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**Design Standards**  
**Section 4**  
**Roadway Construction**

**SECTION IV**  
**ROADWAY CONSTRUCTION**  
**4-1 GENERAL**

This section covers the requirements for construction of roadway pavements including base course, bituminous prime coat, bituminous surface course, and bituminous seal coat.

Pavement structures shall comply with Table 111.

**4-2 BASE COURSE**

Base for all streets shall consist of select material, either natural or crushed.

Prior to placing untreated base course, the Contractor shall submit, in writing, a job-mix gradation to the Engineer for his approval. The job-mix gradation shall have definite single values for the percentage of aggregate passing each specified sieve based on the dry weight of the aggregate. The job-mix gradation shall meet the ideal gradation with the tolerance shown below:

Desirable Average

<u>Sieve Size</u>	<u>Gradation</u>	<u>Percent Passing</u>
3/4-inch	100	100
3/8-inch	85	69 -100
No. 4 Sieve	61	46-75
No. 16 Sieve	33	22-44
No. 200 Sieve	9	4-13

The material shall be deposited and spread in a uniform layer, without segregation of size, with such depth that when compacted, the layer will have the required thickness. Each layer shall be compacted for the full width and depth by rolling with a pneumatic roller weighing at least ten tons. Alternate blading and rolling will be required to provide a smooth even and uniformly compacted course true to cross sections and grade. Places inaccessible to rolling shall be compacted with mechanically operated hand tampers. The gravel base shall be compacted to not less than 95 percent maximum dry density as determined by AASHTO 1-180. Surfaces shall be true to the established grade with thickness being not less than 1/4-inch from the required layer thickness and with the surface elevation varying not more than 1/2 inch in ten feet from the true profile and cross section.

**TABLE 111**  
**ROADWAY PAVEMENT STANDARDS**

Table 111 can be seen in the City Office

**4-2.1 QUALITY CONTROL.** Acceptance of base course with respect to gradation shall be based on the average deviation from the job-mix gradation.

If the mean result of the deviations of the acceptance tests from the job-mix gradation for a particular sieve or sieves is more than the maximum value shown under the 1.00 pay factor in Table IV, the Engineer may order the correction or removal of any or all of the base course in the lot. The pay factor for such base course which is allowed to remain in place shall be 0.50.

The computation of the adjusted unit price for untreated course shall be based upon the minimum pay factor determined from Table IV.

In addition to the random acceptance samples taken from each lot the Engineer may sample the untreated base from any portion of the course that exhibits a nonuniform appearance. The Engineer may reject this material when test results show a deviation allowed under the 0.70 pay factor in Table IV.

The Contractor shall take steps to bring the untreated base course into specifications when the test results show a mean of deviation from the job-mix gradation that exceeds the maximum allowed under the 1.00 pay factor in Table IV.

**4-3 BITUMINOUS PRIME COAT**

The bituminous prime coat shall consist of an application of hot bituminous material MC70 on a previously prepared surface course. Bituminous material for the prime coat shall be applied in quantities of not less than 0.20 gallon nor more than 0.30 gallon per square yard of surface course. The exact quantities, which may be varied to suit field conditions, will be determined by the Engineer.

Immediately before applying the prime coat, all loose material, dirt, clay, or other objectionable material, shall be removed from the surface to be primed. After the cleaning operations and prior to the application of the prime coat, the surface shall be lightly sprinkled with water immediately in advance of the application as directed by the Engineer, to assure a uniform spread of the bituminous material.

Immediately following the preparation of the base course, the bituminous material shall be applied by means of a bituminous distributor at the temperature specified. The bituminous material shall be applied at the pressure and in the amounts directed by the Engineer. The priming shall be so applied that uniform distribution is obtained at all points of the surface to be primed or treated. Unless the distributor is equipped so as to obtain satisfactory results at the junction of previous and subsequent applications and at the junction of the gutters, building paper shall be spread on the surface for a sufficient distance back from the ends of each application so that flow through the sprays may be started and stopped on paper, and that all sprays will be operating at full force on the surface to be treated. Immediately after the application, the building paper shall be removed and destroyed. All spots unavoidably missed by the distributor shall be properly treated with bituminous material.

Following the application of prime material, the surface shall be allowed to dry for a period of not less than 48 hours without being disturbed, or for such additional period of time as may be necessary to attain penetration into the foundation course and drying out or evaporation of the volatiles from prime material, which period shall be determined by the Engineer. The Contractor shall furnish and spread sufficient approved sand on all areas which show an excess, as directed by the Engineer. The primed surface shall be maintained by the Contractor. He shall repair all broken spots.

**TABLE IV**

**ACCEPTANCE SCHEDULE FOR BASE COURSE  
AGGREGATE GRADATION (PERCENTAGE POINTS)**

Review Table IV in the City Office

**4-4 BITUMINOUS SURFACE COURSE**

Over the cured prime coat the Contractor shall place and compact a bituminous surface course. The surface course shall consist of a mixture of mineral aggregate and binder. The supplier shall submit a design mix for approval by the City Engineer before commencement of each construction season or upon selection of new aggregate sources. The design mix gradation shall meet the ideal gradation within the tolerances shown below:

**WEATHER LIMITATIONS.** Apply prime coat on a dry or slightly damp surface when the air temperature in the shade is at least 50°F and rising and the base surface temperature is at least 70°F and when the weather is not foggy or rainy.

Desirable Average

<u>Sieve Size</u>	<u>Gradation</u>	<u>Percent Passing</u>
3/4"	100	100

3/8"	85	70-100
#4	62	48-76
#8	47	36-59
#16	36	27-45
#50	22	16-29
#200	8	5-11

The combined mineral aggregate plus any specified additives when mixed with the specified bituminous binder in accordance with ASTM Designation D-1 559 shall conform to the following requirements:

Marshall Stability 1200 pounds minimum

Flow (0.01 inch) 10-18

Voids Content 2% to 4%

The bituminous surface course shall be mixed at a mixing plant and spread and compacted on the prepared base in conformance with the lines and dimensions shown on the plans and in accordance with these specifications.

4-4.1 CONSTRUCTION METHODS AND EQUIPMENT. The methods employed in performing the work, all equipment, tools and machinery and other appliances used in handling the materials and executing the work shall be the responsibility of the Contractor. The Contractor shall make such changes in the methods employed and in the equipment used as are necessary whenever the bituminous pavement being produced does not meet the specifications herein established.

4-4.2 SPREADING AND COMPACTION. The bituminous mixtures shall be spread with self-propelled mechanical spreading and conditioning equipment capable of distributing at least a twelve-foot width. The mixture shall be spread and struck off in such manner that the finished surface shall result in a uniform smooth surface. The longitudinal joints in succeeding courses shall be offset at least twelve inches transversely to avoid a vertical joint through more than one course.

The temperature of the bituminous mix shall be between 250 degrees F and 325 degrees F when placing.

After the mixture has been spread, the surface shall be rolled in longitudinal direction commencing at the outside edge or lower side and proceeding to the higher side. Each pass of the roller shall overlap the preceding pass at least one-half the width of their roller. Rolling shall continue until 95 percent of the laboratory density as determined in accordance with ASTM Designation D-1 559 for the bituminous mixture being used has been obtained.

Rolling operations shall be conducted in such manner that shoving or distortion will not develop beneath the roller.

The surface of the pavement, after compaction, shall be uniform and true to the established crown and grade. All traffic shall be kept off the surface until rolling is completed.

4-4.3 QUALITY CONTROL. No bituminous surface shall be placed unless the air temperature in the shade is at least 50 degrees F and rising, during rainy or foggy weather, and when the base is wet or during other unfavorable conditions as determined by the Engineer. Acceptance of bituminous surface course with respect to gradation and bituminous shall be based on the average deviation from the job-mix formula of samples taken. If the mean of the deviations of the acceptance tests from the job-mix formula (the job-mix formula refers to the job-mix gradation and the required bitumen content ) for a particular sieve or sieves or for bitumen content is more than the maximum shown under the 1.00 pay factor in Table V, the Contractor has the option to remove and replace or, upon his written request accept the pavement at an adjusted unit price. The mean of the deviation is hereby defined as the sum of the absolute values of the deviations divided by the number of tests.

If the mean result of the deviation of the acceptance tests from the job-mix formula for a particular sieve or sieves, or for bitumen content is more than the maximum value shown under the 0.70 pay factor for any such surface course which is allowed to

remain in place shall be 0.50.

The computation of the adjusted unit price for bituminous surface course shall be based upon the minimum pay factor determined from Table V.

Acceptance of bituminous surface course with respect to density shall be based on the average of all density determinations made in sections of approximately 1,500 square yards.

Acceptance shall be made when the mean of all density determinations made in a section not less than 96 percent of maximum laboratory density (Rice Method) and when no single determination is lower than 92 percent of maximum density (Rice Method).

If an individual test result falls below 92 percent of maximum laboratory density or 89 percent of measured maximum density, the surface course material represented by that test will be considered defective and the Contractor shall further compact the section. After further compaction, the original test site and one other randomly selected site within the section shall be tested. The average of the two test results shall be included in determining the mean density for the selection. The original test results shall not be included. If the section still does not meet the required density, the process of recompacting and retesting may be repeated until the minimum compaction is reached.

In addition to the above acceptance test, the Engineer reserves the right to test any area which appears defective and to require further compaction of areas that do not meet at least 92 percent of maximum laboratory density or 89 percent of measured maximum density.

If the mean of the surface course placed on any production day does not equal or exceed 96 percent of maximum laboratory density or 93 percent of measured maximum density but is not below 92 percent of maximum laboratory density or 89 percent of measured density, the lot may be accepted at a reduced price upon written request from the Contractor. The computation of the adjusted unit price for the bituminous surface course with respect to density below 92 percent of maximum density shall be considered defective. The Engineer may order the removal of any or all of the bituminous mix in that section. The pay factor for any such surface course which is allowed to remain in place shall be 0.50.

#### **TABLE V**

#### **ACCEPTANCE SCHEDULE FOR BITUMINOUS MIXTURE**

#### **BITUMEN CONTENT AND AGGRIGATE GRADATION**

#### **(PERCENTAGE)**

#### **MEAN OF THE DEVIATIONS OF THE ACCEPTANCE TESTS FROM THE JOB-MIX FORMULA**

Table V can be reviewed at the City Office.

The pavement surface shall be tested for smoothness as the work progresses. Longitudinal and transverse measurements shall be made with a twenty-five foot string line.

The variation of the surface from the testing edge of the string line between any two contracts with the surface shall at no point exceed 1/2 inch. All humps or depressions exceeding the specified tolerances shall be corrected at the expense of the Contractor as directed by the Engineer.

Acceptance of the completed bituminous surface course with respect to thickness shall be based on the average thickness in sections of approximately 1500 square yards. Acceptable thickness shall not be less than requirements in Table III. Sections that are not acceptable because of deficient thickness shall be brought into compliance by placing additional surface course as directed by the Engineer.

For subdivision construction the Owner shall pay a penalty equal to all reductions in payment to the Kanab City before acceptance.

#### **4-5 BITUMINOUS SEAL COAT ( CHIP SEAL)**

The bituminous surface treatment shall consist of an application of bitumen covered with mineral aggregate and rolled to a smooth surface presenting an even texture.

The materials used in the application of the bituminous surface treatment shall be mineral aggregate and bituminous material.

4-5.1 BITUMINOUS MATERIAL. MC-3000R emulsion shall be used as a bituminous material unless acceptable substitutes are approved by the Engineer.

4-5.2 MINERAL AGGREGATE (CHIPS). Mineral aggregate shall consist of crushed stone or crushed gravel, free from adherent films of clay, and shall be of such nature that a thorough coating of the bituminous material used in the work will not strip off upon contact with water.

Stripping tests of mineral aggregate which the Contractor proposes to use shall be furnished by the engineer before crushing operations begin. During the crushing of the aggregate, addition i ping tests shall be furnished to the Engineer upon his request.

The gravel or rock shall have a percent of wear not greater than thirty when tested by the Los Angeles Abrasion Test. Chips shall be washed free of dust or clay particles.

4-5.3 DEGRADATION OF AGGREGATES. The crushed stone or crushed gravel shall conform to the following grading for both layers:

<u>Sieve Designation</u>	<u>Percent by Weight Passing</u>
1/2"	100
3/8"	85-100
No. 4	5-2
No. 8	0-5
No. 200	0-1

The bitumen and aggregate shall be spread in the following quantities:

MC-3000R at 0.35 to 0.38 gallon per square yard

Chips at 15 to 20 pounds per square yard

Upon commencement of the work, and during its progress, the individual quantities of bitumen and aggregate may be varied to meet specific field conditions, as directed by the Engineer.

All tools, equipment, and machines used in the performance of the work covered by this section of the specifications shall be subject to the approval of the Engineer and shall be maintained in satisfactory working condition at all times. Immediately before applying the first application of the bituminous material, the primed surface shall be cleaned of loose material, dirt, clay or other objectionable material.

After the cleaning operation has been completed, and prior to the first application of bituminous material, the area to be treated will be inspected by the engineer to determine its fitness for receiving the treatment. Curbs, gutters, and all other concrete surfaces shall be covered with building paper or other protective coating subject to the approval of the Engineer.

The bituminous material shall be so applied that uniform distribution is obtained over all points of the surface to be treated. Unless the distributor is equipped so as to obtain satisfactory results at the junction of previous and subsequent applications, building paper shall be spread on the surface for a sufficient distance back from the ends of each application so that flow through the sprays will be operating at full force on the surface to be treated. Immediately after the application, the building paper shall be removed and destroyed. All lightly coated areas and spots missed by the distributor shall be properly treated with bituminous material applied by hand.

Immediately following the application of bituminous material, the aggregate shall be spread uniformly over the surface. The aggregate shall be spread evenly by hand on all areas missed by the aggregate over the areas having insufficient cover shall be done by hand and shall be continued during the operations whenever necessary.

Chips shall spread by using a self-propelled spreader, fiarity or equal. The surface shall be rolled after sufficient aggregate is spread to prevent pickup of the bituminous material, and rolling shall continue until no more aggregate can be worked into the

surface. The surface shall be broom dragged as soon as possible after rolling but not until the surface has set sufficiently to key and set the aggregate. In all places not accessible to the rollers, the aggregate shall be adequately compacted with hand tampers. Any aggregate that becomes coated or mixed with dirt or any other foreign matter shall be removed, replaced with clean aggregate, and rerolled, as directed by the Engineer.

The surface shall be rolled and broom-dragged in the manner specified until smooth, even-textured surface is produced. All surplus aggregate shall be swept off the surface and removed, and the gutters cleaned, prior to final acceptance.

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