ORDINANCE NO. 5 OF 1998

AN ORDINANCE ADOPTING BY REFERENCE "STANDARDS FOR STREET DESIGN AND CONSTRUCTION" (JULY, 1997)

WHEREAS, the City Council of the City of Benton, Arkansas, caused to be published a Notice of Public Hearing, and on March 23, 1998, did conduct a public hearing on the question of adopting Standards for Street Design and Construction (July, 1997, edition) (hereafter the "Standards") for application within the City of Benton, Arkansas; and,

WHEREAS, pursuant to the provisions of Ark. Code Ann. §§ 14-55-206 and 207, the City is authorized to adopt the Standards by reference, and the City desires to do so; and,

WHEREAS, the Standards constitute a "technical code" within the meaning of Ark. Code Ann. § 14-55-207(b); and,

WHEREAS, at least three (3) copies of the Standards and at least three (3) copies of the text of this ordinance have been filed with the City Clerk of the City of Benton since a date prior to the publication of the Notice of Public Hearing.

NOW, THEREFORE, BE IT ORDAINED by the City Council of the City of Benton, Arkansas, that:

SECTION 1. The City of Benton does hereby adopt by reference "Standards for Street Design and Construction" (July, 1997) for application within the City of Benton, Arkansas.

SECTION 2. The City Clerk shall maintain and keep on file at least three (3) copies of the Standards and at least three (3) copies of the text of this Ordinance for use and examination by the public.

SECTION 3. All ordinances and parts of ordinances in conflict herewith are hereby repealed to the extent of such conflict.

SECTION 4. This ordinance is necessary for the preservation of the public health, safety, and convenience, and shall be in full force and effect immediately upon its passage and approval.

PASSED AND APPROVED this 13th day of April, 1998.

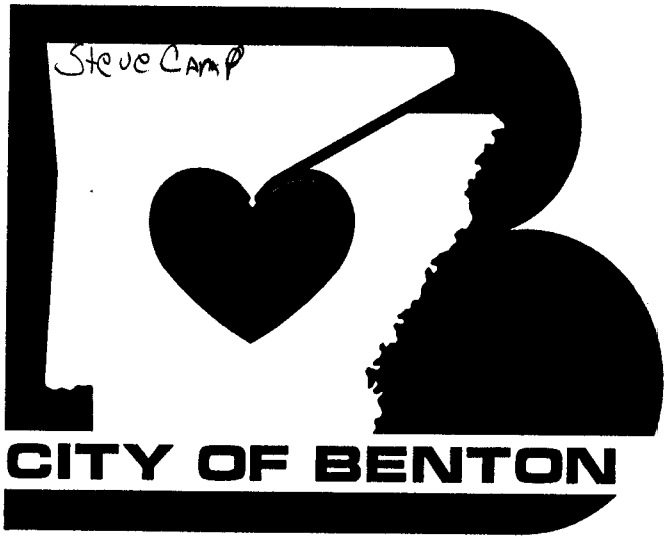
Mitch McDonald
MITCH MCDONALD, MAYOR

Margaret M. Ramsey
MARGARET M. RAMSEY, CITY CLERK

# STANDARDS FOR STREET DESIGN AND CONSTRUCTION

## CITY OF BENTON, ARKANSAS

## JULY 1997



# STANDARDS FOR STREET DESIGN AND CONSTRUCTION

## CITY OF BENTON, ARKANSAS

## JULY 1997

Steve Camp

CITY OF BENTON

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## SECTION 1
## PROCEDURAL REQUIREMENTS

1.1 Street Plans Required - All proposed streets within the City of Benton's territorial jurisdiction shall have complete plans prepared by a registered professional engineer. The plans shall be submitted to the Community Development Department and the City Engineer for review and approval. No preliminary plat approval will be granted for any development until and unless the street plans have been approved by the Community Development Department and the City Engineer.

1.2 Review and Approval of Street Plans - Street plans will be reviewed by the Community Development Department staff, City Engineer and Street Department staff. If it is determined that the plans conform to the requirements of the City of Benton, the plans will be approved or conditionally approved with the conditions for approval set forth.

If it is determined that the plans do not conform with the City's requirements, the plans will be disapproved and returned to the applicant for resubmittal.

1.3 Contents of Street Plans - Street plans shall consist of engineering drawings and specifications which contain (as a minimum) the following data:

1. An overall plan drawing of the proposed streets indicating the extent of the proposed construction and showing all existing streets, sidewalks, trees, structures, drainageways and other notable features adjacent to and within 150 feet of the limits of proposed improvements. Existing elevations shall be indicated by contours with an interval of not more than two (2) feet, except where such contour spacing would render the drawing unreadable. At least two points of reference to the state plane coordinate system shall be provided on each roadway centerline. All pertinent horizontal control data shall be provided.

2. Plan and profile drawings with a scale no smaller than 1"= 100' horizontally and 1"=10' vertically. Elevations shall be indicated at all points of vertical tangent intersection (V. P. I.'s) and the percent of grade between V. P. I.'s must be shown. All vertical curve data, including length and V. P. I. Station, shall be provided for all vertical curves. Horizontal curve data shall be provided for all horizontal curves. All angles of intersection between two streets or between a street and a drainage structure shall be provided. All storm drainage improvements relative to the proposed street shall be shown on the plan/profile drawings.

3. Detail drawings of curb and gutter, street base and paving sections, drainage structures, ditches and all other items appurtenant to the street and drainage system.

4. Specifications for all proposed improvements construction methods and materials.

## SECTION 2
## STREET DESIGN REQUIREMENTS

2.1 Street Classifications - Street classifications shall conform to the City of Benton's Subdivision Regulations and Master Street Plan.

2.2 Right-of-way and Paving Width - Minimum right-of-way and paving widths for various street classifications shall be as indicated by the City of Benton's Subdivision Regulations and Master Street Plan. Right-of-way dedication and pavement width for expressways, freeways and interstate highways shall conform to all Arkansas Highway and Transportation Department standards.

2.3 Design Standards - All streets shall be constructed of asphalt concrete hot mix or portland cement concrete pavement conforming to the City's specifications. All streets regardless of pavement type shall be constructed with a crushed stone or gravel (aggregate) base course over a compacted subbase. The base course for portland cement concrete streets may be reduced or eliminated with proper geotechnical documentation. All streets shall be provided with portland cement concrete curb and gutter. The following geometric design standards shall be required for all proposed streets:

A. Horizontal curves - All horizontal curves shall conform to the following:

| *Street Classification* | *Minimum Curve Radius* | *Minimum Sight Distance* |
|---|---|---|
| Principal Arterial | 650 feet | 350 feet |
| Minor Arterial | 650 feet | 300 feet |
| Collector | 350 feet | 200 feet |
| Local Commercial | 350 feet | 200 feet |
| Local Residential | 225 feet | 150 feet |
| Narrow Residential | 125 feet | 150 feet |

B. Street Grades - Street grades shall conform to the following:

| *Street Classification* | *Maximum Grade* |
|---|---|
| Principal & Minor Arterial | 9% |
| Collector | 12% |
| Local Commercial | 12% |
| Local Residential | 15% |
| Narrow Residential | 16% |

Street grades along the gutter for all streets shall not be less than 0.5%.

C. Intersections - Streets shall intersect at right angles, insofar as is possible. In no case shall stree intersect at less than a 75 degree angle unless approved by t City Engineer.

Wherever possible, property line corners at intersections should not be rounded. Curb radii, and where needed, right-of-way radii shall conform to the following:

| *Intersection of* | *Minimum Curb Radius* | *Minimum R/W Radius* |
|---|---|---|
| Arterial-Arterial | 40 feet | 40 feet |
| Arterial-Collector | 40 feet | 40 feet |
| Arterial-Local Commercial | 40 feet | 40 feet |
| Arterial-Local Residential | 20 feet | 20 feet |
| Collector-Collector | 30 feet | 30 feet |
| Collector-Local Commercial | 30 feet | 30 feet |
| Collector-Local Residential | 15 feet | 15 feet |
| Local Commercial-Local Commercial | 30 feet | 30 feet |
| Local Commercial-Local Residential | 15 feet | 15 feet |
| Local Residential-Local Residential | 15 feet | 15 feet |
| Alleys & any street | 10 feet | 10 feet |
| Driveways & any street | 8 feet | 8 feet |

The minimum allowable distance between intersections shall be 150 feet, centerline to centerline.

Curb cuts are prohibited within 40 feet of an intersection.

D. Storm Drainage Design - Design of all drainage improvements shall be based on storm water runoff calculated by using the Rational Method. The Rational Method of runoff calculation is based on the following formula:

$Q = CiA$

Where:

Q = Runoff in cubic feet per second
C = Runoff Coefficient
i = Rainfall intensity in inches per hour
A = Drainage area in acres

Selection of values for runoff coefficients and rainfall intensity shall be the prerogative of the project designing engineer and shall be based on good engineering practices and experience. A return interval of twenty-five years (minimum) shall be used for determination of runoff flow and sizing of storm sewers.

Storm sewers shall be designed to provide a minimum velocity of three (3) feet per second, and a maximum velocity of ten (10) feet per second when flowing full.

## SECTION 3
## STREET SPECIFICATIONS

3.1 Pavement and Base Material Required Thickness - The thickness of gravel or crushed stone (aggregate) base material, asphalt concrete hot mix pavement and portland cement concrete pavement shall be as shown on the approved plans. The aggregate base for portland cement concrete pavement may be reduced in thickness or eliminated if a complete geotechnical study performed by a qualified geotechnical engineer approved by the City of Benton indicates that adequate pavement strength would be available in the absence or reduced thickness of the base. If no detailed geotechnical study is performed, the thickness for pavements and base material shall be not less than the following:

| | *Minimum Thickness Required* | | |
|---|---|---|---|
| *Street Classification* | *Aggregate Base Course* | *Asphalt Conc. Hot Mix* | *Portland Cement Conc.* |
| Principal Arterial | 15 inches | 5 inches | 10 inches |
| Minor Arterial | 12 inches | 4 inches | 9 inches |
| Collector | 9 inches | 3 inches | 7 inches |
| Local Commercial | 9 inches | 3 inches | 7 inches |
| Local Residential | 6 inches | 2 inches | 6 inches |
| Narrow Residential | 6 inches | 2 inches | 6 inches |
| Alleys | 6 inches | 2 inches | 6 inches |

3.2 Street Construction Methods and Materials - Construction methods and materials for all street construction shall conform to the following:

1. EARTHWORK

A. Description

Earthwork shall consist of excavation, filling and compacting earthwork within the limits of construction in accordance with these specifications and in conformity with the lines, grades and typical cross sections shown on the accepted drawings.

B. Construction Methods

Areas to be graded shall be cut and filled to within 0.1 of a foot of the approved subgrade elevations.

Subgrade preparation shall consist of scarifying and compacting in place soil or placing and compacting fill material to serve as a foundation for a subbase course or a base course.

All stable and suitable material will be acceptable for use as subgrade material. All unstable and unsuitable materials, such as organic substances, high plasticity clays (plasticity index greater than 35), tree stumps, masonry and other obstructions shall be removed from the limits of the work to a depth of two (2) feet below the subgrade elevations, and to a

width of five (5) feet horizontally from proposed pavements, curbs or drainage structures.

Prior to commencing work on the subgrade, it will be necessary to determine the optimum moisture and density of the material in accordance with the Standard Proctor Density Determination Method (AASHTO T-99).

In-place soil shall be completely scarified to a depth of eight inches (8"). The material thus obtained shall be pulverized. The depth of scarification shall be carefully controlled and operations conducted in such a manner to provide that the in-place soil below a depth of eight inches (8") shall remain undisturbed.

Fill material shall be placed in loose lifts not to exceed eight inches (8") in depth.

The moisture content of the material throughout each layer of earthwork to be compacted shall be brought to substantially that of optimum moisture by the addition of water or by aeration, as it may be necessary to increase or decrease moisture under the conditions encountered.

Where water is used to assist in compaction, the water content shall not exceed the amount necessary to obtain a plastic material. Water soaking or ponding shall not be permitted, except where sand is used as a fill material.

Compaction of earthwork shall be accomplished by any satisfactory method or methods that will attain the density hereinafter specified.

The in-place density of the compacted material in each lift shall be determined by field density tests, such as the sand cone method (ASTM D-1556), water balloon method (ASTM D-2167) or other in-place density tests acceptable to the Owner. The in-place density of the compacted material shall not be less than 95% of the maximum density as obtained by the Standard Proctor Density Determination (AASHTO T-99).

2. AGGREGATE BASE COURSE

A. Description

This item shall consist of a foundation course for pavements. It shall be constructed on the prepared subgrade or other completed base course in accordance with these specifications, and in conformity with the lines, grades, compacted thickness and typical cross section shown on the plans.

B. Materials

Aggregate base course shall consist of a foundation course of either gravel and/or crushed stone. The material shall be so

proportioned as to meet the requirements for Class 4,5,6 or 7 aggregate as indicated in the following:

| Sieve Size | Class 4 | Class 5 | Class 6 | Class 7 |
|---|---|---|---|---|
| | Percent Passing | | | |
| 1 1/2 " | 100 | 100 | 100 | 100 |
| 3/4 " | 60-100 | 60-100 | 50-90 | 50-90 |
| No. 4 | 30-60 | 30-60 | 25-55 | 25-55 |
| No. 10 | 20-45 | 20-45 | N/R | N/R |
| No. 40 | 10-35 | 10-35 | 10-30 | 10-30 |
| No. 200 | 3-12 | 3-12 | 3-10 | 3-10 |
| Minimum Percent Crusher Run Material | 0 | 0 | 90 | 90 |

The fraction passing the No. 200 sieve shall not be greater than two-thirds of the fraction passing the No. 40 sieve. The fraction passing the No. 40 sieve shall have a liquid limit not greater than 25 and a plasticity index not greater than 6.

The aggregate shall be hard and durable with a percent of wear by the Los Angeles Abrasion Test (AASHTO T-96) not greater than 45. The material shall not contain more than 5% by weight of shale, slate and other deleterious matter.

C. Construction Methods

Aggregate base course shall be constructed on approved subgrade, and shall serve as a foundation course.

Prior to commencing work on the subgrade, it will be necessary to determine the optimum moisture and density of the material in accordance with the Standard Proctor Density Determination Method (AASHTO T-99).

Aggregate base course shall not be placed on frozen subgrade. The subgrade on which the crushed stone base course is placed shall be free from any excess or deficiency of moisture at the time of placing the crushed stone base course.

The aggregate shall be placed on the subgrade, and spread uniformly to such depth and lines, that when compacted, it will have the required thickness.

The spreading shall be done the same day the material is hauled, and it shall be performed in such a manner that no segregation of coarse and fine particles, nor nests or hard areas caused by dumping the aggregate on the underlying foundation course will exist. To ensure proper mixing, the aggregate shall be bladed across the roadbed before being spread. Care must be taken to prevent mixing of material from the underlying foundation course with the aggregate base course in the blading and spreading operation.

Each course shall be compacted by any satisfactory method that will obtain the density herein specified. The aggregate shall be maintained at optimum moisture during the mixing,

spreading, and compacting operations, water being added, or the material being aerated as may be necessary.

The compacted base course shall be tested for depth, and any deficiencies shall be corrected by scarifying, placing additional material, mixing, reshaping and recompacting to the specified density.

The in-place density of the compacted material in each lift shall be determined by field density tests, such as the sand cone method (ASTM D-1556) water balloon method (ASTM D-2167), or other in-place density tests acceptable to the Owner. The in-place density of the compacted material shall not be less than 95% of the maximum density as obtained by the Standard Proctor Density Determination (AASHTO T-99).

The aggregate base course shall be maintained in a satisfactory and smooth condition until accepted.

## 3. ASPHALT CONCRETE HOT MIX

### A. Description

This item shall consist of an asphalt concrete wearing surface course composed of a compacted mixture of mineral aggregate and asphalt cement constructed on the completed base course in accordance with these specifications and in conformity with the lines, grades, compacted thickness and typical cross sections shown on the plans.

### B. Materials

The asphalt concrete hot mix shall consist of a mixture of mineral aggregate and asphalt cement. The composition of the mixture shall be determined by the Hveem Mix Design Method (ASTM D-1560) or the Marshall Mix Design Method (ASTM D-1559), and in accordance with the range of acceptable mixes set forth herein. A copy of the mix design shall be submitted to the Owner for approval before construction is begun. The form of the report shall be as follows:

Asphalt Concrete Hot Mix Surface Course Mix Design

| Gradation (% Passing Sieve No.) | Range of Acceptable Mixtures Type 2 | Type 3 | Job Mix | Tolerance (%) |
|---|---|---|---|---|
| 3/4" | 100 | 100 | _____ | 0 |
| 1/2" | 97 - 85 | 100 | _____ | ± 7 |
| 3/8" | 90 - 77 | 95 - 88 | _____ | ± 7 |
| No. 4 | 75 - 55 | 80 - 60 | _____ | ± 5 |
| No. 10 | 55 - 40 | 55 - 40 | _____ | ± 5 |
| No. 40 | 32 - 20 | 35 - 20 | _____ | ± 4 |
| No. 100 | 20 - 8 | 18 - 7 | _____ | ± 3 |
| No. 200 | 10 - 4 | 10 - 4 | _____ | ± 2 |
| Bitumen Content | 4.5%-7.0% | 4.5%-7.0% | _____ | ± 0.4 |

If a Type 2 mix cannot be obtained locally, a Type 3 mix shall be used.

The mineral aggregate shall consist of a mixture of gravel or crushed stone and stone screenings, sand and other finely divided mineral matter, so proportioned to meet all applicable requirements of these specifications.

The mineral aggregates for the surface course shall consist of hard, tough, durable fragments of rock of uniform quality, free from any excess of any soft particles. The stone shall have a percent of wear by the Los Angeles Abrasion Test (AASHTO T-96) of not more than 40 and when subjected to 5 cycles of the sodium sulfate soundness test (AASHTO T-104), the loss shall not exceed 12 percent.

Gravel shall consist of hard and durable aggregate, free from any excess of soft particles. The gravel shall have a percent of wear by the Los Angeles Abrasion Test of not more than 40.

Crushed gravel shall be defined as that of which 100 percent of the particles have been produced from larger particles by crushing operations.

The fraction of the mineral aggregate retained on the No. 10 sieve shall contain at least 15 percent of crushed particles.

Fine aggregate (that portion finer than the No. 10 sieve) shall consist of clean, hard durable particles of natural sand or stone sand, or combination of the two.

Aggregates shall be uniformly well graded from coarse to fine and shall be free from lumps of foreign material. They shall be free from adherent films of clay that will prevent thorough coating with bituminous material. The fraction passing the No. 40 sieve shall have a plasticity index of less than 4.

At least one-half the fraction passing the No. 200 sieve shall comply with the requirements for mineral filler and in no case shall the mineral aggregate contain less than 5 percent mineral filler. Mineral filler shall conform with the requirements of AASHTO M-17.

Asphalt cement shall conform to the following requirements:

*Asphalt Cement*

| *Characteristics* | *Requirements* |
|---|---|
| Penetration, 77°F., 100 g., 5 sec. | 50 - 100 |
| Saybolt Furol Viscosity, 275°F., sec. | 140 min. |
| Flash Point, COC°F., minimum | 450 min. |
| Solubility in Trichloroethylene, % | 99.0 min. |

| *Characteristics* | *Requirements* |
|---|---|
| Thin Film Oven Test: | |
| Loss on Heating, % | 0.8 max. |
| Penetration on Residue, % of original | 50 min. |
| Ductility of Residue, 77°F., 5 cm/sec., cm. | 50 min. |
| Spot Test - Standard Naphtha | Negative |

Requirements

C. Construction Methods

Asphalt concrete hot mix shall be constructed on an approved aggregate base course.

1. *Preparing the Mixture* - The asphalt shall be heated at the batch plant to a temperature at which it can be applied uniformly to the aggregate. In no case, however, shall the asphalt cement be heated to a temperature exceeding 325°F.

Coarse and fine aggregates shall be stored separately at the paving plant in a manner that will prevent intermingling. Stockpiles shall be built in a manner that will prevent segregation of aggregate sizes. If the aggregate tends to segregate during handling, it shall be supplied and stockpiled in two or more sizes.

When it is necessary to blend aggregates from one or more sources to produce the combined gradation, each source or size of aggregate shall be stockpiled individually. Aggregate from the individual stockpiles shall be fed through separate bins to the cold elevator feeders. They shall not be blended in the stockpile.

Cold aggregates shall be fed carefully to the plant so that surplus and shortages will not occur and cause breaks in the continuous operation.

The aggregates shall be dried and heated to the temperature necessary to produce a mixture having the desired temperature within the range specified. In no case shall the temperature of the heated aggregate exceed 425°F upon discharge from the drier.

Heated and dried aggregates shall be screened and stored in sizes that may easily be recombined into a gradation meeting the requirements of the job-mix formula.

The heated and dried aggregates shall not contain enough moisture to cause the mixture to slump, the asphalt to foam, or the aggregate to segregate during hauling and placing.

Mixing time shall be the shortest time that will produce a satisfactory mixture. The mixing time will be set to achieve 95% of coated particles for surface mixtures.

Batch plants, dry mixing time shall not exceed 10 seconds. Wet mixing time shall not exceed 50 seconds.

For continuous mix plants, the mixing time will be computed by the following formula:

$$\text{Mixing time, seconds} = \frac{\text{Pugmill dead capacity, lb.}}{\text{Pugmill output, lbs.}}$$

Mixing time shall not exceed 60 seconds.

The temperature of the mixture when discharged from the mixer shall not be less than 295°F nor more then 325°F.

2. *Preparing the Area to be Paved* - The area to be paved shall be substantially true to line and grade. It shall have a dry, firm and properly prepared surface before paving operations begin. All loose and foreign material shall be removed.

Vertical faces of existing pavements and all structures to be in actual contact with the asphalt-aggregate mixture shall be given a thin, even coating of asphalt material. Care shall be taken to prevent spattering with asphalt, surfaces that will not be in contact with the asphalt-aggregate mixture.

A tack coat shall be applied to existing pavement surfaces.

3. *Placing and Compacting the Mixture* - The asphalt concrete hot mix surface course shall be placed only when the specified density can be obtained. The mixture shall not be placed on any wet surface or when weather conditions will otherwise prevent its proper handling or finishing. The asphalt surface course mixture shall not be placed when the surface temperature of the underlying course is below 40°F.

The mixture shall be delivered to the construction site at a temperature of 285°F to 320°F. The surface course mixture shall be placed in one or more lifts with an asphalt paver or spreader. The minimum placement temperature shall be 285°F. The minimum lift thickness shall be at least two times the maximum particle size. The maximum lift thickness shall be that which can be demonstrated to be laid in a single lift and compacted to required uniform density and smoothness.

The mix shall be compacted immediately after placing. Initial rolling shall be accomplished, preferably by use of a pneumatic-tired roller with tire pressure of 90 to 105 psi. However, a steel-wheeled tandem roller, steel three-wheeled roller, or vibratory roller may be used for breakdown rolling if the Contractor elects.

Intermediate rolling shall be accomplished immediately after initial rolling. The minimum tire pressure for pneumatic-tired rollers used for intermediate rolling shall be 60 psi. Final rolling shall eliminate marks from previous rolling operations. In areas too small for a roller, compaction of the

mixture shall be accomplished by use of a vibrating plate compactor or hand tamper.

Rolling shall start longitudinally at the sides and proceed toward the center of the roadway, overlapping on successive trips by at least one-half of the width of the roller. When paving in echelon or abutting a previously placed lane, the longitudinal joint shall be rolled first followed by the regular rolling procedure. The mixture shall be continuously rolled until all roller marks are eliminated and no further compaction is possible. The motion of the roller shall be slow enough to avoid displacement of the mixture. Displacement as a result of reversing the direction of the roller, or from any other cause, shall at once be corrected by the use of rakes and any additional material where required. Precautions shall be taken to prevent adhesion of the mixture to the roller wheels.

Precautions shall be taken at all times to compact the mixture before it cools too much to obtain the required density.

All compaction operations shall be essentially completed before the temperature of the mixture reaches 220°F.

The asphalt concrete hot mix surface course shall be compacted to at least 93% of the laboratory density of a sample taken from the same truck load of asphalt base material. Laboratory density shall be determined using the Marshall Method (ASTM D1559) with 35 compaction blows on each end of the specimen.

4. CONCRETE CURB & GUTTERS, DRIVEWAYS AND SIDEWALKS

A. Description

This item shall consist of Portland Cement concrete curb and gutter, driveways, and sidewalks constructed on a prepared subgrade in accordance with these specifications and the cross sections as shown on the accepted drawings.

B. Materials

All materials shall be secured from approved sources.

Fine aggregate shall consist of sand or other approved inert material with similar characteristics, having hard, strong, durable particles with not more than one percent (1%) by weight of clay lumps or three percent (3%) by weight of material removed by decantation. Mortar specimens made with the fine aggregate shall have a compressive strength at twenty-eight (28) days of not less than ninety percent (90%) of the strength of similar specimens made with Ottawa sand having a fineness modulus of 2.40 ± 0.10. Fine aggregate shall have a fineness modulus of not less than 2.40 and not more than 3.00 and the variation in modulus shall be limited to ± 0.20 from the average of all tests. Gradation shall fall within the following requirements:

| *TOTAL PASSING* | *PERCENT BY WEIGHT* |
|---|---|
| No. 4 Sieve | 95 - 100 |
| No. 16 Sieve | 35 - 75 |
| No. 50 Sieve | 10 - 25 |
| No. 100 Sieve | 2 - 8 |

Coarse aggregate shall consist of crushed stone, gravel, or other inert material of similar characteristics, having clean, hard, strong, durable, uncoated particles with not more than five percent (5%) by weight of soft fragments, one-fourth percent by weight of clay lumps, and one percent (1%) by weight of material removed by decantation, of crushed dirt, the maximum amount permitted may be increased to one and one-half (1-1/2) percent by weight. Coarse aggregate may be either of two sizes, 1-1/2 inch and smaller or 3/4 inch and smaller and shall be graded within the following requirements:

| | *PERCENT PASSING BY WEIGHT* |
|---|---|
| Maximum Size Mesh Screen (Sq. Mesh) | 97 - 100 |
| Half Maximum Size Mesh Screen (Sq. mesh) | 40 - 70 |
| No. 4 Sieve | 0 - 6 |

Portland cement shall conform to the requirements of the Standard Specifications for Portland Cement, ASTM Designation C150-86, Type I.

Water shall be clean and free from injurious amounts of oils, acids, alkalies, salt, organic matter, or other deleterious substances. Test specimens of mortar made from the materials and the water to be used shall develop not less than ninety-five percent (95%) of the seven-day tensile or compressive strength of the same materials and distilled water.

Concrete shall contain not more than six (6) gallons of water to the sack of cement, including the water in the aggregates, and not less than six (6) sacks of cement per cubic yard of concrete and have a twenty-eight (28) day compressive strength of at least thirty-five hundred (3500) pounds per square inch.

C. Construction Methods

Drives, sidewalks, and curb and gutter shall be constructed in locations as indicated on the approved plans.

All boulders, organic materials, high plasticity clay (plasticity index greater than 35), spongy material, and any other objectionable materials shall be removed and replaced with approved material. The subgrade shall be properly shaped, rolled and uniformly compacted to conform with the accepted cross sections and grades.

The forms for the concrete shall be metal, straight, free from warps or kinks and of sufficient strength. Wood forms may

be used for radii, transition sections or other special shapes provided that no curb section greater than sixty feet in length will be formed with wood forms. They shall be staked securely enough to resist the pressure of the concrete without spring. When ready for the concrete to be deposited, they shall not vary from the approved line and grade, and shall be kept so until the concrete has set. Face forms for curbs will not be acceptable.

Just prior to placing the concrete, the subgrade shall be moistened. The concrete mixed to the proper consistency shall be placed in the forms and thoroughly tamped in place so that all honeycombs will be eliminated and sufficient mortar will be brought to the surface. After this, the surface shall be brought to a smooth, even finish, by means of a wooden float or trowel as directed by the Owner. All faces adjacent to the forms shall be spaded so that after the forms are stripped, the surface of the faces will be smooth, even and free of honeycombs. All edges shall be tool rounded.

Half-inch (1/2) expansion joints shall be placed at intervals not exceeding sixty feet (60'). At intervals not greater than ten feet (10') or less than five feet (5'), the concrete shall be scored for a depth equal to one-third the total depth of the concrete.

When completed, the concrete shall be kept moist for a period of not less than three days and longer if necessary, and shall be protected form the elements in a satisfactory manner. An approved curing compound may be used in lieu of the three (3) days' moist cure method.

Backfill shall be of suitable selected material and shall be placed and tamped in layers of not over four inches (4") in depth until firm and solid. Backfilling shall follow immediately after the concrete forms have been removed.

No concrete shall be poured on a frozen or thawing subgrade, or during unfavorable weather conditions, or when the temperature is 38°F and falling.

5. CONCRETE PAVEMENT AND CURB

A. Description

This item shall consist of Portland Cement concrete pavement and curb constructed on an approved base course or approved prepared subgrade in accordance with these specifications and the cross sections as shown on the accepted drawings.

B. Materials

All materials shall be secured from approved sources.

Fine aggregate shall consist of sand or other approved inert material with similar characteristics, having hard, strong, durable particles with not more than one percent (1%) by weight of clay lumps or three percent (3%) by weight of material

removed by decantation. Mortar specimens made with the fine aggregate shall have a compressive strength at twenty-eight (28) days at not less than ninety percent (90%) of the strength of similar specimens made with Ottawa sand having a fineness modulus of 2.40 ± 0.10. Fine aggregate shall have a fineness modulus of not less than 2.4 and not more than 3.00 and the variation in modulus shall be limited to ± 0.20 from the average of all tests. Gradation shall fall within the following requirements:

| *Total Passing* | *Percent by Weight* |
|---|---|
| No. 4 | 95 - 100 |
| No. 16 | 35 - 75 |
| No. 50 | 10 - 25 |
| No. 100 | 2 - 8 |

Coarse aggregate shall consist of crushed stone, gravel, or other inert material of similar characteristics, having clean, hard, strong, durable, uncoated particles with not more than five percent (5%) by weight of soft fragments, one-fourth percent (.25%) by weight of clay lumps, and one percent (1%) by weight of material removed by decantation; of crushed dirt, the maximum amount permitted may be increased to one and one-half percent by weight. Coarse aggregate may be either of two sizes; 1-1/2 inch and smaller or 3/4 inch and smaller and shall be graded within the following requirements:

| | *Percent Passing by Weight* |
|---|---|
| Maximum Size Mesh Screen (sq. mesh) | 97 - 100 |
| Half Maximum Size Mesh Screen (sq. mesh) | 40 - 70 |
| No. 4 Sieve | 0 - 6 |

Portland cement shall conform to the requirements of the standard specifications for Portland Cement, ASTM Designation C-150-46, Type I.

Water shall be clean and free from injurious amounts of oils, acids, alkalies, salt, organic matter, or other deleterious substances. Test specimens of mortar made from the materials and the water to be used shall develop not less than ninety-five percent (95%) of the seven-day tensile or compressive strength of the same materials and distilled water.

Concrete shall contain not more than six (6) gallons of water to the sack of cement, including the water in the aggregate, and not less than six (6) sacks of cement per cubic yard of concrete and have a twenty-eight (28) day compressive strength of at least thirty-five hundred (3500) pounds per square inch; slump shall be between 1 inch and 3 inches.

*Admixtures*

No admixtures shall be used in the concrete without prior approval, and all approved admixtures shall conform to applicable AASHTO and ASTM requirements.

Air-entraining agents shall have proven compatibility with all local concrete materials, including cement, and shall be capable of providing in the concrete the required air contents and an air-void system known to produce durable, scale-resistant concrete.

Admixtures other than air-entraining agents shall not be used until trial mixes with job materials have shown them to be compatible at job temperatures. Trial mixes must also show that desired properties will be imparted to the fresh concrete without any subsequent loss of strength or durability in the hardened concrete.

*Steel*

Deformed bars shall conform to the requirements of ASTM A615, A616, or A617. Deformed billet steel bars conforming to ASTM A615, Grade 40 shall be used for tiebars that are to be bent and restraightened during construction.

Dowel bars shall be plain round bars conforming to ASTM A615 and shall be free from deformations restricting slippage in the concrete. Before delivery to the worksite, one-half the length of each dowel bar shall be painted with one coat of lead or tar paint.

Sleeves for dowel bars to be used in expansion joints shall be metal of an approved design to cover 2 inches, plus or minus 1/4 inch, of the dowel, with a closed end and with a suitable stop to hold the end of the sleeve at least 1 inch from the end of the dowel bar. Sleeves shall be designed so that they do not collapse during construction.

*Joint Materials*

Poured sealer for joints shall conform to the requirements of AASHTO M173 or ASTM D1190.

Preformed fillers for joints shall conform to the requirements of AASHTO M33 or M213; ASTM D994 or D1751 as specified, and shall be punched to admit dowels where called for in the plans. The filler for each joint shall be furnished in a single piece for the full depth and width required for the joint unless otherwise authorized by the Engineer. When the use of more than one piece is authorized for a joint, the abutting ends shall be fastened securely and held accurately to shape by stapling or other positive fastening satisfactory to the Owner.

*Curing Materials*

Curing materials shall conform to the following specifications:

| *Type* | *Specification* |
|---|---|
| Burlap cloth made from jute or kenaf | AASHTO M182 |
| White liquid membrane-forming compounds for curing concrete | AASHTO M148, ASTM C309, CGSB 90-GP-1a |
| Sheet materials for curing concrete | AASHTO M171, ASTM C171 |

C. Construction Methods

Design, capacity, and mechanical condition of equipment and tools necessary for handling materials and performing all parts of the work shall be approved by the Engineer. Equipment shall be at the job site sufficiently ahead of the start of construction operations to be examined thoroughly and approved. Measurement and batching of cement, and fine and coarse aggregates shall be by weight. Scales shall be inspected and sealed as often as the Engineer may deem necessary to assure their continued accuracy. The Contractor shall have on hand all equipment necessary to test scales frequently and accurately.

The top of the base course shall be known as the pavement base and shall conform to the lines, grade, and cross sections shown in the plans.

All soft and yielding material and portions of the base that will not compact readily when rolled or tamped shall be removed and replaced with suitable material.

The base shall be brought to a firm and unyielding condition by compacting it to uniform density at or slightly above standard optimum moisture.

Concrete shall not be placed on a soft, spongy, frozen, or otherwise unsuitable base. The base shall be moist when the concrete is placed.

Before placing concrete, the base shall be tested for conformity with the cross section shown on the plans. If necessary, material shall be removed or added to bring all portions of the base to the correct elevation. It shall then be thoroughly compacted and again tested.

The finished base shall be kept smooth and compacted until the concrete has been placed. Bases must also meet the requirements of these specifications if the slipform method of construction is being employed. Construction equipment shall not operate in the paving lane when conditions of the job will permit operation from outside the lane. If equipment operating in the paving lane causes rutting or displacement of the base material, lighter trucks or suitable runways shall be provided. Trucks, onsite mixers, transit mix trucks, and other heavy equipment shall not be used on previously paved lanes until the

concrete is at least seven (7) days old and the field-cured concrete has a flexural strength of at least 550 psi.

All excess concrete and debris shall be removed from the excavation behind the curb line before backfilling. The area between the curb and sidewalk, or property line where no sidewalks exist, shall be graded in a neat, workmanlike manner.

Concrete may be mixed at the site of construction or at a central point or wholly or in part in truck mixers. Each mixer shall be of an approved type and shall have attached prominently a manufacturer's plate showing the capacity of the drum in terms of volume of mixed concrete and the speed of rotation of the mixing drum or blades.

Mixing shall be done in an approved mixer capable of combining aggregates, cement, and water into a thoroughly mixed and uniform mass within the specified mixing period and capable of discharging the mixture without segregation. The mixer shall be equipped with an approved timing device that will automatically lock the discharge lever when the drum has been charged and release it at the end of the mixing period. The device shall be equipped with a bell or other suitable warning device adjusted to give a clearly audible signal each time the lock is released. If the timing device fails, the mixer may be used for the balance of the day while the timer is being repaired provided that each batch is mixed 90 seconds.

Truck mixers used for mixing and hauling concrete and truck agitators used for hauling central-mixed concrete shall conform to the requirements of AASHTO M157.

Bodies of non-agitating hauling equipment for concrete shall be smooth, mortar-tight, metal containers capable of discharging the concrete at a satisfactory controlled rate without segregation. Covers shall be provided when needed for protection.

Aggregates shall be handled from stockpiles or other sources to the batching plant in such manner as to secure a uniform grading of the material. Aggregates that have become segregated or mixed with earth or foreign material shall not be used. Aggregates that contain high and nonuniform moisture content shall be stockpiled or binned for draining at least 12 hours before being batched.

The fine aggregate and each size of coarse aggregate shall be separately weighed in the amounts set by the Engineer in the job mix. Cement shall be measured by weight. Batches may be rejected unless mixed within 1-1/2 hours after the cement comes in contact with the aggregates.

Batches shall be delivered to the mixer separate and intact, without loss of cement and without spilling of material from one batch into another. Batching shall be so conducted as to result in the weights of each material required within a tolerance of 1% for cement and 2% for aggregates.

Water may be measured either by volume or by weight. The accuracy of measuring the water shall be within a range of error of not over 1%. Unless the water is to be weighed, the water-measuring equipment shall include an auxiliary tank from which the measuring tank shall be filled. The measuring tank shall be equipped with an outside tap and valve for checking the setting unless other means are provided for readily and accurately determining the amount of water in the tank. The volume of the auxiliary tank shall at least equal that of the measuring tank.

Methods and equipment for adding an air-entrainment agent or other admixture to the batch shall be approved by the Engineer. All admixtures shall be measured into the mixer with an accuracy of plus or minus 3%.

Mixing time shall be measured from the time all materials, except water, are in the drum. Ready mixed concrete shall be mixed and delivered in accordance with requirements of AASHTO M157.

When mixed at the site of the work or in a central mixing plant, the mixing time shall not be less than 50 nor more than 90 seconds. Mixing time, which includes transfer time in multiple-drum mixers, ends when the discharge chute opens. The contents of an individual mixer drum shall be removed before a succeeding batch is emptied therein.

The approved mixer shall be operated at the drum speed shown on the manufacturer's nameplate. Any concrete mixed less than the specified time shall be discarded and disposed of by the Contractor at his expense. The batch shall be so charged into the drum that a portion of the mixing water shall enter in advance of the cement and aggregates. The flow of water shall be uniform, and all water shall be in the drum by the end of the first 15 seconds of the mixing period. The throat of the drum shall be kept free of accumulations that may restrict the free flow of materials into the drum.

Mixed concrete from a central mixing plant shall be transported in truck mixers, truck agitators, or non-agitating trucks having special bodies. When the concrete is hauled in non-agitating trucks, no more than 45 minutes shall elapse from the time water is added to the mix until the concrete is deposited in place at the site of the work. When it is hauled in truck mixers or truck agitators, the limit shall be 90 minutes. Re-tempering concrete by adding water or by other means shall not be permitted. Concrete that is unsuitable for placement as delivered shall be rejected.

Forms shall be of such cross section and strength and so secured as to resist the pressure of the concrete when placed and the impact and vibration of any equipment they support, without springing or settlement. Forms shall have a base of not less than 8 inches and a height equal to or greater than the edge thickness of the pavement. Forms shall be cleaned and oiled before being set to line and grade. The method of

connection between sections shall be such that the joints shall not move in any direction. The maximum deviation of the top surface shall not exceed 1/8 inch in 10 feet or the inside face not more than 1/4 inch in 10 feet from a straight line. Flexible or curved forms of proper radius shall be used for curves of 100 feet radius or less.

The subgrade or base under the forms shall be compacted and cut to grade so that the form when set will be uniformly supported for its entire length at the specified elevation. All forms shall be cleaned and oiled each time they are used.

The Contractor shall check and correct alignment and grade elevations of the forms immediately before placing the concrete. When any form has been disturbed or any grade has become unstable, the form shall be reset and rechecked.

In lieu of setting forms, the edge of a previously placed concrete gutter section may be used as a form.

Instead of using fixed forms, the Contractor may place concrete with a slipform paver designed to spread, consolidate, screed, and float-finish the freshly placed concrete in one complete pass of the machine. The slipform paver shall be operated with as nearly a continuous forward movement as possible and all the operations of mixing, delivering, and spreading concrete shall be so coordinated as to provide uniform progress with stopping and starting of the paver held to a minimum.

The subgrade and slipform paver track area shall be brought to proper grade and cross section by means of a properly designed and operated machine. Disturbed grade shall be properly re-compacted. If any traffic is allowed to use the prepared grade, the grade shall be checked and corrected immediately ahead of placing the concrete.

The concrete shall be deposited on a moist grade in such manner as to require as little re-handling as possible. Placing shall be continuous between transverse joints without the use of intermediate bulkheads. Necessary hand spreading shall be done with shovels, not rakes. Workmen shall not be allowed to walk in the freshly mixed concrete with boots or shoes coated with earth or foreign substances.

Concrete shall be thoroughly consolidated against and along the faces of all forms and along the full length and on both sides of all joint assemblies. Vibrators shall not be permitted to come in contact with a joint assembly, the grade, or a side form. The vibrator shall never be operated longer than 15 seconds in any one location.

Concrete shall be deposited as near to expansion and contraction as possible without disturbing them but shall not be dumped onto a joint assembly.

The sequence of operations shall be the strike-off and consolidation, floating if necessary, straight-edging, and final surface finish. The pavement shall be struck off and consolidated with a mechanical finishing machine, vibrating screed, or by hand-finishing methods when approved by the Engineer. A slipform paver may be used.

In general, adding water to the surface of the concrete to assist in finishing operations shall not be permitted. If it is permitted, it shall be applied as a fog spray with approved spray equipment.

After the pavement has been struck off and consolidated, it shall be scraped with a straightedge 10 feet long equipped with a handle to permit operation from the edge of the pavement. Any excess water and laitance shall be removed from the surface of the pavement. The straightedge shall be operated parallel to the centerline of the pavement and shall be moved forward one-half its length after each pass. Irregularities shall be corrected by adding or removing concrete. All disturbed places shall be again straight-edged. The use of long-handled wood floats shall be confined to a minimum; they may be used only in emergencies and in areas not accessible to finishing equipment.

Before final finishing is completed and before the concrete has taken its initial set, the edges of the slab and curb shall be carefully finished with an edger of the radius shown on the plans.

A burlap drag or broom shall be used for final finishing. The burlap drag shall be at least 3 feet wide and long enough to cover the entire pavement width. It shall be kept clean and saturated while in use. It shall be laid on the pavement surface and dragged in the direction in which the pavement is being placed. For a broom finish, a stiff bristled broom shall be drawn from the center to the edge of the pavement with adjacent strokes slightly overlapping to produce surface corrugations of uniform appearance and about 1/16 inch in depth.

Curbs shall be required along the edges of all streets where shown on the plans and shall be formed to the cross section in accordance with the plans. Curbs, and curbs and gutters, may be constructed integrally with the pavement using slipform or extrusion equipment or placed immediately after finishing operations by hand forming.

The curbs shall be given a textured finish to match the pavement.

The Contractor shall have always available materials to protect the surface of the plastic concrete against rain. These materials shall consist of burlap, curing paper, or plastic sheeting. When slipform construction is being used, materials such as wood planks or forms to protect the edges of the pavement shall also be required.

Concrete shall be cured by protecting it against loss of moisture, rapid temperature change, and mechanical injury for at least 3 days after placement. Moist curing, waterproof paper, white polyethylene sheeting, white liquid membrane compound, or a combination thereof may be used. After finishing operations have been completed, the entire surface of the newly placed concrete shall be covered by whatever curing medium is applicable to local conditions and approved by the Engineer. The edges of concrete slabs exposed by the removal of forms shall be protected immediately to provide these surfaces with continuous curing treatment equal to the method selected for curing the slab and curb surface.

The Contractor shall have at hand and ready to install before actual placement begins, the equipment needed for adequate curing.

Moist curing shall be accomplished by a covering of burlap or other approved fabric mat used singly or in combination. Curing mats shall be thoroughly wet when applied and kept continuously wet and in intimate contact with the pavement surface for the duration of the moist-curing period. Burlap or fabric mats shall be long enough to cover the entire width and edges of the pavement lane and lapped at joints to prevent drying between adjacent sheets.

Waterproof paper or white polyethylene sheets shall be in pieces large enough to cover the entire width and edges of the slab and shall be lapped not less than 18 inches. The paper or polyethylene shall be adequately weighted to prevent displacement or billowing due to wind, and material folded down over the side of the pavement edges shall be secured by a continuous bank of earth. Tears or holes appearing in the paper or polyethylene during the curing period shall be immediately repaired.

The membrane method of curing shall be applied behind the final finishing operation after all free water has disappeared from the surface. Complete and uniform coverage at the required rate of 150 square feet per gallon shall be required. The compound shall be kept agitated to prevent the pigment from settling, and it shall be applied to the pavement edges immediately after the forms have been removed. Membrane curing will not be permitted in frost-affected areas on paving that will be exposed to deicing chemicals within 30 days after completion of the curing period.

Except by specific written authorization, concreting shall cease when the descending air temperature in the shade and away from artificial heat falls below 40°F. It shall not be resumed until the ascending air temperature in the shade and away from artificial heat rises to 35°F.

When concrete has been placed in cold weather and the temperature may drop below 35°F, straw, hay, insulated curing blankets, or other suitable material shall be provided along the line of work. Whenever the air temperature may reach the

freezing point during the day or night, the material shall be spread over the concrete deep enough to prevent freezing of the concrete. Concrete shall be protected from freezing temperatures until it is at least 10 days old. Concrete injured by frost action shall be removed and replaced at the Contractor's expense.

*Joints*

Contraction joints, expansion joints, and all longitudinal joints shall be placed as indicated on the plans. Transverse construction joints shall be used as required. Transverse joints shall extend continuously through the pavement and curb.

Transverse contraction joints shall consist of planes of weakness created by forming or cutting grooves in the surface of the pavement. They shall be equal to at least one-fourth the depth of the slab.

a. Transverse strip contraction joints shall be formed by installing a parting strip to be left in place.

b. Formed grooves shall be made by depressing an approved tool or device into the plastic concrete. The tool or device shall remain in place until the concrete has attained its initial set and shall then be removed without disturbing adjacent concrete.

c. Sawed contraction joints shall be created by sawing grooves in the surface of the pavement with an approved concrete saw. After each joint is sawed, the saw cut and adjacent concrete surface shall be thoroughly cleaned.

Sawing of the joints shall begin as soon as the concrete has hardened sufficiently to permit sawing without excessive raveling, usually 4 to 24 hours. All joints shall be sawed before uncontrolled shrinkage cracking occurs. If necessary, the sawing operations shall be carried on both day and night, regardless of weather conditions. A standby saw shall be available in the event of breakdown.

The sawing of any joint shall be omitted if a crack occurs at or near the joint location before the time of sawing. Sawing shall be discontinued if a crack develops ahead of the saws. In general, all joints shall be sawed in sequence. All contraction joints in lanes adjacent to previously constructed lanes shall be sawed before uncontrolled cracking occurs. If extreme conditions make it impracticable to prevent erratic cracking by early sawing, the contraction joint groove shall be formed before initial set of concrete, as provided above.

d. Transverse formed contraction joints shall consist of a groove or cleft extending downward from and normal to the surface of the pavement. These joints shall be made while the concrete is plastic by an approved mechanically or manually operated device to the dimensions indicated on the plans.

Transverse construction joints of the type shown on the plans shall be placed whenever the placing of concrete is suspended for more than 30 minutes. A butt joint with dowels or a thickened-edge joint shall be used if the joint occurs at the location of a contraction joint. Keyed joints with tiebars shall be used if the joint occurs at any other location.

Transverse expansion joints shall consist of a vertical expansion joint filler placed in a butt-type joint with or without dowel bars as shown on the plans. The expansion joint filler shall be continuous from form to form, shaped to the subgrade, curb section, and to the keyway along the form. Preformed joint filler shall be furnished in lengths equal to the pavement width or equal to the width of one lane. Damaged or repaired joint filler shall not be used unless approved by the Engineer.

The expansion joint filler shall be held in a vertical position. An approved installing bar or other device shall be used if necessary to ensure proper grade and alignment during placing and finishing of the concrete. Finished joints shall not deviate in horizontal alignment more than 1/4 inch from a straight line. If joint fillers are assembled in sections, there shall be no offsets between adjacent units. No plugs of concrete shall be permitted anywhere within the expansion space.

Longitudinal joints shall consist of planes of weakness created by forming or cutting grooves in the surface of the pavement. They shall be equal to at least one-quarter the depth of the slab plus 1/2 inch.

a. Sawed longitudinal joints shall be sawed grooves made with a concrete saw after the concrete has hardened. The joint may be sawed at any time before use by construction traffic or before opening if construction traffic does not use the pavement.

b. Longitudinal groove joints are formed in the same manner as transverse formed groove joints.

c. Longitudinal strip joints are formed in the same manner as transverse strip joints.

d. Longitudinal construction joints shall be of the dimensions shown on the plans. Where a key is required, it shall be constructed by forming when the first lane adjacent to the joint is placed. These joints shall be finished with an edger of the radius shown on the plans. When placing the second slab, concrete must not be left overhanging the lip formed in the first slab by the edging tool.

Joints to be sealed shall be filled with joint-sealing material before the pavement is opened to traffic and as soon after completion of the curing period as is feasible. Just before sealing, each joint shall be thoroughly cleaned of all foreign material, including membrane curing compound, and joint faces shall be clean and surface dry when seal is applied.

Material for seal applied hot shall be stirred during heating to prevent localized overheating.

The sealing material shall be applied to each joint opening in accordance with the details shown on the plans or as directed by the Engineer. The joint filling shall be done without spilling material on the exposed surfaces of the concrete. Any excess material on the surface of the concrete pavement shall be removed immediately and the pavement surface cleaned. The use of sand or similar material to cover the seal shall not be permitted. Joint-sealing material shall not be placed when the air temperature in the shade is less than 50°F, unless approved by the Engineer.

Opening to traffic will not be permitted for at least seven (7) days after placing of concrete during construction. No equipment will be allowed on the finished pavement for at least seven (7) days from the date it was placed.

Smoothness shall be tested by the Owner by means of a straight edge applied to each separate lane of pavement. All surface variations of one-eighth (1/8) inch or more in ten (10) feet must be ground off. Brush hammering shall not be permitted.

Sections of pavement containing depressions with a depth in excess of 1/4" in ten (10) feet shall be removed and replaced at the Contractor's expense. Slabs containing excessive cracking, fractures, spalling, or other defects shall be removed and replaced at the Contractor's expense when directed by the Engineer. Such removed sections shall not be less than the full lane width and full distance between joints and lane.

## 6. BACKFILL OF TRENCHES AND STREET CUTS

### A. Description

This item shall consist of backfilling of all street cuts occasioned by the installation of drainage pipe and structures, utilities or trenches cut across streets for any other purpose.

### B. Materials

Material for use in backfilling of street cuts and trenches shall be washed river gravel or crushed stone. One hundred percent of the material shall pass a 1-1/2" sieve, and ninety-three percent, minimum

### C. Construction Methods

All trench excavations that will be within the limits of proposed pavement or curb and gutter shall be backfilled with gravel or crushed stone. The entire depth of the trench shall be filled to the top of the subgrade elevation. The material shall be carefully placed and tamped around the pipe, cable, conduit or other structure occupying the trench. The material shall be thoroughly tamped and/or vibrated throughout the depth of the trench to assure maximum consolidation.

## 7. DRAINAGE CULVERTS AND STORM SEWERS

### A. Description

This item shall consist of laying and backfilling culvert pipe, storm sewer pipe or conduit for the storm sewer system at the locations and elevations shown on the approved plans.

### B. Materials

1. *Reinforced Concrete Pipe* - Concrete sewer pipe shall conform to and be tested and inspected in accordance with ASTM C-76, Type III "B" Wall. Joints shall be sealed with either preformed rubber gaskets or bitumen/butyl rubber plastic gaskets conforming to AASHTO M198.

2. *Corrugated Steel Pipe* - All corrugated steel pipe shall be of the size shown on the plans and shall be asphalt coated, polymer coated or aluminum coated. Metal for asphalt or polymer coated corrugated steel pipe shall conform to the requirements of AASHTO Designation M36 and M218. Corrugations shall be 2 2/3" x 1/2".

The minimum gauge of circular pipes for the various sizes shall be as follows:

| *Diameter* | *Minimum Gauge* |
|---|---|
| 15" | 16 |
| 18" | 16 |
| 24" | 16 |
| 30" | 16 |
| 36" | 14 |
| 42" | 14 |
| 48" | 14 |
| 54" | 14 |
| 60" | 12 |
| 66" | 12 |
| 72" | 12 |

The above specified minimum gauges shall also apply to noncircular pipe of equivalent diameters as shown.

Field joints shall be made by the use of coupling bands made of the same material as the pipe and shall be secured with a minimum of two (2), 1/2" asphalt-coated bolts. Bands may be two thickness gauges lighter than that used for the pipe, but not heavier than 0.109" thick, nor lighter than 0.052" thick.

Asphalt coated corrugated metal pipe shall be in accordance with AASHTO M190, Type A. Polymer coated corrugated metal pipe shall meet the requirements of AASHTO M245. Sheets shall have a coating of 0.010" minimum thickness on both sides after corrugation. Aluminum coated corrugated steel pipe shall be in accordance with AASHTO M 36 and AASHTO M 289.

3. *Polyethylene Pipe* - Polyethylene storm sewer pipe shall conform to the requirements of AASHTO M 294, Type S. Polyethylene pipe shall have a corrugated outer shell with an essentially smooth wall waterway.

C. Construction Methods

Before laying the pipe, the bottom of the trench shall be carefully graded and prepared to provide a proper foundation. Should the foundation in the trench become soft, the soft material must be removed and select materials such as sand or washed gravel will be placed in the trench until the foundation is formed to prevent any subsequent settlement, which might result in excessive pressure or consequent rupture of the pipe.

Where maximum trench widths are exceeded to the point that excessive loads will be imposed on the pipe, the Contractor shall provide such additional pipe foundation and bedding (special bedding) as may be required to protect the pipe.

Regardless of the type of foundation material encountered, the pipe shall be laid so at least two-thirds of the length of the pipe is supported throughout its entire length. The only exception being bell holes excavated at each joint of sufficient depth to allow the placing or checking of jointing material.

Pipes shall be laid to exact grade on the stabilized subgrade. After the pipe work has been approved, fill material shall be carefully deposited around each side of the pipe in layers not to exceed four inches (4") in thickness. The material shall be thoroughly and carefully tamped until the backfill has been brought up to at least one-half the pipe diameter or to a point where the pipe is safe.

The backfill shall continue with the material to a point at least twelve inches (12") above the top of the pipe or to a point where the pipe is safe.

The backfill for storm sewer pipe from a point twelve inches (12") above the top of the pipe may be made by any method that will not damage the pipe or foundation. This backfill may be excavated material, which is free from trash, large rocks and other undesirable material. Backfill shall not contain any rocks larger than eight inches in any dimension.

8. DROP INLETS, CATCH BASINS, MANHOLES, JUNCTION BOXES, BOX CULVERTS AND HEADWALLS

A. Description

This item shall consist of the construction of drainage structures and all necessary appurtenances in accordance with details as shown on the plans. The work shall include all necessary excavation for the structures, the construction of all foundations, concrete, placing the steel, backfilling and all work necessary for complete installation.

B. Materials

All concrete shall be Class "A" concrete having a 28-day compressive strength of at least thirty-five hundred (3500) pounds per square inch. Concrete for manhole foundation shall be Class "B" having a 28-day compressive strength of at least twenty-five hundred (2500) pounds per square inch. All concrete materials shall be mixed in accordance with the recommendations of the Portland Cement Association and approved by the Owner.

All reinforcing bars shall be "Billett Steel Concrete Reinforcement Bars" conforming to ASTM Designation A15 or "Rail Steel Concrete Reinforcement Bars" conforming to ASTM Designation A16. No field bending of rail steel bars shall be permitted.

All reinforcement bars shall be deformed bars. Deformation shall comply with the minimum requirements of the deformation of deformed steel bars of concrete reinforcements, ASTM Designation A305 referred Standard Specifications.

Manhole rings and covers shall be graded iron casting of first quality similar or equal to No. VM-48 machined standard castings, manufactured by Vulcan Foundry, Denham Springs, Louisiana. The words storm sewer shall be cast in each cover. Gratings shall be Vulcan Foundry model VFG-36X36, or equal.

Precast products as manufactured by Dalworth Quickset Company, Benton, Arkansas, are an acceptable alternative. Precast box culverts shall be designed for H-20 loading.

C. Construction

1. *Excavation* - Excavation shall be made to the required depth and width to permit proper working conditions on the outside of the finished walls. The foundation on which the structure will be constructed shall be firm, compacted or undisturbed soil. Should the foundation become soft and mucky or unsuitable material, and is the opinion of the Owner that the structure will settle, this material shall be removed and select material shall be placed in the excavated area until the material has been brought up to grade as required by the Owner. Such material shall be thoroughly compacted in layers to allow no settlement. No layer shall exceed four inches (4") in thickness.

2. *Forms* - Forms for concrete structures shall be made of dressed lumber only and shall be braced or tied in such a manner that they will not give or warp during the pouring of the concrete. The forms shall be level and according to alignment stakes set by the Owner. After the forming has been approved, the concrete shall be placed in a manner so as not to allow any separation of material. The concrete shall be thoroughly vibrated or tamped as directed by the Owner. After the concrete has sufficiently hardened, the forms shall be removed. All ties shall be broken off at least 1/2-inch in the surface of the concrete and these surfaces shall be patched with a mixture of

cement and sand immediately after removal of the forms. All exposed concrete surfaces, meaning those surfaces which will be exposed after the completion of the work, shall be rubbed with a rubbing stone, watered and brushed until the surface is completely finished as directed by the Owner. Each exposed surface shall have at least two (2) rubbings. The last rubbing being after all backfill has been completed and the Contractor is finishing up the project. Unless the concrete has a smooth, homogeneous appearance, the Owner may require the Contractor to rub the structure more than two (2) times.

3. *Casting and Slabs* - Cast iron or other metal frames shall be set on full mortar beds composed of using one part of Portland Cement and two parts of fine masonry sand.

9. PIPE ENCASEMENT FOR CROSSINGS OF EXISTING STREETS

A. Description

This item shall consist of installation of utility or other lines across existing street surfaces.

B. Materials

Encasement pipes shall be steel or PVC, as required by the particular line to be encased.

Steel encasement pipes for street crossings shall be 0.25-inch wall thickness, asphalt-coated welded steel. PVC encasement pipe shall be PVC water pipe, SDR-21.

C. Construction Methods

All utility lines, drainage pipes or other conduits to be installed across existing street surfaces shall be encased where such installation is feasible. Encasement shall be installed without disturbing the surface by boring or jacking.

The encasement pipe shall be of sufficient size to install or remove the carrier pipe or utility line.

10. CUTTING AND REPLACING EXISTING STREET SURFACES

A. Description

This item shall consist of cutting and replacing surfaces of existing streets necessary for utility or drainage system construction. Street surfaces shall be open cut only when installation of the utility or drainage conduit is not feasible by means of boring or jacking.

B. Materials

Material for use as gravel surface cut and replaced shall be Class 7 crushed stone material, or shall be crushed stone meeting the following gradation requirements:

| *Sieve* | *Percent Passing* |
|---|---|
| 1-1/2" | 100 |
| 1" | 100 - 80 |
| 3/4" | 100 - 50 |
| 3/8" | 75 - 35 |
| No. 4 | 60 - 20 |
| No. 10 | 50 - 10 |
| No. 40 | 30 - 5 |
| No. 200 | 10 - 1 |

Material for replacing asphalt surfaces shall be asphalt concrete hot mix surface course consisting of a mixture of mineral aggregate and asphalt cement.

The mineral aggregate shall consist of hard, tough durable fragments of rock of uniform quality, free from any excess of soft particles. Asphalt cement shall conform to the following requirements:

| *Characteristics* | *Requirements* |
|---|---|
| Penetration, 77°F, 100 g., 5 sec. | 50-100 |
| Saybolt Furol Viscosity, 275°F.,sec. | 140 min. |
| Flash Point, COC °F., minimum | 450 min. |
| Solubility in Trichloroethylene, % | 99.0 min. |

Material for use as concrete surface cut and replaced shall be Portland cement concrete proportioned and mixed as described in these specifications for concrete pavement.

C. Construction Methods

In asphalt surfaced areas edges of pavement will be cut straight on each side of the trench by sawing or other method that will produce a smooth, straight uniform cut. Pavement cuts shall extend at least twelve inches past the undisturbed bank of the excavation. Select fill material shall be placed and compacted to a point eight inches below the finished surface. A concrete slab six inches in thickness shall be poured on the compacted select fill with the slab's surface two inches below finished grade. A bituminous tack coat shall be applied to the surface of the concrete, and a two-inch compacted thickness layer of asphalt concrete hot mix surface course shall be placed and compacted to conform with the adjacent surface.

Whenever it becomes necessary in excavating to disturb concrete surfaces, the concrete shall be removed by sawing so that smooth, straight lines can be maintained at the joints. Ragged, broken joints will not be acceptable.

Pavement cuts shall extend at least twelve inches (12") past the undisturbed bank of the excavation on each side of the trench so that the replaced concrete pad will rest on undisturbed soil.

The trench shall be backfilled and compacted, as specified previously, to a point six inches (6") below the finished surface. A pad of Class "A" concrete shall then be placed. The Class "A" concrete shall be reinforced with No. 4 bars at twelve inches on center in both directions. The concrete surface shall be finished to conform to the original surface.

Traffic shall not be allowed on the concrete surface for a period of at least five (5) days.

Concrete surfacing shall be properly protected from too rapid curing or from freezing while green.

In gravel surfaced streets and other areas where the gravel will be disturbed in excavating for trenches and after the backfill has been so placed that no further appreciable settlement will occur, gravel over the trench shall be replaced to the same compacted thickness as the original surfacing. During construction, the gravel on the remainder of the street not occupied by the trench may also be covered with dirt from the excavation. After completion of the backfill, such dirt shall be removed so far as possible and additional gravel shall be placed on the street, until the surface is as weather-resistant and traffic-resistant as the original surfacing.

11. CURB CUTS

A. Description

This item shall consist of cutting existing concrete curb and gutter for the purpose of installing driveways, drainage outlets or for any other purpose.

B. Construction Methods

Whenever it becomes necessary to disturb existing concrete curbs and gutters, the concrete shall be removed by sawing so that smooth, straight lines can be maintained at the joints. Ragged, broken joints will not be acceptable.

The sawed joints shall extend past the proposed driveway or other structure a sufficient distance to completely avoid any damage to the remaining curb and gutter during the construction process. Any existing concrete beyond the sawed joints that is damaged shall be re-sawed to remove the damaged portion.

The driveway or other structure to be constructed in the curb cut shall be provided with smooth transitions to the sawed joints in the existing curb.

## SECTION 4
## STREET LIGHTING AND SIGNS

4.1 Street Lighting Density - Street lights shall be provided at all street intersections within the development; at the terminal ends of all cul-de-sac streets; and at intervals of not less than three hundred feet (300') between street intersections and/or terminal ends of cul-de-sacs.

4.2 Street Lighting Specifications - All street lighting fixtures and poles shall be the standard fixtures and poles provided by the City of Benton Electric Department. If the Developer elects to provide decorative type street lighting in lieu of the City's standard fixtures and poles, the design of the proposed decorative street lighting must be approved by the City Community Development Department.

4.3 Street Lighting Installation and Maintenance - Standard lighting fixtures and poles will be installed by the City, and will be maintained by the Benton Electric Department if the development is located within the city's electric system service area. Approved special or decorative street lighting shall be installed by the Developer, completely at the Developer's expense. Maintenance and replacement of approved special or decorative street lighting shall be the responsibility and expense of the Developer and/or the residents of the development for perpetuity. If the Developer elects to utilize the City's standard fixtures on the Developer's approved special or decorative poles, the Developer shall be responsible for installation and perpetual maintenance of the poles, and the Benton Electric Department will install and maintain the fixtures.

4.4 Street Signs - Standard street signs shall be furnished, installed and maintained by the City of Benton. The Developer will pay 100% of all costs associated with the initial furnishing and installation of street signs. The City will bill the Developer for the street sign cost upon completion of the sign installation.

Approved special or decorative street name signs shall be furnished and installed by the Developer, completely at the Developer's expense. Maintenance and replacement of approved special or decorative street name signs shall be the responsibility and expense of the Developer and/or the residents of the development for perpetuity.

All private streets shall have a sign erected at the entrance of the street indicating that it is a private street.

## SECTION 5
## CONSTRUCTION INSPECTION, TESTING, CERTIFICATION AND ACCEPTANCE

5.1 Inspection of Construction - The City of Benton shall provide inspection of street construction work in progress to ensure that the work conforms to the approved plans and specifications.

5.2 Quality Control Testing -

1. General

During the construction process, the City will require certain testing on construction procedures and materials to insure compliance with the provisions of these specifications.

Testing will be performed by a reputable testing laboratory, which will be selected by the City. The developer, or his Contractor, shall pay for all required testing. Test results shall be submitted directly from the testing laboratory to the City of Benton Community Development Department.

The number of required tests shall be as hereinafter specified, and the testing locations shall be selected by the city.

When test results indicate that the construction does not comply with the requirements of these specifications, the Contractor shall make the necessary corrections and retest until the test results indicate that the construction satisfactorily meets all requirements of the specifications.

Test results from previous projects or test results for standard materials may be utilized at the city's discretion for proposed materials which are identical to those for which previous or standard test results are available.

2. Design Tests

A. *Asphalt Concrete Mix Designs* - The design engineer may use either the Hveem (ASTM D-1560 and D-1561) or the Marshall (ASTM D-1559) design method for the mix design of asphalt concrete. An adequate number of individual specimens, as determined by the testing laboratory and the City will be tested at various asphalt cement contents to determine the optimum asphalt content.

The testing laboratory, as a minimum, must furnish the following items in the Hveem Mix Design Report:

1. Specimen unit weight vs. Percent asphalt cement by weight of aggregate (curve).

2. Percent voids total mix vs. Percent asphalt cement by weight of aggregate (curve).

3. Hveem stability vs. Percent asphalt cement by weight of aggregate (curve).

4. Cohesiometer value vs. Percent asphalt cement by weight of aggregate (curve).

5. Optimum asphalt content.

6. Gradation of each aggregate used in the mix design.

7. Combined gradation of the blended aggregate along with the proportion of each aggregate used in the selected mix design.

The testing laboratory as a minimum must furnish the following in the Marshall Mix Design Report:

1. Specimen unit weight vs. Percent asphalt cement by weight of mix (curve).

2. Percent air voids vs. Percent asphalt cement by weight of mix (curve).

3. Marshall Stability vs. Percent asphalt cement by weight of mix (curve).

4. Percent voids in mineral aggregate vs. Percent asphalt cement by weight of mix (curve).

5. Flow vs. Percent asphalt cement by weight of mix (curve).

6. Optimum asphalt content.

7. Gradation of each aggregate used in the mix design.

8. Combined gradation of the blended aggregate along with the proportion of each aggregate used in the selected mix design.

B. *Portland Cement Concrete Mix Design* - The Contractor shall furnish a mix design for all separate sources of concrete prior to placement of any concrete.

3. Construction Quality Control Tests

A. *Compaction Control of Soils and Granular Materials* - Required compaction density shall be expressed as percentage of the maximum laboratory density as obtained by the Standard Proctor Density Determination (AASHTO T-99). Necessarily, the laboratory Proctor Density shall be determined on the material prior to construction. An adequate number of individual specimens, as determined by the testing laboratory and the City will be compacted to develop the Proctor curve. A Proctor curve shall be developed for each significantly different material used.

Field density tests shall be performed by the sand cone method (ASTM D-1556), water balloon method (ASTM D-2167), nuclear density gauge (ASTM D-2922), or other in-place density tests recommended by the testing laboratory and acceptable to the City. The following test schedule shall be utilized to determine the required number of compaction control tests:

| *Description* | *Method of Test* | *Frequency of Test* |
|---|---|---|
| 1. Standard Proctor Density | AASHTO T-99 | a) one per 2400 sq. yd. of subgrade |
| | | b) one per each subgrade material encountered |
| | | c) one per 400 cu. yd. of subbase, crushed stone base, etc. |
| | | d) one per each different material utilized |
| 2. Field Density Tests | ASTM D-1556 or ASTM D-2167 or ASTM D-2922 | a) one per 1000 sq. yd. of subgrade |
| | | b) one per each subgrade material encountered |
| | | c) one per 1000 sq. yd. per 6" lift of subgrade, crushed stone base, etc. |
| | | d) One per each different material encountered |

B. *Material Characteristic Test for Gravel and Crushed Stone* - Gravel or crushed stone utilized in gravel subbase, crushed stone base, or asphalt concrete shall be subjected to the Los Angeles Abrasion Test (AASHTO T-96). At least one Los Angeles Abrasion Test must be run on each material used.

Crushed stone used in asphalt concrete hot mix surface course must be subjected to 5 cycles of the sodium sulfate soundness test (AASHTO T-104). At least one sodium sulfate soundness test must be run on each material used.

The City may waive the requirement for Los Angles Abrasion and sodium sulfate soundness tests if old test reports on aggregates from the source in question show that the aggregate is historically uniform in quality and in conformance with these parameters.

Gradation tests on gravel and crushed stone shall be provided to the City for each project where these materials are used. Additional gradation tests must be provided for each 1000 cubic yard used of these materials.

C. *Quality Control Tests on Asphalt Concrete* - Field Density shall be expressed as a percentage of the density obtained by compacting control samples of delivered material by either the Hveem or Marshall Method, whichever is applicable. At least one control specimen shall be prepared for each 500 tons of asphalt concrete placed. Field density of in-place compacted asphalt concrete shall be obtained by use of a nuclear density gauge or by "cored" or "sawed" specimen.

At least one density determination must be provided from a cored/sawed specimen for each 300 tons of asphalt concrete placed At least one nuclear density determination must be provided for each 150 tons of asphalt concrete placed. Cored/sawed density determinations may be substituted for nuclear density determinations on a ratio of 1:2. However, nuclear tests may not be substituted for cored/sawed tests.

Extraction (AASHTO T-30) and Gradation (AASHTO T-58) tests shall be performed on the delivered asphalt concrete for each 500 tons of material placed. Also, flow and stability (ASTM D-1559) tests shall be performed for each 500 tons of material placed, when the Marshall method is used. If the Hveem method is used, at least one stability (ASTM D-1560) test shall be run for each 500 tons of material placed.

D. *Quality Control Tests on Portland Cement Concrete* - Four concrete test cylinders shall be collected from each separate concrete "pour". A "pour" is defined as a continuous placement of concrete from the same batching operation. Each day's concrete work will be considered as a separate "pour". The cylinders shall be delivered to the testing laboratory selected by the City for performance of compression tests. One cylinder shall be tested at an age of seven days, and one at an age of twenty-eight days. If either cylinder tested fails to meet the specified compressive strength, an additional cylinder shall be tested. Unused cylinders shall remain in storage until the project is completed and accepted.

5.3 Final Inspection and Acceptance - Upon completion of the street and drainage improvements, the developer shall submit

a request for final inspection of the improvements to the City. The street and drainage improvements will not be considered to be complete, and will not be inspected for acceptance until all of the street and drainage improvements within the approved final plat area have been completed. The City will perform a final inspection of the facilities and will notify the developer of any particulars in which the inspection reveals that the work is defective. The developer shall then make such corrections as are necessary to remedy the defects.

The improvements will not be accepted by the City until such time as the developer has been notified in writing by the City that the final inspection has been performed and that no additional corrective work is required. This notification shall in no way relieve the developer of responsibility for corrections of defective work later observed, or corrective work required by warranty.

5.4 Guaranty - The Developer shall guarantee all materials and work performed on all street construction projects for a period of one (1) year from the date that the improvements are accepted by the City. The Developer shall warrant and guarantee for the said one-year period that the completed streets are free from all defects due to faulty materials or workmanship, and the Developer shall promptly make such corrections as may be necessary by reason of such defects including the repairs of any damage to other parts of the streets resulting from such defects. The City will give notice of observed defects with reasonable promptness. In the event that the Developer should fail to make such repairs, adjustments or other work that may be necessary by such defects, the City may enlist a licensed contractor to perform such work and charge the Developer the cost thereby incurred.

5.5 Performance Bond - To ensure that funds are available to repair any defects the Developer shall furnish the City with a Performance Bond in penal sum equal to the amount of 50% of the total construction cost of the streets. The penal sum of the Performance Bond may be reduced to 25% of the total construction cost of the streets at the discretion of the Street Committee of the Benton City Council provided that the Developer has successfully completed at least two previous street projects on which the guarantee period has expired, and further provided that it has not been necessary for the City to invoke the Bond on any previous project by the Developer.

The Performance Bond shall be conditioned upon the performance by the Developer of all undertakings, covenants, terms, conditions, and agreements of the approved plans and specifications. Such Bond shall be executed by the Developer and a corporate bonding company licensed to transact such business in the state of Arkansas, and named on the current list of "Surety Companies Acceptable on Federal Bonds" as published in the Treasury Department Circular Number 570. The expense of this Bond shall be borne by the Developer. If at any time a surety on any such Bond is declared a bankrupt or loses its right to do business in the state of Arkansas, or is removed from the list of Surety Companies accepted on Federal Bonds, the

Developer shall within ten (10) days after notice from the City to do so, substitute an acceptable Bond (or Bonds) in such form and sum and signed by such other surety or sureties as may be satisfactory to the City. The premiums on such Bond shall be paid by the Developer. The Performance Bond shall remain in full force and effect through the guarantee period.

With the City's approval a cash deposit or irrevocable letter of credit may be furnished by the Developer in lieu of a performance bond. The cash deposit or letter of credit shall be furnished in the same amounts as specified for the performance bond.

The remedy provided for in the foregoing paragraphs of this subsection (5.5) shall not be exclusive, and the City shall retain all of its remedies at law or in equity, whether created by statute or other ordinance, or by common law. These remedies shall include, but not be limited to, express warranty, implied warranty, negligence, strict liability, and breach of contract. Additionally, Developer shall be subject to the penalty provisions of the City's subdivision rules and regulations, specifically Section 15.40.01 and any amendments thereto.

# NOTICE OF PUBLIC HEARING

The City of Benton will hold a Public Hearing at 6:00 p.m. on March 23, 1998, prior to the City Council meeting at the Gene Moss Community Building, 913 East Sevier Street, Benton, Arkansas, for the purpose of discussing a proposal to adopt by reference the following codes:

Standards for Street Design and Construction

Revised Subdivision Rules and Regulations

Cross-Connection Control Program and Backflow Prevention Program

At least three (3) copies of these proposed codes, or pertinent parts thereof, and all related documents are available for public examination at the office of the City Clerk, City Hall, 222 West South Street, Benton, Arkansas.

Any person wishing to comment about these proposed codes should be present at the time and place stated above. Alternatively, any person may submit written comments to the undersigned not later than 12:00 noon on the day of the public hearing.

This Notice of Public Hearing first published on the 4th day of March, 1998.

Margaret M. Ramsey

MARGARET M. RAMSEY, City Clerk