

SECTION 505: CONCRETE PLACEMENT AND FINISHING

505.1 DESCRIPTION

This work shall consist of constructing concrete curb and gutter, curb ramps, sidewalk, driveways, and valley gutters that shall conform to this and other applicable Sections of these Specifications as well as any applicable City Standard Details.

505.2 MATERIALS

The materials shall conform with Section 500 Portland Cement Concrete and Concrete Related Materials of these specifications.

505.3 CONSTRUCTION

505.3.1 Excavation and Subgrade Preparation

Prior to the placement of any concrete, all excavation operations shall be conducted in accordance with Section 202 Excavation – Embankment – Borrow and Section 204 Subgrade Preparation of these specifications. Concrete shall not be placed on mud or an un-compacted subgrade. Unstable subgrade areas shall be removed and replaced with suitable, compacted material.

The subgrade or surface upon which concrete is to be placed shall be approved by the City Engineer or designee in writing as a Critical Activity Point. The subgrade shall be moistened immediately before placing concrete.

When the subgrade has been over-excavated and the forms are in place, deviation from compaction specifications by placing loose fill will not be allowed. In this instance, the Contractor shall, at his own expense, either remove the forms for proper compaction or place concrete of additional thickness to compensate for the over-excavation.

Concrete shall not be placed on frozen ground or in standing or running water.

505.3.2 Placing Forms

Slip form pavers may be used as an alternative to fixed forms.

When the forms have been completed and the reinforcing steel has been placed, before concrete placement, Critical Activity Point inspection will be made of the forms and reinforcing steel to ensure conformity with required lines, grades, dimension sizes, and contours as shown in the plans. No concrete shall be placed until this inspection has been completed and written approval is provided by the City Engineer or designee.

Concrete shall not be placed in wooden forms that have not been sealed or treated with form oil or form release agent.

Concrete shall not be placed in forms that have frost, snow, or ice in or on the forms, reinforcement and/or embedment items.

1. Form Construction - Forms shall be so designed and constructed that they shall:

- A. Conform to the shape, lines, and dimensions of the member(s) called for in the plans and shall be sufficiently tight to prevent leakage of mortar.
 - B. Maintain the continuity of the shape, line, and dimension of the member(s) for which they were constructed during and after the pour until they are stripped without bulging, bending, warping, sagging, or in other ways changing the intended contours.
2. Form Detail - No wood device of any kind used to separate forms shall be permitted to remain in the finished work. Temporary openings shall be placed at the bottom of column and wall forms and at other points where necessary to facilitate cleaning and inspection immediately before placing concrete.

505.3.3 Placing Reinforcing Steel

1. Reinforcing Steel Shipments - Bar reinforcement shall be shipped in standard bundles tagged and marked in accordance with the Code of Standard Practices of the Concrete Reinforcing Steel Institute.
2. Reinforcing Steel Bending - Bent bar reinforcement shall be cold shop bent to the shapes shown in the plans.
3. Clean Reinforcing Steel - Metal reinforcement, at the time concrete is placed, shall be free from loose rust, mud, oil, or other coatings that will destroy or the reduce bond.
4. Tying and Spacing of Reinforcing Steel - Reinforcing bars shall be placed as shown in the plans and shall be securely tied in position with No. 14 or No. 16 gauge wire at all intersections, except where the spacing is less than one (1) foot in either direction, in which case alternate intersections shall be tied. Bars shall be placed with a variation in spacing between adjacent bars not to exceed one-quarter (1/4) inch or one-twenty-fourth (1/24) of the spacing dimension shown in the plans, whichever is greater. The clear coverage of the reinforcement shall not vary more than one-eighth (1/8) of the dimension shown in the plans.
5. Splicing Reinforcing Steel - No splices of reinforcement shall be made except as shown in the plans, within approved shop drawings, as specified in the special provisions of the specifications, or as authorized by the City Engineer or designee.
6. Minimum Cover of Reinforcing Steel - The minimum cover from the surface of the concrete to the face of any reinforcement bar shall not be less than three (3) inches unless otherwise shown in the plans.
7. Welding of Reinforcing Steel - Reinforcing steel shall be welded only when shown in the plans. Welding, when done, shall conform to the Bridge Welding Code, Current Edition produced by the American Welding Society.
8. Reinforcing Steel Support - Metal or plastic spacers, chairs, hangers, and other nonreactive/noncorrosive devices of adequate strength to prevent crushing under full load shall

be used to hold reinforcing bars in the positions required by the plans or authorized by the City Engineer or designee. The reinforcing steel is not to be laying directly on the ground.

The following devices are not to be used (this listing is not all inclusive):

- A. Concrete blocks used to support the reinforcing bars will not be permitted.
- B. Wooden spacers or support shall not be used to hold reinforcement in position.
- C. Wire mesh used to support reinforcement cast on the bare ground will not be permitted.

505.3.4 Portland Cement Concrete Production

The concrete production facilities shall be certified in accordance with the National Ready Mix Concrete Association (NRMCA) Plant Certification Program. The Contractor shall submit documentation of NRMCA certification and equipment calibrations for the facilities to the City Engineer or designee for approval prior to production of concrete.

The concrete production facilities must have a documented Quality Control (QC) program to ensure quality concrete is produced. If requested by the City Engineer or designee, the Contractor shall submit the production facility QC program for review and approval.

505.3.4.1 Moisture Control

For a manually operated facility, or for hoppers or stockpiles not monitored with automatic moisture sensors, the Contractor shall measure the moisture content of each hopper or stockpile at least every four (4) hours, or as required by changing moisture conditions.

For plants equipped with automatic moisture sensing equipment, for each stockpile utilized in the production of concrete, the Contractor shall measure moisture content manually at least once a day. The Contractor shall compare the manual measurement immediately before preparing the first load of concrete to the measure indicated by the moisture sensing equipment. If the measurements differ more than 0.5%, the automatic moisture sensing equipment must be re-correlated.

The Contractor shall send a certificate showing the moisture content determined by manual methods and the moisture correlation (if utilized), with the first load of concrete. If this information is not included with the first load of concrete delivered to the project, that load of concrete and all subsequent loads of concrete shall be rejected by the City Engineer or designee until the information is received at the project.

The Contractor shall determine the aggregate moisture content to the nearest 0.5% in accordance with one (1) of the following:

1. AASHTO T 217: The shelf life of the calcium carbide is relatively short so the Contractor shall closely monitor the age and replace as necessary to remain in compliance with the manufacturer's recommendations.
2. AASHTO T 255: The Contractor can choose the hot-plate or microwave method as long as no material is lost and the pan is continuously agitated during the drying process.

The Contractor shall provide the following information on the moisture certificate:

1. Pan weight;
2. Wet weight of the pan and sample;
3. First dry weight of the pan and sample;
4. Second dry weight of the pan and sample;
5. Third dry weight of the pan and sample (if necessary);
6. Absolute moisture content of the sample;
7. The moisture probe reading from the tested sample (if equipped); and
8. The calculated difference between the actual moisture content test and that shown by the moisture sensing equipment.

The Contractor shall allow washed aggregates to drain before use. If the moisture contents are excessive, the Contractor shall allow the aggregates to remain in the stockpile or storage area for a longer period

505.3.5 Transporting Concrete

The Contractor shall transport mixed concrete in non-agitating trucks only when the concrete mix design slump is less than two (2) inches. Revolving-drum mixer trucks shall be used to transport concrete with a concrete mix design slump exceeding two (2) inches. The Contractor shall transport concrete produced in a dry-batched concrete plant in revolving-drum mixer trucks.

Non-agitator, mixer and agitating trucks used for transporting concrete shall be annually certified by NRMCA. Upon request, the Contractor shall submit documentation to the City Engineer or designee showing current NRMCA certification for each transport truck used on the project.

505.3.5.1 Non-Agitator Trucks

The Contractor shall use only non-agitator trucks with bodies that are smooth, mortar-tight metal containers capable of discharging the concrete at a satisfactory controlled rate without segregation.

The Contractor shall provide covers as needed for protection of the concrete.

505.3.5.2 Truck Mixers and Agitators

The Contractor shall equip agitator trucks with a plate directly attached to the truck in a readily visible location, labeled with the specific truck properties, including the designated drum mixer speed.

The City Engineer or designee will check the water tank site tube when the truck arrives at the project site and if there is water missing from the tank, will reject the load of concrete unless the driver can account for the missing water.

505.3.6 Concrete Mixing Time

“Mixing time” is the elapsed time from when the cement is exposed to the aggregates until the concrete has been placed in its final location.

The maximum mixing time for concrete transported in agitator or mixing trucks is 90 minutes. The Contractor shall not exceed 60 minutes of mixing time when:

1. The concrete temperature is 80 °F or above for bridge decks or approach slabs, or
2. The concrete temperature is 85 °F or above for all other concrete.

For concrete transported in non-agitator trucks the maximum mixing time is:

1. 45 minutes when the concrete temperature is less than 80 °F, or
2. 30 minutes when the concrete temperature is 80 °F or higher.

The Contractor shall reject for use on the project any concrete arriving at the project with a temperature greater than 90 °F.

505.3.6.1 Project Site Mixing

The Contractor shall re-mix the concrete that arrives at the project site in agitator trucks as follows:

1. For concrete mixed in a central mix plant: mix at the designated mixing speed for a minimum of two (2) minutes before discharging;
2. For concrete mixed inside an agitator truck: mix at the designated mixing speed for a minimum of five (5) minutes before discharging; and
3. If any water, water-reducing admixtures, entrained air, or other ingredients are added to the concrete, mix the additional materials as the designated mixing speed for at least five (5) minutes before discharging.

505.3.6.2 Tempering of Concrete

A load of concrete may only be tempered with water after the mix cycle is complete when the slump of the concrete is less than specified and the time limitations in Section 505.3.6 are not exceeded. The addition of water shall be approved by the City Engineer or designee and shall not result in the concrete exceeding the maximum water to cement ratio specified in the concrete mix design.

When additional water is added, a minimum of thirty (30) revolutions at mixing speed are required before discharge.

When the slump of a load of concrete exceeds the specification requirements and the time limitations in Section 505.3.6 are not exceeded, the Contractor may mix the concrete a minimum of fifteen (15) revolutions at mixing speed and re-sample the concrete. If the second sample exceeds the maximum specified slump the concrete load shall be rejected by the City Engineer or designee.

When a sample of concrete prior to discharge shows an air content below the minimum specified and the time limitations in Section 505.3.6 are not exceeded, the Contractor may add additional air entraining admixture specified in the concrete mix design and mix the concrete a minimum of thirty (30) revolutions at mixing speed. In addition to sampling and testing for compliance after tempering with the air entraining agent and prior to discharge, the Contractor shall sample and test the second half of the load to verify slump and entrained air continue in compliance with the specified requirements.

When the entrained air exceeds the specified requirements and the time limitations in Section 505.3.6 are not exceeded, the Contractor may mix the concrete fifteen (15) revolutions at mixing speed

and re-sample and test the concrete. If the entrained air continues to exceed the specified requirements, the load shall be rejected by the City Engineer or designee.

All samples for acceptance of the concrete shall be tested for slump, entrained air, and unit weight after tempering with additional water or air entraining admixtures.

The amount of additional water or air entraining admixtures used in tempering shall be noted on the concrete ticket.

505.3.7 Placing Concrete

505.3.7.1 General

1. General - Before concrete is placed, all equipment for transporting and conveying the concrete shall be clean and all debris (e.g. ice, and other deleterious materials) shall be removed from the interior of the forms to be filled with concrete. Forms shall be thoroughly wetted or oiled. Masonry filler units that will be in contact with concrete shall be well drenched and the reinforcement shall be thoroughly clean of oil or other deleterious coatings. All reinforcement shall be secured in position with the City Engineer or designee providing written approval of a Critical Activity Point inspection.
2. Subgrade - Standing water shall be removed from the place of deposit before concrete is placed unless other provisions are made and approved by the City Engineer or designee. If concrete is to be placed upon a subgrade, the subgrade shall be thoroughly moistened at the time the concrete is deposited. No standing water or over-saturation of the subgrade shall be allowed.
3. Conveyance - Concrete shall be conveyed from the mixer to the place of final deposit by methods which will prevent the separation or loss of materials. Concrete that has attained its initial set, exceeds the time limitations specified in Section 505.3.6, and/or has been contaminated by foreign materials shall not be deposited in the work.
4. Equipment - Equipment for chuting, pumping, and pneumatically conveying concrete shall be of such size and design as to be mortar tight and to ensure a practically continuous flow of concrete at the delivery point without separation of materials.
5. Continuity of Placement – When the concrete operation has begun, it shall be carried on as continuous operation until the placing of the panel or monolithic section is completed.
6. Batch Tickets – The Contractor shall provide to the City Engineer or designee a delivery batch ticket for each load of concrete batched and delivered to the project before unloading at the project. The batch ticket shall be printed, stamped, or written, certifying the concrete and including, at a minimum, the following information:
 - A. Name of Concrete Supplier
 - B. Delivery Ticket Number
 - C. Date of Delivery
 - D. Contractor
 - E. Project Name
 - F. Unique Design Mix Number or NMDOT Material Lab (SMB#)
 - G. Volume of Concrete in Load
 - H. Time Loaded
 - I. Batched Weight (mass) of Cement
 - J. Batched Weight (mass) of Fly Ash (if any)
 - K. Batched Weight (mass) of Fine Aggregate
 - L. Batched Weight (mass) of Course Aggregate
 - M. Batched Weight (mass) or Volume of Each Admixture

- N. Weight or Volume of Water Batched at Plants
 - O. Design Mix Target Proportions
 - P. Weight or Volume (gallons) of Tempering Water Added at Project Site
 - Q. Weight or Volume of Each Tempering Admixture Added at Project Site
 - R. Signature and Name (printed) of Contractor's representative who authorized the tempering, if any, at the Project Site and Affiliation to Project
7. Placement –
- A. Concrete shall be deposited in horizontal layers and shall be thoroughly consolidated by suitable means during placement in such a manner that all voids will be filled and segregation will not occur and further that reinforcing steel and/or forms will not be displaced. Concrete in walls and other similar structure layers shall not exceed two (2) feet in depth and the capacity of the mechanical vibrator to consolidate the concrete and merge it with the previous lift. Segregation from an excessive drop will not be allowed. Concrete shall not have a free fall of more than four (4) feet otherwise a tremie tube shall be used.
 - B. Consolidation of concrete may be achieved by mechanical vibrators of an approved type and design and shall be capable of transmitting vibration to the concrete at frequencies of at least 5000 impulses per minute. Vibrators shall be used to manipulate the concrete thoroughly around the reinforcement, fixtures, corners, and angles within the forms. Vibrators shall be placed perpendicular to the form and shall not be used to move concrete. Vibrators shall not be held against the forms or rebar. The vibration duration shall be sufficient to consolidate the concrete but shall not be prolonged to the point that the concrete begins to segregate. A spare vibrator and power source shall be available onsite during all concrete placement. The City Engineer or designee may request to see these items at any time during the placement. Failure to comply with the requirements may result in stoppage of the concrete placement operation and possible removal of placed material at the Contractor's expense.

505.3.7.1.1 Concrete Pumping

The Contractor shall submit a concrete pumping plan to the City Engineer or designee for review and approval one (1) week prior to the start of a concrete pumping placement operation. The submittal shall identify the pump manufacturer, size and type, rated capacity for the line diameter(s) to be used, distance(s) to be pumped, and quality control processes to ensure quality concrete.

Pumping shall conform to the pump manufacturer's recommendations. The pump manufacturer's operation manual shall be available on the pump equipment and submitted to the City Engineer or designee upon request.

Concrete shall be pumped in a uniform continuous flow to the point of discharge, with all lines kept full during the pumping operation. The Contractor shall provide either a system for controlled discharge of the concrete, or the last five (5) feet of the pump line, immediately prior to the line discharge opening, shall have a slope equal or less than 10:1 horizontal to vertical, during the pumping of concrete.

The concrete shall not be dropped a vertical distance greater than four (4) feet at discharge from the pump line without a tremie. Concrete placed by pump shall conform to the requirements of the contract after discharge from the pump line.

Pumping of concrete shall not commence without written approval from the City Engineer or designee.

505.3.7.2 Temperature and Weather Limitations

The Contractor shall keep the concrete mixture temperature between 50 °F to 90 °F at the time of placement.

505.3.7.2.1 Cold Weather Concrete

The Contractor shall place cold weather concrete in accordance with ACI 306, "Cold Weather Concreting."

If air temperatures are likely to fall below 40 °F during the placement or curing periods, the Contractor shall submit a cold weather concreting and curing plan to the City Engineer or designee for approval before concrete placement. The Contractor shall allow 14 Days for review. The Contractor shall ensure that the Plan details the methods and Equipment to maintain the required concrete temperatures over the entire concrete pour area.

Information submitted will include, but not be limited to:

1. Whether or not outside heating sources will be used (and how the exhaust will be vented away from the fresh concrete);
2. Whether or not the rate of surface evaporation is expected to exceed the limitations detailed in Section 505.3.7.2.3, "Rate of Evaporation Limitations" and measures to be taken;
3. What the target mix temperature will be;
4. How the concrete will be protected from the ambient conditions;
5. Curing methods to be used during and following the protection period;
6. How soon after the placement the protection from the ambient conditions will be implemented;
7. Who will be responsible for ensuring that the proper protection from the environment is properly implemented;
8. How the actual temperature of the concrete will be monitored;
 - a. How often will this be checked;
 - b. Who will do the checking;
9. What actions will be taken if the temperatures fall below the target points;
10. Who will be responsible for taking the necessary actions; and
11. Who the contact will be if the City Engineer or designee need to transmit notices or information about the cold weather conditions.

Review and Acceptance of the Cold Weather Concreting and Curing Plan shall not relieve the Contractor from its obligation to perform the work and provide materials in strict conformance with the Contract.

The Contractor shall not place concrete directly onto any surface that is less than 40 °F unless otherwise approved by the City Engineer or designee. The Contractor shall not place concrete on frozen ground.

If placing concrete at or below air temperatures of 35 °F, the Contractor shall provide suitable enclosures and heating devices. The Contractor shall vent exhaust from combustion type heating

devices outside the placing area so that the exhaust fumes cannot come in contact with the freshly placed concrete.

The Contractor shall ensure the concrete surface temperatures never fall below 45 °F during placement and the first four (4) Days after placing. The Contractor shall not let the surface temperature fall below 40 °F during the next four (4) Days after the initial three (3) Day curing period. If the Contractor fails to adhere to these requirements, a Corrective Action Plan shall be submitted to the City Engineer or designee for approval to determine the actions required for the concrete exposed to the out of specification surface temperatures and to assess improvements to the Contractor's Cold Weather Concreting and Curing Plan. No additional concrete shall be placed prior to approval of the Corrective Action Plan by the City Engineer or designee.

The Contractor shall monitor the minimum concrete temperatures at various locations including edges and corners of slabs or other structures, and check immediately before placing insulating material over the concrete.

If heating the aggregates or water, the Contractor shall use heating methods and equipment that can heat the material uniformly. The Contractor shall not heat the materials to more than 110 °F.

During the heating or mixing process, the Contractor shall not add cement to water and aggregate combinations that are hotter than 90 °F.

No chemical or other foreign matter shall be added to the concrete to prevent freezing.

505.3.7.2.2 Hot Weather Concrete

The Contractor shall place hot weather concrete in accordance with ACI 305, "Hot Weather Concreting."

Hot weather is any combination of the following conditions that tends to impair the quality of freshly mixed or hardened concrete by accelerating the rate of moisture loss and rate of cement hydration or otherwise causing detrimental results: high ambient temperature; high concrete temperature; low relative humidity; wind speed; or solar radiation.

The Contractor shall estimate the rate of evaporation at the surface of the concrete per Section 505.3.7.2.3, "Rate of Evaporation Limitations" and **Figure 505.3.7.2.3**, "Surface Evaporation from Concrete." If the rate of evaporation is anticipated to be greater than 0.2 lb per sq ft per hour, the Contractor shall submit a hot weather concreting and curing plan to the City Engineer or designee for approval before concrete placement. The Contractor shall allow 14 Days for review.

The Contractor's Hot Weather Concreting and Curing Plan shall include measures that shall be taken by the Contractor at their expense and maintained to the satisfaction of the City Engineer or designee to reduce the rate of evaporation during initial cure to within the specified rate. The methods can include but not be limited to following:

1. Erect windbreaks to reduce the wind velocity over the concrete surface;
2. Place concrete during nighttime or early morning hours;
3. Use cool aggregate and mixing water at the plant to lower the fresh concrete temperature;
4. Increase the relative humidity at the site with a fog spray; and/or

5. Apply a liquid-applied evaporation reducer.

Review and Acceptance of the Hot Weather Concreting and Curing Plan shall not relieve the Contractor from its obligation to perform the work and provide materials in strict conformance with the Contract.

505.3.7.2.3 Rate of Evaporation Limitations

The “Rate of Evaporation Limitations” are detailed in ACI 305 – Hot Weather Concrete. These procedures lessen the potential of plastic-shrinkage cracking in concrete. ACI 308 – Guide to Curing Concrete emphasizes that the rate of evaporation limitations can be exceeded in both cold and hot weather and must be addressed in both conditions.

The Contractor shall determine the anticipated rate of evaporation of surface moisture from the concrete by utilizing Figure 505.3.7.2.3, “Surface Evaporation from Concrete.” The Contractor shall not place concrete if the anticipated rate of evaporation exceeds 0.2 lb per square foot per hour at the site over any ten (10) minute period, unless measures are taken to prevent excessive moisture loss from the surface of the concrete during initial curing.

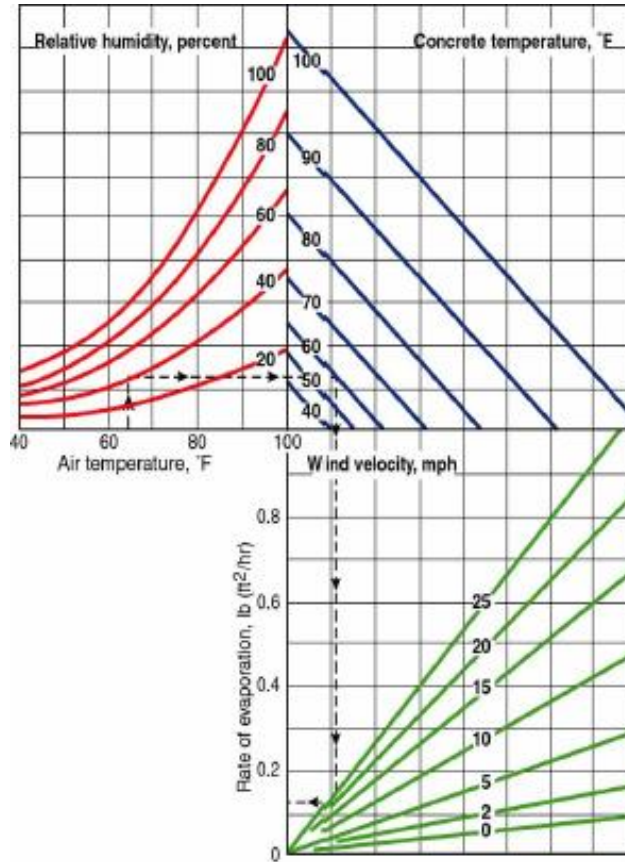
Prior to concrete placement, the Contractor shall submit a plan for collection of Rate of Evaporation data to the City Engineer or designee for approval.

During the concrete placement, the wind speed, relative humidity and ambient air temperature shall be collected by the Contractor. The Contractor shall record readings at minimum five (5) minute intervals until the final curing system has been physically applied. Copies of these readings shall be submitted to the City Engineer or designee within 24 hours of the placement.

Measurements to determine the Surface Evaporation from the Concrete shall be taken at a height of approximately five (5) feet above the concrete for relative humidity and ambient air temperature, and between a height of 20 inches and five (5) feet for wind speed.

For concrete placements that are smaller than ten (10) cubic yards, a handheld anemometer may be used. The handheld anemometer shall be capable of measuring wind speed, humidity and air temperature; and shall be supplied and retained by the Contractor.

Figure 505.3.7.2.3
Surface Evaporation from Concrete (reference ACI 305)



To use this chart:

1. Enter with air temperature, move up to relative humidity
2. Move right to concrete temperature
3. Move down to wind velocity
4. Move left; Read approximate rate of evaporation

505.3.8 Finishing

Finishing of concrete curb and gutter, sidewalks, driveways, and valley gutters shall be as per City Standard Details.

505.3.9 Tolerances

1. Concrete Curb and Gutter - On straight sections, the top surface of the forms shall not vary more than one-quarter (1/4) inch in ten (10) feet from the established grade and the inside face of forms shall not vary more than one-quarter (1/4) inch in ten (10) feet from the established alignment. On curved sections, the top surface of the forms shall not vary more than one-quarter (1/4) inch from a true arc. The use of straight sections of forms acting as chords on curved sections will not be permitted.

2. Sidewalk, Driveways, and Valley Gutters - Final finish for sidewalk, driveways, and valley gutters shall be such that there will be no surface deviations exceeding one-quarter (1/4) inch when tested with a ten (10) foot straightedge in every direction. In addition, sidewalk, driveway, and valley gutter construction, including pedestrian ramps shall comply with the American Disabilities Act of 1990, PROWAG and shall follow City Standard Drawings for ADA ramps as contained in the plans.

505.3.10 Curing

1. General - Water curing or curing with a moist earth cover will not be allowed due to difficulty in maintaining this type of curing. Concrete pavement, floors, slabs, top and bottom slabs of concrete box culverts, sidewalks, footpaths, curb and gutter, driveways, valley gutters, and other horizontal or sloped surfaces shall be cured by one of the following methods:
 - A. Spraying method
 - B. Sheet Plastic Method
 - C. Impervious Membrane (curing compound) - On surfaces that are the face of a construction joint, the membrane method shall not be used.

All exposed surfaces of formed concrete members, unless the forms are left in place to cover the surface, shall be cured for not less than seven (7) days where standard Portland cement is used. If high-early strength Portland cement concrete is used, it shall be cured for not less than three (3) days.

2. Methods
 - A. Spraying - Curing compound shall conform to ASTM C 309 and shall be applied after surface water has disappeared from the concrete surfaces.
 - B. Sheet Plastic Method - After the final finishing operation and the concrete has set up sufficiently prevent marring the surface, the top of the slab and sides (if exposed) shall be entirely covered with waterproof paper or polyethylene sheets conforming to previously stated material specifications. The units as used shall be lapped at least eighteen (18) inches. The material used shall be placed and weighted so that it to remain in intimate contact with the covered surface. The material used shall also remain in place for at least seven (7) days, unless otherwise provided. This material shall extend beyond the edges of the slab for at least twice the thickness of the slab. All overlapping sections must be secured by suitable means such that they do not open-up or separate during the curing process.
 - C. Impervious Membrane - Clear or translucent impervious membrane curing compound shall be used for all concrete surfaces when this method is selected. White pigmented curing compound shall be used for all riding surfaces. All areas slated for curing compound, shall be finished before application of the compound. The impervious

membrane curing compound shall conform to previously stated materials specifications. During the curing period, the concrete shall be protected.

The minimum rate of application shall be one (1) gallon of liquid for three hundred (300) square feet or as recommended by the manufacturer. All concrete cured by liquid curing compound shall receive two (2) applications of said compound. The first application shall be applied immediately after acceptance of the visible concrete finish by the City Engineer or designee.

When the formwork is removed a first application of curing compound shall be applied to exposed concrete. If the surface has dried, the concrete shall be thoroughly wetted with clean water and then the curing compound shall be immediately applied after the water surface film disappears. The second application shall be applied immediately after the first application has set. During curing operations, any unsprayed surfaces shall be kept wet with water.

The coating shall be protected against marring or traffic for a period of not less than seven (7) days after application. Any coating that is marred or otherwise disturbed shall be given an additional coating. When using impervious curing compound, the material shall be thoroughly mixed using air, within one (1) hour before use, to recombine any materials that may have become separated. When the use of impervious curing compound results in a streaked or blotchy appearance, the application shall be discontinued and water curing shall be applied until the cause of the defect in appearance has been corrected.

- D. Leaving Forms in Place - Curing of formed surfaces may be accomplished by leaving the forms in contact with the concrete surfaces for a period of seven (7) days. The forms will be required to be kept continuously moist during periods of hot, dry, or windy weather.
- E. Alternate Methods - Upon written approval by the City Engineer or designee, the Contractor may use methods other than mentioned herein for concrete curing. If other methods are used, those methods must prevent moisture loss from the concrete for a period of no less than seven (7) days. This is at the Contractor's expense and own risk.

505.3.10 Joints

Jointing of concrete curb and gutter, sidewalks, driveways, and valley gutters shall be as per City Standard Details.

505.3.11 Removal of Forms

1. Load-Bearing Forms – Forms and shoring shall not be removed until the seven (7) day test cylinders (or if approved by the City Engineer or designee, the three (3) day test cylinders) have an average compressive strength of at least 66% of the required strength.

2. Non-Bearing Forms – Forms shall remain in place until the concrete has had sufficient time to set up and will not slump or deform upon removal of the form.

If forms and shoring are removed prior to the end of the concrete curing period specified in Section 505.3.10, any exposed concrete surfaces shall continue to be cured for the entire duration of the curing period.

505.3.12 Backfilling Against Concrete

1. Load-Bearing Structures - nothing shall be placed on or against the concrete until the seven (7) day test cylinders (or if approved by the City Engineer or designee, the three (3) day test cylinders) have an average compressive strength of at least 66% of the required strength.
2. Non-Bearing Structures - backfill material shall not be placed against the concrete until there has been time for an adequate average strength to support the load imposed on the concrete.

505.3.13 Patching and Regrading

1. Patching - The Contractor shall be required to patch asphalt pavement adjacent to constructed or reconstructed curb and gutter in accordance with Section 470 Patching Asphalt Pavements. This work shall be incidental to unit price for curb and gutter work for those areas unless otherwise specified.
2. Regrading - The Contractor will be required to maintain a neat work area and replace adjacent surfaces to match new construction with similar materials to the conditions before the construction work began.

505.3.14 Cleaning

The Contractor shall, at their own expense and as directed by the City Engineer or designee, immediately remove from all public and private property all temporary structures, rubbish, debris, or any waste materials resulting from their operations. The entire site in a condition as least as neat as when construction operations commenced as directed by the City Engineer or designee. Concrete washouts shall comply with the SWPPP for the project.

505.3.15 Concrete Sampling and Testing

All testing of material will be done in accordance with the current edition of the NMDOT Standard Specifications Section 900, Quality Criteria, including the T/LPA Special Provision for section 906, [Minimum Testing Requirements \(MTRs\)](#), and the contract plans. Any deviation from these specifications must be approved by the City Engineer or designee.

1. Certifications

The contractor shall submit Certificates of Compliance to the City Engineer or designee before incorporating material in the work and shall ensure each Certificate of Compliance contains the information in section 106.4 of the NMDOT T/LPA Section 100's 2019 Edition, Certificates of Compliance.

The Contractor shall submit all material certification documentation with the Materials Certification of Compliance Cover Letter, Form A-1088.

2. Testing

- A. The Contractor shall furnish whatever labor, assistance, and cooperation is necessary to facilitate proper concrete sampling that may be conducted by the Contractor or Agency at the Contractor’s expense.
- B. Testing for compliance before and during the progress of the work will be performed by an approved independent testing laboratory. If the Contractor chooses to modify the material in the truck by adding water or any other means, they must do so at their own risk and before the sampling and testing takes place. A compressive test shall be considered as the average strength of two (2) cylinders at twenty-eight days.
- C. Failure to meet specified limits shall constitute questionable concrete, and additional tests from hardened concrete shall be performed. If the concrete placed does not conform to these Specifications, measures prescribed by the City Engineer or designee shall be taken to correct the deficiency at no additional cost to the City.
- D. Additional specimens cured under job conditions may be required when, in the opinion of the City Engineer or designee, there is a possibility of the surrounding air temperature falling below 40°F or rising above 90°F.
- E. Tests shall be distributed throughout the work to be representative of all the work.

500.4 METHOD OF MEASUREMENT

Concrete curbing and curb and gutters, and valley gutters shall be measured by the linear foot per each type specified in the plans.

Concrete curb ramps, sidewalks, and driveways shall be measured by the square foot per each type of improvement.

500.5 BASIS OF PAYMENT

Payment for concrete curbing, curb and gutters, and valley gutters at the contract unit price per linear foot of each type shall be considered a complete in-place payment and include, among other things, all materials, equipment, and labor required in the final grading, subgrade preparation and/or subgrade compaction, placing, finishing, curing, bituminous patching, backfilling, filling of cavities, and cleanup.

Pay Item	Pay unit
Concrete Curbing*	Linear Foot
Concrete Curb and Gutter*	Linear Foot
Valley Gutter*	Linear Foot

Payment for concrete curb ramps, sidewalks, and driveways at the contract unit price per square yard of each type shall be considered a complete in-place payment and include, among other things, all materials, equipment, and labor required in the final grading, subgrade preparation and/or subgrade compaction, reinforcing steel when required in the plans, placing, finishing, curing, bituminous patching, backfilling, and cleanup.

Pay Item	Pay Unit
Concrete Curb Ramp*	Square Yard
Concrete Sidewalk*	Square Yard
Concrete Driveway*	Square Yard

*Specify size and type.