete.

Protection - protection of concrete shall remain in place for a minimum of five days after placement. Protection must be capable of maintaining the Concrete temperature at a minimum of 55 degrees Fahrenheit.

Acceptance - all cold weather concreting performed that does not comply with the above requirements and ACI 306R-10, shall not be accepted by the City.

RECOMMENDED BY:

JM 10/7/2016 PPW Committee 10/20/2016
Department Head/Council Committee (if applicable) Date

APPROVED BY:

Moguel 11/14/2016
City Administrator Date

Moguel 11/7/2016
City Council (if applicable) Date

CITY OF CHESTERFIELD
POLICY STATEMENT


EXISTING policy
Recommend delete +
accept new policy 23

PUBLIC WORKS		NO.	23
SUBJECT	Pavement Specification & Acceptance Policy	INDEX	PW
DATE ISSUED	2/5/2001	DATE REVISED	03/20/2017

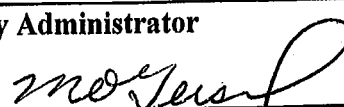
POLICY

Two policy statements dated 03/21/2017, related to Pavement Specifications and acceptance are attached: one for New Development and one for Work Contracted by the City.

RECOMMENDED BY:

 2/15/2017 PPW Committee 3/9/2017
Department Head/Council Committee (if applicable) Date

APPROVED BY:

City Administrator
 3/20/2017
City Council (if applicable) Date

City of Chesterfield
Concrete Pavement Specification & Acceptance Policy
for
New Development

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SECTION 1. CONCRETE

- A. Concrete shall have a minimum of 6.00 sacks (565 lbs.) of Portland Cement (ASTM C 150, Type I) per cubic yard of concrete.
- B. Concrete coarse aggregate shall consist of limestone aggregate for pavement concrete in accordance with Section 1005 of the "Missouri Standard Specifications for Highway Construction, 1999". Coarse aggregates shall be supplied from a MoDOT inspected and approved source.
- C. Concrete fine aggregate shall be Class A sand in accordance with Section 501.2.2.2.1 and Section 1005.2 of the "St. Louis County Standard Specifications for Highway Construction, January 1, 1997." Note that fine aggregates for concrete to be used in sidewalks and drive approaches shall in addition to meeting the requirements of section 1005.2, be free from coal and lignite materials as determined by AASHTO 113.
- D. Water to cement ratio shall not exceed 0.47. No water shall be added to the concrete mix once it leaves the batch plant without the City's approval.
- E. Maximum three-inch (3") slump when placed with a slip-form paver and maximum four-

inch (4") slump when placed using forms, per ASTM C-143.

- F. Concrete shall have a 5% to 8% air content (by volume).
- G. Hand mixing of concrete will not be permitted.
- H. The use of an approved admixture may be permitted upon written request by the Developer. The use of any admixture will be by approval of the Director of Public Works/City Engineer and contingent upon satisfactory performance of the work and permission of its use may be withdrawn at any time satisfactory results are not obtained.
- I. All streets within a development shall be constructed in accordance with the approved improvement plans for that development. All residential streets shall be constructed to the minimum required thickness, unless the approved improvement plans indicate a larger thickness.

SECTION 2. ROCK BASE

- A. During excavation for the rock base, the grade shall be scarified to facilitate drying or moistened as necessary to permit proper compaction. Prior to placement of the rock base, the grade shall be uniform, rolled and compacted to not less than ninety percent (90%) of the maximum density as determined by the Modified Proctor Test AASHTO T-99 (ASTM D-1557-78). The City may, at its sole discretion, accept proof rolling as evidence of compactive effort in lieu of in place density tests.
- B. Rock base shall be Type 1 Aggregate, per Section 1007 of the "St. Louis County Standard Specifications for Highway Construction, January 1, 1997." The rock base shall be placed on the graded and compacted sub-grade then shaped and compacted to not less than ninety percent (90%) of the maximum density as determined by the Modified Proctor Test AASHTO T-99 (ASTM D-1557-78). Soft spots and unstable areas resulting from the Contractor's operation and sequence of work shall be removed and replaced with an approved material.

SECTION 3. FABRIC

- A. Geotextile fabric shall be rolled out in the direction of the traffic lane with all edges overlapping by at least eighteen inches (18") under the 4" compacted rock base.
- B. Fabric specifications and characteristics shall be determined and approved by the Director of Public Works/ City Engineer.

SECTION 4. UNDERDRAINS

- A. Install and connect four-inch (4") diameter perforated drains at all inlets to provide a way for water to exit from beneath the pavement. Underdrains help prevent prolonged pavement

exposure to water, pumping, deflection cracking, faulting and frost action. Underdrain details are to be approved by the Director of Public Works/City Engineer.

SECTION 5. CONCRETE PLACEMENT

- A. Concrete shall not be placed until rock base and/or forms have been checked for line and grade. Vertical control stakes set by a registered land surveyor are required on each side of the proposed pavement. Cut sheets shall be provided to the City.
- B. Steel tie bars (epoxy coated deformed steel bars, ASTM A 615, Grade 40 or 60, 5/8" diameter, 24" long, @ 30" centers for longitudinal joints, and @ 18" centers for transverse joints) shall be installed at transverse and longitudinal joints, in sections of existing adjacent concrete pavement which will remain.
- C. Moisten rock base if necessary, to provide a uniform dampened condition at time concrete is placed. Place concrete on the prepared rock base in a manner to avoid segregation and contamination. Concrete vibrators of an internal type shall be used to consolidate concrete. The vibrators shall be capable of providing a minimum of 4,500 impulses per minute.
- D. A construction joint must be installed if concrete placement is interrupted for more than ½ hour, or if in the opinion of the City's inspector a cold joint has formed.
- E. The paving contractor shall be responsible for all layouts and placement work necessary to maintain positive and proper drainage of the finished pavement.

SECTION 6. JOINTS

- A. All joints shall conform to Drawing C502.01, C502.02 and C502.03 of the Design Criteria For The Preparation of Improvement Plans - St Louis County Department of Highways and Traffic. All transverse joints shall be spaced 15 feet apart.
- B. All catch basins and sills shall be separated from the pavement by ½ inch pre-molded expansion joint material extending completely through the curb and pavement slab. If sump is blocked out, it must be tied back in to the pavement slab. Steel tie bars and their placement shall be in accordance with Section 5, paragraph B. of this specification.
- C. Full-depth expansion joints shall be installed between the curb and driveway approaches.
- D. A tied keyway shall be provided along the centerline joint.

SECTION 7. CONCRETE FINISHING

- A. Under normal working conditions moisture shall not be applied to the surface of the pavement in any form. Added finishing water shall be applied only as ordered by the City Inspector and only in the form of a fine pressure spray by hand methods.

- B. After surface irregularities have been removed, the finished concrete surface shall be given a uniformly roughened surface finish by the use of a broom or a fabric drag. The damp fabric drag shall be dragged in a longitudinal direction. Brooms shall be drawn across the surface from the centerline towards each edge with the broom held perpendicular to the surface, with adjacent strokes slightly overlapping. The brooming operation shall be executed so that the corrugations will be uniform in appearance and not more than 1/8 of an inch in depth. Brooming and dragging shall be completed before the concrete is in a condition that it will be torn or unduly roughened and before the concrete has attained its initial set. Brooms and fabric shall be cleaned or replaced as often as necessary to attain the required surface texture. Upon completion of brooming or dragging, the surface shall be uniform in appearance and shall be free from surplus water, rough or porous spots, irregularities, depressions, and other objectionable features.

SECTION 8. SAW CUTTING

- A. All transverse contraction joints and all longitudinal joints shall be sawed with powered saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut joints into hardened concrete as soon as surface will not be torn, abraded, or otherwise damaged by cutting action. Joints shall be cut to a depth equal to at least 1/3 of the concrete thickness, and a width between 1/4" to 3/8".
- B. Full depth sawcutting is required at limits of pavement removal. Extreme care shall be exercised to avoid damage to adjacent concrete to remain.

SECTION 9. CURING

- A. Concrete shall be cured with a white pigmented membrane curing material, at a minimum rate of 150 square feet per gallon to completely cover the concrete surface. Curing compound shall be applied as soon as possible without damaging or marring the surface.

SECTION 10. JOINT SEALING

- A. Joints shall be sealed with materials that conform to ASTM D3405 for rubberized joint sealer of Federal specification SSS1401C. The sealing material shall be heated to the pouring temperature specified by the manufacturer, and any material which has been heated above the maximum safe heating temperature will be rejected. Prior to the placement of any joint seal material, the Contractor shall provide a bill of material certification that the material meets the appropriate specification.
- B. Immediately prior to crack sealing all joints shall be dry and clean of dust and contaminants for proper adhesion of joint material.
- C. Joints shall be uniformly filled to a level just below the adjacent pavement surface. Care should be taken not to overfill the joints; any excess material shall be removed from the

concrete surface.

- D. All joints are to be filled. This includes: 1) transverse joints, 2) longitudinal joints, 3) joints between the drive aprons and back of curb, 3) joints at storm sewers, and 4) joints between sidewalks and curbs.
- E. All joints shall be sealed before the pavement is open to traffic, including construction traffic, and as soon after completion of a minimum curing period of 24 hours providing vehicles are not placed on the pavement when performing the sealing operation.

SECTION 11. WEATHER CONDITIONS

- A. Concrete operations shall not continue: (1) when either the air temperature or the temperature of the surface on which is to be placed is below 40 degrees F, unless authorized by the Director of Public Works/City Engineer (2) on any frozen surface, or (3) when weather conditions prevent the proper handling or finishing of the mixture.
- B. If approval has been granted by the Director of Public Works/City Engineer for paving below 40 degrees F, the contractor shall perform paving operations in accordance with Public Works City Policy #11 (Winter Paving), which is hereby incorporated into this specification and acceptance policy.

SECTION 12. OPENING TO TRAFFIC

- A. The pavement shall not be opened to normal traffic until the concrete has attained a minimum compressive strength of 3500 psi, and is at least 120 hours old. Compressive strength will be determined by tests made in accordance with ASTM C-31 and C-39. Pavement shall be cleaned and joints sealed prior to opening to traffic.

SECTION 13. TESTING AND ACCEPTANCE.

- A. **Smoothness** – As soon as practicable, the center of each slab, parallel to the direction of travel, will be thoroughly straightedged by the City's inspector. All variations exceeding 3/8 in./10 ft. will be plainly marked, and those slabs shall be considered defective. Corrective action shall be accomplished by longitudinally diamond grinding or by use of an approved device designed for that purpose. The device shall be designed to improve the profile of the riding surface. The use of a bush hammer or other impact device will not be permitted. All corrective work shall be completed prior to determination of pavement thickness. However, removal and replacement will be required, if in the judgement of the Director of Public Works/City Engineer, an inordinate amount of defective slabs are found.

(A schematic of the straightedge will be inserted at a later date.)

- B. **Concrete Thickness** – Cores shall be taken from the newly placed concrete to determine pavement thickness. For the purpose of determining constructed thickness of the pavement,

cores will be taken at random intervals in each traffic lane at a minimum rate of one core per 400 lineal feet. In addition, cores will be taken at all locations where thickness measurements taken during construction indicate a thickness deficiency sufficient to justify a penalty, or at any other locations where, in the judgement of the City's inspector, a thickness deficiency may exist.

When the measurement of any core is deficient in excess of 2/10 inch from the plan thickness, additional cores will be taken ahead and back of the affected location until the extent of the deficiency has been determined. The thickness of any core taken shall be considered representative of the thickness of the monolithic pavement for a distance extending one-half the distance to the next core, measured along centerline, or in the case of a beginning or ending core, the distance will extend to the end of the monolithic pavement section. In any case, distance shall be adjusted to the nearest transverse joint.

If any core measurement is less than the thickness indicated on the construction plans, the Developer will remove and replace the pavement at the Developer's expense, or will be required to pay a penalty, as a special escrow, to the City for the deficiencies in thicknesses as noted on the following schedule. The choice of the alternate penalty under category 4 below will be at the sole discretion of the City. Penalties will be determined based on the escrow amount for "Streets", for that area of pavement represented by the failing core.

category 1	0.00 inch to 0.24 inch – 10% of the S.Y. of "Streets".
category 2	0.25 inch to 0.49 inch - 20% of the S.Y. of "Streets".
category 3	0.50 inch to .99 inch - 40% of the S.Y. of "Streets".
category 4	More than 1.00 inch - remove and replace, or 100% S.Y. of "Streets".

- C. **Compressive Strength** – sets of concrete test cylinders will be prepared and tested in conformance with ASTM C-31 and C-39 at regular intervals by City personnel, or designated representatives, to verify that the concrete as placed meets the City's specifications. The curing and testing of concrete cylinders will be done at the St. Louis County Department of Highways and Traffic Materials Testing Laboratory and will be considered the official test results. For the purpose of this section, test cylinders prepared on a Friday and taken to the testing lab on the following Monday will be considered as complying with the ASTM standards and procedures. Test results from other laboratories, from samples made by the Developer's contractor or from samples taken at other locations will not be considered.

Sets of concrete test cylinders shall be taken at regular intervals and be representative of all concrete placed during the interval. If the locations of each set can be identified, the set will represent that area of pavement bounded by one-half (1/2) the distance to the adjacent sets. If locations of sets are unable to be determined, each set will represent an equivalent percentage of the area poured that day (e.g. if 1,000 S.Y. of pavement are cast and 4 sets of cylinders are made, each set will represent 250 S.Y. of pavement.).

Deductions for deficient concrete strength will only be imposed if any one of the following

conditions is met:

- 1) Any two (2) sets fail to exceed a twenty-eight (28) day strength of 3,250 p.s.i.
- 2) Any three (3) sets fail to exceed a twenty-eight (28) day strength of 3,500 p.s.i.
- 3) Any five (5) sets fail to exceed a twenty-eight (28) day strength of 3,750 p.s.i.
- 4) Any ten (10) sets fail to exceed a twenty-eight (28) day strength of 3,900 p.s.i.

Should deductions be required because any of the above criteria are met, the deductions will be imposed on all concrete failing to meet the specifications. The Developer will be required to pay a penalty, as a special escrow, to the City for that area of pavement represented by the failing test. The penalty shall be a linear penalty varying from no (0) penalty at 4,000 p.s.i. to seventy-five percent (75%) of the escrow amount for "Streets" at 3,000 p.s.i. and a one-hundred percent (100%) penalty for any test result less than 3,000 p.s.i.

The square yardage price will be determined from the escrow amount for "Streets".

Under no circumstance will strength testing of field cores be allowed as a substitute for lab specimens. Cores that have been taken for verification of pavement thickness and may be tested for field strength for informational purposes only. No core strengths will be used for the purpose of complying with the specified strength.

D. Prior to final acceptance of any streets within a development the City of Chesterfield will conduct a thorough inspection of said streets. The following defects will require full slab removal and replacement from joint to joint, at the sole expense of the Developer/Contractor:

- Differential settlement or movement that has occurred at a joint.
- Depressions holding water more than 1/8" deep (the City has the option to permit isolated grinding of small areas of up to 1/4" deep to promote drainage).
- Overbreakage.
- Any damage resulting from negligence on the part of the Developer's contractor.
- Rain damage.
- Cracks— a temperature/shrinkage crack that forms in the center of a slab and is perpendicular to the center line of the street may be acceptable. Not more than 5% of the slabs within a street segment may have a temperature/shrinkage crack so long as no differential settlement or movement has occurred at the crack, and the crack is not located over a utility trench. Multiple adjacent cracked slabs, in the direction of travel, are not acceptable, and will not be included in the 5% calculation, and therefore will be required to be removed and replaced. A street segment is defined as a section of street that is between intersections, or a section of street as measured by the change in the characteristics of the street, i.e. width. A street segment may also

be identified by the sequence of the paving operation. Slabs above this threshold must be removed and replaced. No other types of cracks are acceptable, including but not limited to longitudinal and diagonal cracks. Slabs with unacceptable cracks must also be removed and replaced. All acceptable cracks that are to remain shall be sawed with a random crack saw, and shall be sealed in accordance with Section 6 of this specification.

- E. Half slab replacement, patching or grouting will not be allowed as a form of corrective measure.
- F. For marred surface areas of slightly damaged concrete, as determined by the Director of Public Works/City Engineer, that remain in the completed project, a minimum penalty of twenty percent (20%) of the escrow amount for "Streets" will be assessed for the slabs affected. The Developer will be required to pay the penalty to the City, via cashier's check. All penalties must be paid before escrows are released.
 - A marred surface is defined as having any of the following characteristics: 1) pavement that has been rained on, 2) pavement that has not reached its initial set and has had water flow on its surface washing away cement, 3) pavement that has had plastic placed on it wherein the plastic has actually caused indentations and random patterns, 4) pavement that has been walked on by humans or animals or driven on by any type of vehicle, 5) pavement that has had curing compound sprayed on it before the initial set, resulting in pitting marks, 6) pavement that has been vandalized in any way. Under no circumstances shall concrete surfaces be re-finished with additional cement or other materials as a method to repair damaged or marred surfaces.
- G. The City of Chesterfield will not accept streets for maintenance within subdivisions until all development is completed, or until construction within the subdivision has been substantially completed, as outlined in Public Works City Policy #1 (Acceptance of Streets Within Residential Developments), which is hereby incorporated into this pavement and acceptance policy.

SECTION 14. JUDGEMENT

- A. The Director of Public Works/City Engineer is authorized to use judgement in the application of provisions of this policy to achieve the most beneficial results of these pavement acceptance guidelines. It is recognized that physical conditions may warrant site specific determinations or unusual applications of the guidelines herein specified. The Director of Public Works/City Engineer is hereby instructed to use the pavement acceptance policy as a general directive and to prepare general regulations governing the construction, reconstruction or reparation of pavements consistent with this policy.

City of Chesterfield
Concrete Pavement Specification & Acceptance Policy
for
Work Contracted by the City

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SECTION 1. CONCRETE

- A. Concrete shall have a minimum of 6.00 sacks (565 lbs.) of Portland Cement (ASTM C 150, Type I) per cubic yard of concrete.
- B. Concrete coarse aggregate shall consist of either limestone aggregate or "Meramec C Gravel", as stated in the project specifications. Limestone aggregate for pavement concrete shall be in accordance with Section 1005 of the "Missouri Standard Specifications for Highway Construction, 1999". Limestone aggregates shall be supplied from a MoDOT inspected and approved source. Coarse aggregates containing in excess of 6% total deleterious material are prohibited.
- C. Concrete fine aggregate shall be Class A sand in accordance with Section 501.2.2.2.1 and Section 1005.2 of the "St. Louis County Standard Specifications for Highway Construction, January 1, 1997." Note that fine aggregates for concrete to be used in sidewalks and drive approaches shall in addition to meeting the requirements of section 1005.2, be free from coal and lignite materials as determined by AASHTO 113.
- D. Water to cement ratio shall not exceed 0.47. No water shall be added to the concrete mix once it leaves the batch plant without the City's approval.

- E. Maximum three-inch (3") slump when placed with a slip-form paver and maximum four-inch (4") slump when placed using forms, per ASTM C-143.
- F. Concrete shall have a 5% to 8% air content (by volume).
- G. Hand mixing of concrete will not be permitted.
- H. The use of an approved admixture may be permitted upon written request by the Contractor. The use of any admixture will be by approval of the Director of Public Works/City Engineer and contingent upon satisfactory performance of the work and permission of its use may be withdrawn at any time satisfactory results are not obtained.
- I. All work shall be performed in accordance with the plans and specifications for each project.

SECTION 2. ROCK BASE

- A. During excavation for the rock base, the grade shall be scarified to facilitate drying or moistened as necessary to permit proper compaction. Prior to placement of the rock base, the grade shall be uniform, rolled and compacted to not less than ninety percent (90%) of the maximum density as determined by the Modified Proctor Test AASHTO T-99 (ASTM D-1557-78). The City may, at its sole discretion, accept proof rolling as evidence of compactive effort in lieu of in place density tests.
- B. Rock base shall be Type 1 Aggregate, per Section 1007 of the "St. Louis County Standard Specifications for Highway Construction, January 1, 1997." The rock base shall be placed on the graded and compacted sub-grade then shaped and compacted to not less than ninety percent (90%) of the maximum density as determined by the Modified Proctor Test AASHTO T-99 (ASTM D-1557-78). Soft spots and unstable areas resulting from the Contractor's operation and sequence of work shall be removed and replaced with an approved material.

SECTION 3. FABRIC

- A. Geotextile fabric shall be rolled out in the direction of the traffic lane with all edges overlapping by at least eighteen inches (18") under the 4" compacted rock base.
- B. Fabric specifications and characteristics shall be determined and approved by the Director of Public Works/ City Engineer.

SECTION 4. UNDERDRAINS

- A. Install and connect four-inch (4") diameter perforated drains at all inlets to provide a way for water to exit from beneath the pavement. Underdrains help prevent prolonged pavement exposure to water, pumping, deflection cracking, faulting and frost action. Underdrain

details are to be approved by the Director of Public Works/City Engineer.

SECTION 5. CONCRETE PLACEMENT

- A. Concrete shall not be placed until rock base and/or forms have been checked for line and grade.
- B. Steel tie bars (epoxy coated deformed steel bars, ASTM A 615, Grade 40 or 60, 5/8" diameter, 24" long, @ 30" centers for longitudinal joints, and @ 18" centers for transverse joints) shall be installed at transverse and longitudinal joints, in sections of existing adjacent concrete pavement which will remain.
- C. Moisten rock base if necessary, to provide a uniform dampened condition at time concrete is placed. Place concrete on the prepared rock base in a manner to avoid segregation and contamination. Concrete vibrators of an internal type shall be used to consolidate concrete. The vibrators shall be capable of providing a minimum of 4,500 impulses per minute.
- D. A construction joint must be installed if concrete placement is interrupted for more than ½ hour, or if in the opinion of the City's inspector a cold joint has formed.
- E. The paving contractor shall be responsible for all layouts and placement work necessary to maintain positive and proper drainage of the finished pavement.

SECTION 6. JOINTS

- A. All joints shall conform to Drawing C502.01, C502.02 and C502.03 of the Design Criteria For The Preparation of Improvement Plans - St Louis County Department of Highways and Traffic. All transverse joints shall be spaced 15 feet apart.
- B. All catch basins and sills shall be separated from the pavement by ½ inch pre-molded expansion joint material extending completely through the curb and pavement slab. If sump is blocked out, it must be tied back in to the pavement slab. Steel tie bars and their placement shall be in accordance with Section 5, paragraph B. of this specification.
- C. Full-depth expansion joints shall be installed between the curb and driveway approaches.
- D. A tied keyway shall be provided along the centerline joint.

SECTION 7. CONCRETE FINISHING

- A. Under normal working conditions moisture shall not be applied to the surface of the pavement in any form. Added finishing water shall be applied only as ordered by the City Inspector and only in the form of a fine pressure spray by hand methods.
- B. After surface irregularities have been removed, the finished concrete surface shall be given a

uniformly roughened surface finish by the use of a broom or a fabric drag; whichever is called out in the project specifications. The damp fabric drag shall be dragged in a longitudinal direction. Brooms shall be drawn across the surface from the centerline towards each edge with the broom held perpendicular to the surface, with adjacent strokes slightly overlapping. The brooming operation shall be executed so that the corrugations will be uniform in appearance and not more than 1/8 of an inch in depth. Brooming and dragging shall be completed before the concrete is in a condition that it will be torn or unduly roughened and before the concrete has attained its initial set. Brooms and fabric shall be cleaned or replaced as often as necessary to attain the required surface texture. Upon completion of brooming or dragging, the surface shall be uniform in appearance and shall be free from surplus water, rough or porous spots, irregularities, depressions, and other objectionable features.

SECTION 8. SAW CUTTING

- A. All transverse contraction joints and all longitudinal joints shall be sawed with powered saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut joints into hardened concrete as soon as surface will not be torn, abraded, or otherwise damaged by cutting action. Joints shall be cut to a depth equal to at least 1/3 of the concrete thickness, and a width between 1/4" to 3/8".
- B. Full depth sawcutting is required at limits of pavement removal. Extreme care shall be exercised to avoid damage to adjacent concrete to remain.

SECTION 9. CURING

- A. Concrete shall be cured with a white pigmented membrane curing material, at a minimum rate of 150 square feet per gallon to completely cover the concrete surface. Curing compound shall be applied as soon as possible without damaging or marring the surface.

SECTION 10. JOINT SEALING

- A. Joints shall be sealed with materials that conform to ASTM D3405 for rubberized joint sealer of Federal specification SSS1401C. The sealing material shall be heated to the pouring temperature specified by the manufacturer, and any material which has been heated above the maximum safe heating temperature will be rejected. Prior to the placement of any joint seal material, the Contractor shall provide a bill of material certification that the material meets the appropriate specification.
- B. Immediately prior to crack sealing all joints shall be dry and clean of dust and contaminants for proper adhesion of joint material.
- C. Joints shall be uniformly filled to a level just below the adjacent pavement surface. Care should be taken not to overfill the joints; any excess material shall be removed from the concrete surface.

- D. All joints are to be filled. This includes: 1) transverse joints, 2) longitudinal joints, 3) joints between the drive aprons and back of curb, 3) joints at storm sewers, and 4) joints between sidewalks and curbs.
- E. All joints shall be sealed before the pavement is open to traffic, including construction traffic, and as soon after completion of a minimum curing period of 24 hours providing vehicles are not placed on the pavement when performing the sealing operation.

SECTION 11. WEATHER CONDITIONS.

- A. Concrete operations shall not continue: (1) when either the air temperature or the temperature of the surface on which is to be placed is below 40 degrees F, unless authorized by the Director of Public Works/City Engineer (2) on any frozen surface, or (3) when weather conditions prevent the proper handling or finishing of the mixture.
- B. If approval has been granted by the Director of Public Works/City Engineer for paving below 40 degrees F, the contractor shall perform paving operations in accordance with Public Works City Policy #11 (Winter Paving), which is hereby incorporated into this specification and acceptance policy.

SECTION 12. OPENING TO TRAFFIC

- A. The pavement shall not be opened to normal traffic until the concrete has attained a minimum compressive strength of 3500 psi, and is at least 120 hours old. Compressive strength will be determined by tests made in accordance with ASTM C-31 and C-39. Pavement shall be cleaned and joints sealed prior to opening to traffic.

SECTION 13. TESTING AND ACCEPTANCE.

- A. **Smoothness** – As soon as practicable, the center of each slab, parallel to the direction of travel, will be thoroughly straightedged by the City's inspector. All variations exceeding 3/8 in./10 ft. will be plainly marked, and those slabs shall be considered defective. Corrective action shall be accomplished by longitudinally diamond grinding or by use of an approved device designed for that purpose. The device shall be designed to improve the profile of the riding surface. The use of a bush hammer or other impact device will not be permitted. All corrective work shall be completed prior to determination of pavement thickness. However, removal and replacement will be required, if in the judgement of the Director of Public Works/City Engineer, an inordinate amount of defective slabs are found.

The following areas will be excluded from the smoothness determination:

- New slabs adjacent to existing slabs that are to remain.
- Areas that have less than five consecutive new slabs.

(A schematic of the straightedge will be inserted at a later date.)

- B. **Concrete Thickness** – Cores shall be taken from the newly placed concrete to determine pavement thickness. For the purpose of determining constructed thickness of the pavement, cores will be taken at random intervals in each traffic lane at a minimum rate of one core per 400 lineal feet. In addition, cores will be taken at all locations where thickness measurements taken during construction indicate a thickness deficiency sufficient to justify a penalty, or at any other locations where, in the judgement of the City's inspector, a thickness deficiency may exist.

When the measurement of any core is deficient in excess of 2/10 inch from the plan thickness, additional cores will be taken ahead and back of the affected location until the extent of the deficiency has been determined. The thickness of any core taken shall be considered representative of the thickness of the monolithic pavement for a distance extending one-half the distance to the next core, measured along centerline, or in the case of a beginning or ending core, the distance will extend to the end of the monolithic pavement section. In any case, distance shall be adjusted to the nearest transverse joint.

If any core measurement is less than the thickness indicated on the construction plans, the Contractor will remove and replace the pavement at the Contractor's expense, or will be required to reimburse the City for the deficiencies in thicknesses as noted on the following schedule. The choice of the alternate penalty under category 4 below will be at the sole discretion of the City. A deduction will be made to the contract unit price for "Removal and Replacement of P.C.C. Pavement" for that area of pavement represented by the failing core. The amounts due as penalties under this section shall be immediately withheld from any sums due the Contractor as soon as the extent of the deficiencies are determined.

category 1	0.00 inch to 0.24 inch – 10% of the bid unit price.
category 2	0.25 inch to 0.49 inch - 20% of the of the bid unit price.
category 3	0.50 inch to .99 inch - 40% of the bid unit price.
category 4	More than 1.00 inch - remove and replace, or 100% of the bid unit price.

- C. **Compressive Strength** – sets of concrete test cylinders will be prepared and tested in conformance with ASTM C-31 and C-39 at regular intervals by City personnel, or designated representatives, to verify that the concrete as placed meets the City's specifications. The curing and testing of concrete cylinders will be done at the St. Louis County Department of Highways and Traffic Materials Testing Laboratory and will be considered the official test results. Test cylinders prepared on a Friday and taken to the testing lab on the following Monday will be considered as complying with the ASTM standards and procedures. Test results from other laboratories, from samples made by the Contractor's personnel or from samples taken at other locations will not be considered.

Sets of concrete test cylinders shall be taken at regular intervals and be representative of all concrete placed during the interval. If the locations of each set can be identified, the set will represent that area of pavement bounded by one-half (½) the distance to the adjacent sets. If

locations of sets are unable to be determined, each set will represent an equivalent percentage of the area poured that day (e.g. if 1,000 S.Y. of pavement are cast and 4 sets of cylinders are made, each set will represent 250 S.Y. of pavement.).

Deductions for deficient concrete strength will only be imposed if any one of the following conditions is met:

- 1) Any two (2) sets fail to exceed a twenty-eight (28) day strength of 3,250 p.s.i.
- 2) Any three (3) sets fail to exceed a twenty-eight (28) day strength of 3,500 p.s.i.
- 3) Any five (5) sets fail to exceed a twenty-eight (28) day strength of 3,750 p.s.i.
- 4) Any ten (10) sets fail to exceed a twenty-eight (28) day strength of 3,900 p.s.i.

Should deductions be required because any of the above criteria are met, the deductions will be imposed on all concrete failing to meet the specifications. A deduction will be made to the contract unit price for "Removal and Replacement of P.C.C. Pavement" for that area of pavement represented by the failing test. The deduction shall be a linear deduction varying from no (0) deduction at 4,000 p.s.i. to seventy-five percent (75%) of the contract unit price at 3,000 p.s.i. and a one-hundred percent (100%) deduction for any test result less than 3,000 p.s.i.

Under no circumstance will strength testing of field cores be allowed as a substitute for lab specimens. Cores that have been taken for verification of pavement thickness and may be tested for field strength for informational purposes only. No core strengths will be used for the purpose of complying with the specified strength.

D. The following defects will require full slab removal and replacement from joint to joint, at the sole expense of the Contractor:

- Differential settlement or movement that has occurred at a joint.
- Depressions holding water more than 1/8" deep (the City has the option to permit isolated grinding of small areas of up to 1/4" deep to promote drainage).
- Overbreakage.
- Any damage resulting from negligence on the part of the Contractor.
- Rain damage.
- Cracks – a temperature/shrinkage crack that forms in the center of a slab and is perpendicular to the center line of the street may be acceptable. Not more than 5% of the slabs within a street segment may have a temperature/shrinkage crack so long as no differential settlement or movement has occurred at the crack, and the crack is not located over a utility trench. Multiple adjacent cracked slabs, in the direction of travel, are not acceptable, and will not be included in the 5% calculation, and therefore will be required to be removed and replaced. A street segment is defined as a section of street that is between intersections, or a section of street as measured by

the change in the characteristics of the street, i.e. width. A street segment may also be identified by the sequence of the paving operation. Slabs above this threshold must be removed and replaced. No other types of cracks are acceptable, including but not limited to longitudinal and diagonal cracks. Slabs with unacceptable cracks must also be removed and replaced. All acceptable cracks that are to remain shall be sawed with a random crack saw, and shall be sealed in accordance with Section 6 of this specification.

E. Half slab replacement, patching or grout will not be allowed as a form of corrective measure.

F. For marred surface areas of slightly damaged concrete, as determined by the Director of Public Works/City Engineer, that remain in the completed project, a deduction of twenty percent (20%) of the unit bid price for "Removal and Replacement of P.C.C. Pavement" will be made for the slabs affected.

- A marred surface is defined as having any of the following characteristics: 1) pavement that has been rained on, 2) pavement that has not reached its initial set and has had water flow on its surface washing away cement, 3) pavement that has had plastic placed on it wherein the plastic has actually caused indentations and random patterns, 4) pavement that has been walked on by humans or animals or driven on by any type of vehicle, 5) pavement that has had curing compound sprayed on it before the initial set, resulting in pitting marks, 6) pavement that has been vandalized in any way. Under no circumstances shall concrete surfaces be re-finished with additional cement or other materials as a method to repair damaged or marred surfaces.

SECTION 14. JUDGEMENT

A. The Director of Public Works/City Engineer is authorized to use judgement in the application of provisions of this policy to achieve the most beneficial results of these pavement acceptance guidelines. It is recognized that physical conditions may warrant site specific determinations or unusual applications of the guidelines herein specified. The Director of Public Works/City Engineer is hereby instructed to use the pavement acceptance policy as a general directive and to prepare general regulations governing the construction, reconstruction or reparation of pavements consistent with this policy.