

MDSAR manual, List II-7, "Epoxy Resin Systems for Use with Portland Cement Concrete", shall be placed for bonding freshly mixed concrete to hardened concrete. Keyways and dowels shall be placed as shown on the plans or directed.

5. WATER STOPS.

Water stops shall be furnished and placed as required by the plans. They shall form continuous watertight joints.

(g) EXPANSION JOINTS.

All joints shall be constructed according to details shown on the plans, providing the design width designated for the expansion joint. The insertion and removal of joint forming material shall be accomplished without chipping or breaking the corners of the concrete. Expansion material, when required, shall be placed as shown on the plans.

(h) FORMS.

1. GENERAL.

Reference is made to Article 105.02 concerning working drawings and other details that require submission.

Forms shall be substantial and unyielding and so designed and constructed that the finished concrete will conform to the plan dimensions and contours within tolerances listed in other portions of these Specifications.

Basic bridge plan design is for removable forms and plan concrete quantities computed accordingly. Hence, removable forms are to be used unless stay-in-place forms are allowed by contract plan notes and details. When shown by contract plan details, the Contractor will be allowed the option of using permanent steel forms under deck slabs between girders, beams or stringers provided the cost of extra concrete and materials required by this type of form is at the Contractor's expense.

2. DESIGN.

a. Removable Forms.

All removable forms shall be designed so that they may be removed without damage to the concrete. Forms shall be so constructed that portions where finishing is required can be removed for that purpose without loosening supports or disturbing portions of forms that must still remain in place.

b. Permanent Steel Bridge Deck Forms.

The forms and supports shall be zinc coated (Galvanized) steel conforming to ASTM A 653 with coating Class of G165 according to ASTM A 525 and shall otherwise meet all requirements relevant to permanent steel forms and the placing of concrete as specified herein and as noted on the plans. Miscellaneous fastener hardware (bolts, nuts, metal screws, and washers) shall be common stock hardware items galvanized to provide a zinc coating equal to or better than that required by ASTM B 633.

The following criteria shall govern the design of permanent steel bridge deck forms:

(1) The steel forms shall be designed on the basis of dead load of form, reinforcement, and plastic concrete plus 50 pounds per square foot {2.4 kN/m²} for construction loads. The unit working stress in the steel shall not be more than 0.725 of the specified minimum yield strength of the material furnished, but not to exceed 36,000 pounds per square inch {250 MPa}. The uncoated thickness of the forms shall not be thinner than 0.0359 inch {0.9 mm}.

(2) Deflection under the weight {mass} of the forms, the plastic concrete, and reinforcement shall not exceed 1/180 of the form span or 0.5 inches {13 mm}, whichever is less, but in no case shall this loading be less than 120 pounds per square foot {5.7 kN/m²} total.

The permissible form camber shall be based on the actual dead load condition. Camber shall not be used to compensate for deflection in excess of the foregoing limits.

(3) The design span of the form sheets shall be the clear span of the form plus 2 inches {50 mm} measured parallel to the form flutes.

(4) Physical design properties shall be computed in accordance with requirements of the American Iron and Steel Institute Specification for the Design of Cold Formed Steel Structural Members, latest published edition.

(5) The plan dimensions of both layers of primary deck reinforcement from the top surface of the concrete deck shall be maintained. A minimum concrete cover of 1 inch {25 mm} shall be maintained for the bottom slab steel.

(6) Forms shall not be welded to any part of the structural steel main members (the definition of "main members" is given in Section 836. The installation of forms may be done by welding attachment straps together if backing plates are installed under the straps. The backing plates shall be thick enough to prevent burn-through. The width of the backing plates shall be at least one inch wider than the width of the welded attachment straps so that the backing plates extend out at least one half inch beyond each edge of the welded straps.

3. CONSTRUCTION.

a. Removable Forms.

(1) Forms shall be mortar tight and placed and maintained true to designated lines and grades until the concrete has been placed and hardened. Forms found unsatisfactory in any respect shall not be used and, if rejected, shall be removed from the immediate work site.

(2) All moldings, panel work, and bevel strips shall be straight and true with neatly mitered joints and all corners in the finished work shall be true, sharp, and clean cut and of good workmanship. Forms shall be filleted and chamfered at all sharp corners except where angles exceed 90°, such as at the face of bridge curbs and deck overhangs. Unless otherwise shown on the plans, the equal sides on triangular molding or chamfer shall be 0.75 inches {19 mm}, except that for small members the width shall be 0.5 inches {13 mm}.

(3) For narrow walls, columns, et cetera, the Engineer may require daylight and inspection holes at vertical intervals as directed.

(4) Bolts or ties shall be used to prevent forms from spreading. All such bolts or ties shall be arranged so that at least 1 inch {25 mm} of that part adjacent to the concrete surface can be removed or broken off.

(5) Anchor devices may be cast in the concrete for later use in supporting forms only if they are detailed on approved formwork or falsework plans.

(6) The inside of all forms shall be coated with a non-staining oil or other approved material to prevent the concrete adhering to them. Extreme care shall be exercised to ensure that form oil does not come in contact with structural or reinforcing steel.

(7) The forms shall be inspected before placing the concrete and the interior dimensions carefully checked to ensure that the concrete will be of the form and dimensions shown on the plans. The inside faces of the form shall be thoroughly examined and any projections, ridges, depressions, offsets, spaces or other unevenness corrected so that the surface of the concrete will be smooth, even and true, and mortar tight. All forms shall be wetted immediately prior to placing the concrete, but no excess water shall remain in the forms.

(8) To permit proper surface finishing, forms shall be removed as soon after the concrete has set as is practicable and safe. In the determination of the time for the removal of forms, except those listed elsewhere in this Section, consideration shall be given to the location and character of the structure, the weather and other conditions influencing the setting of the concrete, and the material used in the mixture. Methods of form removal likely to cause over-stressing of the concrete shall not be used. Forms shall not be removed without the approval of the Engineer.

b. Permanent Steel Bridge Deck Forms.

(1) All forms shall be installed in a manner acceptable to the Engineer.

(2) On steel members, form sheets will not be permitted to rest directly on the top of the stringer or floor beam flanges. Sheets shall be securely fastened to form supports and shall have a minimum bearing length of 1 inch {25 mm} at each end. Form supports shall be placed in direct contact with the flange of stringer or floor beam. The installation of attachment straps, shelf angles, and forms shall be carefully monitored to make sure that no welding (weld, arc strike, etc.) is done to the structural steel.

On concrete girders, form supports to be cast into the girders shall be shown on the shop drawings. All attachments to form supports shall be made by permissible welds, bolts, clips, or other approved means. Attachment by welding to form supports may be performed by non-ALDOT qualified welders with welding electrodes recommended by the form manufacturer.

All form welds shall be cleaned of slag and wire brushed just prior to placing of the deck concrete.

(3) Any permanently exposed form metal where the galvanized coating has been damaged shall be thoroughly cleaned, wire brushed, and painted with two coats zinc oxide-zinc dust primer, Federal Specification TT-P-641, Type II, no color added, to the satisfaction of the Engineer. Minor heat discoloration in areas of welds need not be touched up.

(4) Transverse construction joints shall be located at the bottom of a flute and 0.375 inch {10 mm} weep holes shall be field drilled at not more than 12 inches {300 mm} apart along the line of the joint. If a bridge is on a skew, or in a curve, a weep hole shall be drilled in the bottom of each flute the joint crosses.

(i) FALSEWORK.

1. DESIGN AND CONSTRUCTION.

a. General.

For the purpose of this specification, falsework shall be divided into two classes as follows:

Class 1 - Common or simple falsework such as temporary bracing to provide stability for bridge girders, permanent steel bridge deck forms, deck overhang supports, screed rail support systems, or substructure supports attached to permanent parts of the structure (i.e. drilled shafts, columns, caps, etc.).

Class 2 - Unique or complex falsework such as that required for box girder construction, RCDG construction, structural cofferdams, or any falsework used in connection with steel erection.

The Contractor shall be responsible for designing and constructing safe and adequate falsework which provides the necessary strength and rigidity, supports all loads imposed, and produces a finished structure with lines and grades shown on the plans. Falsework shall be designed and constructed to withstand all imposed loads during erection, construction, usage, and removal.

The Contractor shall submit to the Construction Engineer working drawings and design calculations for falsework in accordance with Article 105.02.

For both classes of falsework drawings, the Construction Engineer will verify that the licensed Professional Engineer signature and stamp requirements of Subarticle 105.02(d) are met. Class 1 drawings will be stamped for distribution and then distributed. Class 2 drawings will be forwarded to the Bridge Engineer for review to determine if the results of the licensed Professional Engineer's calculations are in compliance with design criteria. If the design criteria are met, the submittal will be returned to the Construction Engineer to be stamped for distribution and then distributed.

All falsework will be inspected by the Project Manager using the distributed drawings. For all Class 2 falsework, the licensed Professional Engineer who signed the falsework submittal shall verify that the falsework as constructed meets all design criteria prior to any load being placed thereon. A signed statement from the licensed Professional Engineer covering the verification shall be furnished to the Project Manager by the Contractor.

When falsework of either class is to be used over highway, pedestrian, or railroad traffic, additional details will be required to provide for special protection to prevent debris from falling on the traffic below. These additional details will be required for both removal and construction work.

All falsework drawings shall include a description and size of all members, connections, and miscellaneous hardware. When pre-manufactured assemblies are used, all parts shall be easily identified as those shown on the drawings.

All falsework shall be designed and constructed to provide the necessary rigidity and to support the loads without appreciable settlement or deformation. Screw jacks and/or hardwood wedges shall be used to take up any settlement in the formwork either before or during the placing of concrete.

Any part of the permanent structure to which falsework will be attached shall attain a minimum compressive strength of 2400 psi {17 MPa} from cylinders prepared in conformity with AASHTO T 23 prior to the attachment.

Falsework that cannot be founded on a satisfactory footing shall be supported on piling, which shall be spaced, driven, and removed in an approved manner.

All spans shall be given a temporary camber to allow for deflection, shrinkage, and settlement. Bridges shall have a permanent camber only where so shown on the plans or directed.

b. Design Criteria.

Falsework shall be designed to withstand all imposed loads during erection, construction, usage, and removal. Designs shall be based on minimum loads, maximum stresses and deflections, and conditions in the following paragraphs. Allowable stresses are based on use of