

**UNIFORM STANDARD SPECIFICATIONS
CLARK COUNTY AREA**

SPECIFICATION - YEAR 2006 REVISIONS

Section	Title	Nature of Change	Page Number	Effective Date
105	Control of Work	Revision to Subsection 105.17, "Claims For Adjustment and Disputes" to clarify to the contractor that all documents must be submitted at the same time and certified as accurate.	105-8 - 105-9	1/1/2006
107	Legal Relations And Responsibilities To The Public	Addition of Subsection 107.22 "Vibratory Equipment Operations" to address the use of vibratory equipment operations on construction projects.	107-10-107-11	7/1/2006
501	Portland	Revision to Subsection 501.03.04, "Classification and Proportions" to delete the grading limits table and insert a reference to the same table which is in Subsection 706.02.01.	501-6- 501-7	1/1/2006
613	Concrete Curb, Walk, Gutters, Driveways, and Alley Intersections	Revision to Subsection 613.03.06, "Slip Forms" to replace reference to California State Specification with proposed Subsection 728.03.11.	613-3 - 613-4	1/1/2006
707	Joint Material	Revision to Section 707, "Joint Materials" to address requirements of the Clark County Regional Flood District.	707-1 - 707-8	1/1/2006
716	Sign Materials	Revision to Section 716, "Sign Materials" to revise the reflective sheeting requirements for traffic control devices and signs used in work zones.	716-1 - 716-6	1/1/2006

review prior to the planned hauling. Approval will be based on a review of the shoring details and a physical inspection of the shoring complete and in place.

The engineer shall make sufficient checks to satisfy himself that the Contractor is complying with all limitations, and any violation shall result in denying the Contractor use of the structure until the violation has been corrected to the satisfaction of the Engineer.

The provision that the Contractor may haul construction loads greater than legal loads on new structures shall not relieve the Contractor of his responsibility for all damage caused by his hauling equipment.

The Engineer may, for the protection of the traveling public, establish speed limits on or adjacent to the project. Such limitations of speed shall be strictly observed by the Contractor.

105.14 MAINTENANCE DURING CONSTRUCTION: The Contractor shall maintain the work during construction and until the project is accepted, except as provided for in Subsection 104.04, "Maintenance of Traffic," and 107.15, "Relief from Maintenance and Responsibility." This maintenance shall constitute continuous and effective work prosecuted day by day, with adequate equipment and forces to the end that the roadway and structures are at all times, to be kept in a condition satisfactory to the Engineer.

In the case of a contract for the placing of a course upon a course or subgrade previously constructed, the Contractor shall maintain the previous course or subgrade during all construction operations.

Except as provided for in Subsection 104.04, "Maintenance of Traffic," and 107.15 "Relief from Maintenance and Responsibility," all costs of maintenance work during construction and before the project is accepted shall be included in the unit prices bid on the various pay items and the Contractor will not be paid an additional amount for such work.

105.15 FAILURE TO MAINTAIN ROADWAY OR STRUCTURE: If the Contractor, at any time, fails to comply with the provisions of Subsection 105.14, "Maintenance During Construction," the Engineer will immediately notify the Contractor in writing of such noncompliance. If the Contractor fails to remedy unsatisfactory maintenance within twenty-four (24) hours after receipt of such notice, the Engineer may immediately proceed to maintain the project, and the entire cost of this maintenance will be deducted from money due or to become due the Contractor.

If a condition develops that is dangerous to public safety in the opinion of the Engineer, such condition may be immediately remedied with whatever means is available and the cost of this maintenance will be deducted from money due or to become due to the Contractor.

105.16 FINAL ACCEPTANCE: Upon due notice from the Contractor of presumptive completion of the entire project, the Engineer will make an inspection and if all construction and final cleanup provided for and contemplated by the contract is found completed to his satisfaction, that inspection shall constitute the final inspection and the Engineer will so advise the governing body or commission, who will notify the Contractor in writing of the acceptance of the contract as of the date of the final inspection. Such notice will not be given to the board or commission until all work has been completed to the satisfaction of the Engineer.

105.17 CLAIMS FOR ADJUSTMENT AND DISPUTES: If, in any case, the Contractor deems that additional compensation is due him for work or material not clearly covered in the contract or not ordered by the Engineer as extra work as defined herein, the Contractor shall notify the Engineer in writing of his intention to make claim for such additional compensation before he begins the work on which he bases the claim. If such notification is not given, and the Engineer is not afforded proper facilities by the Contractor for keeping strict

account of actual cost as required, then the Contractor hereby agrees to waive any claim for such additional compensation. Such notice by the Contractor, and the fact that the Engineer has kept account of the cost as aforesaid, shall not in any way be construed as proving or substantiating the validity of the claim. If the claim, after consideration by the Engineer, is found to be just, it will be paid as extra work as provided herein for "Force Account" work. Nothing in this subsection shall be construed as establishing any claim contrary to the terms of Subsection 104.02, "Increased or Decreased Quantities and Change in Character of Work."

For all claims, the Contractor shall certify in writing that the claim is made in good faith, that the supporting data are accurate and complete to the best of Contractor's knowledge and belief, and that the amount requested accurately reflects the Contract adjustment for which the contractor believes the Owner is liable. Subcontractor claims shall not be considered except as submitted by the Contractor as the Contractor's claims.

Any controversy or claim arising out of or relating to this contract which cannot be resolved by mutual agreement shall be settled by arbitration in accordance with the Rules of the American Arbitration Association.

to a minimum, and that services rendered by those parties will not be unnecessarily interrupted. The Contractor will be held responsible for the protection of the property of public or private utilities within the limits of the work.

In general, the repair and adjustment of street structures such as water lines, sewers, telephone, telegraph, gas, and electric lines, above or below the ground, will be made by the owners thereof as specified in Subsection 105.06, Paragraph 11. When included in the proposal, the adjustment of sewer manhole frames and covers, inlets and catch basin frames and covers and the like, will be within the Contractor's responsibility. The Contractor shall see that they are adjusted to conform to the lines, grades, and typical cross sections as shown on the plans, or as prescribed, without respect to whether the repairs and the roughing-in work have been performed by the Contractor or others.

Pipes or other construction shall be maintained in continuous service as far as practicable and shall be properly protected and supported. In no case shall interruption of the water service be allowed to exist outside of working hours.

Fire hydrants shall be accessible at all times to the fire department. No material or other obstruction shall be placed closer to a fire hydrant than permitted by ordinances, rules, or regulations, or within 15 feet (4.6 meters) of the fire hydrant in the absence of such ordinances, rules, or regulations.

The Contractor shall give notice in writing to the proper authorities in charge of streets, gas, water pipes, sewer lines, electric, and other conduits, railroads, poles, manholes, catch basins, and all other property that may be affected by the Contractor's operations, at least forty-eight (48) hours before breaking ground.

In the event of interruption to water or utility services as a result of accidental breakage, the Contractor shall promptly notify the proper authority. He shall cooperate with said authority in the restoration of service as promptly as possible.

Attention is directed to Subsection 105.06, "Cooperation with Utilities."

107.18 FURNISHING RIGHT-OF-WAY: The Contracting Agency will be responsible for the securing of all right-of-ways shown in the plans. Any exceptions will be indicated in the contract.

107.19 PERSONAL LIABILITY OF PUBLIC OFFICIALS: In carrying out any of the provisions of these specifications or in exercising any power or authority granted to them by or within the scope of the contract, there shall be no liability upon the officers or employees of the Contracting Agency, either personally or as officials of the County or Municipality, it being understood that in all such matters they act solely as agents and representatives of the Political Subdivision.

107.20 NO WAIVER OF LEGAL RIGHTS: The Contracting Agency shall not be precluded or estopped by any measurements, estimate, or certificate made either before or after the completion and acceptance of the work and payment therefor, from showing the true amount and character of the work performed, and materials furnished by the Contractor, nor from showing that any such measurement, estimate, or certificate is untrue or is incorrectly made, nor that the work or materials do not in fact conform to the contract. The Contracting Agency shall not be precluded or estopped, notwithstanding any such measurement, estimate, or certificate, and payment in accordance therewith, from recovering from the Contractor or his sureties, or both, such damages as it may sustain by reason of his failure to comply with the terms of the contract. Neither the acceptance by the Contracting Agency, or any representative of the Contracting Agency, nor any payment for or acceptance of the whole or any part of the work, nor any extension of time, nor any possession taken by the Contracting Agency, shall operate as a waiver of any portion of the contract or of any power herein reserved, or of any right to damages. A waiver of any breach of the contract shall not be held to be a waiver of any other or subsequent breach.

107.21 DUST CONTROL: Dust that originates from the Contractor's operations either inside or outside the right-of-way, shall be controlled at all times by the Contractor in accordance with Federal, State and local laws, ordinances and regulations at the sole expense of the Contractor.

A permit from the Clark County Air Pollution Officer shall be obtained by the Contractor prior to the start of construction operations.

Reference is made to Section 637, "Pollution Control."

107.22 VIBRATORY EQUIPMENT OPERATIONS: All construction activities involving vibratory equipment shall be conducted by the contractor on a performance basis. The contractor may be required to conduct impact assessment test of their vibratory equipment prior to initiation or during construction. The frequency and amplitude of the vibratory equipment shall be calibrated and used to measure ground velocity for conformance to the current regulatory limit of 0.5 inch per second peak ground velocity at the nearest affected structure. The measurements shall comply with the recommendations of the "Office of Surface Mining, Blasting Guidance Manual, 1987."

TABLE 1

Class of Concrete	Cement Range		Kg. Per Cubic Meter	Coarse Min. Agg. Size No.	Compressive Strength (28 Day)		Slump Range		Air Range %	Unit Weight Variation	
	Sacks Per Cubic Yard	ASTM C 143			PSI	Mpa	Inches**	Centimeters		Pounds	Kg.
A	6.0 - 7.5	334 - 419	467	20.7	1 - 4	2.5 - 10	--	±3	1.4	General use	
AA	6.0 - 7.5	334 - 419	467	20.7	1 - 4	2.5 - 10	4 - 7	±3	1.4	General use	
D	6.0 - 7.5	334 - 419	67	20.7	1 - 4	2.5 - 10	--	±3	1.4	General use	
DA	6.0 - 8.0	334 - 446	67	20.7	1 - 4	2.5 - 10	4 - 7	±3	1.4	General use	
E	6.0 - 7.5	334 - 419	57	20.7	1 - 4	2.5 - 10	--	±3	1.4	Reinforced sections	
EA	6.0 - 8.0	334 - 446	57	20.7	1 - 4	2.5 - 10	4 - 7	±3	1.4	curbs, etc.	
PAA	6.0 - 8.0	334 - 446	67	Specified on Plans	0 - 4	0 - 10	Specified on Plans	±3	1.4	Prestressed Members	
Modified A & AA	6.0 - 8.0	334 - 446	467	Specified on Plans	1 - 4	2.5 - 10	4 - 7 (AA only)	±3	1.4	Where specified on plans	
Modified D & DA	6.0 - 8.0	334 - 446	67	Specified on Plans	1 - 4	2.5 - 10	4 - 7 (DA only)	±3	1.4	Where specified on plans	

* NOTE: Based on aggregate in a saturated dry condition.

** NOTE: When the deck of a structure is used as a riding surface, the slump shall conform to that specified in Subsection 409.03.01, "Classification and Proportions." The difference in slump, determined by comparing slump tests on two samples of mixed concrete for each individual batch tested, shall not exceed two (2) inches (5) centimeters). When the difference in slump does exceed two (2) inches (5 centimeters), procedure and equipment used in producing the concrete shall be adjusted to reduce the difference in slump to not more than two (2) inches (5 centimeters).

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Samples will not exceed five hundred (500) pounds (200 kilograms) for each separate grading.

Before beginning concrete work, the Contractor shall submit in writing to the Engineer the proposed concrete mix design giving the cement factor in sacks per cubic yard (cubic meter) indicating the proportions of cement, water, admixtures and the gradation of the primary aggregate nominal sizes which he proposes to furnish. When the primary coarse aggregate is separated into two sizes, the gradation shall consist of the gradation for each individual size, and the proposed proportions of each individual size, combined mathematically with the fine aggregate to indicate one proposed gradation. Such gradation shall meet the grading requirements of Subsection 706.02.01 of these specifications (Not applicable to light weight concrete). If the Contractor proposes to use an admixture other than an air-entraining agent, he shall state its complete brand name and the quantity proposed to be used per sack of cement.

Portland cement concrete shall be proportioned using the aggregates tested such that the compressive strength requirements in Table 1 of this subsection will be satisfied. The Contractor shall give the Engineer advance notice in writing when any changes are to be made in the batch proportions.

Batches of concrete shall not vary more than \pm three (3) pounds per cubic foot (\pm 48 kilograms per cubic meter) in unit weight from design mix. The cement factor of any individual batch placed in the work shall not be more than 0.15 sack per cubic yard less, nor more than 0.25 sack per cubic yard (8.4 kilograms per cubic meter less or 14.0 kilograms per cubic meter more) greater than the designated factor (sacks of cement per cubic yard) (kilograms of cement per cubic meter). The weights used may be varied as necessary to comply with the above tolerances in cement factor and unit weight.

501.03.05 PROPORTIONING METHODS: Except as hereinafter noted, aggregate bins shall conform to either (a) or (b) as follows:

- (a) Each specified size of aggregates shall be stored in a separate bin. Except as hereinafter specified, each bin shall be provided with an individual outlet gate, designed and constructed to prevent leakage when closed. The gates shall cut off quickly and completely.
- (b) Each size aggregate shall be weighed individually in a single bin, providing there is a satisfactory method employed to eliminate any excess material resulting from over-charging of the bin before the material reaches the surge hopper.

(a) and (b) above will not be required when batching for culvert headwalls, manholes, small boxes, sidewalks, etc., and the total quantity of concrete called for on the project does not exceed 300 cubic yards (229 cubic meters).

All aggregates for use in Portland cement concrete shall be proportioned by weight, with the exception that aggregates for culvert headwalls, short pieces of curb and gutter, or small sections of sidewalk and related minor work may be proportioned either by weight or volume as the Contractor may elect. Measuring boxes of known capacity shall be furnished and used to measure each size of aggregate proportioned by volume. Batches requiring fractional sacks of cement will not be permitted, unless the Contractor elects to weigh the cement in each batch.

Bulk cement shall be weighed separately when the batch is one (1) cubic yard (cubic meter) or more. The scale and weigh hopper for the cement shall be separate and cement hopper shall be interlocked against opening before the full amount of cement is in the hopper, against closing before the contents of the hopper are entirely discharged and the scales are back in balance, and against opening when the amount of cement in the hopper is underweight by more than one (1) percent of the amount specified. An interlock system will not be required on projects having less than three hundred (300) cubic yards (229 cubic meters) in the bid schedule.

Scales utilized in the proportioning device may be of the springless dial type or of the multiple beam type.

If of the dial type, the dial shall be of such size and so arranged that it may be read easily from the operating platform.

If of the multiple beam type, the scales shall be provided with an indicator operated by the main beam which will give positive visible evidence of over or under weight. The indicator shall be so designed that it will operate during the addition of the last four hundred (400) pounds (180 kilograms) of any weighing. The over travel of the indicator hand shall be at least one-third of the loading travel. The indicator shall be enclosed against moisture and dust.

Weighing equipment shall be insulated against vibration or movement of other operating equipment in the plant. When the entire plant is running, the scale reading and cutoff shall not vary from the weight designated by more than one (1) percent for cement and one and one-half (1-1/2) percent for any size aggregate, nor one and one-half (1-1/2) percent for the total aggregate in any batch.

Scales shall be approved with a certificate of inspection as required by Subsection 109.01, "Measurement of Quantities."

Should separate supplies of aggregate and material of the same size group, but of different moisture content or specific gravity be available at the proportioning plant, withdrawals shall be made from one supply exclusively and the material therein completely exhausted before starting upon another.

Stockpiled aggregates shall be in a saturated surface dry condition just prior to batching. The moisture content of the aggregate shall be such that no visible separation of moisture and aggregate will take place during transportation from the proportioning plant to the point of mixing. Aggregate containing excess moisture shall be stockpiled prior to use until sufficiently dried to meet the above requirements.

Batches with cement in contact with damp aggregates shall be mixed within thirty (30) minutes after being proportioned. Batch trucks hauling more than one (1) batch of cement and aggregate shall be so constructed that materials do not flow from one compartment to another during haul or discharge.

Coarse and fine aggregate shall be handled and measured separately. Each bag of cement shall contain ninety-four (94) pounds (42.5 kilograms) net and shall be emptied directly into the charging skip of the mixer. Water shall be measured either by volume or by weight.

The equipment for measuring and supplying the water to the mixer shall be so constructed and arranged that the amount of water added to the mixture can be measured in one operation into the mixing drum without dribbling. The equipment shall be so designed that water from the source of supply cannot enter the measuring tank while the water is being discharged from the measuring tank into the mixer. Tanks or other equipment for measuring and discharging water into the mixer shall be sufficiently accurate that the amount of water delivered to the mixer for any batch shall not vary more than one (1) percent from the required quantity of water for any position of the mixer with respect to a level plane. The tanks or other equipment shall be so arranged as to permit the checking of the amount of water delivered by discharging into measured containers.

501.03.06 MACHINE MIXING: Concrete manufactured by any procedure which results in any unmixed lumps of cement in the mixed product shall be rejected.

The Engineer shall be provided with a legible ticket with each load of concrete delivered to the contract which shall contain the following information:

Name of Vendor
Name of Contractor
Number of Cubic Yards in the Load
Actual Weights of Cement and of each Size of Aggregate
Amount of Water Added at the Plant
Amount of Water in the Aggregate
Brand and Type of Cement
Brand and Amount of Admixture
Time and Date of Batching

When mix proportions have been designated for a project and are identified by number, the Engineer may waive the foregoing and accept a legible ticket which shall contain the following information:

Name of Vendor
Name of Contractor
Number of Cubic Yards in the Load
. Mix Designation Number
Amount of Water Added at the Plant (including Water in Aggregates)
Time and Date of Batching

Space shall be provided on the ticket so the amount of water added on the job may be indicated.

- (a) **General.** All concrete shall be mixed in mechanical mixers, except that when permitted by the Engineer, batches not exceeding one-third (1/3) cubic yard (1/3 cubic meter) may be mixed by hand methods in accordance with the provisions of Subsection 501.03.07, "Hand Mixing." Mixers shall have legible permanently attached plates showing manufacturer's rated capacity, mixing speeds, and serial number.

Mixers may be stationary mixers or truck mixers. Agitators may be truck mixers operating at agitating speed or truck agitators. Each mixer and agitator shall have attached thereto in a prominent place a metal plate or plates on which is plainly marked the various uses for which the equipment is designed, the manufacturer's guaranteed capacity of the drum or container in terms of the volume of mixed concrete and the speed of rotation of the mixing drum or blades.

The Contractor, at his expense, shall furnish samples of the fresh concrete and provide safe and satisfactory facilities for obtaining the samples.

Concrete mixers may be of the revolving drum or the revolving blade type and the mixing drum or blades shall be operated uniformly at the mixing speed recommended by the manufacturer.

The temperature of materials as charged into the mixer shall be such that the temperature of the mixed concrete at the time it is placed in final position is not less than fifty (50) degrees F. nor more than ninety (90) degrees F. (10 degrees C. nor more than 32 degrees C.) as specified in Subsection 501.03.10(b). Aggregates and water used for mixing shall not exceed one hundred fifty (150) degrees F. (66 degrees C.).

Concrete for structures shall be mixed for a period of not less than sixty (60) seconds nor more than five (5) minutes after all materials, including water, are in the mixer.

Cement shall be batched and charged into the mixer by means that will not result either in loss of cement due to the effect of wind, or an accumulation of cement on surfaces of conveyors or hoppers, or in other conditions which may vary the required quantity of cement in the concrete mixture.

Stationary mixers having a capacity of one (1) cubic yard (1 cubic meter) or more and all paving mixers shall be operated with an automatic timing device that can be locked by the Engineer. The time device and discharge mechanisms shall be so interlocked that during normal operations no part of the batch will be discharged until the specified mixing time has elapsed.

The total elapsed time between the intermingling of damp aggregates and cement and the start of mixing shall not exceed thirty (30) minutes.

Mixers and agitators which have an accumulation of hard concrete or mortar or worn blades shall not be used.

When central-mixed concrete is furnished and non-agitating hauling equipment is used for transporting concrete to the delivery point for Portland cement concrete pavement, discharge into the laydown machine shall be completed within forty-five (45) minutes after the addition of the cement to the aggregates.

- (b) **On-Site Mixed Concrete.** When mixing at the site of the work, the mixers used shall be of the paving or stationary type. The size of batch shall not exceed the rated capacity as determined by the standard requirements of the Associated General Contractors of America, except that in paving mixers when used for Portland cement concrete pavement, concrete slope protection and curbs and sidewalks, the size of the batch may exceed the rated capacity of the mixer as determined by the standard requirements of the Associated General Contractors of America to a total of 32.4 cubic feet (0.92 cubic meter) in 27 E mixers and 40.8 cubic feet (1.15 cubic meters) in 34 E mixers, provided that all parts of the mixer will hold the overcharge without spillage, that the uniformity and strength of the resulting concrete is not reduced, and provided further that when paving mixers are operating on grades in excess of six (6) percent, the size of batch shall not exceed 29.7 cubic feet (0.84 cubic meter) in 27 E mixers nor 37.4 cubic feet (1.06 cubic meters) in 34 E mixers.
- (c) **Ready-Mixed Concrete.** Ready-mixed concrete shall be either central-mixed, shrink-mixed or transit-mixed concrete. Shrink-mixed concrete is that which has been mixed partially in a stationary mixer and the mixing completed in a truck mixer.

The size of batch in truck mixers and truck agitators shall not exceed the rated capacity as determined by the current Standard Requirements of Truck Mixer Manufacturers Bureau. The size of batch in stationary mixers shall not exceed the rated capacity of the mixer as determined by the standard requirements of the Associated General Contractors of America. No batches requiring fractional sacks of cement will be permitted unless all of the cement is weighed when added to the batch.

If the use of ready-mixed concrete is approved, the producers shall use only that cement approved by the Contracting Agency for use on the project. Contracting Agency approved cement shall be stored at the concrete plant in such a manner that it can be identified and kept separate from other cement.

Ready-mixed concrete for structures shall be transported in truck mixers or truck agitators.

The mixer, when loaded to capacity, shall be capable of combining the ingredients of the concrete within the specified time, into a thoroughly mixed and uniform mass and of discharging the concrete with a satisfactory degree of uniformity. The agitator, when loaded to capacity, shall be capable of maintaining the mixed concrete in a thoroughly mixed uniform mass and of discharging the concrete with a satisfactory degree of uniformity.

Mixers and agitators shall be examined periodically for changes in condition due to accumulation of hardened concrete or mortar or to wear of the blades. When any such change in condition is found, the concrete should be subjected to the slump tests. If the tests indicate that the concrete is not being properly mixed, the faulty equipment shall be corrected before its further use is allowed.

Truck mixers shall be equipped with electrically or mechanically actuated revolution counters by which the number of revolutions of the drum or blades may be readily verified. The counters shall be of the continuous-registering, non-resettable type, which accurately register the number of revolutions, and shall be mounted on the truck mixer so that the Engineer may safely and conveniently inspect them from alongside the truck.

When a truck mixer is used, each batch of concrete shall be mixed for not less than seventy (70) nor more than one hundred (100) revolutions of the drum or blades at the rate of rotation designated by the manufacturer of the equipment as mixing speed. If any additional mixing is done, it shall be at the speed designated by the manufacturer of the equipment as agitating speed.

When shrink-mixed concrete is furnished, concrete that has been partially mixed at a central plant shall be transferred to a truck mixer and all requirements for transit-mixed concrete shall apply. No credit in the number of revolutions at mixing speed shall be allowed for partial mixing in a central plant.

No additional mixing water shall be incorporated into the concrete during hauling or after arrival at the delivery point, unless permitted by the Engineer. If the Engineer permits additional water to be incorporated into the concrete, the drum shall be revolved not less than thirty (30) revolutions at mixing speed after the water is added and before discharge is commenced.

The rate of discharge of mixed concrete from truck mixer-agitators shall be controlled by the speed of revolution of the drum in the discharge direction with the discharge gate fully open.

When truck mixer or truck agitator is used for transporting concrete that has been completely mixed in a stationary mixer, mixing during transportation shall be at the speed designated by the manufacturer of the equipment as agitating speed.

When a truck mixer or agitator is used for transporting concrete, the concrete shall be delivered to the site of the work and discharge shall be completed within ninety (90) minutes after the introduction of the mixing water to the cement and aggregates, or the introduction of the cement to the aggregates. In hot weather, or under conditions contributing to quick stiffening of the concrete as determined by the Engineer, a delivery time of less than ninety (90) minutes may be required. When a truck mixer is used for the complete mixing of the concrete the mixing operations shall begin within thirty (30) minutes after the cement has been intermingled with the aggregate.

If the mixing plant is such a distance from the site of the work that is not practical to have the mixed concrete delivered and placed in forms within the time limit specified, cement and water shall not be added until such time as requirements can be complied with.

The organization supplying concrete shall have sufficient plant capacity and transporting apparatus to insure continuous delivery at the rate required. The rate of delivery of concrete shall be used as to provide for the proper handling and placing of concrete. An interval of more than forty-five (45) minutes between any two consecutive batches or loads, or a delivery and placing rate of less than eight (8) cubic yards (6 cubic meters) of concrete per hour shall constitute cause of shutting down work for the remainder of the day, and if so ordered by the Engineer, the Contractor shall make, at his own expense, a construction joint at the location and of the type directed by the Engineer in the concrete already mixed.

After mixing of ready-mixed concrete has been completed, it shall be agitated continuously at agitating speed until it has been discharged from the drum.

501.03.07 HAND MIXING: Hand mixing shall not be permitted, except in case of an emergency or under written permission of the Engineer. When permitted, it shall be done only on watertight platforms. The sand shall be spread evenly over the platform and the cement spread upon it. The sand and cement shall then be thoroughly mixed while dry by means of shovels until the mixture is of uniform color, after which it shall be formed into a "crater" and water added in the amount necessary to produce mortar of the proper consistency. The material upon the outer portion of the "crater" ring shall then be shoveled to the center and the entire mass turned and sliced until a uniform consistency is produced. The coarse aggregate shall then be thoroughly wetted and added to the mortar and the entire mass turned and returned at least six (6) times and until all of the stone particles are thoroughly covered with mortar and the mixture is of a uniform color and appearance. Hand mixing will not be permitted for concrete to be placed under water.

501.03.08 RETEMPERING: Concrete shall be mixed only in such quantities as are required for immediate use and shall be placed before initial set has taken place. Any concrete in which initial set has begun shall be wasted and not used in the work. No retempering of concrete shall be allowed.

501.03.09 CURING:

- (a) **General.** All concrete shall be cured for the length of time hereinafter specified. If Type III cement is used, the curing time may be reduced as directed by the Engineer. In the event of low temperatures, the time will be increased according to the produce specified in Subsection 501.03.10(b), "Cold Weather."

Curing shall commence immediately upon completion of the finish. In the event that the application or placement of the curing medium is delayed, curing will be as described under (b) below.

- (b) **Water Method.** The concrete shall be kept continuously wet by the application of water for a minimum period of seven (7) days after the concrete has been placed.

The entire surface of the concrete shall be kept damp by applying water in the form of a fine fog mist, until the surface of the concrete is covered with the curing medium. The moisture from the nozzle shall not be applied under pressure directly upon the concrete and shall not be allowed to accumulate on the concrete in a quantity sufficient to cause a flow or wash the surface.

Cotton mats, rugs, carpets, or earth or sand blankets may be used as a curing medium to retain the moisture during the curing period. The cotton mats, rugs, or carpets shall be of such character that they will retain water.

- (c) **Curing Compound Method.** The entire surface of the concrete shall be sprayed uniformly with a curing compound. It shall be applied when just a light film of water is present on the surface. If the surface is dry, water shall be added as specified in (b) above before the curing compound is applied.

On decks or slabs cured by this method, foot traffic must be held to a minimum and these surfaces shall not be used as a work area during the cure period. Should the film of the compound be damaged before the expiration of seven (7) days, the damaged portions shall be repaired immediately with additional compound.

This method shall not be used on surfaces until all finishing is completed.

The curing compound shall be delivered to the work in ready-mixed form. At the time of use, the compound shall be in a thoroughly mixed condition with the pigment uniformly dispersed throughout the vehicle. The compound shall not be diluted or altered in any manner, unless dilution is recommended by the manufacturer.

Curing compound that has become chilled to such an extent that it is too viscous for satisfactory application shall be warmed to a temperature not exceeding one hundred (100) degrees F. (38 degrees C.).

The curing compound shall be applied to the exposed surface at a uniform minimal rate of one (1) gallon per one hundred fifty (150) square feet (1 liter per 3.7 square meters) of area.

- (d) **Waterproof Membrane.** The membrane shall be formed into sheets of such width as to provide a complete cover of the entire concrete surface. All joints in the sheets shall be securely cemented together in such a manner as to provide a waterproof joint. Overlap of sheets shall have a minimum lap of eighteen (18) inches (46 centimeters). The sheets shall be securely weighted down by placing a bank of earth on the edges of sheets or by other means satisfactory to the Engineer.

The curing membrane shall remain in place for a period of not less than seven (7) days.

Should any portion of the sheets be broken or damaged before the expiration of the curing period, the broken or damaged portion shall be immediately repaired with new sheets properly cemented into place, or water curing as described above shall commence immediately. Sections of the membrane shall not be used which have lost their waterproof qualities or have been damaged to such an extent as to render them unfit for curing.

- (e) **Form Method.** If forms are kept on the concrete surfaces, this will be considered adequate cure for these surfaces. However, should the forms be removed within seven (7) days after the concrete has been placed, one of the above methods must be used on the exposed surfaces.

Attention is directed to Subsection 502.03.11, "Removal of Falsework and Forms."

501.03.10 WEATHER LIMITATIONS:

- (a) **General.** If impending inclement weather conditions exist, the Contractor shall decide whether or not to begin the pour and he shall have sole responsibility for his decision. Before any concrete is placed, the Contractor shall have adequate provisions readily available as approved by the Engineer, to protect the concrete from any impending weather conditions. In case precipitation should occur after placing operations have started, the Contractor shall provide ample covering to protect the work. The placing of concrete shall be stopped before the quantity of precipitation is sufficient to cause a flow or to wash the surface.
- (b) **Cold Weather -- General.** All concrete shall be maintained at a temperature of not less than fifty (50) degrees F. (10 degrees C.) for three (3) days or not less than forty (40) degrees F. (4.4 degrees C.) for seven (7) days. The count of time shall commence immediately upon completion of final placement and vibration. The three (3) fifty (50) degree (10 degree C.) days need not be consecutive.

One twenty-four (24) hour period shall constitute one (1) day.

The temperature of the concrete shall be determined by placement of thermometers on the concrete surfaces and properly insulating said devices to record the surface temperature of the concrete. Temperature shall be monitored continuously throughout the total protection time required by this subsection. In case the surface temperature of the concrete falls below forty (40) degrees F. (4.4 degrees C.) for a duration of three (3) hours or more in any twenty-four (24) hour period during the time of temperature protection, the time shall be increased one (1) day for each day this occurs. An absolute minimum temperature of thirty-five (35) degrees F. (1.7 degrees C.) must be maintained for the total time of protection specified in this subsection. Should the temperature of the concrete fall below thirty-five (35) degrees F. (1.7 degrees C.) at any time, damage may occur. The assessment of damage will be determined by the Contracting Agency and concrete so damaged may require repair or replacement at the option of the Engineer.

The concrete shall have a temperature of at least fifty (50) degrees F. (10 degrees C.) and not more than ninety (90) degrees F. (32 degrees C.) at the time of placing. (Also see Subsection 501.03.06, "Machine Mixing"). Heating equipment or methods which alter or prevent the entrainment of the required amount of air in the concrete shall not be used. The equipment shall be capable of heating the materials uniformly. Aggregates and water used for mixing shall not be heated to a temperature exceeding one hundred fifty (150) degrees F. (66 degrees C.). Concrete containing frost or lumps at the time of placing shall not be used.

Stockpiled aggregates may be heated by the use of dry heat or steam. Aggregates shall not be heated directly by gas or oil flame or on sheet metal over fire.

Reinforcing steel shall be free of ice, snow or frost during placement of concrete. Concrete shall not be placed on frozen ground.

(c) Low Temperature Protection.

- (1) **General.** After the concrete has been placed, means shall be taken to protect the concrete from any impending low temperatures. Methods and materials not hereinafter prescribed may be used if approved by the Engineer and the following requirements adhered to:
 - (a) Materials shall be fire resistant
 - (b) Materials shall be waterproof
 - (c) Materials shall not adhere, abrade or damage the surface of the concrete.

Approval of the Engineer shall not relieve the Contractor from obtaining specification results.

- (2) **Insulating Blankets.** Insulating blankets used to protect concrete from low temperatures shall be fire resistant and waterproof. The blankets must be secured and overlapped along the edges and joints to insure that no opening will exist in the protection during high winds or other adverse conditions. Provisions shall be made to allow the reading of any thermometers placed inside of the protection. When depositing concrete against previously cast concrete, the blanket insulation shall extend at least fourteen (14) inches (36 centimeters) onto the existing concrete and shall be securely held in place.
- (3) **Low Temperatures Protection – Heating and Housing.** In order to meet the provisions of Articles (a) and (b) of this subsection, the concrete may be protected by applying artificial heat within an enclosure. The enclosure will be constructed with fire resistant material, unless otherwise directed by the Engineer, and shall be subject to his approval. The heating system shall be so arranged as to provide uniform heating, insuring that the concrete farthest from the source of heat is receiving adequate protection without drying the concrete near the source of heat so as to cause shrinkage cracks.

- (d) **Hot Weather.** The maximum temperature of cast-in-place concrete shall not exceed ninety (90) degrees F. (32 degrees C.) immediately before placement.

The consistency of the concrete as placed should allow the completion of initial finishing operations without the addition of water to the surface. When conditions are such that additional moisture is needed for initial finishing, the required water shall be applied to the surface fog spray only, and shall be held to a minimum amount. Fog spray for this purpose may be applied with hand-operated fog equipment, as approved by the Engineer.

From the time of initial strike-off until final finish is complete, the unformed surfaces of slab concrete shall be protected from rapid evaporation of mixing water from the concrete due to wind, high temperature, low humidity or combination thereof.

Equipment for fogging, type of evaporation retarder and method of application shall be approved by the Engineer. Equipment shall be portable, adapted for intermittent use and operable in the direction of any prevailing wind.

After all finishing operations are complete a final curing membrane shall be applied.

MORTAR

501.03.11 GENERAL: Cement mortar shall consist of a mixture of Portland cement, sand and water. Cement and sand shall first be combined in the proper proportions, and then thoroughly mixed with the required amount of water.

- (a) Cement mortar shall be designated by class and proportioned by loose volume as follows:

Designation	Proportions
Class "A" Mortar	1 Part Cement to 1 Part Sand
Class "B" Mortar	1 Part Cement to 1-1/2 Parts Sand
Class "C" Mortar	1 Part Cement to 2 Parts Sand
Class "D" Mortar	1 Part Cement to 2-1/2 Parts Sand
Class "E" Mortar	1 Part Cement to 3 Parts Sand
Class "F" Mortar	1 Part Cement to 3-1/2 Parts Sand

The quantity of water to be used in the preparation of mortar shall be only that required to produce a mixture sufficiently workable for the purpose intended.

Mortar shall be used as soon as possible after mixing and shall show no visible signs of setting prior to use. Retempering of mortar will not be permitted.

- (b) **Cement.** Cement shall conform to the requirements of Section 701.

- (c) **Sand.** Sand shall conform to the requirements of Subsection 706.03.04. In proportioning the sand it shall be measured loose (without shaking or compacting) in measuring boxes or other suitable containers of known capacity.
- (d) **Admixtures.** No admixture shall be used in mortar unless otherwise specified or approved by the Engineer.

501.04.01 BLANK:**BASIS OF PAYMENT**

501.05.01 PAYMENT: Portland cement concrete shall be measured and paid for in accordance with the provisions specified in the various sections of these specifications covering construction requiring concrete.

base, the surface shall be thoroughly cleaned and the adhesive specified below shall be applied. Cleaning of the pavement or base shall be accomplished by wire brushing or by blast cleaning if the latter method is ordered by the Engineer. The cleaned surface shall be free from dust, loose material or oil.

The adhesive shall consist of two (2) components which shall be mixed together at the site of the work and shall conform to the requirements of "Subsection 728.03.11, Binder (Adhesive), Structural Epoxy."

The grade for the top of the curb shall be indicated by an offset guide line set by the Contractor from survey marks established by the Engineer. The forming tube portion of the extrusion machine shall be readily adjustable vertically during the forward motion of the machine to provide when necessary, a variable height of curb conforming to the predetermined curb grade. A grade line gage or pointer shall be attached to the machine in such manner that a continual comparison can be made between the curb being placed and established curb grade as indicated by the offset guide line.

In lieu of the above method for maintaining the curb grade, the extrusion machine may be operated on rails or forms set at uniform depth below the predetermined finished top of the grade.

The top and face of the finished curb shall be true and straight, and the top surface of curbs shall be of uniform width, free from humps, sags, or other irregularities. When a straightedge ten (10) feet (3 meters) long is laid on the top or face of the curb or on the surface of gutters, the surface shall not vary more than 0.01 foot (0.30 centimeters) from the edge of the straightedge, except at grade changes or curves.

Crawler track driven extrusion machines shall not be used on finished course plantmix surface. Concrete shall be fed to the machine at a uniform rate. The machine shall be operated under sufficient uniform restraint to forward motion to produce a well compacted mass of concrete free from surface pits larger than three-sixteenths (3/16) inch (0.48 centimeters) in diameter and requiring no further finishing, other than light brushing with a brush filled with water only. Finishing with a brush application of grout will not be permitted.

Expansion joints shall be required at E.C. and B.C. of curb returns, and also along the line of work at regular intervals not to exceed three-hundred (300) feet (91 meters). Unless otherwise specified transverse weakened plane joints on curb and gutter produced by an extrusion machine shall be constructed at ten (10) feet (3 meters) intervals along the line of the work.

Weakened plane joints shall be constructed as specified in Subsection 613.03.10.

Expansion joints shall be constructed as specified in Subsection 613.03.09.

Curing of slip form curb, gutter, and sidewalk shall be done as specified in Subsection 613.03.15.

613.03.07 PLACING CONCRETE: Concrete shall be placed on a subgrade sufficiently dampened to insure that no moisture will be absorbed from the fresh concrete.

Concrete shall be placed in curb, gutter, and curb and gutter forms in horizontal layers not exceeding six (6) inches (15 centimeters) in thickness, each layer being spaded along the forms and thoroughly tamped. Concrete may be placed in layers of more than six (6) inches (15 centimeters) in thickness only when authorized by the Engineer and the spading and tamping is sufficient to consolidate the concrete for its entire length.

After the concrete for walk has been placed, a strike-off shall be used to bring the surface to the proper elevation when compacted. It shall be spaded along the form faces and tamped to assure a dense and compact mass, and to force the larger aggregate down while bringing to the surface not less than three-eighths (3/8) inch (1 centimeter) of free mortar for finishing purposes.

Concrete shall be placed in cross gutters in horizontal layers of not more than four (4) inches (10 centimeters) in thickness, each layer being spaded along the form faces and thoroughly tamped into a dense and

compact mass. If internal vibrators are used, the full specified thickness may be placed in one operation.

After the concrete has been placed and tamped, the upper surface shall be struck off to the specified grade.

613.03.08 JOINTS: Joints in concrete curb, gutter, and walk shall be designated as expansion joints and weakened plane joints.

613.03.09 EXPANSION JOINTS: Expansion joints shall be constructed in curbs, walk and gutter as shown on the plans, Standard Drawings or as specified herein. Such joints shall be filled with pre-molded joint filler conforming with the requirements prescribed in Section 707. No such joints shall be constructed in cross gutters, alley intersections or driveways except as may be approved by the Engineer.

One-half inch (1.3 centimeters) joints shall be constructed in curb and gutter at the end of all returns except where cross gutter transitions extend beyond the curb return, in which case they shall be placed at the ends of the cross gutter transition. No joints shall be constructed in returns. Where monolithic curb and gutter is constructed adjacent to concrete pavement, no expansion joints will be required except at E.C. and B.C. of curb returns.

Expansion joint filler one-half (1/2) inch (1.3 centimeters) thick shall be placed in walk at the E.C. and B.C. of all walk returns, around all utility poles which may project into the concrete along the line of the work, and in walk returns between the walk and the back of curb returns when required by the Engineer. At the E.C. and B.C. and around utility poles, the joint filler-strips shall extend the full depth of the concrete placed. Joint filler strips between walk and curb shall be the depth of the walk plus one (1) inch (2.5 centimeters) with the top set flush with the specified grade at the top of curb.

All expansion joint filler strips shall be installed vertically, and shall extend to the full depth and width of the work in which they are installed, and be constructed perpendicular to straight curb or radially to the line of the curb constructed on a curve. Expansion joint filler materials shall completely fill these joints to within one-fourth (1/4) inch (0.6 centimeters) of any surface of the concrete. Excess filler material shall be trimmed off to the specified dimension in a neat and workmanship manner. During the placing and tamping of the concrete, the filler strip shall be held rigidly and securely in proper position.

613.03.10 WEAKENED PLANE JOINTS: Weakened plane joints shall be straight and constructed in accordance with paragraphs (a) or (b) below, unless otherwise shown on the plans.

In walk, joints shall be transverse to the line of work and at regular intervals not exceeding ten (10) feet (3 meters). At curves and walk returns, the joints shall be radial.

In gutter, including gutter integral with curb, joints shall be at regular intervals not exceeding ten (10) feet (3 meters). Where integral curb and gutter is adjacent to concrete pavement, the joints shall be aligned with the pavement joints where practical.

- (a) **Control Joint.** After preliminary trowelling, the concrete shall be parted to a depth of two (2) inches (5 centimeters) with a straightedge to create a division in the coarse aggregate. The concrete shall be refloated to fill the parted joint with mortar. Headers shall be marked to locate the weakened plane for final joint finishing, which shall be accomplished with a jointer tool having a depth of one-half (1/2) inch (1.3 centimeters) and a radius of one-eighth (1/8) inch (0.3 centimeters). The finished joint opening shall not be wider than one-eighth (1/8) inch (0.3 centimeters).

SECTION 707

JOINT MATERIAL

SCOPE

707.01 MATERIAL COVERED: This specification covers the quality requirements for poured filler, preformed fillers, and resilient and rubber type gaskets used in the construction of bridges, culverts, sidewalks, etc.

PHYSICAL PROPERTIES AND TESTS

707.02 JOINTS: Materials for joints in concrete structures shall comply with the following:

707.02.01: The following materials shall be supplied and installed in weakened plane joints, contraction joints and construction joints when required by the engineer:

Joint Sealant Two component polyurethane pourable joint sealant (ACI 504R, Table 1, Type IV)

Sealant shall be able to expand and compress plus or minus 25 percent movement as the joint opens and closes. Sealant shall be self-leveling for flat surfaces and non-sagging for sloped and vertical joints. The sealant shall meet or exceed requirements of Table 1 below.

TABLE 1

MINIMUM REQUIREMENTS FOR POURABLE JOINT SEALER

Material Characteristics	Self-leveling	Non-sagging
Application Temperature	40 to 100 degrees F (4.4 to 37.8°C)	40 to 100 degrees F (4.4 to 37.8°C)
Service Range	-40 to 170 degrees F (-40.0 to 76.7°C)	-40 to 170 degrees F (-40.0 to 76.7°C)
Curing Rate	Tack-free Time: 1-2 hours Final Cure: 3-5 days	Tack-free Time: 6-8 hours Final Cure: 3 days
Tear Strength (ASTM D624)	---	45 lbs/in
Shore A Hardness (ASTM D2240)	45 +/- 5 (21 day)	25 +/- 5
Tensile Properties (ASTM D412) Tensile Strength Elongation Modulus of Elasticity (100%)	550 psi (3.79 MPa)(21 day) 700% (at break) 150 psi (1.03 MPa)	120 psi (0.83 MPa)(at break) 500% 70 psi (0.48 MPa)
Adhesion in Peel (Fed Spec TT-00227E)	Concrete Substrate Peel Strength: >30 lbs (133 N) % Adhesion Loss: 0%	Concrete Substrate Peel Strength: 25 lbs (111 N) % Adhesion Loss: 0%

No material shall be used that has skinned over or settled in the container to the extent that it cannot be easily redispersed by hand stirring to form a smooth uniform product.

Each container shall be clearly labeled or each delivery of material in the tanks of two component equipment shall be accompanied with a ticket showing designation (Component A or B), the manufacturer's name, lot or batch number, date of manufacture, date of packaging, date, if any, beyond which the polyurethane sealant shall not be used without additional testing and approval, and manufacturer's instructions for use.

The sealant shall be machine mixed and placed with equipment that accurately proportions and mixes the two components and extrudes the mixed material into the joint. Such equipment shall be of a type approved by the manufacturer of the sealant and all manufacturer's instructions shall be followed. Polyurethane liquid components that have been exposed to the atmosphere for more than 24 hours shall not be used.

Primer	Special material furnished by the manufacturer of the sealant to improve bond of polyurethane sealant to concrete.
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Primer shall be applied to the sides of the groove and to all exposed vertical surfaces in the joint prior to placing the polyurethane sealant. The primer shall be dry prior to placing the sealant. Contaminated primer shall be removed and replaced.

707.02.02: The following materials shall be supplied and installed in expansion joints with widths 1-inch or less designed for channels included in Clark County Regional Flood Control District's Master Plan:

Joint Sealant	Two component polyurethane pourable joint sealant (ACI 504R, Table 1, Type IV)
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Sealant shall be able to withstand up to plus or minus 25 percent movement. Sealant shall be self-leveling for flat surfaces and non-sagging for slopes. The sealant shall meet or exceed requirements of Table 1 in Section 707.02.01.

No material shall be used that has skinned over or settled in the container to the extent that it cannot be easily redispersed by hand stirring to form a smooth uniform product.

Each container shall be clearly labeled or each delivery of material in the tanks of two component equipment shall be accompanied with a ticket showing designation (Component A or B), the manufacturer's name, lot or batch number, date of manufacture, date of packaging, date, if any, beyond which the polyurethane sealant shall not be used without additional testing and approval, and manufacturer's instructions for use.

The sealant shall be machine mixed and placed with equipment that accurately proportions and mixes the two components and extrudes the mixed material into the joint. Such equipment shall be of a type approved by the manufacturer of the sealant and all manufacturer's instructions shall be followed. Polyurethane liquid components that have been exposed to the atmosphere for more than 24 hours shall not be used.

Joint Filler Preformed, ASTM D1752, Type I (sponge rubber) or inert, preformed, closed cell, polypropylene material.

Bond breaker tape Adhesive backed polyethylene tape meeting or exceeding the following:
Adhesive Strength 35 ounces/in width Tensile Strength 20 lbs./in width Mil thickness 14

Size tape so that it covers the entire back surface of the joint without extending up the concrete slabs. In joints that have considerable width variation, one tape may be lapped over another to accomplish total backside coverage. Bond breaker tape shall be thick enough to permit easy handling and proper insertion.

Backer rod Non-absorbent expanded, closed cell polyethylene foam.

The backer rod shall be approximately 25 percent larger in diameter than the width of the joint to be sealed. Other back-up materials (paper, rope and open cell foam) are unacceptable. The backer rod shall be compatible with the sealant, and no bond or reaction shall occur between the backer rod and sealant.

707.02.03: The following materials shall be supplied and installed in expansion joints with widths 1-inch or less designed for structures other than those listed in Section 707.03.01.02:

Joint Sealant Two component polyurethane pourable joint sealant (ACI 504R, Table 1, Type IV)

Sealant shall be able to withstand up to plus or minus 25 percent movement. Sealant shall be self-leveling for flat surfaces and non-sagging for slopes. The sealant shall meet or exceed requirements of Table 1 above.

No material shall be used that has skinned over or settled in the container to the extent that it cannot be easily redispersed by hand stirring to form a smooth uniform product.

Each container shall be clearly labeled or each delivery of material in the tanks of two component equipment shall be accompanied with a ticket showing designation (Component A or B), the manufacturer's name, lot or batch number, date of manufacture, date of packaging, date, if any, beyond which the polyurethane sealant shall not be used without additional testing and approval, and manufacturer's instructions for use

The sealant shall be machine mixed and placed with equipment that accurately proportions and mixes the two components and extrudes the mixed material into the joint. Such equipment shall be of a type approved by the manufacturer of the sealant and all manufacturer's instructions shall be followed. Polyurethane liquid components that have been exposed to the atmosphere for more than 24 hours shall not be used.

Joint Filler Preformed filler conforming to AASHTO M 213 or ASTM D 1751 (fiber type).

Filler material shall be punched or drilled to admit dowels where called for on the plans. Filler for each joint shall be furnished in a single piece for the full depth and width required for the joint unless otherwise specified by the Engineer. When the use of more than one piece is authorized for a joint, the abutting ends

shall be fastened securely and held in place, by stapling or other positive fastening satisfactory to the Engineer.

Bond breaker tape Adhesive backed polyethylene tape meeting or exceeding the following:
Adhesive Strength 35 ounces/in width Tensile Strength 20 lbs./in width Mil
thickness 14

Size tape so that it covers the entire back surface of the joint without extending up the concrete slabs. In joints that have considerable width variation, one tape may be lapped over another to accomplish total backside coverage. Bond breaker tape shall be thick enough to permit easy handling and proper insertion.

Backer rod Non-absorbent expanded, closed cell polyethylene foam.

The backer rod shall be approximately 25 percent larger in diameter than the width of the joint to be sealed. Other backer materials (paper, rope and open cell foam) are unacceptable. The backer rod shall be compatible with the sealant and no bond or reaction shall occur between the backer rod and sealant.

707.02.04: The following materials shall be supplied and installed in expansion joints with widths greater than 1-inch:

Joint Sealant Impermeable closed-cell, cross-linked, ethylene vinyl acetate, low density polyethylene copolymer, nitrogen blown foam material.

Joint sealant shall have a minimum working movement range of 60% compression and 30% tension. The sealant shall meet or exceed the requirements listed in Table 2 below.

Joint sealant shall have 1/8" deep by 1/8" wide (3 cm by 3 cm) grooves spaced at 1/4" to 1/2" along both sides of the joint and running the entire length of the joint to increase bond surface area.

Joint sealant material must be resistant to degradation due to ultraviolet radiation or must be coated with a material that provides adequate protection.

The joint sealant shall be installed with a width 25% greater than width of joint opening at a near neutral condition.

All direction changes in joint sealant shall be done using heat welding method.

Joint sealant shall be installed using all of manufacturer's recommendations.

Joint sealant shall be installed prior to significant joint movement after concrete placement.

Contractor shall prevent construction equipment from traversing joint after sealant has been placed or adequate steps must be taken to protect sealant from construction traffic.

TABLE 2
MINIMUM REQUIREMENTS FOR PREFORMED JOINT SEALER

Material Characteristics	Physical Requirements
Service Range	-94-160 degrees F (-70°-71°C)
Tensile Strength	115 lb/in ²
Elongation at break	255%
Tear Resistance (ASTM D-624)	16 lb/in ²
Water Absorption (ASTM 3575, Suffix L)	0.2 lb/ft ²
Density	2.8 – 3.4 lb/ft ³

Joint Filler Inert, preformed, closed cell, polypropylene material.

Bond Breaker Tape Adhesive backed polyethylene tape meeting or exceeding the following:
Adhesive Strength 35 ounces/in width Tensile Strength 20 lbs./in width Mil
thickness 14

Size tape so that it covers the entire back surface of the joint without extending up the concrete slabs. In joints that have considerable width variation, one tape may be lapped over another to accomplish total backside coverage. Bond breaker tape shall be thick enough to permit easy handling and proper insertion.

Bonder Two component, 100% solid epoxy adhesive designed to bond joint material to steel, cured concrete or wood.

707.03.01 RUBBER GASKETS: The ring gaskets shall conform to the requirements of AASHTO M 198.

707.03.02 WATERSTOPS: Waterstops shall conform to the following requirements:

(a) Natural Rubber.

Test	Test	Method Requirements
Tension Testing of Vulcanized Rubber	ASTM D 412	Tensile strength 3,500 lbs. min. psi (24.1Mpa) - Elongation at breaking of 550 percent. Unit stress (300 percent) 1,100 lbs. psi min. (7.6 MPa). Unit stress (500 percent) 2,800 lbs. psi Min. (19.3 MPa).
Test for Accelerated aging of Vulcanized Rubber by the Oxygen Pressure Method	ASTM D 572	After 7 days in air at 158 degrees (plus or minus 2 degrees) Fahrenheit (70 degrees (plus or minus 1 degree) Celsius) or after 48 hours in oxygen at 158 degrees (plus or minus 2 degrees) Fahrenheit (70 degrees (plus or minus 1 degree) Celsius) and 300 lbs. psi (2.07 MPa), the tensile strength and elongation shall not be less than 65 percent of the original.

Test	Test	Method Requirements
Test for Indentation of Rubber by Means of a Durometer	ASTM D 2240	55 to 65 hardness

Natural rubber waterstops shall be manufactured from a stock composed of a high grade compound made exclusively from new plantation rubber, reinforced carbon black, zinc oxide, accelerators, antioxidants, and softeners. This compound shall contain not less than seventy-two (72) percent by volume of new plantation rubber.

(b) Synthetic Rubber.

Test	Test	Method Requirements
Tension Testing of Vulcanized Rubber	ASTM D 412	Tensile strength 2,500 lbs. psi min. (17.26 MPa). Elongation at breaking of 425 percent.
Test for Accelerated aging of Vulcanized Rubber by the Oxygen Pressure Method	ASTM D 572	After 7 days in air at 158 degrees (plus or minus 2 degrees) Fahrenheit (70 degrees (plus or minus 1 degree) Celsius) or after 48 hours in oxygen at 158 degrees (plus or minus 1 degree) Fahrenheit (70 degrees (plus or minus 1 degree) Celsius) and 300 lbs psi (2.07 MPa), the tensile strength and elongation shall not be less than 65 percent of the original.
Test for Indentation of Rubber By Means of a Durometer	ASTM D 2240	50 to 70 hardness

(c) Polyvinyl Chloride.

Test	Test	Method Requirements
Polyvinyl Chloride Waterstops	Corp. of Engr CRD-C 572	Compliance of paragraph 6

707.03.03 ASPHALT PLANK: Asphalt plank shall conform to the requirements of ASTM Designation D 517 for Plain Asphalt Plant.

707.03.04 PREFORMED ELASTIC JOINT SEALER: Preformed elastic joint sealer and lubricant adhesive shall conform to the requirements of AASHTO Designation M 220 "Preformed Elastomeric Compression Joint Seals for Concrete."

The lubricant adhesive shall be homogeneous and shall remain workable from 5 to 120 degrees Fahrenheit (-15 to 49 degrees Celsius). Each lot of the adhesive shall be in containers with the manufacturer's name or trademark and the date of manufacture plainly marked. Adhesive shall be stored at a temperature of 50 to 80 degrees Fahrenheit (10 to 26.7 degrees Celsius) and shall be used within 270 days after the date of its manufacture.

The lubricant adhesive shall conform to the following requirements:

Average new weight per gallon, lbs.	7.84 ±5%
	(0.94 Kilograms per liter)
Solids content by weight, %	22 - 28

Each lot of the preformed elastic joint sealer, and lubricant adhesive furnished under these specifications shall be identified as specified herein and shall be products which have been tested by a reputable testing laboratory, recognized by the Contracting Agency, who shall certify that the materials meet these specifications and requirements. The Contractor shall furnish the Contracting Agency with these certifications prior to using the material.

707.03.05 SUBMITTAL: Material shall be tested and certified per the Table 3 frequency. Prior to the use of these materials, the Contractor shall submit to the Engineer for approval a document certifying that the material meets these specifications and requirements. The test shall be performed in an accredited laboratory such as the American Association for Laboratory Accreditation (A2LA) or other as approved by the Engineer. A test certificate shall be included with the certifying document. Subsequent submittals shall be reviewed by the Contractor for compliance then transmitted to the Engineer.

The Statute of Limitations duration for the record storage shall be as required by the Nevada Revised Statutes.

Table 3- Submittal Requirements

Spec Section	Description	Item	Reference	Frequency
707.02.01	Joint Sealant	Certification with copy of tests	Table 1 requirements	1 per lot
707.02.02	Joint Sealant	Certification with copy of tests	Table 1 requirements	1 per lot
707.02.02	Joint filler	Certification with copy of tests	Tested per ASTM D1752 type I	1 per lot
707.02.02 707.02.03 707.02.04	Bond Breaker Tape	Certification with copy of tests	Adhesive strength 35 ounces/in width Tensile Strength 20 lb/in width Mil Thickness 14 min	1 per lot
707.02.02 707.02.03	Backer Rod	Certification	Non-absorbent expanded, Closed cell polyethylene	1 per lot
707.02.03	Joint Sealant	Certification with copy of tests	ACI 504R, Table 1, type IV	1 per lot
707.02.03	Joint filler	Certification with copy of tests	AASHTO M 213	1 per lot
707.02.04	Joint Sealant	Certification with copy of tests	Table 2 requirements	1 per lot
707.02.04	Joint Filler	Certification	Inert, preformed, closed cell, polypropylene material	1 per lot
707.03.01	Rubber Gaskets	Certification with copy of tests	AASHTO M 198	1 per lot
707.03.02	Waterstops Natural & Rubber	Certification with copy of tests	ASTM D 412 ASTM D 572 ASTM D 2240	1 per lot
707.03.02	Waterstops Polyvinyl Chloride	Certification with copy of tests	Corp of Engr CRD-C 572	1 per lot
707.03.03	Asphalt Plank	Certification with copy of tests	ASTM D 517	1 per lot
707.03.04	Preformed Elastic Joint Sealer	Certification with copy of tests	AASHTO M 220	1 per lot

SECTION 715
GALVANIZING

SCOPE

715.01.01 MATERIALS COVERED: This specification covers the quality and thickness of galvanizing used on various material when called for on the plans or designed in the specifications.

715.02.01 BLANK:

PHYSICAL PROPERTIES AND TESTS

715.03.01 PRODUCTS ONE-EIGHTH (1/8) INCH (0.3 CENTIMETERS) THICK AND THICKER: Galvanizing of products fabricated from rolled, pressed, and forged steel shapes, plates, bars, and strip shall conform to the requirements of ASTM Designation A 123.

715.03.02 GUARDRAIL ELEMENTS: All rail elements shall be galvanized in accordance with AASHTO Designation M 180, Type 2.

715.03.03 HARDWARE: Bolts, nut, washers, and fastenings shall be galvanized in accordance with the requirements of ASTM Designation A 153.

SECTION 716

SIGN MATERIALS

SCOPE

716.01.01 MATERIALS COVERED: This specification covers the kind and quality of materials used in the construction and fabrication of Traffic Control Devices used in temporary event zones and for permanent installations.

REQUIREMENTS

716.02.01 GENERAL: The following materials shall conform to the requirements as noted:

Portland Cement Concrete	Section 501
Reinforcing Steel	Section 505

716.02.02 CERTIFICATES: It shall be the Contractor's responsibility to ascertain that all required tests have been made by qualified testing laboratories as approved by the Contracting Agency. The Contractor shall furnish the Engineer with a written certification that all required tests have been satisfactorily completed and that materials and fabrication thereof comply with all the requirements.

PHYSICAL PROPERTIES AND TESTS

716.03.01 REFLECTIVE SHEETING: Sheeting shall be of the following class sets, as specified in the plans or the proposal, and unless otherwise specified or approved by the Engineer, shall be Class 6. The sheeting shall be a material approved by the Engineer, applied to approved sign substrate per manufacturer's instructions, and conform to the applicable requirements below.

Class 1 - Non-retroreflective plastic film (ScotchCal. or equal). Pressure sensitive adhesive coated plastic film for sign copy and borders shall be a material recommended by the retroreflective sheeting manufacturer as compatible with the background retroreflective sheeting, and shall meet the requirements for Type I, Class 1 of MIL-M-43719B, "Marking Materials and Markers, Adhesive, Elastomeric, Pigmented."
Life: Shall be the same as material applied upon.

Class 2 - Enclosed Lens Retroreflective Sheeting (Engineer grade, or equal). Class 2 sheeting shall meet the requirements of ASTM D4956, TYPE I.
Life: Seven (7) years

Class 3 - Enclosed Lens Retroreflective Sheeting (Super Engineering grade, or equal). Class 3 sheeting shall meet the requirements of ASTM D4956, TYPE II.
Life: Ten (10) years

Class 4 - Encapsulated Lens Retroreflective Sheeting (High Intensity grade, or equal). Class 4 sheeting shall meet the requirements of ASTM D4956, TYPE III and/or TYPE IV.

Life: Ten (10) years

Three (3) years for Work Zone retroreflective sheeting

Retroreflective sheeting for work/special event zone reboundable devices, (cones and delineators) shall be Class 4 sheeting.

Class 5 - Wide Angle Prismatic Retroreflective Sheeting. Class 5 sheeting shall meet the requirements of ASTM D4956, TYPE VII sheeting and shall have minimum coefficients of retroreflection, in units of candelas per footcandle per square foot (candelas per lux per square meter), not less than the values shown below:

Life: Ten (10) years for fluorescent sheeting

Twelve (12) years for non-fluorescent sheeting

Three (3) for fluorescent sheeting

- Class 5 fluorescent orange sheeting shall be used on all construction warning signs and devices except TYPE I, II, III barricades
- TYPE I, II, III barricades shall use non-fluorescent Class 5 sheeting. Legends and borders for signs using Class 5 fluorescent orange retroreflective sheeting shall be in accordance to manufacturer's recommendations.
- Effective September 20, 2007, retroreflective sheeting for work/special event zone reboundable devices (traffic barrels/drums) shall be Class 5 sheeting.

Class 6 - Wide Angle Prismatic Retroreflective Sheeting. Class 6 sheeting is a wide angle retroreflective sheeting with optimized performance over a broad range of observation angles and shall meet the requirements of ASTM D4956, TYPE IX sheeting.

Life: Ten (10) years for fluorescent sheeting

Twelve (12) years for non-fluorescent sheeting

Three (3) for fluorescent orange sheeting

Flourescent yellow-green reflective sheeting shall be used on the following signs only: School advance (S1-1), School Bus Stop Ahead (S3-1), School Speed Limit (S5-1), Advance Pedestrian Crossing (W11-2) Bicycle Crossing (W11-1), and related supplemental plates.

Inks and films for legends and borders on retroreflective sheeting shall be in accordance with manufacturer's specification.

Field Performance Life Requirements. The supplier shall warranty that signs supplied shall have an effective retroreflective life of not less than that specified in the previous subsections. The retroreflective sheeting shall be considered unsatisfactory (and failing this life requirement) if it has deteriorated due to natural causes to the extent that:

- (1) the sign is ineffective for its intended purpose when viewed from a moving vehicle under normal day and night conditions;

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- (2) the values for the coefficients of retroreflection for Classes 2 - 6 are less than 50% of the required values for the same sign when new, or
- (3) the sign material's integrity or adhesion to the sign substrate has substantially failed. Sheeting which fails this requirement within the specified required lifetime shall be replaced at no charge. Replaced sheeting lifetime shall begin at time of replacement and life shall be to the lifetime requirement per sheeting type. All finished signs shall be dated with the month and year of delivery in order to ascertain compliance with these lifetime requirements.

716.03.02 BLANK:

716.03.03 ALUMINUM SIGN PANELS (FOR REFLECTIVE SHEETING): Sheet aluminum for sign panels shall be of 0.100 inch (2.5 millimeter) aluminum alloy Alclad 5052-H38 or 6061-T6 and shall conform to specifications for ASTM Designation B 209. Sign panels for street name signs shall be as required in the Standard Drawings.

Sign panel sections shall be fabricated of standard width aluminum sheets not less than four (4) feet (1.2 meters) wide, except that not more than two (2) sheets for any one sign may be cut not less than eighteen (18) inches (460 millimeters) in width, so as to provide sign widths to nearest six (6) inch (150 millimeters) increments. Panel sections shall run from the top edge to the bottom edge of the sign without horizontal joints.

The aluminum shall be free of all corrosion, white rust, and dirt. All sign dimensions, metal gage, and bolt holes shall conform to the requirements set forth on the plans and in these specifications. Blanks shall be cleaned, degreased and chromated or otherwise properly prepared according to methods recommended by the sheeting manufacturer.

Metal shall not be handled, except by device or clean canvas gloves between all cleaning operations and the applications of the sign background material. There shall be no opportunity for the aluminum to come in contact with greases, oils, or other contaminants prior to the applications of the background material.

All fabrication, including cutting, shall be completed prior to the cleaning process. Metal panels shall be cut to size and shape and shall be free of defects resulting from fabrication. The surface of all sign panels shall be a plane surface.

716.03.04 BLANK:

716.03.05 OVERHEAD SIGN STRUCTURES AND SIGN FRAMES: The materials used in the fabrication of overhead sign structures and footings shall conform to the following requirements:

- (1) **Sign frames.** Bars, plates, and shapes shall be structural steel conforming to the specifications of ASTM Designation A 36.
- (2) **Sign pipe posts.** Pipe posts shall be welded or seamless steel pipe conforming to the specifications of ASTM Designation A 53, Grade B. At the option of the Contractor, posts may be fabricated from structural steel conforming to the specifications of ASTM Designation A 36 or of ASTM Designation A 283, Grade D, except that plates more than one inch (25 millimeters) in thickness shall be structural steel conforming to the specifications of ASTM Designation A 373.

- (3) **Sign steel walkway gratings.** Steel walkway gratings shall be furnished and installed in accordance with details shown on the plans and the following provisions:
- (a) Gratings shall be the standard product of an established grating manufacturer.
 - (b) Material for gratings shall be structural steel conforming to the specifications of ASTM Designation A 36.
 - (c) For welded type gratings, each joint shall be full resistance welded under pressure to provide a sound, completely beaded joint.
 - (d) For mechanically locked gratings, the method of fabrication and interlocking of the members shall be approved by the Engineer, and the fabricated grating shall be equal in strength to the welded type.
 - (e) After fabrication, gratings shall be hot-dip galvanized.
 - (f) Gratings shall be free from warps, twists, or other defects affecting their appearance or serviceability. The tops of the bearing bars and cross members shall be in the same plane. Gratings distorted by the galvanizing process shall be straightened.
- (4) **Bolts and Nuts.** Bolts and nuts shall conform to the specifications of ASTM Designation A 307. Bolted connections shall conform to the provisions in Subsection 506.03.10, "Bolts and Bolted Connections."
- (5) Bearing plates and gusset or stiffener plates shall be of the sizes and dimensions shown on the plans and shall be galvanized after fabrication. Steel shall conform to ASTM Designation A 36. Galvanizing shall conform to ASTM Designation A 123. All welding shall conform to the requirements set forth in Subsection 506.03.20, "Welding."
- (6) Anchor bolts, nuts and washers shall be of structural carbon-steel conforming to Section 710, "Structural and Eyebar Steel," and shall be galvanized in accordance with ASTM Designation A 153, or Cadmium plated in accordance with ASTM Designation A 165 Type TS. The top portion of anchor bolts shall be galvanized or cadmium plated to such extent that the galvanized or cadmium plated portion will extend at least two (2) inches (50 millimeters) into concrete. Anchor bolts shall be of the size, shape and length as shown on the plans.
- (7) All bolts, nuts, clamps and metal washers not otherwise noted shall be galvanized or cadmium plated. Cadmium plating shall conform to the specifications of ASTM Designation A 165, minimum thickness as prescribed for grade Type TS and galvanizing shall conform to the requirements of ASTM Designation A 153.

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- (8) Supporting frame shall be manufactured in accordance with the plans and requirements herein specified. All metal parts shall be galvanized after fabrication, in accordance with the provisions of Section 715. When permission is granted by the Engineer to zinc coat a surface by means other than hot-dip galvanizing, the metalizing process shall be used to place the zinc. Metalizing shall be performed in accordance with the AWS Specifications and the thickness of the sprayed zinc coat shall be at least 5 mils (0.13 millimeters).
- (9) Truss frames shall be fabricated to the largest practical sections prior to galvanizing. Splice locations shall be submitted to the Engineer for approval and the Contractor shall not commence fabrication until such splice locations are approved.
- (10) All welding on the fabrication of the structure shall be done by welders qualified in accordance with AWS requirements using the inert-gas shielded-arc method. Welds shall be free from cracks, blow holes and other irregularities and shall be wire brushed or otherwise cleaned. No field welding on any part of the structural assembly will be permitted.

NOTE: Before fabrication is started, five (5) sets of shop drawings for each overhead sign structure shall be submitted to the Engineer for approval.

716.03.06 SIGN HARDWARE, POST, AND RELATED MATERIALS: Bearing plates and gusset or stiffener plates shall be of the sizes and dimensions shown on the plans and shall be galvanized after fabrication. Steel shall conform to ASTM Designation A 36. Galvanizing shall conform to ASTM Designation A 123. All welding shall conform to the requirements set forth in Subsection 506.03.20, "Welding."

Structural I-beam steel shall be galvanized in accordance with ASTM Designation A 153, or cadmium plated in accordance with ASTM Designation A 165 Type TS.

Anchor bolts, nuts and washers shall be of structural carbon-steel conforming to Section 710. The top portion of anchor bolts shall be galvanized or cadmium plated to such extent that the galvanized or cadmium plated portion will extend at least two (2) inches (50 millimeters) into the concrete. Anchor bolts shall be of the size, shape and length as shown on the plans.

Steel pipe for posts shall conform to the specifications of ASTM Designation A 120 and shall be galvanized. Galvanized steel pipe posts shall be of the diameter and length shown on the plans. The top of the posts shall be fitted with a cover. Posts showing damage shall be repaired or rejected.

Wood posts shall be constructed of Douglas Fir, West Coast Hemlock, or any other equivalent stress rated wood material, at the option of the Contractor. Said wood material shall be construction grade, free of heart center, minimum stress rating of 1200f, and shall be graded in accordance with the provisions contained in Section 718. Sweep shall not exceed 0.08 feet (24.4 millimeters) in 10 feet (3 meters).

Aluminum stiffeners, braces, and stringers used as horizontal supporting structural members shall be of aluminum alloy 6061-T6. These extrusions shall have a continuous inverted "T" slot. This inverted "T" shall accommodate positionable stainless steel clamping devices. These clamping devices shall provide complete freedom of alignment within this slot forming an interlocking clamp system for fastening the sign to the post. The sign support system described herein shall conform to AASHTO Standard Specifications for Highway Signs, Luminaires and Traffic Signals, latest revision, and be rated for minimum wind velocities of 80 mph. All bolts, nuts, clamps and metal washers in contact with this aluminum channel shall be Stainless Steel Type 304. The system shall be compatible with all I-beam, steel post and wood post systems.

All other bolts, nuts, clamps and metal washers in contact with other aluminum components shall be galvanized or cadmium plated. Cadmium plating shall conform to the specifications of ASTM Designation A 165, minimum thickness as prescribed for grade Type TS and galvanizing shall conform to the requirements of ASTM Designation A 153.

Cantilever arm brackets shall be used when it is desired to offset the entire length of a sign to one side of a post or pole. Cantilever arm brackets shall consist of a stainless steel or aluminum head mounted to an extruded aluminum "TEE" section. This "TEE" section will have a continuous slot that will accept signs up to 1/8" (3.2 millimeters) thick. If sign thickness (including aluminum sign panel and reflective sheeting) exceeds the width of the "TEE" section slot, sign panel thickness may be reduced to not less than 0.080", or reflective sheeting may be eliminated in the bracket area, as directed by the Engineer. The heads shall be designed to accept 3/4" (19.1 mm) stainless steel banding. The "TEE"-shaped extrusions shall be made from 6061-T6 aluminum alloy. The cantilever arm brackets shall be used to support the entire length of the sign on both the top and the bottom. The sign shall be attached to the brackets using 1/8" (3.2 mm) rivets spaced according to the hole pattern pre-drilled on the extruded "TEE" section. These cantilever arm brackets shall be compatible with any size and shape of post or pole. This system shall be designed for use on signs up to 72 inches (1.83 meters) in length with a maximum surface area of 9.5 square feet (0.88 square meters). Signs with surface area greater than 2 square feet (0.19 square meters) shall be fastened to round posts or poles using 3/4" X .030 (19.1 mm X 0.76 mm) stainless steel banding. When mounting to square posts or flat surfaces, compatible stainless steel threaded studs or bolts can be used as well as 3/4" X .030 (19.1 mm X 0.76 mm) stainless steel banding. For signs less than 2 square feet (0.19 square meters) in surface area, 5/8" (15.9 mm) banding is acceptable.

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