



Division of Facilities Construction and Management

CONSTRUCTION SPECIFICATIONS

HOT MIX ASPHALT (HMA)

1) SCOPE

The work shall consist of the construction of a surface course composed of mineral aggregate and bituminous binder, placed and compacted within the lines and grades as directed.

2) MATERIALS

- a) Asphaltic Cements: Viscosity grades of asphalt cement prepared from petroleum shall conform to the requirements of AASHTO Designation M-226.
- b) Asphaltic Emulsions: Anionic emulsified asphalt shall conform to the requirements of AASHTO Designation M-140.
- c) Mineral Aggregate: Mineral aggregate shall consist of crusher processed virgin aggregate material consisting of crushed stone, and gravel, conforming to the following requirements:
 - i) Course aggregate retained on the No. 4 sieve shall consist of clean, hard, tough, durable, and sound fragments, with not more than 3 percent by weight of flat, elongated, soft or disintegrated particles, and shall be free from vegetable matter or other deleterious substances.
 - ii) That portion of the aggregate retained as the No. 4 sieve shall have not less than 50% of particles by weight with at least two mechanically fractured face, or clean angular face.
 - iii) The aggregate shall have a percentage of wear not exceeding 50% for road mix and 40% for plant mix, when tested in accordance with AASHTO Designation T-96. The

Contractor shall certify that the mineral aggregate used on the job shall meet this wear test prior to its placement in the surface course.

- iv) Fine aggregate passing the No. 4 sieve, may be either a natural or manufactured product. The aggregate shall be clean, hard-grained and moderately sharp, and shall contain not more than 2 percent by weight of vegetable matter or other deleterious substances.
- v) That portion of the fine aggregate passing the No. 40 sieve shall be nonplastic when tested in accordance with AASHTO Designation T-90.
- vi) The weight of minus 200 mesh sieve material retained in the aggregate as determined by the difference in percent passing a No. 200 sieve by washing and dry sieving without washing shall not exceed 6 percent of the total sample weight.
- vii) The combined mineral aggregate plus any specified additives, when mixed with the specified bituminous binder in accordance with ASTM Designation D-1559, shall conform to the following requirements:

Marshall Stability.....1200-2500 lbs.
 Flow (0.01 inch).....10-18
 Voids content.....1.5% to 3.0%

The requirements specified in this subsection shall be used to determine the suitability of the aggregate sources.

- viii) The combined dry mineral aggregate shall be uniformly graded and of such size that it meets the following gradation band:

<u>1/2" Gradation</u>	<u>Ideal Gradation of Passing Band</u>	<u>% Passing Gradation Band</u>
1/2"	100	100
#4	70	60-80
#16	35	28-42
#50	17	11-23
#200	5	3-7

Any deviation from the above gradation bands must be approved in writing by the Engineer.

- ix) Contractor will be required to supply the Owner with a job mix formula based on the proceeding criteria. Job mix formula must be approved by the Owner.

3) **CONSTRUCTION METHODS**

- a) **Hot Mix Plant:** The mineral aggregate and bituminous binder shall be mixed at a central mixing plant. The shortest mixing time consistent with satisfactory coating of the aggregate shall be used. The mineral aggregate shall be considered satisfactorily coated with bitumen when all of the particles passing the No. 4 sieve and 98 percent of the particles retained on the No.4 sieve are coated.
- b) **Spreading and Compaction:** Place asphalt concrete pavement of 4-inches or more, in total compacted thickness, in two equal courses. The mixture shall be spread and struck-off in such a manner that finished surface shall conform to the elevations, grades, and cross-sections shown on the drawings or as instructed in the field.

After the mixture has been spread, the surface shall be longitudinally rolled, beginning at the outside edge or lower side and proceeding toward the high side. Each pass of one roller shall overlap the proceeding pass by at least one-half the width of the roller. The surface shall be rolled by 4 passes with a pneumatic or steel-wheel exerting a minimum pressure of 40 psi., or by an approved equal method. Rolling operations shall be conducted in such a manner that shoving or distortion will not develop beneath the roller.

- c) **Finishing:** The surface shall be finished to a smooth, uniform line and grade with surface deviations not exceeding 1/8-inch in 10 feet. Determination of compliance with smoothness may be made with a straight edge, chalk-line, or profilograph at the option of the Owner. Any irregularities shall be satisfactorily corrected at the expense of the Contractor.
- d) **Temperature Control:** The minimum temperature of the bituminous material at the time of application shall be 250 degrees Fahrenheit.
- e) **Weather Limitations:** Bituminous material shall not be placed when weather conditions are unfavorable or when the air temperature in the shade is less than 50 degrees Fahrenheit.
- f) **Weight Devices:** When the method of measurement is by weight, the Contractor shall provide weigh scales, at the job site. Scales will be certified by the Department of Agriculture.

The scales shall be accurate to within 1 percent of the correct weight throughout the range of use. Before using the scales and as frequently thereafter as the Owner determines necessary to insure accuracy, the Contractor shall have the scales checked, adjusted, and certified by a representative of the State agency. The Contractor shall maintain the scales to the required accuracy.

- g) Sampling of Aggregate: The Contractor shall submit test results and a certification of compliance that states that the gradation of the aggregate meets the contract requirements. The Contractor shall equip crushing, screening, and mixing plants with sampling devices. The Contractor shall take additional samples of material for testing as directed by the Owner. These samples may be required at any time to validate the certification furnished by the Contractor.

Provisions shall be made for accurate proportioning. Each compartment shall have an outlet feed that can be shut off completely when any bin becomes empty. The bins or aggregate feeding system shall be constructed so samples can be readily obtained.

Positive weight measurement of the combined cold feed shall be maintained to allow regulation of the feed gate and permit automatic correction for variations in load.

The bitumen feed control shall be coupled with the total aggregate weight measurement device to automatically vary the bitumen feed rate and to maintain the required proportion. Means shall be provided for checking the quantity or rate of flow of bitumen into the mixing unit. Thermometers shall be fixed in the bitumen feed line at the charging valve of the mixer unit and at the discharge chute of the mixer unit. The Owner may require replacement of any thermometer by an approved temperature-recording apparatus to allow better regulation of the material temperature.

A method shall be provided to automatically adjust the bituminous content in the mix for moisture variations in the cold feed.

- h) Hauling Equipment: Trucks used for hauling bituminous mixtures shall have tight, clean, smooth metal beds that have been thinly coated with a material to prevent the moisture from adhering to the beds. Truck beds shall be drained prior to loading. Each truck shall have a cover to protect the mixture from the weather. When necessary to insure that the mixture will be delivered at the specified temperature, truck beds shall be insulated and covers shall be securely fastened.
- i) Bituminous Pavers: Bituminous pavers shall be self-contained, power-propelled units, provided with an adjustable activated-screed or strike-off assembly, heated if necessary, and capable of spreading and finishing courses of bituminous plant mix material in lane widths and thicknesses shown on the drawings. When shown on the drawings, pavers shall be equipped with a control system capable of automatically maintaining the proper screed elevation. The control system shall be automatically actuated from either a reference line or surface through a system of sensors that will maintain the paver screed at a predetermined transverse slope and at the proper elevation to obtain the required surface.

The transverse slope control system shall be capable of being made inoperative so that the screed can be controlled by mechanisms that will independently control the elevation of each end of the screed from reference line or surfaces.

The controls shall be capable of working in conjunction with any of the following attachments:

1. Ski-type device of not less than 40 feet in length.
2. Taut stringline (wire) set to grade.
3. Short ski or shoe.

Compaction shall be performed with either vibratory steel-wheel or steel-wheel and pneumatic-tire rollers.

Rolling shall begin at the sides and proceed longitudinally parallel to the road centerline, each trip overlapping one-half the roller width, gradually progressing to the center. When paving in echelons or abutting a previously placed land, the longitudinal joint shall be rolled first, then followed by the above rolling procedure. On super-elevated curves the rolling shall begin at the low side and progress to the high side.

Along forms, curbs, header walls, and other places not accessible to the rollers, the mixture shall be thoroughly compacted with hot hand tampers, smoothing irons, or mechanical tampers.

- j) Joints, trimming edges, and cleanup: Placing of the bituminous mixture shall be continuous. Rollers shall not pass over the unprotected end of a freshly laid mixture. Transverse joints shall be formed by cutting back into the previous run to expose the full depth of the course. Heat shall be applied to contact surfaces or transverse joints just before any additional mixture is placed against the previously rolled material.

4) ACCEPTANCE SAMPLING AND TESTING

- a) Finished work samples. When required by the Owner, the Contractor shall cut samples from the pavement. Samples size and locations will be designated by the Owner. Samples shall be neatly cut with a saw or core drill. Voids left by sampling shall be backfilled and compacted to the density of the surrounding material.
- b) The Owner will perform the testing of bituminous mixture (gradation and bituminous content). Acceptance samples of the mixture will be taken after it has been placed on the finished surface and just prior to compaction. Samples will be selected on a random basis and taken as frequently as the Owner elects.

- c) Acceptance and testing bituminous mixture (compaction). After the bituminous mixture has been placed and compacted, the pavement shall meet the following density requirements.

Percent of Maximum Theoretical Density, pcf
92.5 Minimum

Samples and tests will be taken as indicated on drawings or at such locations as the Owner elects. Compaction testing will be performed by the Owner.

- d) Acceptance sampling and testing of bituminous mixture (surface and thickness tolerance).
- i) Surface. Acceptance testing will be performed on the top surface. The surface will be tested by the Owner with a straightedge. The variation of the surface from the testing edge of the straightedge shall not deviate at any point more than 1/8-inch.
 - ii) Thickness. The total compacted thickness of the mixture shall not vary more than 1/4-inch from the specified thickness. The compacted thickness shall not consistently be below nor consistently above the specified thickness.
 - iii) The Owner reserves the right to test areas which appear defective and if determined defective require immediate correction.

5) **PRICE ADJUSTMENTS**

Gradation and Asphalt Content.

1. The computation of the adjusted unit price will be based upon the pay factor determined from Table 1- Pay Factor- Marshall Mix Design APWA 32-12-05.

1. The Owner may order the removal of the mix if the acceptance tests deviate from the job-mix formula for a particular sieve or sieves or if the asphalt content is more than the values shown under the 0.85 pay factor for asphalt concrete in Table 1.

2. The pay factor for material allowed to remain will be 0.50 for asphalt concrete.
3. A lot equals the number of square feet placed during each production day.

2. Density

1. Areas with deficient density will be subject to the following price reductions:

PAY FACTOR	
AVERAGE DENSITY IN PERCENT	ASPHALT CONCRETE
92.5 or more	1.00
90.5 to 92.4	0.90
Less than 90.5	0.50

6) ITEMS OF WORK AND CONSTRUCTION DETAILS

Items of work to be performed in conformance with this specification and construction details are:

3-inch HMA PG 58-28 (1/2-inch Mix)

1. The work shall consist of furnishing the mineral aggregate, bituminous material, mixing the aggregate and bituminous material, spreading, and compacting the mixture as shown on the drawings.
2. Contractor will supply the Owner with the mix calibration factor, and a set of calibration samples 7 days prior to placement of asphalt or as required by testing agency.
3. The aggregate shall meet the gradation requirements as listed in Section 2.C.8 of these specifications. The gradation of the aggregate shall be submitted in writing to the Owner for approval prior to the placing of the asphalt. The borrow area selected by the Contractor must meet the approval of the Owner.

4. The asphalt shall be grade PG 58-28, viscosity graded. Any variation must be approved by owner
5. The aggregates and the bituminous material shall be measured or gauged and introduced into the mixer in the amount specified by the job mix formula.

After the required amounts of aggregate and bituminous material have been introduced into the mixer, the materials shall be mixed until a complete and uniform coating of particles and a thorough distribution of the bituminous material throughout the aggregate is obtained.

6. On areas where irregularities or unavoidable obstacles make the use of mechanical spreading and finishing equipment impractical, the mixture may be placed and finished by hand tools.
7. Hot mixture shall be placed at a temperature not less than 250 degrees Fahrenheit.
8. Material trimmed from the edges and any other discarded bituminous mixture shall be removed and disposed of by the Contractor in an approved area.
9. Contractor will be required to hand rake all seams.
10. Testing noted in Section 4.a may not be required.
11. Asphalt shall be placed at the finished depth instructed. Tack coat will be required on all existing asphalt and concrete.
12. 8-inch untreated base course will be required under all asphalt.
13. Granular borrow may be required under asphalt as directed.
14. Contractor will not stockpile hot asphalt on existing asphalt prior to placement unless approved by owner.
15. Bituminous surface course will not be placed during rain, when the roadbed is wet or during other adverse weather conditions. The owner will not be responsible for any bituminous surface course that is on the project site, but unable to spread due to adverse weather.
16. Contractor will hand sweep and remove all sluffage on existing asphalt just prior to bituminous surface course placement to assure a clean surface and proper depth.

*Refer to American Public Works Association- Manual of Standard Specifications (APWA) 32-12-05 for additional requirements, details and information. Where discrepancies exist, APWA Standards govern.

Untreated Base Course

1. The work will consist of providing, placing, watering, blading, and compacting the untreated base course to the lines and grades, as directed.
2. The dry mineral aggregate will be **non-plastic** and conform to the following 1 1/2-inch gradation:

1 1/2 - inch Gradation

<u>Sieve Size</u>	<u>% Passing Gradation Band</u>
1 1/2"	100
1"	90-100
3/4"	70-85
1/2"	65-80
3/8"	55-75
#4	40-65
#16	25-40
#200	7-11

Variation to the above Gradation Schedule must be approved by the Owner.

3. **Price Adjustments** - Gradation - The computation of the adjusted unit price will be based upon the pay factor determined from Table 1- Gradation Pay Factors- APWA 32-11-23.
 - a. The Owner may order the removal of the material if the acceptance tests deviate on any sieve size more than the 0.70 pay factor from the gradation specifications outlined.
 - b. The area requiring adjustment will be based on that day's placement.
 - c. If the material is allowed to remain the pay factor will be 0.50.
4. The base course gravel will uniformly be mixed with water prior to compaction.
5. Prior to untreated base course placement Contractor will be required to confirm project area maintains positive drainage throughout.
6. Untreated Base Course compaction will be by Class A and will be moistened and compacted to acquire at least ninety-five percent (95%) of the maximum

density as determined in accordance with AASHTO Designation T-180. If placed on native ground, the earth foundation will be proof rolled to determine stability.

7. The aggregate will have a percentage wear not exceeding 50% when tested in accordance with AASHTO designation T-96. Certification that the aggregate meets this wear test will be required of the Contractor prior to his placement of the base course.
8. The moisture content of the material at the time of compaction will be between + 2% optimum and - 2% of optimum.
9. Contractor will confirm positive drainage throughout project area prior to placements of asphalts.
10. The Contractor will select the source of material and submit certification the material meets these specifications to the Owner for approval.

Granular Borrow

1. The work shall consist of providing, placing, watering, blading and compacting the granular borrow material required to complete to the lines and grades shown on the drawings or as directed by the Owner.
2. Borrow will be supplied by the Contractor and shall be non-plastic.
3. The moisture content of the material at the time of compaction shall be between +2% optimum and -2% of optimum.
4. Granular Borrow compaction will be by Class A and will be moistened and compacted to acquire at least ninety-five percent (95%) of the maximum density as determined in accordance with AASHTO Designation T-180. If placed on native ground, the earth foundation will be proof rolled to determine stability.
5. Contractor will confirm positive drainage throughout project area prior to placements of asphalts.
6. Soil Classification and gradation according to requirements of APWA 31-05-13- classification determined per project.

*Refer to American Public Works Association- Manual of Standard Specifications (APWA) 31-05-13 for additional requirements, details and information. Where discrepancies exist, APWA Standards govern.

CONSTRUCTION SPECIFICATION

CONCRETE FOR MINOR STRUCTURES

1. **SCOPE**

The work will consist of furnishing, forming, placing, finishing and curing portland cement concrete as required to build the structure named in Section 24 of this Specification.

2. **MATERIALS**

Portland cement will conform to the requirements of ASTM Specification C-150 for the specified type.

Aggregates will conform to the requirements of ASTM Specification C-33 unless otherwise specified. The grading of coarse aggregates will be as specified in Section 24.

Water will be clean and free from injurious amounts of oil, salt, acid, alkali, organic matter or other deleterious substances.

Performed expansion joint filler will conform to the requirements of ASTM Specification D 1752.

Waterstops will conform to the requirements of the applicable ASTM specification for the specified kinds.

3. **CLASS OF CONCRETE**

Concrete for minor structure will be classified as follows:

<u>Class of Concrete</u>	<u>Maximum Water Content (gallons/bag)</u>	<u>Minimum Cement Content (bags/cu.yd.)</u>
4000	7	6.5

4. **AIR CONTENT AND CONSISTENCY**

Unless otherwise specified, the slump will be 3 to 5 inches. If air entrainment is specified, the air content by volume will be 5 to 7.5 percent of the volume of the concrete. When specified or when directed by the Owner, a water-reducing, set-retarding admixture approved by the Owner will be used.

5. **DESIGN OF THE CONCRETE MIX**

The proportions of the aggregates will be such as to produce a concrete mixture that will work readily into the corners and angles of the forms and around reinforcement when consolidated, but will not segregate or exude free water during consolidation.

Prior to placement of concrete, the Contractor will furnish the Owner, for approval, a statement of the materials and mix proportions (including admixtures, if any) he intends to use. The statement will include evidence satisfactory to the Owner that the materials and proportions will produce concrete conforming to this specification. The materials and proportions so stated will constitute the "job mix." After a job mix has been approved, neither the source, character or grading of the aggregates nor the type or brand of cement or admixture will be changed without prior notice to the Owner. If such changes are necessary, no concrete containing such new or altered materials will be placed until the Owner has approved a revised job mix.

6. **INSPECTION AND TESTING**

The Owner will have free entry to the plant and equipment furnishing concrete under the contract. Proper facilities will be provided for the Owner to inspect materials, equipment and processes and to obtain samples of the concrete. All tests and inspections will be conducted so as not to interfere unnecessarily with manufacture and delivery of the concrete.

7. **HANDLING AND MEASUREMENT OF MATERIALS**

Materials will be stockpiled and batched by methods that will prevent segregation or contamination of aggregates and insure accurate proportioning of the ingredients of the mix.

Cement will be measured by weight or in bags of 94 pounds each. When cement is measured in bags, no fraction of a bag will be used unless weighed.

Aggregates will be measured by weight. Mix proportions will be based on saturated, surface-dry weights. The batch weight of each aggregate will be the required saturated, surface- dry weight plus the weight of surface moisture it contains.

Water will be measured, by volume or by weight, to an accuracy within one percent of the total quantity of water required for the batch.

Admixtures will be measured within a limit of accuracy of three percent.

8. **MIXERS AND MIXING**

Concrete will be uniform and thoroughly mixed when delivered to the work. Variations in slump of more than 1 inch within a batch will be considered evidence of inadequate mixing and will be corrected by increasing mixing time or other means.

For stationary mixers, the mixing item after all cement and aggregates are in the mixer drum will not be less than 1 ½ minutes. When concrete is mixed in a truck mixer, the number of revolutions of the drum or blades at mixing speed will be not less than 70 nor more than 100.

No mixing water in excess of the amount called for by the job mix will be added to the concrete during mixing or hauling or after arrival at the delivery point.

9. **FORMS**

Forms will be of wood, plywood, steel or other approved material and will be mortar tight. The forms and associated false work will be substantial and unyielding and will be constructed so that the finished concrete will conform to the specified dimensions and contours. Form surfaces will be smooth and free from holes, dents, sags or other irregularities. Forms will be coated with a nonstaining form oil before being set into place.

Metal ties or anchorages within the forms will be equipped with cones, she-bolts or other devices that permit their removal to a depth of at least one inch without injury to the concrete. Ties designed to break off below the surface of the concrete will not be used without cones.

All edges that will be exposed to view when the structure is completed will be chamfered, unless finished with molding tools as specified in Section 18.

10. **PREPARATION OF FORMS AND SUBGRADE**

Prior to placement of concrete the forms and subgrade will be free of chips, sawdust debris, water, ice, snow, extraneous oil, mortar, or other harmful substances or coatings.

Any oil on the reinforcing steel or other surfaces required to be bonded to the concrete will be removed. Rock surfaces will be cleaned by air-water cutting, wet sandblasting or wire brush scrubbing, as necessary, and will be wetted immediately prior to placement of concrete. Earth surfaces will be firm and damp. Placement of concrete on mud, dried earth or uncompacted fill frozen subgrade will not be permitted.

Unless otherwise specified, when concrete is to be placed over drain fill, the contact surface of the drain fill will be covered with a layer of asphalt-impregnated building

paper or polyvinyl sheeting prior to placement of the concrete. Forms for weepholes will extend through this layer into the drain fill.

Items to be embedded in the concrete will be positioned accurately and anchored firmly.

Weepholes in walls or slabs will be formed with nonferrous materials.

11. **CONVEYING**

Concrete will be delivered to the site and discharged into the forms within 1 ½ hours after the introduction of the cement to the aggregates. In hot weather or under conditions contributing to quick stiffening of the concrete, the time between the introduction of the cement to the aggregates and discharge will not exceed 45 minutes. The Owner may allow a longer time, provided the setting time of the concrete is increased a corresponding amount by the addition of an approved set-retarding admixture. In any case, concrete will be conveyed from the mixer to the forms as rapidly as practicable by methods that will prevent segregation of the aggregates or loss of mortar. Concrete will not be dropped more than five feet vertically unless suitable equipment is used to prevent segregation.

12. **PLACING**

Concrete will not be placed until the subgrade, forms and steel reinforcement have been inspected and approved. No concrete will be placed except in the presence of the Engineer. The Contractor will give reasonable notice to the Owner each time they intend to place concrete. Such notice will be far enough in advance to give the Owner adequate time to inspect the subgrade, forms, steel reinforcement and other preparations for compliance with the specifications before concrete is delivered for placing.

The concrete will be deposited as closely as possible to its final position in the forms and will be worked into the corners and angles of the forms and around all reinforcement and embedded items in a manner to prevent segregation of aggregates or excessive laitance. Unless otherwise specified, slab concrete will be placed to design thickness in one continuous layer. Formed concrete will be placed in horizontal layers not more than 20 inches thick. Hoppers and chutes, pipes or “elephant trunks” will be used as necessary to prevent splashing of mortar on the forms and reinforcing steel above the layer being placed.

Immediately after the concrete is placed in the forms, it will be consolidated by spading, hand tamping or vibration as necessary to insure smooth surfaces and dense concrete. Each layer will be consolidated to insure monolithic bond with the preceding layer. If the surface of a layer of concrete in place sets to the degree that it will not flow and merge with the succeeding layer when spaded or vibrated, the Contractor will discontinue placing concrete and will make a construction joint according to the procedure specified

in Section 13.

If placing is discontinued when an incomplete horizontal layer is in place, the unfinished end of the layer will be formed by a vertical bulkhead.

13. **CONSTRUCTION JOINTS**

Construction joints will be made at the location shown on the drawings. If construction joints are needed which are not shown on the drawings, they will be placed in locations of typical industry standards or as directed by Owner.

Where a feather edge would be produced at a construction joint, as in the top surface of a sloping wall, an insert form will be used so that the resulting edge thickness on either side of the joint is not less than 6 inches.

In walls and columns, as each lift is completed, the top surfaces will be immediately and carefully protected from any condition that might adversely affect the hardening of the concrete.

Steel tying and form construction adjacent to concrete in place will not be started until the concrete has cured at least 12 hours. Before new concrete is deposited on or against concrete that has hardened, the forms will be retightened. New concrete will not be placed until the hardened concrete has cured at least 12 hours.

Surfaces of construction joints will be cleaned of all unsatisfactory concrete, laitance, coating or debris by washing and scrubbing with a wire brush or wire broom or by other means approved by the Owner. The surfaces will be kept moist for at least one hour prior to placement of the new concrete.

14. **EXPANSION AND CONTRACTION JOINTS**

Expansion and contraction joints will be made only at locations shown on the drawings or as directed. If expansion and contraction joints are needed which are not shown on the drawings, they will be placed in locations of typical industry standards or as directed by Owner.

Exposed concrete edges and expansion and contraction joints will be carefully tooled or chamfered, and the joints will be free of mortar and concrete. Joint filler will be left exposed for its full length with clean and true edges.

Preformed expansion joint filler will be held firmly in the correct position as the concrete is placed.

When open joints are specified, they will be constructed by insertion and subsequent

removal of a wooden strip, metal plate or other suitable template in such a manner that the corners of the concrete will not be chipped or broken. The edges of open joints will be finished with an edging tool prior to removal of the joint strips.

15. **WATERSTOPS**

Waterstops will be held firmly in the correct position as the concrete is placed. Joints in the metal waterstops will be soldered, brazed or welded. Joints in rubber or plastic waterstops will be cemented, welded or vulcanized as recommended by the Manufacturer.

16. **REMOVAL OF FORMS**

Forms will not be removed without the approval of the Owner. Forms will be removed in such a way as to prevent damage to the concrete. Supports will be removed in a manner that will permit the concrete to take the stresses due to its own weight uniformly and gradually.

17. **FINISHING FORMED SURFACES**

Immediately after the removal of the forms:

- a. All fins and irregular projections will be removed from exposed surfaces.
- b. On all surfaces, the holes produced by the removal of form ties, cone-bolts, and she-bolts, will be cleaned, wetted and filled with a dry-pack mortar consisting of one part portland cement, three parts sand that will pass a No. 16 sieve, and water just sufficient to produce a consistency such that the filling is at the point of becoming rubbery when the material is solidly packed.

18. **FINISHING UNFORMED SURFACES**

All exposed surfaces of the concrete will be accurately screened to grade and then wood float finished, unless specified otherwise.

Excessive floating or troweling of surfaces while the concrete is soft will not be permitted.

The addition of dry cement or water to the surface of the screened concrete to expedite finishing will not be allowed.

Joints and edges on unformed surfaces that will be exposed to view will be chamfered or finished with molding tools.

19. **CURING**

Concrete will be prevented from drying for a curing period of at least 7 days after it is placed. Exposed surfaces will be kept continuously moist for the entire period, or until curing compound is applied as specified below. Moisture will be maintained by sprinkling, flooding, or fog spraying or by covering with continuously moistened canvas, cloth mats, straw, sand, or approved material. Wood forms (except plywood) left in place during the curing period will be kept wet. Formed surfaces will be thoroughly wetted immediately after forms are removed and will be kept wet until patching and repairs are completed. Water or covering will be applied in such a way that the concrete surface is not eroded or otherwise damaged.

Concrete, except at construction joints, may be coated with an approved curing compound in lieu of continued application of moisture. The compound will be sprayed on the moist concrete surfaces as soon as free water has disappeared, but will not be applied to any; surface until patching, repairs and finishing of that surface are completed. The compound will be applied at a uniform rate of not less than one gallon per 150 square feet of surface and will form a continuous adherent membrane over the entire surface. Curing compound will not be applied to surfaces requiring bond to subsequently placed concrete, such as construction joints, shear plates, reinforcing steel and other embedded items. If the membrane is damaged during the curing period, the damaged area will be re-sprayed at the rate of application specified above.

20. **REMOVAL OR REPAIR**

When concrete is honeycombed, damaged or otherwise defective, the Contractor will remove and replace the structure or structural member containing the defective concrete or, where feasible, correct or repair the defective parts. The Owner will determine the required extent of removal, replacement or repair.

Prior to starting repair work the Contractor will obtain the Owner's approval of his plan for affecting the repair. The Contractor will perform all repair work in the presence of the Owner.

21. **CONCRETE IN COLD WEATHER**

Concrete will not be mixed nor placed when the daily minimum atmospheric temperature is less than 40° F unless facilities are provided to prevent the concrete from freezing. The use of accelerators or antifreeze compounds will not be allowed.

22. **CONCRETE IN HOT WEATHER**

The Contractor will apply effective means to maintain the temperature of the concrete

below 90° F during mixing, conveying and placing.

25. **ITEMS OF WORK AND CONSTRUCTION DETAILS**

Items of work to be performed in conformance with this specification and the construction details include:

Curb and Gutter

1. This item will consist of furnishing and placing the portland cement concrete as required to construct the curb and gutter along with the necessary excavation and fill, as shown on the drawings.
2. All cement used will be Type V.
3. Six inches of untreated base course will be required under curb and gutter, as shown on the project drawings or as directed.
4. Concrete will be Class 4000.
5. Concrete mix design will be in accordance with Section 5.5. Minimum cement content will be 6.5 bags per cubic yard.
6. Class 2 course aggregate will be size 57 (1" to No. 4, ASTM C-33 Table II).
7. Air entrainment will be required. Air content by volume will be 5 to 7.5 percent of the volume of the concrete. Unless otherwise specified, the slump will be 3 to 5 inches.
8. Contractor will be required to apply curing compound as soon as finishing has been completed.
9. Curb and gutter damaged during construction will be replaced by the Contractor at his expense.
10. Contractor will be required to connect all existing asphalt and concrete driveways and sidewalks to the newly installed curb and gutter.
11. All rocks and debris larger than 2-inches exposed during excavation and installation of the curb and gutter will be disposed of by the Contractor.

Concrete Flatwork

1. This will consist of furnishing and placing the 4" thick concrete flatwork as shown on the drawings, and as required by these specifications or as directed by the Owner. The work will also include the excavation and untreated base course as required to complete the work.
2. All concrete used will be Class 4500. Only Type V cement will be used in the permanent work. 6.5 bags of cement will be used in each yard of concrete.
3. Class 2 course aggregate will be size 57 (1" to No. 4, ASTM C-33 Table II).
4. Air entrainment will be required. Air content by volume will be 5 to 7.5 percent. Unless otherwise specified, the slump will be 3 to 5 inches.
5. Six inches of untreated base course is required under concrete flatwork.
6. The backfill shall be compacted to at least 95% of the maximum density obtained in compaction test in accordance with AASHTO Designation T-180.
7. Reinforcing steel will be Grade 60 and will be required as shown on the drawings or as directed.
8. All flatwork will be saw cut on 10 ft. C.C or equally spaced not to exceed 10 ft. The saw cut will be 1 1/2" deep and filled with Sicaflex concrete joint sealant or equivalent.
9. Any required dowel work will be furnished and installed along with any drilling, epoxy, or other items necessary or incidental to the completion of work.

Reinforced Concrete Flatwork

1. This item will consist of furnishing and placing the concrete flatwork as shown on the drawings, and as required by these specifications or as directed by the Owner. The work will also include the excavation, untreated base course and any granular borrow as required to complete the

work.

2. All concrete used will be Class 4000. Only Type V cement will be used in the permanent work. 6.5 bags of cement will be used in each yard of concrete.
3. Class 2 course aggregate will be size 57 (1" to No. 4, ASTM C-33 Table II).
4. Air entrainment will be required. Air content by volume will be 5 to 7.5 percent. Unless otherwise specified, the slump will be 3 to 5 inches.
5. Six inches of untreated base course is required under reinforced concrete flatwork, as shown on the project drawings or as directed.
6. Granular borrow may be required under reinforced concrete flatwork, as shown on the project drawings or as directed.
7. The backfill shall be compacted to at least 95% of the maximum density obtained in compaction test in accordance with AASHTO Designation T-180.
8. Reinforcing steel will be Grade 60 and will be required as shown on the drawings or as directed.
9. All flatwork will be saw cut on 10 ft. C.C or equally spaced not to exceed 10 ft. If saw cut is not shown but is needed it will be cut to typical industry standards. The saw cut will be 1 ½" deep and filled with Sicaflex concrete joint sealant or equivalent.
10. Any required dowel work will be furnished and installed with any drilling, epoxy, or other items necessary or incidental to the completion of work.

*Refer to American Public Works Association- Manual of Standard Specifications (APWA) 03-30-04 for additional requirements, details and information. Where discrepancies exist, APWA Standards govern.