

SECTION 503 - CONCRETE STRUCTURES

503.01 Description. This work includes constructing concrete bridges, grade *|
separations, culverts, head walls, retaining walls and other types of *|
concrete structures according to the contract. *

503.02 Materials.

(A) Portland Cement Concrete. Concrete shall be Class A and shall |
conform to Section 601 - Structural Concrete. |

(B) Other Materials. Other materials shall conform to the following: |

| | |
|---------------------------------------|-----------|
| Joint Filler | 705.01 |
| Joint Sealer | 705.04 |
| Flashing Compound | 705.05 |
| Waterproofing | 705.06 |
| Waterstops | 705.07 |
| Dowels | 709.01(E) |
| Curing Materials | 711.01 |
| Bearing Devices and Related Materials | 712.09 |
| Abrasive Coating | 712.11 |

503.03 Construction Requirements.

(A) Foundation. The Contractor shall excavate and backfill the *|
foundations according to Section 206 - Excavation and Backfill for *|
Conduits and Structures and as specified herein. *

The elevation of the bottom of footings shown in the contract are *|
approximate only. The Engineer may order in writing such changes in *|
dimensions or elevations of footings as may be necessary to secure a *|
foundation according to the contract. *

The Engineer will inspect and accept the foundations before the *|
Contractor places the concrete. The Contractor shall backfill *|
unauthorized excavation made below the required footing elevation or *|
beyond the lines shown in the contract with concrete at no cost to the *|
State. If according to the contract, the Contractor requires a *|
redesign of the foundation because of the unauthorized excavation, the *|
Contractor shall construct the redesign foundation at no cost to the *|

State. The Contractor may, at its option, prepare and submit for acceptance the detailed plans incorporating the necessary redesign of the foundation. This work shall be at no cost to the State. The Contractor shall place piling according to Section 505 - Piling.

(B) Falsework and Centering. Falsework, formwork or centering is temporary construction work on which other work is wholly or partially supported until the permanent construction is strong enough to support itself. The falsework, formwork or centering includes the form lining and sheathing plus the necessary supporting members, hardware, and bracing. The Engineer shall consider the use of the words falsework, formwork, and centering as mutually interchangeable herein.

The Contractor shall submit working drawings and design calculations for falsework and centering to the Engineer. The Contractor shall also submit manufacturer's certificates or test the falsework and centering as necessary when requested by the Engineer. Tests done shall be at no cost to the State.

The Contractor shall provide the Engineer with sufficient time to review and accept the drawings and calculations. Such time shall be proportionate to the complexity of the falsework and centering and shall not be less than two (2) weeks. No falsework or centering construction shall start until the Engineer has reviewed and accepted the drawings and calculations. The Engineer will not relieve the Contractor of the responsibility for results obtained by using such drawings and calculations.

For Non-Federal Aid County projects, the Engineer will not require acceptance of the Contractor's drawings and calculations for falsework and centering construction. The Contractor shall be solely responsible for the results obtained by using such drawings and calculations.

The allowable stresses in the design of the falsework, formwork or centering shall be the same as those specified in the latest edition of "Standard Specifications for Highway Bridges". For allowable stresses not specified in AASHTO, nationally recognized industry specifications or codes may be used upon acceptance by the Engineer. The Contractor shall use the service load design method in the calculations. The Contractor shall avoid the cantilevered falsework members. The maximum deflection due to the weight of dead and live loads shall be 0.4 percent of the span. The Contractor shall compensate for the deflections or other movements greater than quarter (1/4) inch by camber strips.

The Contractor shall calculate the spans as the smaller of center to center distance between supports or the clear span plus the member depth. The Contractor shall design the formwork for the bottom slab of box girders to carry the dead and live loads of both the top and bottom slabs unless the Contractor computes the bottom slab to carry the loads temporarily imposed upon.

The Contractor shall arrange the falsework system so that the loads imposed produce symmetrical and approximately equal reactions. The Contractor shall submit the falsework soil pressure, pile capacity and ground preparation for acceptance by the Engineer. The Contractor shall show them on the shop drawings. Where structures cross over waterways and other flood prone areas, the Contractor shall provide special consideration in the design of the supporting falsework to prevent reduction of supporting capacity due to effects of water.

If the Contractor is to prestress the concrete, the Contractor shall design the falsework to support the increased or readjusted loads caused by the prestressing forces.

The design load for the falsework or centering includes dead and live vertical loads and lateral load. The minimum vertical live load used in the design shall be fifty (50) pounds per square foot of surface area plus one hundred and fifty (150) pounds per linear foot applied at the outside edge of cantilevered members. The Contractor shall add the minimum vertical live load to the actual weight of the equipment. The minimum lateral load used in the design shall be three (3) percent of the total dead load or one hundred and fifty (150) pounds per linear foot whichever is greater. The Contractor shall apply the minimum lateral load at the top surface of the falsework support.

The design calculations shall show the stresses and deflections in the load supporting members. Anticipated total settlements of falsework and forms shall be shown on the falsework drawings. These should include falsework footing pressure and settlement and joint take-up. The Contractor shall construct the deck slab form between girders with no allowance for settlement. A Hawaii Registered Structural Engineer shall prepare the drawings and calculations for falsework supporting structures or portions of the structure over forty (40) feet high and falsework openings with a span of twenty (20) feet or more.

In designing falsework and centering, the Contractor shall assume a weight of one hundred and sixty (160) pounds per cubic foot for concrete. The Contractor shall design and construct the falsework to provide the necessary rigidity and to support the loads without appreciable settlement or deformation. The Contractor shall employ screw jacks or hardwood wedges to take up settlement in the formwork either before or during placing of concrete. The Contractor shall design the falsework for the support of the superstructure to support the loads that would be superimposed as if the entire superstructure were poured at once. For falsework design, the Contractor shall design the vertical falsework members supporting spans with a single hinge or double hinges within the span for twice the tributary falsework requirements for a distance of ten (10) feet, measured parallel to the centerline of the girder, each side of the hinges. This requirement shall apply to conventionally reinforced and prestressed structures. The Contractor shall design the falsework for prestressed structures for additional loads caused by prestressing.

The Contractor shall place the falsework or centering upon a substantial footing safe against undermining and protected the footing from softening. *

The Contractor shall space, drive, and remove the falsework piling, when used, and acceptable to the Engineer. The Contractor shall set the falsework to give the finished structure the camber specified or shown in the contract. *

The Contractor shall construct the arch centering according to centering plans acceptable by the Engineer. The Contractor shall make provisions by acceptable devices for the gradual lowering of centers and rendering the arch self-supporting. When ordered, the Contractor shall place the centering upon acceptable jacks to correct slight settlement that may occur during the placement of concrete. *

In the design of bottom slab plywood forms and timber joists for concrete box girders, the Contractor may omit the top slab loads when the Contractor pours the top slab separately from the webs and bottom slab. *

In the lost post method of deck forming of concrete box girders, the Engineer may not require two (2) inches by six (6) inches continuous mudsills beneath the posts, if the Contractor uses two (2) inches by (4) inches timber posts or smaller with soft wood wedges for supports. *

Manufactured items shall conform to AASHTO standards. If the item is not covered by AASHTO, the Contractor may use the standards of nationally known organizations such as the AISC for steel, ACI for concrete, and NFPA for lumber. The Contractor shall furnish data listing the manufacturer's design criteria and recommendations or shall do such tests as are necessary to show the adequacy of the proposed device. *

(C) Forms.

(1) **Construction.** Forms shall be of wood, metal or other acceptable material. The forms shall be mortar tight and sufficiently rigid to prevent distortion due to the pressure of the concrete and other loads incidental to the construction operations including vibration. The Contractor shall construct and maintain the forms to prevent the opening of joints due to shrinkage of the lumber. *

The Contractor shall fillet the forms at sharp corners. The Contractor shall give the fillet a bevel or draft such as girders and copings, to insure easy removal. *

The Contractor shall set and maintain the forms true to the lines designated. When forms appear to be unsatisfactory, either before or during the placing of the concrete, the Engineer may order the work stopped until the Contractor have corrected the defects. *

If the Contractor submerges the forms in water and the concrete poured in the dry, the Contractor shall make the forms watertight below the high water level by caulking, battens or other acceptable means.

The Contractor shall cover the knot holes and damaged areas with metal patches.

The Contractor shall control the rate of depositing concrete in forms to prevent deflections of the forms or form panels over the deflections permitted by the contract.

Forms not completely enclosed or hidden below the permanent ground surface shall conform to the contract for forms for exposed surfaces. The Engineer will consider interior surfaces of underground drainage structures completely enclosed surfaces.

Before the Contractor uses each forming system for exposed surfaces, the Contractor shall furnish form design and materials data to the Engineer for acceptance.

The Contractor shall design and construct the forms for exposed concrete surfaces so that the formed surface of the concrete does not undulate excessively between studs, joists, form stiffeners, form fasteners, or wales. The Engineer will consider undulations exceeding either three thirty-secondths ($3/32$) inch or $1/270$ of the center to center distance between studs, joists, form stiffeners, form fasteners or wales excessive. If forms or forming system produce a concrete surface with excessive undulations, its use shall cease until the Contractor have made modifications according to the contract. The Engineer may reject portions of concrete structure with surface undulations over the limits herein.

The Contractor shall form exposed surfaces of each element of a concrete structure with the same forming material or with materials that produce similar concrete surface textures, color and appearance.

The Contractor shall face the forms for exposed surfaces with form panels. A form panel is a continuous section of form facing material, unbroken by joint marks, against which the Contractor places concrete.

(2) Form Lumber. Form lumber, except curved and special surfaces, shall be five (5) ply panel boards or dressed shiplap, used with or without form liners. The Contractor may use rough lumber for unexposed surfaces in the finished structure. The Contractor may use three (3) ply panel boards for forming the soffit of the unexposed portions of the top slabs of box girders.

Plywood for forms shall conform to the latest edition of "United States Product Standard PS-1 for Construction and Industrial Plywood". The Contractor shall place form panels in uniform widths of not less than thirty-six (36) inches and in uniform lengths of not less than six (6) feet, except where the dimensions of the members formed are less than the specified panel dimensions. The Contractor shall place the plywood panels with the grain of the outer plys in the direction of the span.

The Contractor shall place the form panels in a neat, symmetrical pattern subject to the acceptance of the Engineer. The Contractor shall place the panels with the long dimensions horizontal. Horizontal joints shall be level and continuous. The Contractor shall stagger and be perpendicular to the vertical joints when shown in the contract.

(3) Form Ties. Form ties shall be of sufficient strength and number to hold the form securely and prevent spreading of the forms during concrete placement. The Engineer will not permit the use of ties consisting of twisted wire loops to hold forms in position. The Engineer will not permit non-metallic forming ties, anchorages, forming supports or other accessories that the Contractor embeds permanently in the concrete.

The Engineer will not permit the use of driven type of anchorages for fastening forms or form supports to the concrete.

The Contractor shall construct the form ties or anchorages within the forms to permit their removal to a depth of at least one (1) inch from the face without injury to the concrete. The Contractor shall design the fittings for form ties or anchorages so that upon their removal, the cavities left are of the smallest possible size. The Contractor shall fill the cavities with cement mortar and leave the surface sound, smooth, even and uniform in color.

(4) Walls. For narrow walls and columns and where the bottom of the form is inaccessible, the Contractor shall leave the lower form boards loose.

(5) Surface Treatment. The Contractor shall clean and treat the forms with a non-staining form oil immediately before each use. The Contractor shall not use Materials that cling to or discolor the concrete.

(6) Metal Forms. The specifications for forms, regarding design, mortar tightness, filleted corners, beveled projections, bracing, alignment, removal, reuse and oiling, apply to metal forms. The metal thickness used for forms shall be such that the forms will remain true to shape. The Contractor shall countersink the bolts and rivet heads. The Contractor shall design clamps, pins or other connecting devices to hold the forms rigidly together and to allow

removal without injury to the concrete. The Contractor shall not use metal forms that do not present a smooth surface or do not line up properly.

(7) **Reuse of Forms.** The Contractor shall maintain the shape, strength, rigidity, watertightness and surface smoothness of reused forms. The Contractor shall resize the warped or bulged lumber before using. The Contractor shall not use unsatisfactory forms.

(D) **Removal of Falsework and Forms.** The Contractor shall not remove falsework or forms without the consent of the Engineer.

The Contractor shall not use methods of removal likely to cause overstressing of the concrete. The Contractor shall remove the supports to permit the concrete to uniformly and gradually take the stresses due to its own weight. In long span girder bridges and in arch bridges, the Contractor shall remove the falsework or centering according to the contract. In continuous or rigid frame structures, the Contractor shall not release the falsework before the last concrete (excluding concrete above the bridge deck) in that span and the first adjoining spans on each side has been in place for fourteen (14) days. For falsework removal, the Contractor shall consider the spans with single hinge within the span continuous. The Contractor shall consider the hinges of suspended spans within a bridge as ends of bridge for determining shoring requirements. In structures of these types, the Contractor shall remove the falsework gradually and uniformly over their whole length, as ordered by the Engineer.

The Contractor shall not remove or release the falsework and forms earlier than the time specified in Table 503-I after placing the concrete. The Engineer will determine the exact time.

| TABLE 503-I - REMOVAL OF FALSEWORK AND FORMS | | | | | | |
|---|-----|----|--------------|----|----|------------|
| Centering under beams, arches and other members - 14 days | | | | | | |
| Slabs with a maximum thickness of (Inches) | 9 | 12 | more than 12 | | | |
| Removal Time (Days) | 7 | 10 | 14 | | | |
| Walls, columns and vertical sides of beams with a maximum height of (Feet) | 2 | 5 | 10 | 20 | 30 | 40 or more |
| Removal Time (Days) | 0.5 | 1 | 2 | 3 | 5 | 7 |
| Note: Where forms also support the vertical or horizontal loads imposed on slab or beam soffits, the Contractor shall use the longer requirements for the removal time of the latter. | | | | | | |

The Contractor shall not remove the falsework and forms supporting *|
 the bottom slab of box girders until fourteen (14) days after the final *|
 top slab pour. The Contractor shall remove the forms for the webs of box *|
 girders before the Contractor pours the deck slab. The Contractor may *|
 leave the forms supporting the concrete top slab of box girders in place. *|
 The Contractor shall remove the interior forms in box girders except *|
 those permitted to remain in place, completely. The Contractor shall *|
 clear and sweep clean inside the box girder of loose material. *|

The Engineer may reduce the requirement of fourteen (14) days for *|
 the removal of falsework to ten (10) days if the concrete test specimens *|
 develops a compressive strength equal or greater than the twenty-eight *|
 (28) day compressive strength. The Engineer will cure the concrete test *|
 specimen under the provisions of paragraph 9.4 of AASHTO T 23. *|

The Contractor may strip the falsework for concrete box culverts and *|
 other concrete structures with spans of fourteen (14) feet or less when *|
 concrete strength reaches one thousand five hundred (1,500) pounds per *|
 square inch. The Contractor shall reshore the top slab. The Contractor *|
 shall not impose loads (including backfill) on the structure. *|

The Contractor shall always remove the forms from the columns to *|
 show the condition of the concrete in the columns before the Contractor *|
 removes the shoring beneath beams and girders. *|

(E) Loading. No parts of the structure, except abutment walls and wing *|
 walls, shall receive loading outside its own weight until: *|

(1) at least fifteen (15) days have elapsed after placing the *|
 concrete and

(2) until the test specimens show that the concrete has developed a *|
 compressive strength the larger of three thousand (3,000) pounds per *|
 square inch or the required twenty-eight (28) day compressive *|
 strength.

The Engineer will not permit the storing of materials on the *|
 structure until at least fifteen (15) days have elapsed since placement of *|
 concrete. The weight of the material shall not exceed fifty (50) percent *|
 of the live load. *|

The Contractor shall not place load on the structure until the *|
 Contractor has released the falsework completely. *|

The Engineer will not permit live load on completed portions of the *|
 structure when such live load will induce stresses above the allowable. *|

When twin structures are to be constructed side by side, the *|
 Engineer will consider on an individual conditional permit basis the use *|
 of a mobile crane on the completed inbound or outbound bridges. The *|
 Engineer will account for the inaccessibility of construction safety, and *|
 frequency of loading.

Backfilling of abutment walls and wing walls shall be according to *|
Section 206 - Excavation and Backfill for Conduits and Structures. *

(F) Placing Concrete.

(1) **General.** The Contractor shall use the concrete while fresh *|
and before the concrete has taken an initial set. The Contractor *|
shall not retemper or remix the concrete that has partially *|
hardened. The interval between placement of two (2) consecutive *|
batches or loads of concrete shall not exceed thirty (30) minutes. *

The Engineer will not permit deviation from the schedule for *|
pouring concrete without the permission of the Engineer. *

The Contractor shall moisten the surfaces thoroughly with *|
water immediately before placement of concrete. The Contractor *|
shall use neat cement mortar at construction joints. *

The Contractor shall not place concrete in the structure *|
before the Engineer have checked and accepted the forms and the *|
reinforcing steel. The forms shall be clean of debris before *|
placement of the concrete. The Contractor shall submit the method *|
and sequence of placing concrete for acceptance. *

The Contractor shall place the concrete for foundations, *|
bottom slabs of box culverts and aprons on ground free from water. *|
The Contractor shall dewater, sheath, place filter material and do *|
other work as required by field conditions to provide a dry *|
foundation bed according to the contract. The Engineer will *|
consider costs for obtaining a dry foundation bed as included in *|
the price for structure excavation. *

The Contractor shall excavate and pour the sides of concrete *|
or masonry footings not supported on piles or rock, to neat lines. *

The Contractor shall place the concrete beginning at the low *|
point and proceeding upgrade. The Contractor shall remove struts, *|
stays, braces or blockings when the concrete placed has reached an *|
elevation rendering their services unnecessary. *

The Contractor shall deposit the concrete in approximately *|
horizontal layers to avoid flowing along the forms. If the *|
Contractor places less than a complete layer in one operation, the *|
Contractor shall end the layer in a vertical bulkhead. The depth of *|
layers shall be such that the Contractor shall place the succeeding *|
layer before the previous layer has attained its initial set. The *|
thickness shall be not greater than can be satisfactorily *|
consolidated with vibrators. *

The Contractor shall work the external surface of concrete *|
thoroughly during the placing of tools of an acceptable type. The *|
work shall be such as to force the coarse aggregate from the surface *|
and to bring mortar against the forms. The work shall produce a *|
smooth finish nearly free from water and air pockets, or honeycomb. *|

Immediately after the Contractor stops placing concrete, the *|
Contractor shall remove the accumulations of mortar on the *|
reinforcing steel and the surfaces of forms. The Contractor shall *|
not puddle the dried mortar chips and dust into wet concrete. If the *|
concrete sets before the Contractor removes the accumulations, the *|
Contractor shall exercise care not to injure or break the concrete- *|
steel bond at and near the surface of the concrete while cleaning *|
the reinforcing steel.

The Contractor shall place and allow the base slab or footings *|
of box culverts to set at least twelve (12) hours before the *|
Contractor constructs the remainder of the culvert. The Contractor *|
may construct the sidewalls and top slab of box culverts four (4) *|
feet or less in height monolithically. *|

In the construction of box culverts more than four (4) feet in *|
height, the Contractor shall place and allow the concrete in the *|
walls to set at least twelve (12) hours before the Contractor places *|
the top slab. The Contractor shall provide the appropriate keys in *|
the sidewalls for anchoring the cover slab. *|

The Contractor shall pour the bottom slab of box girder spans *|
monolithically with the girder stems. *|

The Contractor may pour the top slab of box girders ten (10) *|
days after the Contractor pours the bottom slabs and stems if the *|
concrete test specimens of the bottom slab and stem concrete first *|
shows a compressive strength equal or greater than three thousand *|
(3,000) pounds per square inch. The Contractor shall cure the *|
concrete test specimens under paragraph 9.4 of AASHTO T 23. *|

The Contractor shall place the concrete in columns in one (1) *|
continuous operation. *|

The Contractor shall allow the concrete to set at least twelve *|
(12) hours before the Contractor places the columns, caps or beams. *|

The Contractor shall not pour the horizontal members or *|
sections until the Contractor has consolidated the concrete in the *|
supporting vertical members or sections and shrinkage has occurred. *|
When the contract shows construction joints, at least twelve (12) *|
hours shall elapse between pours. *|

The Contractor shall not place the concrete in the superstructure until the Contractor has stripped the column forms sufficiently to show the character of the concrete in the columns. The Contractor shall not allow the load of the superstructure to come upon the bents until the bents have been in place at least fourteen (14) days.

The Contractor shall not pour the concrete in suspended span until the adjacent continuous spans are complete in place.

In structures with one (1) or two (2) hinges in a span, the Contractor shall pour the supporting ends of the hinges including the top slabs before the supported end.

The Contractor shall not pour the concrete sidewalks and curbs not monolithic with the bridge deck until after the Contractor has released the falsework for the spans.

(2) Chutes and Troughs. The Contractor shall place the concrete to avoid segregation of the materials and the displacement of reinforcement.

Where the contract requires steep slopes, the Contractor shall equip the chutes with baffle boards or be in short lengths that reverse the direction of movement.

The Engineer will permit the use of long troughs, chutes and pipes only with written authorization by the Engineer. The Contractor shall incline the chutes or pipes, if permitted, to permit the flow of concrete of the required consistency. The diameter of pipes shall not be less than six (6) inches. The Engineer will not allow the addition of water in the concrete mix to promote free flow in chutes of low inclination.

The Contractor shall not drop the concrete in the forms a distance of more than five (5) feet unless confined by closed chutes or pipes. Care shall be taken to fill each part of the form by depositing the concrete as near final position as possible. The Contractor shall work the coarse aggregate back from the forms and worked around the reinforcement without displacing the bars. After initial set of the concrete, the Contractor shall not jar the forms and shall not place strain on the ends of projecting reinforcing.

The Contractor shall keep the chutes, troughs and pipes clean and free from coatings of hardened concrete by thoroughly flushing with water after each run. The Contractor shall discharge the water used for flushing clear of the concrete already in place. The Engineer will not permit the use of aluminum chutes, tremies, troughs and pipes.

(3) **Vibrating.** The Contractor shall consolidate the concrete, *|
 except concrete placed under water, by high frequency internal *|
 vibrators of a type, size and number acceptable by the Engineer. The *|
 frequency of the transmitted vibration shall be not less than four *|
 thousand five hundred (4,500) impulses per minute. The frequency of *|
 the transmitted vibration shall be such as to visibly affect a mass *|
 of concrete of one (1) inch slump over a radius of at least eighteen *|
 (18) inches. The number of vibrators employed shall be sufficient *|
 to consolidate the incoming concrete to a proper degree within *|
 fifteen (15) minutes after the Contractor deposits the vibrator in *|
 the forms. At least two (2) vibrators shall be available at the *|
 structure site when the Contractor places more than twenty-five (25) *|
 cubic yards of concrete. The Contractor shall apply the vibrators *|
 at uniformly spaced points and not farther apart than is visibly *|
 effective. The Contractor shall not attach the vibrators to or held *|
 against the forms or the reinforcing steel. *

The Contractor may use acceptable external vibrators for *|
 consolidating concrete when the concrete is inaccessible for *|
 adequate consolidation provided the forms are constructed *|
 sufficiently rigid to resist displacement or damage from external *|
 vibration. *

When required, the Contractor shall supplement the vibration by *|
 hand spading with suitable tools to assure proper and adequate *|
 compaction. The Contractor shall manipulate the Vibrators to work *|
 the concrete thoroughly around the reinforcement and imbedded *|
 fixtures and into corners and angles of the forms. The Contractor *|
 shall not use the vibrators to cause concrete to flow or run into *|
 position instead of placing. The vibration shall be of sufficient *|
 duration to compact but shall not be prolonged to the point where *|
 segregation occurs. *

(4) **Depositing Concrete Underwater.** The Contractor shall not *|
 deposit concrete except cofferdam seals underwater. Concrete *|
 deposited underwater shall be seal concrete according to Section 601 *|
 - Structural Concrete. *

The Contractor shall place the concrete deposited underwater *|
 carefully in a compact mass in its final position by a tremie, a *|
 closed-bottom dump bucket or other acceptable methods. The *|
 Contractor shall not disturb them after being deposited. The *|
 Contractor shall maintain the still water at the point of deposit. *

A tremie includes a tube having a diameter of not less than ten *|
 (10) inches, constructed in sections having flanged couplings fitted *|
 with gaskets. The Contractor shall equip the tube with the following *|
 to prevent water from entering the tube while charging the tube with *|
 concrete: *

(a) a receiving hopper at the top and *|

(b) a device that closes the discharge end. *|

The Contractor shall support the tremie to permit: *|

(a) free movement of the discharge end over the entire top *|
surface of the work and *|

(b) rapid lowering when necessary to retard or stop the flow *|
of concrete. *|

The Contractor shall close and seal the discharge end entirely *|
at the start of work to prevent water entering the tube. The *|
Contractor shall keep the tremie tube full to the bottom of the *|
hopper. When the Contractor dumps a batch into the hopper, the *|
Contractor shall induce the flow of concrete by slightly raising *|
the discharge end. The Contractor shall always keep the discharge *|
end in the deposited concrete. The flow shall be continuous until *|
the Contractor completes the work. *|

The underwater bucket shall have an open top. The bottom doors *|
shall open freely outward when tripped. The Contractor shall fill *|
the bucket completely and slowly lower the bucket to avoid *|
backwash. The Contractor shall not dump the bucket until the *|
bucket rests on the surface upon which the Contractor is to deposit *|
the concrete. After discharge, the Contractor shall raise the *|
bucket slowly until well above the concrete. The Engineer will not *|
permit the use of bottom dump buckets for bottom seal around *|
foundation piling. *|

The Contractor is solely responsible for the design and *|
construction of concrete seal. The exact thickness of concrete seal *|
shall depend upon the hydrostatic head, bond and spacing of piles *|
and size of the cofferdam. The Contractor shall allow the seal to *|
remain in place for not less than seven (7) days before dewatering *|
to set sufficiently to withstand the hydrostatic pressure. After *|
sufficient time has elapsed, the Contractor shall dewater the *|
cofferdam and clean the top of the concrete of scum, laitance and *|
sediment. Before the Contractor deposits the fresh concrete, the *|
Contractor shall remove the local high spots as necessary to *|
provide proper clearance for reinforcing steel. *|

(5) Hot Weather Concreting. The Contractor shall not place the *|
concrete where the temperature of the concrete is above ninety (90) *|
degrees Fahrenheit. *|

When the ambient temperature is above ninety (90) degrees *|
Fahrenheit, the Contractor shall cool the reinforcing steel, forms *|
and other surfaces to below ninety (90) degrees Fahrenheit by a *|
water spray or other acceptable methods. *|

(G) Joints.

(1) Construction Joints. The Contractor shall make the construction joints only at locations shown on the plans. Construction joints shall be perpendicular to the principal lines of stress and shall be at points of minimum shear. The Contractor shall roughen the surface of the construction joint to a full amplitude of approximately quarter (1/4) inch.

After the Contractor has placed concrete to the construction joint and after the concrete has set, the Contractor shall clean the entire surface of the joint including the projecting reinforcement thoroughly. The Contractor shall clean the joint of surface laitance, curing compound and other material foreign to the concrete. The Contractor shall expose the cleaned coarse aggregate by abrasive blast cleaning after the curing period or immediately before placing concrete at the joint.

Before placing new concrete, the Contractor shall draw the forms tightly against the concrete already in place. The Contractor shall clean thoroughly, saturate with water, and cover the old surface with a coat of mortar or neat cement grout before the mortar or grout has attained its initial set. The Contractor shall place the concrete in substructures so that horizontal construction joints shall be truly horizontal. Where possible, the Contractor shall not expose the joints to view in the finished structure. Where vertical construction joints are necessary, reinforcing bars shall extend across the joint to make the structure monolithic. The Contractor shall take special care to avoid construction joints through paneled wing walls or other large surfaces that the Contractor are to treated architecturally.

When a joint is necessary because of an emergency, the Contractor shall furnish and place reinforcing steel across the joint as ordered by the Engineer at no cost to the State.

(2) Expansion Joints. The Contractor shall provide expansion and contraction of concrete structures for by expansion joints. Expansion joints shall be of the type and in the location shown in the contract. Expansion joints may be the friction, open, filled compression, mortise or special type.

Metal friction joints include cast iron or bronze plates shown in the contract. The Contractor shall anchor the plates in correct position. The Contractor shall plane the sliding surfaces true and smooth. The direction of movement of the planing tool shall conform to the direction of movement of the structure. The Contractor shall not impede the movement by contacts of surfaces other than the bearing surfaces.

The Contractor shall construct open joints by removable bulkheading forms so that the Contractor may remove the forms *| without damage to the concrete.

The Contractor shall make the filled compression joints with *| preformed expansion joint filler. The Contractor shall cut the *| preformed joint filler to the same shape as the area to be covered. *| Preformed joint filler shall be quarter (1/4) inch smaller along *| the exposed surfaces in the finished work. The Contractor shall fix *| the preformed joint filler firmly against the surface of the *| concrete already in place so that the Contractor does not displace *| the preformed joint filler when the Contractor deposits the *| concrete against the filler. When necessary to use more than one *| piece to cover a surface, the Contractor shall cover the joint *| between the separate pieces with a layer of two (2) ply roofing *| felt. The Contractor shall cover one (1) side with hot asphalt to *| insure proper retention. The Contractor shall fill the quarter *| (1/4) inch space along the edges at exposed faces with wooden *| strips of the same thickness as the joint material. The Contractor *| shall saturate these wooden strips with oil and have sufficient *| draft to make the wooden strips readily removable after the *| Contractor places the concrete. Immediately after the Contractor *| removes the forms, the Contractor shall inspect the expansion joint *| carefully. The Contractor shall clean and remove the concrete or *| mortar that has sealed across the joint. *|

The Contractor shall construct the mortised joints according *| to the contract. The mortised joints include a concrete or metal *| part sliding in a concrete or metal socket. The construction shall *| permit freedom of movement in two (2) directions and be watertight *| and rustproof as far as possible.

Steel joints include plates, angles or other structural shapes *| that the Contractor shall shape accurately at the shop to conform *| to the section of the concrete floor. The fabrication and painting *| shall conform to the contract. When specified in the contract, the *| Contractor shall zinc-coat the material instead of painting the *| material. The Contractor shall insure that the surface of the *| finished plane is true and free of warping. The Contractor shall *| use the positive methods in placing the joints to keep the joints *| in correct position during placing of the concrete. The opening at *| expansion joints shall be that designated on the plans. The *| Contractor shall avoid impairment of the clearance. *|

The Contractor shall so place the metal joints so that they *| are free from kinks. The joints shall be watertight and so arranged *| to lead drainage water to a point of discharge to prevent staining *| of the exposed concrete surfaces. The Contractor shall rivet and *| solder the joints. At bends, the strips shall be preferably one *| (1) piece.

The Contractor shall remove stones, forms or other foreign matter that would interfere with the efficiency of the joints.

When required, the Contractor shall furnish and install the waterstops according to the contract. The Contractor shall position the waterstops correctly in the form work so that the Contractor aligns and centers the bulb with the joint opening. The Contractor shall vibrate the concrete surrounding the imbedded waterstops well to attain impervious concrete near joints. The Contractor shall cut and splice the waterstops at changes in direction as may be necessary to avoid buckling or distortion of the web or flange. Field splices shall be according to Subsection 705.07 - Waterstops.

(H) Waterproofing. Concrete surfaces shall be smooth and free from holes and projections that might puncture the waterproofing membrane. The Contractor shall dry and clean the surfaces thoroughly of dust and loose materials before waterproofing. The Contractor shall not waterproof in wet weather or when the temperature is below sixty-five (65) degrees Fahrenheit without written authorization from the Engineer.

Waterproofing includes a firmly bonded membrane composed of two (2) layers of saturated fabric and three (3) moppings of waterproofing asphalt. The Contractor shall apply a coat of primer to the surface of concrete according to the contract or ordered by the Engineer.

The Contractor shall apply a coating of primer to the surface extending twelve (12) inches on each side of the joint. The Contractor shall allow the primer to dry before the first application of asphalt. The Contractor shall heat the asphalt to a temperature of not less than three hundred (300) degrees Fahrenheit or not more than three hundred and fifty (350) degrees Fahrenheit. The Contractor shall mop the asphalt thoroughly onto the surface.

The Contractor shall place a strip of fabric eighteen (18) inch wide immediately on the hot asphalt. The Contractor shall carefully press the fabric into place to eliminate trapped air bubbles and to obtain close contact with the surface.

The Contractor shall then mop the second application of asphalt on the fabric and three (3) inches beyond the edges. Immediately following this operation, the Contractor shall press the second layer of fabric into place on top of the first layer.

The Contractor shall then mop the third and final application of asphalt on the fabric and three (3) inches beyond the edges. Laps at the ends of the fabric shall be twelve (12) inches.

The Contractor shall apply the primer to the concrete surface at the rate of one (1) gallon per one hundred (100) square feet. The Contractor shall apply the asphalt at the rate of fifteen (15) gallons per one hundred (100) square feet of finished work.

(I) Joint Sealing.

(1) Joint Seal (Poured) for Bridge Deck. The Contractor shall *| apply the sealant according to the contract and as ordered by the *| Engineer.

Immediately before applying the joint sealer, the Contractor *| shall clean the joints thoroughly by abrasive blasting or other *| acceptable means. The Contractor shall remove mortars, laitances, *| scales, dirt, dust, oil and other foreign matters. The Contractor *| shall then blow out the joint with high pressure, oil-free *| compressed air, removing the residue.

The Contractor shall not apply the joint sealer unless the *| joint is acceptable to the Engineer. The concrete and ambient *| temperatures shall not be less than fifty (50) degrees Fahrenheit. *|

The method of mixing and applying the two (2) component *| pourable joint sealer shall result in a homogeneous product. The Contractor shall power mix the materials for about eight (8) *| minutes. When the Contractor supplies component "A" that is less *| than twenty-five (25) percent by weight of Component "B", the *| Contractor shall not allow portions of Component "A" spatter on the *| side of the mixing container.

The Contractor shall apply the joint sealer so that the *| Contractor fills the joints without forming air holes and *| discontinuities. The top of the joint sealer shall be quarter *| (1/4) inch below the finished surface. *|

The Contractor shall remove the joint sealer that does not: *|

- (a) cure to a homogeneous and rubber-like compound, |
- (b) bond to the joint faces, or |
- (c) comply with other requirements of this section. |

The Contractor shall reclean the joint. The Contractor shall *| place the new joint sealer at no cost to the State. *|

After the Contractor seals the joints, the Engineer will not *| permit vehicles to travel over the joints until the Engineer grants *| permission. *|

(2) Joint Seal (Preformed) for Bridge Deck. The Contractor shall *| install the sealer as specified below and ordered by the Engineer. *|

Immediately before applying the joint sealer, the Contractor *| shall clean the joint thoroughly removing mortars, laitances, *| scales, dirt, dust, oil and other foreign matter.

The Contractor shall install the seal so that the Contractor *|
will not abrade the seal by traffic, but effectively keep foreign *|
material from entering the joint. The Contractor shall correct the *|
spalls and protrusions in the joint before installation. *|

The Contractor shall install the preformed seal in one (1) *|
continuous piece without field splices.

The Contractor shall not place the seal so that its top edge is *|
below the riding surface according to the contract. The Contractor *|
shall not go deeper than quarter (1/4) inch below the surface. *|

The top edge of the gasket should be in contact with the *|
vertical walls of the joint. If spalling is evident, the Contractor *|
shall repair the major spalls. The Contractor shall depress the seal *|
below the minor spalls to have its top edge in contact with the *|
vertical wall of the joint.

The Engineer will not permit twisting, curling, and nicking of *|
the seal. *|

The Contractor shall protect the joint from the intrusion of *|
earth, gravel, mortar or other foreign matter so that the structure *|
can expand and contract as designed.

The groove width (w) shown on the plans shall be the width of *|
the expansion joint at the time of the concrete pour. If this width *|
is less than the manufacturer's minimum width for proper *|
installation of the joint seal, the Contractor shall defer *|
installation until after the Contractor pours the concrete. The *|
Contractor shall install the seal after the joint width has *|
increased to a width equal or greater than the minimum width *|
recommended by the manufacturer.

-- The steel angle protective nosing assembly shall extend beyond *|
the curb line and shall end one (1) inch from the edge of deck. *|

(3) Flashing Compound for Joints. The Contractor shall apply the *|
flashing compound for retaining wall joints and other joints shown *|
on the plans as recommended by the manufacturer. *|

(J) Concrete Exposed to Sea Water. In concrete structures exposed to sea *|
water, the Contractor shall not form the construction joints between *|
levels of extreme low water and high water as determined by the Engineer. *|
Between these levels, the Contractor shall not remove the forms for *|
thirty (30) days or longer if required by the Engineer. *|

(K) Protection and Curing. The Contractor shall protect the concrete *|
from injurious action of the sun, rain, flowing water and mechanical *|
damage. The Contractor shall not allow the concrete to dry out from the *|

time the Contractor places the concrete until expiration of the minimum *
curing period. The minimum curing period shall be as follows:

(1) The Contractor shall cure the structures for at least seven *
(7) days. The Contractor shall maintain the temperature of *
structural concrete at no less than forty-five (45) degrees *
Fahrenheit for seventy-two (72) hours after placing. The Contractor *
shall maintain the temperature at no less than forty (40) degrees *
Fahrenheit for an additional four (4) days. When required by the *
Engineer, the Contractor shall submit a written outline of its *
proposed method for protecting the concrete. *

(2) If the Contractor will submerge the cast-in-place parts of a *
structure permanently in fresh water, the Contractor may cure them *
for a period sufficient to prevent washing out of cement and then *
submerge immediately. *

(3) If the Contractor will submerge the cast-in-place parts of a *
structure permanently in brackish or sea water, the Contractor *
shall them with fresh water for at least five (5) days. The *
Contractor shall then submerge the cast-in-place parts except to *
Subsection 503.03(J) - Concrete Exposed to Sea Water. *

(L) **Curing Methods.** The Contractor shall cure the concrete by either *
water curing, impervious membrane curing or a combination of both. The *
exception is that the Contractor shall cure the full width of concrete *
bridge decks by a combination of impervious membrane curing and water *
curing. The Contractor may cure the surfaces of the horizontal *
construction joints by the application of non-membrane curing compound *
that seals the concrete and does not reduce the bonding capacity of the *
interface. Before the Contractor applies that curing compound, the *
Contractor shall submit a written request including copies of test *
results and the manufacturer's catalogue for acceptance by the Engineer. *
The Contractor may steam cure precast concrete members according to *
-Section 504 when permitted by the Engineer. *

(1) **Water Curing.** The Contractor shall water cure by keeping the *
concrete continuously wet with fresh water by water sprays, *
acceptable water saturated coverings, or by ponding. The Contractor *
shall keep wood forms that the Contractor leaves in place *
sufficiently damp to prevent opening at the joints and drying of *
the concrete. *

The Contractor shall apply the moisture to the surface of the *
concrete with a fog spray nozzle when the surface water has *
evaporated. The Contractor shall continue the moisture to the *
surface until the regular curing begins. The amount of moisture *
applied shall not damage the surface or texture of the concrete. *
The water supply shall be adequate to fog and water cure the *
concrete. *

Water curing for bridge decks shall begin after the Contractor *|
 applies the curing compound and immediately after the concrete *|
 surface is hard enough to receive the water without damaging the *|
 surface or texture of the concrete. The Contractor shall continue *|
 until the end of the specified curing period. *|

The Contractor shall provide adequate means to prevent curing *|
 water from falling on the traveled roadways under the structure. The *|
 Contractor shall also channel the water away from falsework and *|
 structure foundations. *|

(2) Impervious Membrane Curing. The Contractor shall seal the *|
 concrete surface thoroughly with a liquid membrane-forming compound. *|
 The Contractor shall apply the compound uniformly in two (2) or *|
 more applications. The ratio shall be a total of at least one (1) *|
 gallon for each one hundred fifty (150) square feet of concrete *|
 surface. *|

The Contractor shall not use curing compounds that will *|
 permanently darken the concrete on exposed surfaces in the completed *|
 structure. If the Contractor is to bond the concrete or apply *|
 waterproofing or epoxy, the Contractor shall not apply membrane *|
 curing compound. Exception is for the full width of bridge decks. *|

The Contractor shall not allow the concrete surfaces to dry *|
 before the Contractor applies the impervious membrane. If the *|
 Contractor breaks or damages the membrane film during the specified *|
 curing period, the Contractor shall give the area a new treatment *|
 duplicating the first application. *|

(M) Finishing Concrete Surfaces. The following requirements shall apply *|
 to the several classes of surface finish that the Contractor ordinarily *|
 apply to the various parts of concrete structures. *|

(1) Class 1 Ordinary Surface Finish. The Contractor shall apply *|
 the ordinary surface finish to concrete surfaces either as a final *|
 finish or preparatory to a higher class finish. On buried surfaces *|
 or enclosed surfaces such as the cells of box girders, the *|
 Contractor will not require removal of fins and form marks and the *|
 rubbing of mortared surfaces to a uniform color. *|

During the placing of concrete, the Contractor shall ensure
 that the methods of compaction used will result in a surface:

- (a) of even texture, *|
- (b) free from voids, water or air pockets, and *|
- (c) where the Contractor forces the coarse aggregate away from *|
 the forms. *|

After the Contractor removes the forms, the Contractor shall *
 remove the form bolts and ties to a depth of at least one (1) inch *
 below the surface of the concrete. The Contractor shall clean, wet, *
 and fill the resulting holes or depressions with mortar. Mortar *
 includes one (1) part by volume of cement to two (2) parts of sand. *
 The Contractor shall add white cement to the mortar in sufficient *
 quantity to tint the mortar a shade lighter than the repaired *
 concrete. Mortar shall not be more than one hour old. The *
 Contractor shall get a perfect bond with the concrete. After the *
 mortar has thoroughly hardened, the Contractor shall rub the *
 surface with a carborundum stone to obtain the same color in the *
 mortar as in the surrounding concrete. The Contractor shall remove *
 the fins caused by form joints and other projections. The *
 Contractor shall remove stains and discolorations visible from the *
 traveled way.

The Contractor shall clean and fill the pockets with mortar. *
 Exceptions are those scattered pockets or pinholes less than half *
 (1/2) inch in length or width and three-eighths (3/8) inch in *
 depth. They shall also not affect the strength of the structure or *
 endanger the life of the steel reinforcement. The Contractor shall *
 fill the pockets on surfaces visible from pedestrian traffic and *
 surfaces exposed to stream flow, salt air and salt water. The *
 Contractor shall treat mortar for filling pockets as specified for *
 bolt and tie holes. If rock pockets will affect the strength of *
 the structure materially or to endanger life of the steel *
 reinforcement, the Engineer may declare the concrete defective and *
 require the removal and replacement of the structure affected.

The Contractor shall clean, wet, and fill the holes or *
 depressions in surfaces that are to receive Class 2 Rubbed Finish *
 with mortar. They shall clean, wet, and fill at least seven (7) *
 days before starting Class 2 Rubbed Finish. *

(2) Class 2 Rubbed Finish. The Contractor shall apply the Class 2 *
 Rubbed Finish to the following surfaces: *

(a) Surfaces of bridge superstructures, including pedestrian *
 overpasses. The inside vertical surfaces of "T" girders, slab *
 soffits of interior bays of "T" girders, enclosed surfaces of *
 box girders, top surfaces of bridge decks, walkway surfaces *
 and median strips need not apply Class 2 Rubbed Finish. *

(b) Surfaces of bridge and pedestrian overpass piers, piles, *
 columns, pier caps, abutments, wing walls, and retaining walls *
 above finished ground and to at least one (1) foot below *
 finished ground.

(c) Surfaces of open spandrel arch rings, spandrel columns *
 and abutment towers.

(d) Surfaces above finished ground of culvert headwalls, and endwalls where visible from a traveled way.

(e) Surfaces inside the culvert barrels having a height of four (4) feet or more for a distance inside the barrel at least equal to the height of the culvert. They shall also be visible *| from the traveled way.

(f) Surfaces of concrete railings, end posts and curbs.

After completion of the Class I Ordinary Surface Finish, the Contractor shall sand the areas that do not exhibit a smooth, even surface of uniform texture and appearance. The Contractor shall *| sand the areas with a power sander or other acceptable abrasive *| means to obtain a uniform appearance and texture.

The Contractor shall use the power carborundum stones or disks *| to remove unsightly bulges or irregularities. *|

The intent is to secure a smooth, even surface of uniform *| appearance and to remove unsightly bulges or depressions due to form *| marks and other imperfections. The Engineer will not consider the *| scattered pockets or pinholes permitted under ordinary finish to *| affect the uniformity or texture. The extent of sanding and grinding *| will be according to the contract. *|

The final operation for this finish shall be the removal of the powder on the surface resulting from sanding and grinding. If the Contractor makes additional repair after sanding and grinding, *| the Contractor shall repeat the sanding and grinding after the *| Contractor cures the repair. The Contractor shall leave the finished *| surface free from powder and other foreign matter by washing or wiping with clean cloth.

(3) **Class 6 Float Finish.** The Contractor shall attain the Class 6 *| Float Finish as follows: *|

(a) **Finishing Bridge Decks.** The Contractor shall obtain a *| smooth riding surface of uniform texture true to the required *| grade and cross section, on bridge roadway decks. *|

The Engineer will not permit the Contractor to place *| concrete in bridge decks until the Contractor ensures the *| minimum rate of finished deck shall be at least twenty (20) *| linear feet per hour. The Contractor shall employ experienced *| operators and concrete finishers to finish the deck. The *| necessary finishing tools and equipment shall be on hand at the *| work site and in satisfactory condition for use. The Contractor *| shall measure the rate along the centerline of the roadway. *|

Unless the Contractor provides acceptable lighting facilities, the Contractor shall complete the finishing operations during daylight hours. *|
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Immediately before placing bridge deck concrete, the Contractor shall check the falsework and wedges. The Contractor shall insure that settlement and deflection due to the added weight of the bridge deck concrete shall be at a minimum. The Contractor shall provide suitable instruments, such as settlement gages, to permit ready measurement by the Engineer of settlement and deflection. *|
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*|

If settlement or other unanticipated events occur, the Contractor shall stop the placing of deck concrete until the Contractor provides corrective measures according to the contract. If the Contractor does not provide satisfactory measures before initial set of the concrete, the Contractor shall stop the placing of concrete. The Contractor shall install a bulkhead at a location determined by the Engineer. The Contractor shall remove the concrete in place beyond the bulkhead. *|
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The Contractor shall place the bridge deck concrete in a uniform heading approximately perpendicular to the roadway centerline. The Contractor shall limit the rate of placing concrete that the Contractor may finish before the beginning of initial set. The Contractor shall not place the concrete for the deck surface more than ten (10) feet ahead of strike off. The Contractor shall spread the concrete to a uniform height and so as not to require striking off more than three (3) inches of concrete. *|
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The Contractor shall finish the bridge decks with concrete wearing surfaces according to machine finishing unless the contract specifies manual finishing. *|
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The Contractor may finish the bridge decks with asphalt wearing surfaces as described herein or by other methods acceptable in writing by the Engineer. *|
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*|

During the finishing operation while the concrete is still plastic, the Contractor shall test the surface with a ten (10) foot straight edge. The Contractor shall test the surface from the side or from transverse finishing bridges in the presence of the Engineer. The Contractor shall make the necessary corrections so that the Contractor will attain the required tolerance with a minimum amount of remedial work after the concrete has hardened. *|
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After the concrete has hardened sufficiently, the Contractor shall test the finished surface in the presence of the Engineer by a straight edge ten (10) feet long. The surface for concrete deck finish shall not vary more than one-eighth (1/8) inch from the lower edge of the straight edge. *|

If the concrete of the bridge deck is to be covered one (1) inch or more in thickness by bituminous surfacing, earth, or other cover, the surface of the concrete shall not vary more than quarter (1/4) inch from the lower edge of the ten (10) foot straight edge. *|

The Contractor shall remove high areas in the hardened surface by grinding. The Contractor shall not smooth or polish the finished texture of the structure as produced by grinding. They shall have a uniform texture of transverse grooves as ordered by the Engineer. *|

The Contractor shall submit the method of correcting low areas in writing. The Contractor shall not work on the low spots unless accepted by the Engineer. *|

The Contractor shall strike off the bridge deck surfaces under the curbs, railings, and sidewalks to the same plane as the roadway. The Contractor shall leave the bridge deck surfaces under the curbs, railings, and sidewalks undisturbed when future widening is shown on the plans. *|

When the width of the deck unit is four (4) feet or less, the Contractor may use the finishing methods other than those specified herein providing the completed deck surface conforms to the contract. *|

The Contractor shall remedy the completed bridge decks not according to the contract at no cost to the State until the Contractor gets the required finish. *|

1. Machine Finishing. The strike off and finishing machines shall be of an acceptable self-propelled type, operating on rails. The Contractor shall use a strike off machine and a finishing machine or hand tools conforming to the contract. *|

The screed rails shall be adjustable for elevations. The screed shall be set to elevations, with allowances for anticipated settlement, camber and deflection, as required to form the surface of the bridge deck to the line and grade shown in the contract. The Contractor shall install screed rail type such that the rails shall not deflect appreciably under the applied loads. *|

Before the Contractor begins concrete operations, the Contractor shall operate the strike off and finishing machines over the full length of the bridge segment to be paved. The Contractor shall this test run with the screed and float adjusted to their finishing positions. While testing the machines, the Contractor shall check:

- a. the screed rails for deflection,
- b. the proper adjustment made,
- c. the cover on slab reinforcement measured,
- d. the controlling dimensions of slab reinforcement and
- e. the forms.

The Contractor shall make the necessary corrections at this time.

After the Contractor has placed and consolidated the concrete, the Contractor shall strike off the surface of the concrete carefully by a strike off machine. The Contractor shall get a uniform deck surface true to the required grade and cross section.

When the acceptable machine used for strike off has a wheel base greater than six (6) feet, the Contractor shall float the concrete by a:

- a. hand-operated longitudinal float board or
- b. finishing machine equipped with a longitudinal float or
- c. rotating element followed by a drag float pan.

The longitudinal float on the finishing machine shall have a length of not less than eight (8) feet nor more than twelve (12) feet. When both strike off and floating are by machines, the Contractor shall use two (2) machines with operators. The Contractor shall float the final pass as far back of the strike off as the workability of the concrete will permit.

The accepted strike off machine shall have a wheel base six (6) feet or less. The Contractor shall follow the strike off machine by two (2) separate hand-operated float boards for longitudinal floating or an acceptable

finishing machine. The Contractor shall place the first *|
 hand-operated float in operation when the condition of the *|
 concrete will permit. The Contractor shall operate the *|
 second hand-operated float as far back of the first float *|
 as the workability will permit. Hand-operated float boards *|
 shall apply to the two (2) separate float boards for *|
 longitudinal floating.

The Contractor shall use longitudinal floats with *|
 the long axis of the float parallel to the center line of *|
 the bridge roadway. Longitudinal floats may be either *|
 hand-operated or machine-operated. The Contractor shall *|
 operate longitudinal floats with a combined longitudinal *|
 and transverse motion. The Contractor shall operate the *|
 rotating float with a rotational and transverse movement. *|
 The floats shall plane off the high areas and float the *|
 material removed into the low areas. Each pass of the *|
 float shall lap the previous pass by half (1/2) the length *|
 of the float. The Contractor shall continue floating *|
 until the Contractor gets a smooth riding surface. The *|
 Contractor shall meet the surface tolerances. *|

The Contractor may use an acceptable single machine *|
 equipped with a rotating auger for strike off and a *|
 rotating element. A drag float pan for consolidation and *|
 finishing shall follow. The Contractor shall have used *|
 this single machine successfully for finishing highway *|
 bridges. The finishing machine shall produce a deck *|
 surface according to the contract. When requested by the *|
 Engineer, the Contractor shall submit three (3) copies of *|
 manufacturer's operators and parts manual for the dual *|
 purpose alternate machine. Its operations shall be *|
 according to the manufacturer's manual. *|

Hand operated float boards and transverse finishing *|
 bridges shall conform to the manual finishing. *|

The Contractor shall provide not less than two (2) *|
 transverse finishing bridges. *|

At a specified time, the Contractor shall texture the *|
 pavement uniformly by combing with a single row of spring *|
 metal tines to produce transverse grooves. The tines *|
 shall have: *|

- a. one thirty-secondth (1/32) inch in thickness, *|
- b. three thirty-secondth (3/32) inch in width, *|
- c. four (4) inches in length and *|

d. three-quarters (3/4) inch centers along the row. *|

The Contractor shall position the tines such that *|
their widths will be perpendicular with the direction of *|
grooving. The grooves shall be one-eighth (1/8) inch to *|
three-sixteenth (3/16) inch in depth. The Engineer may *|
allow deviations from the stated dimensions provided the *|
Contractor can produce a finished texture according to *|
the contract. *|

2. **Manual Finishing.** After the Contractor places the *|
concrete and consolidates the surface, the concrete shall *|
receive a preliminary finish. The preliminary finish *|
includes striking off the surface of the concrete *|
carefully with a template or strike board operated on and *|
between supports or headers. *|

The Contractor shall set the supports or headers to *|
elevations as required to form the surface of the bridge *|
deck to the line and grade shown in the contract. The *|
Contractor allow for anticipated settlement, camber, and *|
deflection when computing the elevation. *|

The Contractor shall use the template or strike *|
board to alternately tamp and strike off the concrete and *|
move forward with a combined longitudinal and transverse *|
motion. The Contractor shall leave a uniform film of *|
mortar or grout of suitable consistency on the surface of *|
the concrete after the last pass of the template or *|
strike board.

The template or strike board shall be of rigid *|
construction. The Contractor shall design the template *|
or strike board such that the template or strike board *|
shall resist deflection and distortion when in use. *|

The Contractor shall install such supports or *|
headers that the supports or headers shall not deflect *|
appreciably under the applied loads. *|

Supports or headers for deck pours shall be *|
completely in place for the full length of the pour. The *|
Contractor shall secure the supports and headers before *|
placing deck concrete. *|

Following completion of the preliminary finish, the *|
Contractor shall float the deck for concrete wearing *|
surface in a direction parallel with the centerline of *|
roadway from transverse bridges. *|

The Contractor shall span the transverse finishing *|
bridges completely. The finishing bridges shall be of *|
rigid construction. The finishing bridges shall be free *|
of wobble and springing when used by the operators of the *|
floats. The Contractor shall be able to move the finishing *|
bridges easily. The number of finishing bridges provided *|
shall be sufficient to permit the floating operation to *|
follow the preliminary finishing operations without undue *|
delay. The Contractor shall provide not less than two (2) *|
transverse finishing bridges. *|

The Contractor shall float with two (2) separate *|
wooden floats, each between twelve (12) to sixteen (16) *|
feet long. The float boards shall be one (1) inch thick *|
and four (4) to eight (8) inches wide. The Contractor *|
shall rib the float boards rigidly. The Contractor shall *|
provide adjusting screws at not more than twenty-four (24) *|
inch centers between rib and float board. The Contractor *|
shall maintain the float board flat and true. *|

The Contractor shall provide each float with *|
adjustable handles at each end. The Contractor shall rib *|
and truss each float as necessary to insure the float *|
board has a true, rigid surface. *|

The Contractor shall operate the floats with a *|
combined longitudinal and transverse motion, planing off *|
the high areas and floating the material removed into the *|
low areas. Each pass shall lap the previous pass by half *|
(1/2) the length of the float. The Contractor shall *|
continue the floating until the Contractor gets a smooth *|
surface. *|

The Contractor shall put the first float into *|
operation when the condition of the concrete surface *|
permits smoothing. The Contractor shall keep the first *|
float in continuous operation until subsidence has taken *|
place. *|

The Contractor shall operate the second float as far *|
back of the first float as the workability of the concrete *|
shall permit. *|

After the Contractor completes the floating operation *|
the Contractor shall texture the deck surface according to *|
the procedures outlined under machine finishing. *|

(b) Sidewalks and Median Strips. The Contractor shall do the *|
final finish for concrete sidewalks and median strips with a *|
wooden float. The wooden float shall be slightly rough. The *|

degree of roughness will be according to the contract. The top surfaces of decks, ramps and approach ramps for pedestrian structures and the top surfaces of sidewalks shall have an abrasive coating.

If abrasive coating is specified, the Contractor shall sprinkle quarter (1/4) pound of grain per square foot uniformly on the fresh concrete. The Contractor shall finish the surface with a wooden float. The Engineer will consider the application of abrasive coating incidental to concrete. The abrasive coating will not be paid for separately.

(N) Cleaning Up. Upon completion and before final acceptance of the structure, the Contractor shall remove falsework, excavated or useless material, rubbish and temporary buildings. The Contractor shall replace or restore public or private fences or property damaged during the prosecution of the work. The Contractor shall leave the bridge site and adjacent highway in a neat and presentable condition according to the contract. The Contractor shall remove the excavated material or falsework placed in the stream channel during construction before final acceptance.

503.04 Method of Measurement. The Engineer will measure the concrete by the cubic yard according to the dimensions shown in the contract or as ordered by the Engineer.

The Engineer will not measure concrete when contracted on a lump sum basis.

The Engineer will not make deductions for the volume occupied by reinforcing steel, piles, floor drains, weepholes, timber bumpers, pipes less than eight (8) inches, conduits, or expansion joint materials.

The Engineer will consider the wingwalls to be a part of the structure.

The Engineer will measure reinforcing steel according to Section 602 - Reinforcing Steel.

The Engineer will measure bearing and expansion plates according to Section 506 - Bearing and Expansion Plates.

503.05 Basis of Payment. The Engineer will pay for the accepted quantities of concrete complete in place at the contract unit price per cubic yard or at the contract lump sum price for the pay items listed below and contained in the proposal.

The contract unit price or lump sum amount paid shall be full compensation for the concrete; for placing, curing and finishing; for furnishing materials including admixtures and cement (including extra cement added to concrete deposited under water); for furnishing and installing drains, scuppers, premolded joint fillers, joint seals, waterproofing at

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construction joints, waterstops, pipes and conduits; for furnishing and installing metal rockers, anchor bolts, structural shapes for expansion joints and other similar items; for timber bumpers, forms, form lining and falsework or centering, bearing pads, structural steel bearing plates; and for equipments, tools, labor, materials and incidentals necessary to complete the work.

The Engineer will make payment under: *|

| Pay Item | Pay Unit |
|--|------------|
| Concrete Other Than in Bridges, (Class _____ if applicable) | Cubic Yard |
| Concrete In _____ (Class _____ if applicable) | Cubic Yard |
| Concrete In _____ (Class _____ if applicable)(____ C.Y.) | Lump Sum |

The Engineer will pay for reinforcing steel according to Section 602 - *|
Reinforcing Steel. *|

The Engineer will pay for bearing and expansion plates according to *|
Section 506 - Bearing and Expansion Plates. *|