304 - AGGREGATE BASE COURSE (OP SPECIAL)

304.1 DESCRIPTION

This work shall consist of furnishing and placing aggregate base course in accordance with the following specifications and as shown on the plans.

304.2 MATERIALS

a. Compaction

Compaction requirements shall be based on the results of a test section constructed by the Contractor, using the materials, methods, and equipment proposed for use in the work. The test section shall meet the requirements of paragraph "Test Section" and shall be observed by the City Engineer.

(1) Compaction Equipment

A dual or single smooth drum roller with vibratory capability and static weight not less than 150 lbs/in width of drum.

b. Sampling and Testing

(1) Samples

Samples for material gradation, liquid limit, and plastic limit tests shall be taken in conformance with ASTM D 75.

(2) Initial Test

One of each of the following tests shall be performed on the proposed material, prior to commencing construction for each source (geological unit) of material: Sieve analysis, wear test, soundness, absorption, specific gravity, liquid limit and plasticity index, and moisture-density relationships. Certified test results shall be submitted to the City Engineer prior to commencing construction.

(3) Sieve Analyses

Sieve analyses shall be made in conformance with ASTM C 117 and C 136. Sieves shall conform to ASTM E 11.

(4) Liquid Limit and Plasticity Index:

Liquid Limit and plasticity index shall be determined in accordance with ASTM D 4318.

(5) Testing Frequency

Testing frequency for sieve analysis, liquid limit and plasticity index -- Results shall verify that the material complies with the specifications. After the initial test, a minimum of one analysis shall be performed for each 835 tons of material placed, with a minimum of one analysis for each day's placement until the base course is completed. When the source of materials is changed or deficiencies are found, the initial analysis shall be repeated and the material already placed shall be re-tested to determine the extent of unacceptable material. All in-place unacceptable material shall be replaced.

(6) Density

Density will be determined by roller pattern. The City Engineer may perform check density test as specified herein at random times.

(7) Soundness, Wear, Absorption, and Specific Gravity Test shall conform to the requirements of Section 1104 of the standard specifications. The above test shall be performed in accordance with test methods stated in Section 1115 of the standard specifications.

c. Approval of Material

(1) Aggregates

Aggregates shall consist of clean, sound, durable particles of crushed limestone stone. The Contractor shall obtain materials that meet the specification and can be used to meet the grade and smoothness requirements specified herein, after all compaction operations have been completed. The aggregates shall be free of silt and clay as defined by ASTM D 2487, vegetable matter, and other objectionable materials or coatings. The portion retained on the No. 4 sieve shall be known as coarse aggregate; that portion passing the No. 4 sieve shall be known as fine aggregate.

(2) Coarse Aggregates

Coarse aggregates shall be angular particles of uniform density. The percentage of flat and/or elongated particles shall not exceed 20 in the fraction retained on the 1/2 inch sieve and in the fraction passing the 1/2 inch sieve. A flat particle is one having a ratio of width to thickness greater than 3; an elongated particle is one having a ratio of length to width greater than 3. When the coarse aggregate is supplied from more than one source, aggregate from each source shall meet the requirements set forth herein.

(3) Fine Aggregate

Fine aggregate shall be natural sand or angular particles produced by crushing stone or gravel that meets the requirements for wear and soundness specified for coarse aggregate.

(4) Gradation Requirements

Gradation requirements specified herein shall apply to the completed <u>compacted</u> base course. The aggregates shall have a maximum size of 2 inches and be graded continuously well within the limits specified in Table I. Sieves shall conform to ASTM E 11.

TABLE I. GRADATION OF AGGREGATES

Percentage by Weight Passing Square-Mesh Sieve:

Sieve Designation	Percent Passing
50 mm (2 inches)	100
37.5 mm (1 ½ inches)	70-100
25 mm (1 inch)	45-80
12.5 mm (1/2 inch)	30-60
4.75 mm (No. 4)	10-35
2.36 mm (No. 8)	5-25
425 µm (No. 40)	4-18
75 µm (No. 200)	0-10

Liquid limit and plasticity index requirements stated herein shall apply to any aggregate component that is blended to meet the required gradation and also to the aggregate in the completed base course. The portion of the aggregate passing the No. 40 sieve shall be either non-plastic or have a liquid limit not greater than 25 and a plasticity index not greater than 5.

(5) Stockpiling Material

Prior to stockpiling of material, storage sites shall be cleared and leveled by the Contractor. Aggregates shall be stockpiled on the cleared and leveled areas designated by the City Engineer so as to prevent segregation. Materials obtained from different sources shall be stockpiled separately.

304.3 CONSTRUCTION REQUIREMENTS

a. Preparation Of Surface

Immediately prior to placing aggregate base course, the previously constructed underlying surface course shall be cleaned of all foreign substances; if the surface of the underlying material has been damaged after placement or has inadequate compaction or other deviations from this contract specification requirements, such defects shall be repaired immediately prior to placement of this course.

b. Grade Control

During construction, the lines and grades including crown and cross slope indicated for the base course shall be maintained by means of line and grade stakes placed by the Contractor.

c. Weather Limitation

Base courses shall be placed when the atmospheric temperature is above 36° F. Areas of completed base course that are damaged by freezing, rainfall, or other weather conditions shall be corrected to meet specified requirement.

d. Mixing of Materials

The coarse and fine aggregates shall be mixed in a stationary plant. **Water shall also be added to the aggregate prior to placement at a stationary mixing plant. The amount of water added shall be considerably above optimum moisture.** The Contractor shall make such adjustments in mixing procedures or in equipment as may be directed to obtain true grades, to minimize segregation or degradation, to obtain the required water content, and to insure a satisfactory base course meeting all requirements of this specification.

e. Placing

The mixed material shall be placed on the prepared sub-grade or sub-base in layers of uniform thickness with an approved spreader box when possible as directed by City Engineer. Tracked equipment operated on base course material shall have street tracks. When a compacted layer 6 inches or less in thickness is required, the material shall be placed in a single layer. When a compacted layer in excess of 6 inches is required, the material shall be placed in layers of equal thickness. No layer shall exceed 6 inches or be less than 3 inches when compacted. The layers shall be so placed that when compacted they will be true to the grades or levels required with the least possible surface disturbance. Where the base course is placed in more than one layer, the previously constructed layers shall be cleaned of loose and foreign matter by sweeping with power sweepers, power brooms, or hand brooms, as directed. Such adjustments in placing procedures or equipment shall be made as may be directed to obtain true grades, to minimize segregation and degradation, to adjust the water content, content, and to insure an acceptable base course. Mixed material shall not be placed on or above frozen material.

f. Test Section

(1) General

A test section shall be constructed to evaluate placement and compaction procedures. Test section data will be used by the City Engineer to determine the required number of passes and the field dry density requirements for full scale production. The test section shall be located with the limits of the base course construction area at a location approved by the City Engineer. The underlying courses shall be completed, inspected and approved in the test section prior to constructing the base course. The test section shall be 12 feet wide and contain approximately 100 tons of completed base course. Whenever the quarry starts producing the base course material from a different geological unit, a new test section shall be constructed.

(2) Mixing, Placement, and Compaction

Mixing, placement, and compaction shall be accomplished using equipment meeting the requirements stated hereinbefore. Compaction equipment speed shall be no greater than 1.5 miles/hour.

(a) Procedure

The test section shall be constructed with aggregate in a moist state so as to establish a correlation between number of roller passes and dry density achievable during field production. Density and moisture content tests shall be conducted at the surface and at intervals of 2 inches of depth down for the total layer thickness, in accordance with ASTM D 2922 and ASTM D 3017. Sieve analysis tests shall be conducted on composite samples, taken adjacent to the density test locations, which represent the total layer thickness. One set of tests (i.e. density, moisture, and sieve analysis) shall be taken before compaction and after each subsequent compaction pass at three separate locations as directed by the City Engineer. Compaction passes and density readings shall continue until the difference between the average dry densities of any two consecutive passes is less than or equal to 0.5 pcf.

(3) Evaluation

Within 5 working days of completion of the test section, the Contractor shall submit to the City Engineer a Test Section Construction Report complete with all required test data and correlations. The City Engineer will evaluate the data and provide to the Contractor the required number of passes of the roller, the dry density for field density control during construction, the depth at which to check the density, and the need for a final static pass of the roller.

g. Compaction

Compaction shall be accomplished using rollers meeting the requirements of paragraph "Compaction Equipment" and operating at a rolling speed of no greater than 1.5 miles per hour. Each lift of material, including shoulders, shall be compacted with the number of passes of the roller as specified by the City Engineer. In addition, a minimum field dry density, as specified by the City Engineer, shall be maintained. If the required field dry density is not obtained, the number of roller passes shall be adjusted. Excessive rolling resulting in crushing of aggregate particles shall be avoided. In all places not accessible to the rollers, the material shall be compacted with mechanical hand operated tampers.

h. Finishing

The surface of top layer of base course shall be finished after final compaction, by cutting any overbuild to grade and rolling with a steel-wheeled roller. In no case will thin layers of material be added to the top layer of base course to meet grade. If the elevation of top layer of base course is 1/2 inch or more below the grade, the top layer of base shall be scarified to a depth of at least 3 inches, new material shall be added, and the layer shall be blended and recompacted to bring to grade. Adjustments in rolling and finishing procedures shall be made as may be directed to obtain grades, to minimize segregation and degradation of base course material, to adjust the water content, and to insure an acceptable base course. Material found unacceptable shall be removed and replaced, as directed, with acceptable material. As stated here in before the gradation applies to the completed compacted base.

i. Edges of Base Course

Acceptable material shall be placed along the edges of the base course in such quantity as will compact to the thickness of the course being constructed. When the course is being constructed in two or more layers, at least a 1 foot width of the shoulder shall be rolled and compacted simultaneously with the rolling and compacting of each layer of the base course, as directed.

j. Smoothness Test

The surface of the top layer shall not deviate more than 1/2 inch when tested with 10 foot straightedge applied parallel with and at right angles to the centerline of the area to be paved. Deviations exceeding 1/2 inch shall be corrected as directed. Measurements taken at right angles to the centerline shall be taken at a minimum of 50 foot intervals.

k. Thickness Control

The completed thickness of the base course shall be within 1/2 inch of the thickness indicated. The thickness of the base course shall be measured at intervals providing at least one measurement for at least each 500 square yards of base course. The depth measurement shall be made by test holes at least 3 inches in diameter. Where the measured thickness of the base course is more than 1/2 inch deficient, such areas shall be corrected by excavating to the required depth and replacing with new material. Where the measured thickness of the base course is 1/2 inch more than indicated, it will be considered as conforming with the requirements plus 1/2 inch, provided the surface of the base course is within 1/2 inch below established grade and not above the established grade. The average job thickness shall be the average of the job measurements as specified above but within 1/4 inch of the thickness indicated.

l. Maintenance

The base course shall be maintained in a condition that will meet all specification requirements until accepted. As directed by the City Engineer and at the Contractor's expense, aggregate base course that is contaminated by foreign material or sediment shall be removed and replaced.

Within 15 days after completion of the aggregate base course it shall be covered with asphaltic concrete intermediate course. The aggregate base course shall not be used as a haul road except for curb construction.

304.4 MEASUREMENT AND PAYMENT

The Engineer will measure the aggregate base course (OP Special) by the square yard of placed material.

Payment for "Aggregate Base Course (OP Special)" at the contract unit price bid is full compensation for the specified work.