

## 708 - FALSEWORK AND FORM CONSTRUCTION

### SECTION 708

#### FALSEWORK AND FORM CONSTRUCTION

##### 708.1 DESCRIPTION

Design and construct safe, adequate falsework to provide the necessary rigidity, support the loads imposed and produce the final structure to the lines and grades shown in the Contract Documents. Falsework is defined to be any temporary structure which supports structural members or form work.

<u>BID ITEM</u>	<u>UNITS</u>
Falsework Inspection	Lump Sum

##### 708.2 MATERIALS

Use sound falsework piling to withstand driving, is reasonably straight, and is of sufficient size to provide the strength to safely carry the actual loads imposed. Use sound timber in good condition and free from defects that might impair its strength.

All approved metal or wood forms shall present a smooth surface, be mortar tight and sufficiently rigid to prevent distortion due to the pressure of the concrete and other loads incident to the construction operations, including placement and vibration of the concrete.

Do not use aluminum forms in contact with concrete.

##### 708.3 CONSTRUCTION REQUIREMENTS

###### a. Falsework Design.

(1) General Falsework Design Requirements. Design falsework according to the KDOT Bridge Design Manual, Falsework Design, Analysis and Inspection.

Include the type, size, grade and finish of all lumber used. Provide adequate details of the proposed method of construction. The Engineer may request additional information.

In designing forms and centering, regard concrete as a liquid. In computing loads, assume a weight of 150 pounds per cubic foot for the vertical pressure, and a minimum of 85 pounds per cubic foot in computing horizontal pressure.

Do not place cast-in-place shear bolts, coil inserts or other devices used as falsework support in pier columns without the approval of the Engineer. Through bolts are permitted. Do not drill and grout bolts or other devices into the pier columns unless shown in the Contract Documents.

(2) Category 1 Structures. On the structures listed below, submit to the Engineer for review (See **SECTION 105**) by the State Bridge Office (SBO) (or Bureau of Local Projects) and, if applicable, the railroad company, 7 copies of detailed falsework plans designed and sealed by a Professional Engineer.

- All structures over or under railroad tracks;
- All structures built over highways or streets carrying traffic;
- All structures requiring falsework that directly carries highway traffic loads during construction;
- Deck overhangs greater than beam depth or greater than 54 inches;
- Superstructure forming with "non-typical" support (i.e. needlebeams); and
- All structures that require falsework plans to be submitted to the SBO (or Bureau of Local Projects) as noted in the Contract Documents.

(3) Category 2 Structures. If not included in the Category 1 structures above, submit to the Engineer for review (See **SECTION 105**) by the Field Engineer, 3 copies of detailed falsework plans designed and sealed by a Professional Engineer on the Category 2 structures listed below.

- All cast-in-place span structures supported on falsework;
- Concrete Box Structures with cell spans greater than 16 feet or cell heights greater than 14 feet;
- Decks with girder spacing equal to or greater than 14 feet; and
- Substructure forming with "non-typical" support.

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Falsework or formwork details for deck construction are not required for all other structural steel, prestressed concrete girder and reinforced concrete box bridge construction.

**b. Falsework Construction.** Adhere to all falsework details.

Drive falsework piling to a satisfactory depth and bearing value to support all falsework that is not founded on rock, shale or thick deposits of other compact material in their natural beds. Do not use mudsills on earth, sand, gravel and similar materials, unless otherwise noted in the Contract Documents. Do not support falsework on any part of the structure, except the footings, without written approval from the Engineer. The number and spacing of falsework piling, the adequacy of sills, caps and stringers, and the amount of bracing in the falsework framing is subject to approval of the Engineer.

If the falsework piling or vertical members are of sufficient length to cap at the desired elevation for the horizontal members, cap them and construct frames to the proper elevation. If falsework piling are not of sufficient length, extend them using an approved pile splice. Do not use wedges at pile splices. Cut the ends of the piling or vertical members square for full bearing. If vertical splices are necessary, the abutting members shall be of the same approximate size, with the ends cut square for full bearing. Provide an adequate splice to maintain rigidity of the joint, including inserting a #9 reinforcing bar 18 inches into each end of the abutting members.

Upon completion, remove all forms and falsework according to **SECTION 710**. Pull or cut off falsework piling 12 inches below low water level, the natural ground or the bottom of a channel change. On grade separation structures, pull or cut off the falsework piling 12 inches below subgrade elevation of the roadbed that the piles are driven into. Pull or cut off all other falsework piling 12 inches below finished grade.

Unless the Contract Documents provide for permanent camber, construct the falsework to provide only sufficient camber to prevent final settlement below the finish grades shown in the Contract Documents. Use adequate hardwood wedges or screw jacks in all falsework construction, and place and adjust them to provide the proper form alignment. If required, provide a means for adjusting forms to offset any excessive settlement. When screw jacks are used, adequately brace and secure them to prevent tipping of the jacks in any direction.

**c. Falsework Inspection Requirements.** For Category 1 structures, the falsework designer of record shall make a Falsework Inspection of the as-built falsework for substantial compliance with the falsework plans prior to placing concrete in the structure.

Conduct an on-site review of the falsework. Items to be reviewed include but are not limited to:

- The condition of the materials used for piling, cross bracing, beams, plywood decking, shims and jacks.
- The size and spacing of all structural members regarding their compliance to the submitted falsework plan.
- The condition and compliance of all splices.

Provide written documentation to the Engineer stating the falsework as-built is acceptable and in compliance with the original sealed plans. If the falsework is not in compliance, make corrections to the falsework or submit a revised, sealed falsework design prior to the placement of any concrete. When modifications are made to the falsework, the designer of record shall make Falsework Inspections until written documentation is provided to the Engineer stating that the falsework is in compliance, at no additional cost to KDOT.

For Category 2 falsework plans, conduct a walk-through review of the falsework with the Field Engineer, prior to placing concrete in the structure. Variations and deficiencies from the plan will be noted in writing and supported with photos or sketches. Forward the documentation to the falsework designer. The designer must respond in writing that the deficiencies are minor and the falsework is in substantial compliance, or must propose a new falsework plan which addresses the deficiencies.

The Engineer will refuse approval to proceed with other phases of the work if the falsework is determined to be unsafe or inadequate to properly support the subjected loads.

**d. Forms.** Do not separate forms at joints. Design the forms to permit easy removal without injury to the concrete. Use form lining such as plywood or metal forms for all exterior exposed surfaces which shall be visible after backfilling. The inside surface of the walls and slab of box culverts and bridges, the inside arch ring of arch culverts and bridges, the underneath surface of all floor slabs and the interior vertical surfaces of girders do not require form lining. Extend the forms to low water level, 1 foot below the bottom of the channel, or the top of the completed backfill. Use forms in the largest practical panels to minimize joints. Do not use small panels. If wooden panels are used, place the adjacent panels so that the grain of the wood shall be in the same general

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direction (all horizontal or all vertical). Undressed lumber of uniform thickness may be used as backing for the form lining. Dressed, sized lumber of uniform thickness may be used for all other exposed surfaces. Wooden plyform of adequate thickness, which is supported to meet these requirements, may be used alone in lieu of the lined forms.

Maintain forms to eliminate warping and shrinkage. Check dimensions and condition immediately before placing concrete. The Engineer may at any time require the revision or reconstruction of forms to maintain satisfactory work, and may refuse approval to place concrete within the forms until they are satisfactorily constructed. If during or after placing the concrete, the forms show signs of sagging or bulging, remove the concrete to the extent directed by the Engineer, bring the forms to the proper position and place new concrete.

Metal forms shall be of such thickness that the forms shall remain true to shape, line and grade. Countersink all bolt and rivet heads. Design clamps, pins or other connecting devices to hold the forms rigidly together, and allow removal without injury to the concrete. Exercise care to keep metal forms free from rust, grease or other foreign matter. Any form which will leave permanent impressions or ridges will not be approved.

Before placing the reinforcing steel, oil the inside of all forms for exposed surfaces (except those lined with certain composition materials) with a light, clear, paraffin base oil that will not discolor or otherwise injure the surface of the concrete.

Moisten wooden forms with water before placing the concrete.

Consider the nature of the work when determining the width and thickness of the lumber, and the size and spacing of studs and wales. Provide the size and spacing of studs and wales to maintain rigidity of the forms, and prevent distortion of the forms due to the pressure of the concrete.

Use either steel or non-metallic form bolts, rods and ties. Use the type that permits the major part of the tie to remain permanently in the structure. Hold forms in place by devices attached to the wales capable of developing the strength of the ties. The Engineer may permit the use of wire ties on irregular sections and incidental construction if the concrete pressures are nominal and the form alignment is maintained by other means. Remove the ties on all exposed surfaces. Remove steel ties to a depth a minimum of ½ inch below the concrete surface. Non-metallic ties may be removed flush with the concrete surface. Cut wire ties back a minimum of ¼ inch below the concrete surface. Fill the cavities on exposed surfaces with cement mortar and leave the surface sound, smooth, even and uniform in color. Tar or roofing cement is acceptable for filling cavities on unexposed surfaces. Do not use form ties through forms for handrail. Remove wood, or metal spreaders as the concrete is placed. Do not use cofferdam braces or struts that extend through the forms for any concrete section. An exception may be approved in unusual situations.

Where the bottom of the forms is inaccessible, make provisions so that extraneous material can be removed from the forms immediately before placing the concrete.

Bevel all exposed edges by using dressed, triangular molding having ¾-inch sides unless provided otherwise in the Contract Documents.

Steel traveling forms may be used on reinforced concrete box structures or other applications when approved by the Engineer. Continuance of the use of such forms is based on satisfactory performance. Steel traveling forms may be discontinued at any time the Engineer determines their use is unsatisfactory. If traveling forms are used, provide supports as listed in **TABLE 708-1** before loosening and moving the forms.

spans up to 9 feet	1 support located at center of span
spans 9 to 14 feet	2 supports located at third points of span
spans over 14 to 18 feet	3 supports located at quarter points of span

The maximum longitudinal spacing of the supports is at 4 foot centers. The time the supports must be left in place is specified in **TABLE 710-3**. Do not loosen and move the forms until the concrete has been in place a minimum of 14 hours. When concrete is exposed as a result of moving the forms after the minimum 14 hours, but before the stipulated curing time, immediately coat the concrete with liquid membrane-forming compound applied according to **DIVISION 700**.

### 708.4 MEASUREMENT AND PAYMENT

The Engineer will not measure Falsework Design, Falsework Construction or Forms (design or construction) for payment.

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On structures designated as Category 1 by KDOT, the Engineer will measure falsework inspection by the Lump Sum. Falsework inspection on Category 2 structures is subsidiary to other items of the contract. If KDOT designated the structure as Category 2, and the Contractor's operations (use of non-typical supports) cause the falsework to become Category 1, the Engineer will not measure the falsework inspection for separate payment.

Payment for "Falsework Inspection" on structures designated by KDOT as Category 1 will be made on the paid invoice amount +5%, not to exceed the "Lump Sum" amount set in the contract and is full compensation for the specified work.