

51-1.12H Elastomeric Bearing Pads

- Elastomeric bearing pads shall conform to the provisions in these specifications and the special provisions.
- Pads $\frac{1}{2}$ inch or less in thickness shall conform to the provisions in Section 51-1.12H(1), "Plain and Fabric Reinforced Elastomeric Bearing Pads." At the Contractor's option, pads over $\frac{1}{2}$ inch in thickness shall conform to either the provisions in Section 51-1.12H(1) or to the provisions in Section 51-1.12H(2), "Steel Reinforced Elastomeric Bearings."
- Before constructing bearing seats upon which elastomeric bearing pads are to be placed, the Contractor shall notify the Engineer, in writing, of the type of bearing to be used. The elevation of the bearing seats shall correspond to the thickness of the bearings to be used.

51-1.12H(1) Plain and Fabric Reinforced Elastomeric Bearing Pads

- Pads $\frac{1}{2}$ inch or less in thickness shall be either laminated or all elastomer. Pads over $\frac{1}{2}$ inch in thickness shall be laminated. Stacking of individually laminated pads to attain thicknesses over $\frac{1}{2}$ inch, or cold bonding of individual laminated pads will not be permitted.
- Laminated pads shall consist of alternate layers of elastomer and fabric reinforcement bonded together. The top and bottom layers of reinforcement shall be uniformly covered with a maximum of $\frac{1}{8}$ inch of elastomer.
- Laminated pads shall have reinforcement every $\frac{1}{2}$ inch through the entire thickness. Fabric reinforcement shall be single ply at top and bottom surfaces of the pad and double ply within the pad. The reinforcement shall be parallel to the top and bottom surfaces of the pad. Variations in the location of the reinforcement in excess of $\frac{1}{8}$ inch from its theoretical location shall be cause for rejection. The total out to out thickness of a pad shall not be less than the thickness shown on the plans nor more than $\frac{1}{4}$ inch greater than that thickness.
- Pads of all elastomer or with fabric reinforcement may be cut from large sheets. Cutting shall be performed in such a manner as to avoid heating of the material and to produce a smooth edge with no tears or other jagged areas and to cause as little damage to the material as possible.
- The peel strength test will be performed after immersing the sample in water for a minimum of 10 days. The bond between elastomer and fabric shall be such that when a sample is tested for separation, the bond shall have a minimum peel strength of 5.3 kN/m when tested in conformance with the requirements in California Test 663.
- Fabric reinforcement shall be woven from 100 percent glass fibers of "E" type yarn with continuous fibers. The minimum thread count in either direction shall be 25 threads per inch. The fabric shall have either a crowfoot or an 8 Harness Satin weave. Each ply of fabric shall have a breaking strength of not less than 140 kN/m of width in each thread direction when 76-mm x 914-mm samples are tested on split drum grips. The bond between double plies shall have a minimum peel strength of 3500 N/m.

SECTION 51

CONCRETE STRUCTURES

- The sole polymer in the elastomeric compound shall be neoprene and shall be not less than 60 percent by volume of the total compound. The elastomer shall be Type CR, Grade 3, and shall have a shear modulus of 110 psi ±10 psi, in conformance with the requirements in ASTM Designation: D 4014.
- The elastomer, as determined from test specimens, shall conform to the following:

Test	ASTM Designation	Requirement
Tensile strength, (psi)	D 412	2,250 Min.
Elongation at break, percent	D 412	350 Min.
Compression set, 22 h at 158° F, percent	D 395 (Method B)	25 Max.
Tear strength, lb/in	D 624 (Die C)	180 Min.
Hardness (Type A)	D 2240 with 2 kg. Wt.	55 ±5
Ozone resistance 20% strain, 100 h at 104° F ±3.6° F	D 1149 (except 100 ±20 parts per 100,000,000)	No cracks
Instantaneous thermal stiffening at -40° F	D 1043	Shall not exceed 4 times the stiffness measured at 73.4° F
Low temperature brittleness at -40° F	D 746 (Procedure B)	Pass

- After accelerated aging in conformance with ASTM Designation: D 573 for 70 hours at 212° F. the elastomer shall not show deterioration changes in excess of the following:

Tensile strength, percent	-15
Elongation at break, percent	-40; but not less than 300% total elongation of the material
Hardness, points	+10

- A Certificate of Compliance conforming to the provisions in Section 6-1.07, "Certificates of Compliance," shall be furnished to the Engineer certifying that the elastomer, and fabric (if used), in the elastomeric bearing pads to be furnished, conforms to the above requirements. The Certificate of Compliance shall be supported by a certified copy of the results of tests performed by the manufacturer upon samples of the elastomer and fabric to be used in the pads.
- A fabric sample not less than 36" x 48" will be taken by the Engineer for testing from each new lot of fabric used in manufacturing bearing pads. A sample pad not less than 8" x 12" in size will be taken by the Engineer for testing from each lot of pads or batch of elastomer to be furnished, whichever results in the greater number of samples. The samples will be selected at random at the point of manufacture or, at the option of the Contractor, at the jobsite. Samples taken at the jobsite shall consist of complete pads as detailed on the plans, and the Contractor shall furnish additional complete pads to replace those taken for testing. Pads shall be available for sampling at least 4 weeks in advance of intended use. All sample pads for testing shall be furnished by the Contractor at the Contractor's expense.

- Specimens tested in conformance with the requirements in California Test 663 shall meet the requirements for the bond between elastomer and fabric reinforcement laminations.
- Test specimens for tensile strength, elongation, tear strength, peel strength and ozone resistance will be taken from production run pads by the Engineer, and will be prepared for testing by cutting and grinding.

51-1.12H(2) Steel Reinforced Elastomeric Bearings

- Steel reinforced elastomeric bearings shall conform to the requirements for steel-laminated elastomeric bearings in ASTM Designation: D 4014 and the following:
 - A. The bearings shall consist of alternating steel laminates and internal elastomer laminates with top and bottom elastomer covers. Steel laminates shall have a nominal thickness of 1.9 mm (14 gage). Internal elastomer laminates shall have a thickness of $\frac{1}{2}$ inch, and top and bottom elastomer covers shall each have a thickness of $\frac{1}{4}$ inch. The combined thickness of internal elastomer laminates and top and bottom elastomer covers shall be equal to the bearing pad thickness shown on the plans. The elastomer cover to the steel laminates at the sides of the bearing shall be $\frac{1}{8}$ inch. If guide pins or other devices are used to control the side cover over the steel laminates, any exposed portions of the steel laminates shall be sealed by vulcanized patching. The length, width, or diameter of the bearings shall be as shown on the plans.
 - B. The total thickness of the bearings shall be equal to the thickness of elastomer laminates and covers plus the thickness of the steel laminates.
 - C. Elastomer for steel reinforced elastomeric bearings shall conform to the provisions for elastomer in Section 51-1.12H(1), "Plain and Fabric Reinforced Elastomeric Bearing Pads."
 - D. A Certificate of Compliance conforming to the provisions in Section 6-1.07, "Certificates of Compliance," shall be furnished to the Engineer certifying that the bearings to be furnished conform to all of the above provisions. The Certificate of Compliance shall be supported by a certified copy of the results of tests performed by the manufacturer on the bearings.

- E. One sample bearing shall be furnished to the Engineer from each lot of bearings to be furnished for the contract. Samples shall be available at least 3 weeks in advance of intended use. The sample bearing shall be one of the following:

Bearing Pad Thickness as Shown on the Plans	Sample Bearing
≤ 2 inches	Smallest complete bearing shown on the plans
> 2 inches	* 2.25 ± 0.125 -inch thick sample not less than 8 inches x 12 inches in plan and cut by the manufacturer from the center of one of the thickest complete bearings

*The sample bearing plus remnant parts of the complete bearing shall be furnished to the Engineer.

- F. A test specimen taken from the sample furnished to the Engineer will be tested in conformance with the requirements in California Test 663. Specimens tested shall show no indication of loss of bond between the elastomer and steel laminates.

51-1.13 BONDING

- Construction joints shall be made only where located on the plans or shown in the placing schedule, unless otherwise approved by the Engineer.
- Horizontal construction joints may be made without keys, except when keys are shown on the plans. Surfaces of fresh concrete at horizontal construction joints shall be rough floated sufficiently to thoroughly consolidate the concrete at the surface without completely removing surface irregularities.
- Construction joints shall be cleaned of surface laitance, curing compound and other foreign materials before fresh concrete is placed against the surface of the joint. Abrasive blast methods shall be used to clean horizontal construction joints to the extent that clean aggregate is exposed. Construction joints shall be flushed with water and allowed to dry to a surface dry condition immediately prior to placing concrete.
- When existing structures are to be modified, construction joints between new and existing concrete shall be cleaned and flushed as specified herein for horizontal joints.
- In case of emergency, construction joints shall be made as directed by the Engineer. When it is necessary to make a joint because of an emergency, additional reinforcing steel shall be furnished and placed across the joint as directed by the Engineer. The additional reinforcing steel shall be furnished and placed by the Contractor at the Contractor's expense.
- When new concrete is shown on the plans to be joined to existing concrete by means of bar reinforcing steel dowels grouted into holes drilled in the existing concrete, the holes shall be drilled by methods that will not shatter or damage the concrete adjacent to the holes. Holes in which longitudinal or transverse reinforcement is encountered during drilling before the specified depth is attained shall be rejected. A new hole, which does not strike reinforcement, shall be drilled adjacent to the rejected hole to the depth shown on the plans. With approval of the

Engineer, all holes including rejected holes may be cored through reinforcing steel to the correct depth. The diameters of the drilled holes shall be $\frac{1}{4}$ inch larger than the nominal diameter of the dowels unless shown otherwise on the plans. The grout shall be a neat cement paste of portland cement and water. The water content shall be not more than 4 gallons per 94 pounds of cement. Retempering of grout will not be permitted. Immediately prior to placing the dowels, the holes shall be cleaned of dust and other deleterious materials, thoroughly saturated with water, have all free water removed and be dried to a saturated surface dry condition. Sufficient grout shall be placed in the holes so that no voids remain after the dowels are inserted. Grout shall be cured for a period of at least 3 days or until the dowels are encased in concrete, whichever occurs first, by either the curing compound method or by keeping the surface of the grout continuously damp. Any dowels or grout which fail to bond or are damaged before the new concrete is placed shall be removed and replaced.

51-1.135 MORTAR

- Mortar shall be composed of portland cement, sand, and water proportioned and mixed as specified in this Section 51-1.135.
- Mortar shall be furnished and placed in recesses and holes, on surfaces, under structural members, and at other locations specified in these specifications, the special provisions or shown on the plans.
- The proportion of cement to sand, measured by volume, shall be one to 2 unless otherwise specified.
- Materials shall conform to the provisions in Section 90, "Portland Cement Concrete."
- The maximum size of sand shall not be larger than 0.5 of the size of the recess, hole or space where the mortar is to be placed.
- The mortar shall contain only enough water to permit placing and packing.
- Concrete areas to be in contact with the mortar shall be cleaned of all loose or foreign material that would in any way prevent bond between the mortar and the concrete surfaces and shall be flushed with water and allowed to dry to a surface dry condition immediately prior to placing the mortar.
- The mortar shall completely fill and shall be tightly packed into recesses and holes, on surfaces, under structural members, and at other locations specified. After placing, all surfaces of mortar shall be cured by the water method as provided in Section 90-7, "Curing Concrete," for a period of not less than 3 days.
- Keyways, spaces between structural members, holes, spaces under structural members and other locations where mortar could escape shall be mortar-tight before placing mortar.
- No load shall be allowed on mortar that has been in place less than 72 hours, unless otherwise permitted by the Engineer.
- All improperly cured or otherwise defective mortar shall be removed and replaced by the Contractor at the Contractor's expense.

51-1.14 WATERSTOPS

- Waterstops embedded in concrete shall be furnished and installed in conformance with the details shown on the plans, the provisions in these specifications and the special provisions.
- Waterstops shall conform to the cross section and to the minimum dimensions shown on the plans.
- Waterstops shall be manufactured either from neoprene or from polyvinyl chloride (PVC).
- Neoprene shall be manufactured from a vulcanized elastomeric compound containing neoprene as the sole elastomer and shall conform to the following:

Test	ASTM Designation	Requirement
Tensile strength, (psi)	D 412	2,000 Min.
Elongation at break, percent	D 412	300 Min.
Compression set, 22 h at 158° F, percent	D 395 (Method B)	30 Max.
Tear strength, lb/in	D 624 (Die C)	150 Min.
Hardness (Type A)	D 2240	55±5
Ozone resistance 20% strain, 100 h at 100° F ±2.2° F	D 1149 (except 100±20 parts per 100,000,000)	No cracks
Low temperature brittleness at -40° F	D 746 (Procedure B)	Pass
Flame resistance	C 542	Must not propagate flame
Oil Swell, ASTM Oil #3, 70 h at 212° F, volume change, percent	D 471	80 Max.
Water absorption, immersed 7 days at 158° F, change in weight, percent	D 471	15 Max.

- After accelerated aging in conformance with the requirements in ASTM Designation: D 573 for 70 hours at 212° F the elastomer shall not show deterioration changes in excess of the following:

Tensile strength, percent	-15
Elongation at break, percent	-40
Hardness, points	+10

- Polyvinyl chloride waterstops shall be manufactured from polyvinyl chloride conforming to the Corps of Engineers Specification Number CRD-C 572 and shall conform to the ozone resistance as required for neoprene waterstops. A certificate shall be furnished with the test sample supplied stating that all of the performance requirements specified under paragraph 6 of that specification have been complied with.
- Waterstops shall be furnished full length for each straight portion of the joint, without field splices. Manufacturer's shop splices shall be fully vulcanized.
- The two No. 3 reinforcing bars provided to support the waterstops shown on the plans shall be securely held in position by the use of spacers, supporting wires or other approved devices as provided in Section 52-1.07, "Placing." The two

No. 3 reinforcing bars shall be considered, for payment purposes, as a part of the waterstop.

- If, after placing concrete, waterstops are materially out of position or shape, the surrounding concrete shall be removed, the waterstop reset, and the concrete replaced, all at the Contractor's expense.
- Field splices for neoprene waterstops shall be either vulcanized; mechanical, using stainless steel parts; or made with a splicing union of the same stock as the waterstop, at the option of the Contractor. All finished splices shall have a full size tensile strength of 100 pounds per inch of width.
- Field splices for polyvinyl chloride waterstops shall be performed by heat sealing the adjacent surfaces in conformance with the manufacturer's recommendations. A thermostatically controlled electric source of heat shall be used to make all splices. The heat shall be sufficient to melt but not char the plastic.
- Waterstops when being installed shall be cut and spliced at changes in direction as may be necessary to avoid buckling or distortion of the web or flange.

51-1.145 STRIP WATERSTOPS

- Strip waterstops, consisting of neoprene sheets bonded to surfaces of structures, shall be furnished and installed in conformance with the details shown on the plans, the provisions in these specifications and the special provisions.
- The neoprene sheet shall be fabricated from neoprene conforming to the provisions for "Neoprene" in Section 51-1.14, "Waterstops." The neoprene sheet shall be smooth, free from pin holes or surface blemishes, and shall show no evidence of delamination. The surfaces of the neoprene sheet on which adhesive is to be used shall be cloth finish, or shall be buffed, and shall be dry and free of powder, dust, oil, wax or other deleterious material when adhesive is applied.
- The adhesive used in bonding neoprene to surfaces of the structures or in bonding neoprene to neoprene shall conform to Federal Specification MMM-A-121.
- Protective board shall be $\frac{1}{2}$ inch minimum thick wood or fiberboard. Boards shall be not less than 4 feet in length and the width shown on the plans.
- Joints between neoprene sheets shall be made as follows:

Laps shall be not less than 12 inches in length. A coating of adhesive shall be applied to both faces of the sheets to be joined at the rate recommended by the manufacturer. The adhesive shall be allowed to remain undisturbed until it develops an aggressive tack without transferring to a dry finger touch. The sheets in the joint shall then be brought into contact and rolled in both directions to obtain a tight bond between the sheets.

- Surfaces to receive strip waterstops shall be abrasive blast cleaned to remove all dirt, dust, loose concrete, curing compound and other deleterious materials. Surfaces shall be allowed to air dry for not less than 24 hours before applying adhesive.
- Adhesive shall be applied to both the surface of the structure and the surface of the sheet at the rate recommended by the manufacturer and shall be allowed to

remain undisturbed until it develops an aggressive tack. The neoprene sheet shall then be applied to the surface of the structure and rolled in both directions to obtain a tight bond between the sheet and the surface of the structure.

- After installation, the strip waterstops shall be completely and tightly covered with one layer of protective board. Protective board shall be attached with spots or strips of a commercial quality adhesive of sufficient strength to hold the protective board in place until backfill has been completed.
- The Contractor shall be responsible for protecting the strip waterstops during backfill operations or any other operation which may damage the strip waterstops. The Contractor, at the Contractor's expense, shall repair or replace any unacceptable or damaged strip waterstop.

51-1.15 DRAINS IN WALLS

- Drain holes and weep holes shall be constructed in abutment walls, wingwalls and retaining walls as shown on the plans, and pervious backfill material shall be placed as provided in Section 19-3.065, "Pervious Backfill Material."
- Retaining wall and abutment wall drains shall be covered at the back face of the wall with hardware cloth conforming to the following:

A. Hardware cloth shall be a commercial quality, approximately 1/4 inch mesh wire cloth of aluminum or of galvanized steel wire. The aluminum wire, and steel wire before galvanizing, shall have a diameter of 0.025-inch, minimum. Hardware cloth shall be mounted in the forms prior to placing concrete in such a manner that the wire is firmly bonded to the concrete or may be fastened to the exterior of the concrete surface by masonry nails or other methods approved by the Engineer.

B. Alternative methods of providing screened drain hole openings may be submitted to the Engineer for approval.

- In addition to the drain holes and weep holes specified in the preceding paragraph, holes approximately 3 inches in diameter for relief of hydrostatic pressure shall be provided at the bottom of walls, immediately above the footing, at approximately 15-foot centers.

51-1.16 RAILINGS AND BARRIERS

- Railings and barriers shall conform to the provisions in Section 83, "Railings and Barriers."
- Falsework supporting spans of cast-in-place girders, slab bridges or culverts shall be released prior to constructing or installing railings or barriers on such spans unless permitted otherwise by the Engineer.

51-1.17 FINISHING BRIDGE DECKS

- The completed roadway surfaces of structures, approach slabs and adjoining approach pavement, and the top surfaces of concrete decks which are to be covered with another material, shall be constructed true to the required grade and cross section and to the smoothness, surface texture and surface crack requirements specified herein.