

SECTION 00540 - STRUCTURAL CONCRETE

(Follow all instructions. If there are no instructions above a subsection, paragraph, sentence, or bullet, then include them in the project but make necessary modifications to only include project specific specifications. Delete specifications that do not apply to the project.)

Comply with Section 00540 of the Standard Specifications modified as follows:

00540.10 General - Add the following sentence to the end of this subsection:

Furnish a concrete surface retarder from the QPL.

00540.15 Form Materials - Replace this subsection, except for the subsection number and title, with the following:

Furnish wood, minimum nominal 5/8 inch thick APA exterior grade plywood, minimum nominal 5/8 inch thick APA plyform, metal, or other suitable form material. For round concrete columns, provide either metal or other approved form material that produces a smooth and true surface free from fins, joints and other irregularities. Use APA plyform for all decks and slabs.

00540.17(a) Aggregate - Delete the sentence that reads "Blend aggregates only as allowed in 02001.20."

00540.17(c) Hardened Concrete - In the paragraph that begins "Cast and cure test...", replace "14 inch x 8 inch" with "4 inch x 8 inch".

00540.17(c-3) Acceptance - Replace the paragraph that begins "If an ASTV falls..." with the following paragraph:

If an ASTV falls below $f'c$, the Contractor may submit a written plan outlining a proposed alternate method of evaluating compressive strength. Submit the plan for review by the Engineer within three days of the test. Provide evidence that a reasonable $f'cr$ (over-design) was maintained and that there is credible evidence (besides low strength) which warrants consideration of this option. The Engineer may allow an alternate method of acceptance if the compressive strength test results are determined to be suspect from definable external factors.

00540.43(a) Construction Joints - Replace the paragraph that begins "Within 24 hours after..." with the following paragraphs:

Apply a concrete surface retarder according to the manufacturer's recommendations. Remove surface mortar within the time period recommended by the manufacturer and clean the joint surface and reinforcing steel by removing loosened particles of aggregate, damaged concrete, unconsolidated concrete and surface laitance with a high pressure washer conforming to 00540.28 to the extent that clean aggregate (free of surface mortar) is exposed on 50% of the surface. Clean the joint surface again immediately prior to the concrete placement to remove any subsequent deposits of dirt, debris or other foreign

materials. Saturate the joint surface with potable water immediately before resuming concrete placement. Remove standing water in depressions or hollows of the joint surface.

Saw cut the top 1 inch of the deck joints with a straight vertical cut before subsequent concrete placement and before saturating the surface with water. Where joints are straight and without spalls, the Engineer may waive this saw cut requirement.

Hand rub or brush fresh concrete paste onto the existing surface of vertical deck joints down to the top mat of reinforcing steel at the beginning of subsequent concrete placement.

Stay in place joint forms are not allowed in bridge deck construction joints.

00540.43(c) Joint with Fillers - Add the following sentence to the end of the paragraph:

Provide a 3/4 inch chamfer on each edge of the joint unless otherwise noted.

00540.48(g) Bridge Decks - Add the following bullet to the bullet list:

- Has saturated the tops of precast prestressed concrete members and formwork by applying continuous water for a minimum of 2 hours immediately prior to beginning deck placement.

00540.49(a-2-a) General - Replace the paragraph that begins "Do not place ..." with the following two paragraphs:

Do not place concrete if the air temperature is, or is forecast to be, below 40 °F the day of placement or is forecast to be below 40 °F on any of the next seven calendar days (14 calendar days for decks) after placement unless a Cold Weather Plan has been approved by the Engineer.

To place concrete when the temperature is below 40 °F, submit a Cold Weather Plan that identifies the methods that will be used to prevent the concrete temperature from falling below 50 °F. Methods include heated enclosures and insulated forms. Also include in the plan measures that will be taken if the concrete temperature falls below 50 °F. Provide a 24 hour continuous recording thermometer to verify the concrete temperature.

00540.49(b) Bridge Deck Placement - Add the following bullet before the first bullet:

- Only if precipitation is not forecast between 2 hours before and 2 hours after the scheduled placement duration. An acceptable forecast will have less than 30% chance of precipitation for the entire placement window. Provide a forecast to the Engineer 1 hour before placement.

00540.50(c) Deck Roadway Texturing - In the bullet that begins "Unequally space...", replace "Unequally space grooves from" with "Space grooves randomly from".

Add the following bullet after the bullet that begins "Orient the grooves...":

- Do not groove within 6 inches of joint blockouts and bridge ends. For skewed bridges, additional ungrooved portions at joint blockouts and bridge ends are allowed to accommodate the width of the gang saw.

00540.51(b) Curing Concrete Bridge Decks - In the bullet that begins "Provide wind breaks...", replace "0.20 pounds per square foot" with "0.10 pounds per square foot".

00540.53(a-1) On All Surfaces - In the bullet that begins "Fill holes and...", replace "1/2 inch" with "1/4 inch".

00540.53(d-1) Concrete Paint - In the sentence that begins "Thoroughly saturate the surface...", replace "02210.30(c)" with "02210.30".

00540.54 Crack Inspection and Deck Sealing - Replace the paragraph that begins "Immediately after the cure..." with the following paragraph:

Before opening the bridge deck to traffic, the Engineer will inspect the deck for cracks.

(Use the following subsection .80(a-1) when concrete is paid for on the lump sum basis. List by bridge number then by bid item name. Add items as appropriate. Delete what does not apply. Obtain information from the Bridge Designer.)

00540.80(a-1) Lump Sum - Add the following to the end of this subsection:

The estimated quantity of concrete is:

Bridge No. _____

Type and Class	Quantity (Cu. Yd.)
Foundation Concrete, Class _____	_____
Deck Concrete, Class _____	_____
General Structural Concrete, Class _____	_____

Bridge No. _____

Type and Class	Quantity (Cu. Yd.)
Foundation Concrete, Class _____	_____
Deck Concrete, Class _____	_____
General Structural Concrete, Class _____	_____

00540.80(b) Saw Cut Texturing - Replace this subsection, except for the subsection number and title, with the following:

The quantities of surface texturing will be measured on the area basis and will be the area of each bridge deck or end panel shown less 16 inches along each curb. Field measurement of surface texturing will not be made. The area will be calculated to the nearest square yard for each bridge deck or end panel.

(Include the following falsework design checklist when required by the Bridge Designer.)

FALSEWORK DESIGN CHECKLIST

Instructions - This checklist was developed to facilitate the design, review, and erection of falsework to be used for Oregon Department of Transportation bridge construction projects. This checklist is intended to act as a reminder to design or check for specific important aspects of this construction. It is not a substitute for plan and/or design criteria or specification requirements.

The Checklist is to be completed and signed by the Falsework Design Engineer. Answer every question. Attach to the Checklist an explanation of any negative responses.

Submit the Checklist according to 00540.41(a).

	YES	NO	N/A
A. Contract Plans, Specifications, Permits, Etc.			
1. Are the falsework plans prepared, stamped and signed by an engineer registered to practice in Oregon?	_____	_____	_____
2. Have three complete sets (five if railroad approval is required) of the design calculations been included with the falsework drawings submittal?	_____	_____	_____
3. Are falsework plans in compliance with the requirements of the construction plans general notes?	_____	_____	_____
4. Are falsework plans in compliance with contract plan structural details?	_____	_____	_____
5. Are falsework plans in compliance with the requirements of the Oregon Standard Specifications for Construction, subsection 00150.35?	_____	_____	_____
6. Are all existing, adjusted or new utilities in proximity with the proposed falsework shown on the falsework plans and is protection of these utilities addressed?	_____	_____	_____
7. Are clearance requirements satisfied and shown on the falsework plans?	_____	_____	_____
8. For construction in or over navigable waters have all requirements for construction of falsework that are called for in the Coast Guard Permit been incorporated in the falsework design?	_____	_____	_____
9. Has possible damage from traffic been considered in the falsework design?	_____	_____	_____

- 10. Has damage from stream drift been considered in the falsework design? _____
- 11. Is the concrete placing sequence shown and is it consistent with the contract plans? _____

B. Foundation Requirements

- 1. Are driven falsework piling provided as called for on the contract plans? _____
 - a. Is a minimum pile tip elevation or penetration indicated on the drawings? _____
 - b. If timber falsework piles are specified, are the recommended order lengths sufficient to virtually eliminate the possibility of pile splices? _____
 - c. Is a detailed static pile capacity analysis included in the calculations? _____
 - d. If lateral loads are applied to the piling by equipment, dead loads, flowing water, or drift, is a detailed lateral load analysis included in the calculations? _____
 - e. When piling are in an active waterway, have the potential effects of scour on axial and lateral pile support been addressed in the calculations? _____
 - f. Does the proposed falsework pile hammer meet the minimum field energy requirements as listed in 00520.20(d-2)? _____
 - g. Will a driving criteria graph [FHWA Gates Equation, in 00520.42(b)] plotting blow count versus stroke for an acceptable pile hammer be provided for the project inspector? _____
- 2. Is falsework supported on spread footings or mud sills? _____
 - a. Are the spread footing elevations shown on the drawings? _____
 - b. Has a rational method for determining the ultimate bearing capacity of the foundation materials been presented and described in the calculations? _____

- c. Have the soil parameters used in calculating the ultimate bearing capacity been listed and confirmed by the designer? _____
- d. Has an appropriate Factor of Safety been used for calculating the allowable bearing capacity of the foundation materials? _____
- e. Are spread footing settlement estimates included in the calculations? _____
- f. Have effective stresses been used in the calculations, when applicable? _____
- g. When spread footings are founded near the top of a slope or in a slope, have the ultimate bearing capacity calculations been modified accordingly? _____
- h. When spread footings may be subjected to flowing water, have the potential effects of scour on ultimate bearing capacity been addressed in the calculations? _____

C. Loads

- 1. Are the magnitude and location of all loads, equipment and personnel that will be supported by the falsework shown and noted on the falsework plans? _____
- 2. Has the mass of specific equipment units to be supported by the falsework been included in the calculations or on the falsework plans? _____
- 3. Is the deck finishing machine supported in a manner that will not impose load on concrete forms except deck overhang brackets? _____
- 4. Are design loads and material properties used to determine design stresses for each different falsework member shown on the falsework plans? _____
- 5. Is the worst loading and member property condition, rather than the average condition, used to obtain design loads? _____
- 6. Are deck forms for concrete box girders supported from the girder stem and not from the bottom slab? _____
- 7. Are diaphragm loads or other concentrated loads included in the analysis of supporting beams? _____

8. If sloping structural members exert horizontal forces on the falsework, is bracing or ties used to resist these loads? _____

D. Allowable Stresses

1. Has the method used for falsework design of all members except for manufactured assemblies been noted in the design calculations? _____
2. Are manufactured assemblies identified as to manufacturer, model, rated working capacity and ultimate capacity? _____
3. Is the allowable stress and the calculated stress listed in the summary for each different falsework member, except for manufactured assemblies? _____

E. Timber Falsework Construction

1. Are timber grades consistent with material to be delivered to the construction site, and noted on falsework drawings, and in accompanying calculations for all timber falsework material? _____
2. If "rough" lumber is specified for falsework by the falsework designer are the actual lumber dimensions used in calculations shown? _____
3. If plywood spans are governed by the strength of the plywood, are the allowable stress and the calculated stress shown on the submitted calculations? _____
4. If plywood spans are governed by the allowable spacing of supporting joists, are the allowable and the proposed spacing shown on the falsework plans? _____
5. Have timber stringers been checked for bending, shear, bearing stresses, and 1/240 of the span length deflection? _____
6. Are joists identified as being continuous over 3 or more spans when they are not analyzed as simple spans? _____
7. Have stringers and cap beams been checked for bearing stresses perpendicular to the grain as well as for bending and shear stresses? _____
8. Have posts been checked as columns as well as for compression parallel to the grain? _____

F. Steel Falsework Construction

- 1. Are steel structural shapes and plates identified by ASTM number on the falsework plans and in the calculations? _____
- 2. Have steel beams been checked for bending, shear, web crippling and buckling of the compression flange? _____
- 3. Has horizontal plane bracing been shown where required to limit compression flange buckling? _____

G. Deflections and Settlement

- 1. Is falsework deflection for concrete dead load shown on the plans for all falsework spans? _____
- 2. Is falsework deflection from concrete dead load limited to 1/240 of the span length for all falsework spans? _____
- 3. Do stringers supporting cast-in-place concrete compensate for estimated camber? _____
- 4. For beam spans with cantilevers, has the upward deflection of the cantilevers due to load placed on the main spans been investigated? _____
- 5. Are provisions shown for taking up falsework settlement? _____

H. Compression Members, Connections and Bracing

- 1. Has general buckling been evaluated for all compression members? _____
- 2. Has bracing been provided at all points of assumed support for compression members? _____
- 3. Was bracing in each direction considered in establishing the effective length used to check post capacity? _____
- 4. Is bracing strength and stiffness sufficient for the intended purpose? _____
- 5. If temporary bracing is required during intermediate stages of falsework erection, is it shown on the falsework plans? _____
- 6. Have all connections been designed and detailed? _____
- 7. Are web stiffeners required on steel cap beams to resist eccentric loads? _____

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|-----|--|-------|-------|-------|
| 8. | Are wedges required between longitudinal beams and cap beams to accommodate longitudinal slope or to reduce eccentric loading? | _____ | _____ | _____ |
| 9. | Has the width to height ratio of wedge packs been verified to fall within the limits given in the special provisions? | _____ | _____ | _____ |
| 10. | If overhang brackets are attached to unstiffened girder webs, has the need for temporary bracing to prevent longitudinal girder distortion been investigated? | _____ | _____ | _____ |
| 11. | Have beams and stringers with height/width ratios greater than 2.5:1 been checked for stability? | _____ | _____ | _____ |
| 12. | Have sloping falsework members that exert horizontal forces on the falsework been braced or tied to resist these loads? | _____ | _____ | _____ |
| 13. | If beams supporting cast-in-place concrete have cantilever spans, have the falsework plans been noted to require the main spans be loaded before loading the cantilever spans? | _____ | _____ | _____ |
| 14. | Have timber headers set on shoring towers been checked for eccentric loads, and for shear and bending stresses produced by the eccentricity? | _____ | _____ | _____ |

I. Highway and Railroad Traffic Openings (For falsework over or adjacent to highway or railroad traffic openings.)

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|----|---|-------|-------|-------|
| 1. | Do falsework plans satisfy construction clearances shown on the contract plans? | _____ | _____ | _____ |
| 2. | Are posts designed for 150% of the calculated vertical loading and increased or readjusted for loads caused by prestressing forces? | _____ | _____ | _____ |
| 3. | Are mechanical connections 2,000 pounds minimum capacity shown at the bottom of posts to footing connections? | _____ | _____ | _____ |
| 4. | Are mechanical connections 1,000 pounds minimum capacity shown at the top of the post to cap connections? | _____ | _____ | _____ |
| 5. | Are beam tie downs 500 pounds minimum capacity shown for all beams? | _____ | _____ | _____ |
| 6. | Are 5/8 inch or larger diameter bolts used at connections for timber bracing? | _____ | _____ | _____ |
| 7. | Are temporary erection and removal bracing shown? | _____ | _____ | _____ |

J. Additional Requirements for Railroad Traffic Openings

- 1. Do falsework plans show collision posts as shown on the contract plans? _____
- 2. Do posts adjacent to the openings have a minimum section modulus of?
 - a. steel - 9.5 cubic inches _____
 - b. timber - 250 cubic inches _____
- 3. Are soffit and deck overhang forming details shown? _____
- 4. Are falsework bents within 20 feet of centerline of the track sheathed solid between 3 feet and 17 feet above top of rail with 5/8 inch thick minimum plywood and properly blocked at the edges? _____
- 5. Is bracing on the bents within 20 feet of the centerline of the track adequate to resist the required assumed horizontal load or minimum 5,000 pounds, whichever is greater? _____

Designer's Signature Date

