Florida Department of Transportation

CHARLIE CRIST
GOVERNOR

605 Suwannee Street
Tallahassee, FL 32399-0450

STEPHANIE KOPELOUSOS
SECRETARY

April 14, 2008

Dr. Leslie McCarthy, PhD, P.E.
Program Operations Engineer
Federal Highway Administration
545 John Knox Road, Suite 200
Tallahassee, Florida 32303

Re: Office of Design, Specifications
Section 400
Proposed Specification: 4000507 Concrete Structures – Stay-In-Place Metal Forms

Dear Dr. McCarthy:

We are submitting, for your approval, two copies of the above referenced Supplemental Specification.

Richard Kessler of the State Materials Office proposed this change to:

- Allow the use of polymer coated galvanized steel stay-in-place metal bridge deck forms.

Please review and transmit your comments, if any, within four weeks. Comments should be sent via Email to ST986RP or rudy.powell@dot.state.fl.us.

If you have any questions relating to this specification change, please call Rudy Powell, State Specifications Engineer at 414-4110.

Sincerely,

Signature on File

Rudy Powell, Jr., P.E.
State Specifications Engineer

RP/ft
Attachment
cc: Gregory Jones, General Counsel
Florida Transportation Builders' Assoc.
State Construction Engineer
Marvin Williams, Federal Highway Administration

CONCRETE STRUCTURES – STAY-IN-PLACE METAL FORMS.
(REV ~~11-1-07~~*3-25-08*~~-~~)

Section 400-5.7 is revised and expanded as follows:

400-5.7 Stay-In-Place Metal Forms:

400-5.7.1 ~~-~~General: ~~(a) Use of permanent stay-in-place metal forms: Permanent~~*a form, of~~*~~a form, using of~~*The u*Utilization of* ~~-~~stay-in-place metal forms *is permitted in lieu of removable forms to form concrete bridge decks between beams and between ~~across~~ the webs of individual box girders~~,~~ ~~will be allowed as~~when ~~approved by the Engineer~~designated in the plans~~des~~. Stay-in-place metal forms may be of the cellular or non-cellular type, however, do not use cellular type forms when polymer sheeting is required.~~If approved in the plans, the stay-in-place metal forms~~ may be used in lieu of removable forms to form concrete bridge deck slabs only when allowed by design note in the plans, and is subject to the conditions, limitations, and requirements contained herein. Use forms made of corrugated material of cellular or non-cellular construction.~~ *The flutes of non-cellular stay-in-place metal forms may be filled with polystyrene foam or concrete. When polystyrene foam is used to fill the forms, f~~F~~*ill form flutes completely*; do not allow any portion of the polystyrene foam to extend beyond the limits of the flutes.* ~~with concrete :~~ Ensure that the polystyrene foam *remains in its required position within flutes* during *the entire* concrete placement *process. Do not use reinforcing steel ~~bar~~ supports or other accessories in such a manner as to cause damage to the polystyrene foam. Replace all damaged polystyrene foam to the satisfaction of the engineer.~~.~~*

When the bridge superstructure environment is classified as moderately or extremely aggressive due to proximity to saltwater, apply polymer sheeting to the entire exterior surface of stay-in-place metal forms, except that the exterior surface of stay-in-place metal forms used to form the area between the webs of individual box girders does not require polymer sheeting. When polystyrene foam is used to fill the flutes of stay-in-place metal forms, apply polymer sheeting on the entire inside surface ~~, which are all surfacesdirectly in contact with concrete and polystyrene foam,~~for all environmental classifications. ~~When polystyrene is used, bbottom between the webs of individual es~~When the flutes are concrete-filled, polymer sheeting is not required on the inside surface of the stay-in-place metal forms.~~es ; however, polymer coating is required for outside surfaces of forms used in moderately or extremely~~ Use ~~aggressive enviroments~~polymer sheeting materials and application methods as described herein.~~.~~

~~Do not use fillers, such as sand, Styrofoam, etc. to fill the form flutes.~~

~~Stay-in-place metal forms may be used to form the portion of the top slab which lies between the webs of individual steel box girders regardless of the environmental classification.~~

Prior to using stay-in-place *metal* forms, submit detailed plans for approval of the forming system, including method of support and attachment and method of protecting the supporting structural steel components from welding effects. ~~-~~Submit design calculations for the forming system, which have been signed and sealed by the Specialty Engineer. ~~-~~Detail stay-in-place *metal* forms such that they in no way infringe upon the concrete outline of the slab shown on the plans. Use stay-in-place *metal* forms

that provide and maintain the dimensions and configuration of the original slab in regards to thickness and slope.

Do not weld stay-in-place metal form supports and connections to *the* structural steel components. ~~Make attachments by permissible welds, bolts, clips, or other approved means. If metal form supports and connections are field welded in place, protect~~*Do not connect polymer coated angles or other hardware that support polymer coated metal forms to the beam attachment straps or clips by welding.*

Protect structural steel components from damage by using a shield to guard against weld splatter, weld overrun, arc strikes, or other damaging effects of the welding process. Upon completion of welding, rest the metal form support flush on the supporting steel component. Should any weld spatter, weld overrun, arc strike, or other effects of the welding process be evident or occur to the structural steel component, immediately stop in-~~-~~place welding of the metal form supports for the remainder of the work. In this event, weld all metal form supports off of the structure and erect the forms after prefabrication, or use an alternate approved method of attaching the form supports. Remove improper weldment, repair the supporting steel component for any improper welding ~~technique.~~ *P*~~and p~~erform all required verification and testing at no expense to the Department and to the satisfaction of the Engineer.

Do not use stay-in-place *metal* forms until the forming system has been approved by the Engineer. The Contractor is responsible for the performance of the stay-in-place forms.

Structures designed, detailed, and dimensioned for the use of removable forms: Where stay-in-place metal forms are permitted, the Contractor is responsible and shall obtain the approval of the Engineer for ~~the additional slab thickness, elevation changes,~~ *any* changes in design, etc. to accommodate the use of stay-in-place forms. The Engineer will compute pay quantities of the various components of the structure which are paid on a cubic yard basis from the design dimensions shown on the plans with no allowance for changes in deflection or dimensions necessary to accommodate the stay-in-place forms or concrete to fill the form flutes. The Engineer will limit pay quantities of other Contract items that the Contractor increases to accommodate the use of stay-in-place forms to the quantity required for the original plan design.

Submit all changes in design details of bridge structural members that support stay-in-place forms, showing all revisions necessary to enable the supporting components to withstand *any*~~the~~ additional weight of the forms and the weight of *any*~~the~~ extra concrete *that may be* required to fill the form~~s flutes~~. Include with the design calculations a comparative analysis of the stresses in the supporting components as detailed on the Contract plans and as modified to support the forms. Use the identical method of analysis in each case, and do not allow the stresses in the modified components to exceed those of the component as detailed in the Contract plans. Include with the design the adjusted cambers for any changes in deflection over those shown on the original plans. Modify the beams to provide additional strength to compensate for the added dead loads imposed by the use of stay-in-place forms. Obtain the additional strength by adding strands to the pre-stressed beams or by adding steel material to increase the section modulus of steel girders. Substantiate the added strength by the

comparative calculations. Do not use stay-in-place forms until the forming system and all necessary design revisions of supporting members have been approved by the Engineer.

(*b*~~c~~) Structures designed, detailed, and dimensioned for the use of stay-in-place metal forms:

Prior to using stay-in-place *metal* forms, submit detailed plans for approval of the forming system (including method of support and attachment) together with design calculations. Include an analysis of the actual unit weight of the proposed forming system over the projected plan area of the metal forms. ~~-~~If the weight thus calculated exceeds the weight allowance for stay-in-place metal forms and concrete required to fill the form*s* ~~flutes~~ shown on the plans, then modify the supporting components to support the excess ~~in weight as stipulated in 400-5.7.1(b)~~*weight as specified by the Contractor's Specialty Engineer*.

~~(d) Painting of top flange:~~

For all structures utilizing structural steel supporting components ~~for which stay-in-place metal forms are to be used~~, paint the vertical sides of the top flange prior to installation of the stay-in-place *metal* forms in accordance with *Section* 560.

~~(e) Zinc coating of supports and connections: Apply a~~

For non-polymer sheeting form surfaces, use~~,~~ zinc paint coating in accordance with ~~Section~~ *Section* 562 to all ~~welded areas of supports and to~~ accessories cut from galvanized sheets, which are not embedded in concrete.

400-5.7.2 ~~Materials:~~ ~~Fabricate permanent stay-in-place metal forms and supports from steel meeting the requirements of ASTM A 653 having a coating designation G165. Do not use form materials that are less than 22 gauge in thickness.~~

~~400-5.7.3~~ Design: Meet the following criteria for the design of ~~permanent~~ *stay-in-place* bridge deck forms:

1.~~——~~ Design the forms on the basis of ~~dead~~*dead* load of form, reinforcement, and plastic concrete plus ~~50~~ *50* lb/ft^2 for construction loads. Use a unit working stress in the steel sheet of not more than 0.~~725~~ *725* of the specified minimum yield strength of the material furnished, but not to exceed 36,~~000~~ *000* psi.

~~(~~2~~).~~~~——~~ Do not allow deflection under the weight of the forms, reinforcement, and plastic concrete to exceed 1/~~180~~ *180* of the form span or 1/~~2~~ *2* inch, whichever is less, for form spans of ~~10~~ *10* feet or less, or 1/~~240~~ *240* of the form span or 3/~~4~~ *4* inch, whichever is less, for form spans greater than ~~10~~ *10* feet~~.~~ . In all cases, do not use a loading that is less than ~~120~~ *120* psf total.

~~(~~3~~).~~ ~~—~~Use a design span of the form equal to the clear span of the form plus ~~2~~ *2* inches. Measure the span parallel to the form flutes.

~~(~~4~~).~~~~——~~ Compute physical design properties in accordance with requirements of the AISI Specifications for the Design of Cold Formed Steel Structural Members, latest published edition.

~~(~~5~~).~~ ~~—~~For all reinforcement, maintain the design concrete cover required by the plans.

~~(~~6~~).~~ ~~—~~Maintain the plan dimensions of both layers of primary deck reinforcement from the top surface of the concrete deck.

~~(~~7~~).~~ ~~—~~Do not consider the permanent bridge deck form as lateral bracing for compression flanges of supporting structural members.

~~(~~8~~).~~ ~~—~~Do not use permanent steel bridge deck forms in panels where longitudinal deck construction joints are located between stringers.

~~(~~9~~).~~ ~~—~~Secure forms to the supporting members by means other than welding directly to the member.

400-5.7.3~~-~~ Materials:

102-8.6 ***400-5.7.3.1 Metal Forms:*** *Fabricate stay-in-place metal forms and supports from steel meeting the requirements of ASTM A653 having a coating designation G165. Do not use form materials that are less than 0.03 inch uncoated thickness.*

400-5.7.3.2 Polymer Sheeting: *Use polymer sheeting comprised of at least 85% ethylene acrylic acid copolymer capable of being applied to both G165 and G210 steel sheet as described in ASTM A742. Ensure that the polymer sheeting has a nominal thickness of 12 mils (0.012 inch) as manufactured and a minimum thickness of 10 mils (0.010 inch) after lamination to the steel sheet. Ensure that the polymer sheeting remains free of holes, tears and discontinuities and sufficiently flexible to withstand the forming process without any detrimental effects to durability or performance. Ensure that the polymer sheeting is UV stabilized and contains antioxidants. Ensure that the as-manufactured polymer sheeting (prior to application) has an Oxidative Induction Time (OIT) of 60 to 75 minutes at 170 °C in air when tested according to ASTM D3895. Perform additional OIT tests on samples taken from the finished product (polymer sheeting applied to forms) resulting in a minimum OIT according to ASTM D3895 of 32 minutes at 170 °C in air. Ensure that the polymer sheeting adheres to galvanized metal sufficient to prevent undercutting at penetrations made through the polymer sheeting or metal forms to the satisfaction of the Engineer. Ensure that edges subjected to shear cutting are coated by the form manufacturer with two coats of a compatible liquid coating repair material before delivery to the site. Ensure that steel used to produce polymer laminated metal forms is appropriately cleaned and prepared per NCCA (National Coil Coating Association) standard continuous coil coating practices. Ensure that pretreatment~~s~~ for use in conjunction with the manufacturer's polymer sheeting material is approved as compatible~~,~~ by the polymer sheeting manufacturer. Apply ~~P~~pretreatment ~~must be applied per~~in accordance with the polymer sheeting manufacturer's procedures. ~~The a~~Apply polymer sheeting ~~be~~ in accordance with the manufacturer's recommendations and procedures. Ensure that all steel has the polymer sheeting applied prior to fabrication of the stay-in-place forms and accessories.*

Ensure that the screws to be used in the fastening of the stay-in-place laminated metal forms have a corrosion resistant cladding that will not have an adverse ~~ae~~effect to the system due to the contact of dissimilar metals.

102-8.7 ***400-5.7.3.3 Certification:*** *Provide a written certification from the manufacturer stating the product meets the requirements of this specification along with the delivery of the coated forms to the job site. Ensure that the certification conforms to the requirements of Section 6. Ensure that the manufacturer has a quality control program conforming to ISO 9001:2000 standards.*

102-8.8 ***400-5.7.3.4 Polystyrene Foam:*** *Use polystyrene foam comprised of expanded polystyrene manufactured from virgin resin of sufficient density to support the weight of concrete without deformation. Extrude the polystyrene foam to match the geometry of the flutes and provide a snug fit. Use polystyrene foam that has a density of*

not less than 0.8 lbs/cubic foot. Use polystyrene foam that has water absorption of less than 2.6% when tested according to ASTM C272. Provide a written certification from the manufacturer stating the product meets the requirements of this specification along with the delivery of the product.

400-5.7.4 Construction: Install all forms in accordance with approved fabrication and erection plans.

D*o* ~~o~~ not rest form sheets directly on the top of the stringer of floor beam flanges. Fasten sheets securely to form supports, and maintain a minimum bearing length of ~~1~~ *1* inch at each end for *metal* forms. Place form supports in direct contact with the flange of the stringer or floor beam. Make all attachments ~~for~~*for coated metal* forms by bolts, clips, *screws,* or other approved means.

400-5.7.4.1 Form Galvanizing Repairs: For any permanent exposed steel where the galvanized coating has been damaged, thoroughly clean, wire brush, and paint it with two coats of galvanizing compound in accordance with ~~Section~~ *Section* 975 to the satisfaction of the Engineer. Do ~~not~~ *not* touch up minor heat discoloration in areas of welds.

~~Locate transverse construction joints at the bottom of a flute, and field drill 1/4 inch weep holes at not less than 12 inches on center along the line of the joints.~~

400-5.7.4.2 Polymer Sheeting Repairs: *Inspect and identify areas for damage to the polymer sheeting and repair with liquid polymer coating similar and compatible with respect to durability, adhesion and appearance ~~(per~~in accordance with ASTM A762~~),~~as furnished by the stay-in-place form manufacturer. Ensure that the inspection includes checking the polymer sheeting for cuts, tears, cracking, surface pits, peeling, dirt, grease, oil, stains, rust or bare areas. Reject any panels that show coating blistering, peeling or cracking. Repair all polymer sheeting damage according to the following:*

a.~~)~~ Surface Preparation: Ensure that all surfaces to be repaired are clean and free of any deleterious substances. Remove all traces of dirt, soil, oil deposits, greases, and other surface contaminates in accordance with the polymer sheeting and coating manufacturer's written specifications prior to touch-up and~~/or~~ recoating.

b.~~)~~ Application Procedures: Ensure that the liquid polymer repair coating is applied to a clean dry surface and in accordance with the manufacturer's written specifications.Apply ~~T~~the repair coating ~~shall be applied~~ using a suitable paintbrush or other means acceptable to the ~~e~~Engineer. Apply a first coat of product to the surface at 2-4 mils in thickness. Let the first coat ~~to~~ air dry. Apply a second coat ~~T~~to form a complete layer and increase the thickness, ~~apply a second coat~~ immediately after verifying the first coat is dry to the touch (15 - 25 minutes depending on the local air drying temperature and atmospheric conditions). Apply ~~T~~the second coat ~~shall be applied~~ at the same coating thickness as the first at 2-4 mils. Ensure that the total dry film thickness of the two coats is not less than 6 mils. Apply additional coats in this same manner until desired coating thickness is achieved.

400-5.7.5 **Placing of Concrete:** Vibrate concrete to avoid honeycomb and voids, especially at construction joints, expansion~~s~~ joints, ~~and~~ valleys and ends of

form sheets. Use approved pouring sequences. Do not use calcium chloride or any other admixture containing chloride salts in the concrete.

400-5.7.~~6~~*6*~~-~~ Inspection: The Engineer will observe the Contractor's method of construction during all phases of the construction of the bridge deck slab, including the installation of the ~~-~~metal ~~forms~~*form system*; location and fastening of the reinforcement; composition of concrete items; mixing procedures, concrete placement, and vibration; and finishing of the bridge deck. Should the Engineer determine that the procedures used during the placement of the concrete warrant inspection of the underside of the deck, remove at least one section of the *metal* forms in each span for this purpose. Do this as soon after placing the concrete as practicable in order to provide visual evidence that the concrete mix and the procedures are obtaining the desired results. Remove an additional section in any span if the Engineer determines that there has been any change in the concrete mix or in the procedures warranting additional inspection.

If, in the Engineer's judgment, inspection is needed to check for defects in the bottom of the deck or to verify soundness, sound the metal forms with a hammer as directed by the Engineer after the deck concrete has been in place a minimum of two days.~~After the deck concrete has been in place for a minimum period of two days, test for soundness and bonding of the forms by sounding with a hammer as directed by the Engineer.~~ If sounding discloses areas of doubtful soundness to the Engineer, remove the *metal* forms from such areas for visual inspection after the concrete has attained adequate strength. Remove ~~permanent~~*metal* bridge deck forms at no expense to the Department.

At locations where sections of the *metal* forms have been removed, the Engineer will not require the Contractor to replace the *metal* forms. Repair the adjacent *metal* forms and supports to present a neat appearance and to ensure their satisfactory retention *and where they are polymer sheeted, coat all exposed surfaces of stay-in-place metal form system elements that are not coated or are damaged with a field applied liquid polymer coating as specified in 400-5.7.4.2* . As soon as the form is removed, the Engineer will examine the concrete surfaces for cavities, honeycombing, and other defects. If irregularities are found, and the Engineer determines that these irregularities do not justify rejection of the work, repair the concrete as directed, and provide a General Surface Finish in accordance with 400~~-~~-15. If the Engineer determines that the concrete where the form is removed is unsatisfactory, remove additional *metal* forms as necessary to inspect and repair the slab, and modify the method of construction as required to obtain satisfactory concrete in the slab. Remove and replace all unsatisfactory concrete as directed, at no expense to the Department.

If the method of construction and the results of the inspections as outlined above indicate that sound concrete has been obtained throughout the slabs, the amount of sounding and form removal may be reduced when approved *by the Engineer*.

Corrosion of assembly screws will not be considered a structural or aesthetic problem and is considered acceptable.

Provide the facilities for the safe and convenient conduct of the inspection procedures.

CONCRETE STRUCTURES – STAY-IN-PLACE METAL FORMS.
(REV 3-25-08)

SECTION 400-5.7 is revised and expanded as follows:

400-5.7 Stay-In-Place Metal Forms:

400-5.7.1 General: Utilization of stay-in-place metal forms is permitted in lieu of removable forms to form concrete bridge decks between beams and between the webs of individual box girders when designated in the plans. Stay-in-place metal forms may be of the cellular or non-cellular type, however, do not use cellular type forms when polymer sheeting is required. The flutes of non-cellular stay-in-place metal forms may be filled with polystyrene foam or concrete. When polystyrene foam is used to fill the forms, fill form flutes completely; do not allow any portion of the polystyrene foam to extend beyond the limits of the flutes. Ensure that the polystyrene foam remains in its required position within flutes during the entire concrete placement process. Do not use reinforcing steel supports or other accessories in such a manner as to cause damage to the polystyrene foam. Replace all damaged polystyrene foam to the satisfaction of the engineer.

When the bridge superstructure environment is classified as moderately or extremely aggressive due to proximity to saltwater, apply polymer sheeting to the entire exterior surface of stay-in-place metal forms, except that the exterior surface of stay-in-place metal forms used to form the area between the webs of individual box girders does not require polymer sheeting. When polystyrene foam is used to fill the flutes of stay-in-place metal forms, apply polymer sheeting on the entire inside surface for all environmental classifications. When the flutes are concrete-filled, polymer sheeting is not required on the inside surface of the stay-in-place metal forms. Use polymer sheeting materials and application methods as described herein.

Prior to using stay-in-place metal forms, submit detailed plans for approval of the forming system, including method of support and attachment and method of protecting the supporting structural steel components from welding effects. Submit design calculations for the forming system, which have been signed and sealed by the Specialty Engineer. Detail stay-in-place metal forms such that they in no way infringe upon the concrete outline of the slab shown on the plans. Use stay-in-place metal forms that provide and maintain the dimensions and configuration of the original slab in regards to thickness and slope.

Do not weld stay-in-place metal form supports and connections to the structural steel components. Do not connect polymer coated angles or other hardware that support polymer coated metal forms to the beam attachment straps or clips by welding.

Protect structural steel components from damage by using a shield to guard against weld splatter, weld overrun, arc strikes, or other damaging effects of the welding process. Upon completion of welding, rest the metal form support flush on the supporting steel component. Should any weld spatter, weld overrun, arc strike, or other effects of the welding process be evident or occur to the structural steel component, immediately stop in-place welding of the metal form supports for the remainder of the work. In this event, weld all metal form supports off of the structure and erect the forms

after prefabrication, or use an alternate approved method of attaching the form supports. Remove improper weldment, repair the supporting steel component for any improper welding. Perform all required verification and testing at no expense to the Department and to the satisfaction of the Engineer.

Do not use stay-in-place metal forms until the forming system has been approved by the Engineer. The Contractor is responsible for the performance of the stay-in-place forms.

Structures designed, detailed, and dimensioned for the use of removable forms: Where stay-in-place metal forms are permitted, the Contractor is responsible and shall obtain the approval of the Engineer for any changes in design, etc. to accommodate the use of stay-in-place forms. The Engineer will compute pay quantities of the various components of the structure which are paid on a cubic yard basis from the design dimensions shown on the plans with no allowance for changes in deflection or dimensions necessary to accommodate the stay-in-place forms or concrete to fill the form flutes. The Engineer will limit pay quantities of other Contract items that the Contractor increases to accommodate the use of stay-in-place forms to the quantity required for the original plan design.

Submit all changes in design details of bridge structural members that support stay-in-place forms, showing all revisions necessary to enable the supporting components to withstand any additional weight of the forms and the weight of any extra concrete that may be required to fill the forms. Include with the design calculations a comparative analysis of the stresses in the supporting components as detailed on the Contract plans and as modified to support the forms. Use the identical method of analysis in each case, and do not allow the stresses in the modified components to exceed those of the component as detailed in the Contract plans. Include with the design the adjusted cambers for any changes in deflection over those shown on the original plans. Modify the beams to provide additional strength to compensate for the added dead loads imposed by the use of stay-in-place forms. Obtain the additional strength by adding strands to the pre-stressed beams or by adding steel material to increase the section modulus of steel girders. Substantiate the added strength by the comparative calculations. Do not use stay-in-place forms until the forming system and all necessary design revisions of supporting members have been approved by the Engineer.

(b) Structures designed, detailed, and dimensioned for the use of stay-in-place metal forms:

Prior to using stay-in-place metal forms, submit detailed plans for approval of the forming system (including method of support and attachment) together with design calculations. Include an analysis of the actual unit weight of the proposed forming system over the projected plan area of the metal forms. If the weight thus calculated exceeds the weight allowance for stay-in-place metal forms and concrete required to fill the forms shown on the plans, then modify the supporting components to support the excess weight as specified by the Contractor’s Specialty Engineer.

For all structures utilizing structural steel supporting components, paint the vertical sides of the top flange prior to installation of the stay-in-place metal forms in accordance with Section 560.

For non-polymer sheeting form surfaces, use zinc paint coating in accordance with Section 562 to all accessories cut from galvanized sheets, which are not embedded in concrete.

400-5.7.2 Design: Meet the following criteria for the design of stay-in-place bridge deck forms:

1. Design the forms on the basis of dead load of form, reinforcement, and plastic concrete plus 50 lb/ft^2 for construction loads. Use a unit working stress in the steel sheet of not more than 0.725 of the specified minimum yield strength of the material furnished, but not to exceed 36,000 psi.

2. Do not allow deflection under the weight of the forms, reinforcement, and plastic concrete to exceed 1/180 of the form span or 1/2 inch, whichever is less, for form spans of 10 feet or less, or 1/240 of the form span or 3/4 inch, whichever is less, for form spans greater than 10 feet. In all cases, do not use a loading that is less than 120 psf total.

3. Use a design span of the form equal to the clear span of the form plus 2 inches. Measure the span parallel to the form flutes.

4. Compute physical design properties in accordance with requirements of the AISI Specifications for the Design of Cold Formed Steel Structural Members, latest published edition.

5. For all reinforcement, maintain the design concrete cover required by the plans.

6. Maintain the plan dimensions of both layers of primary deck reinforcement from the top surface of the concrete deck.

7. Do not consider the permanent bridge deck form as lateral bracing for compression flanges of supporting structural members.

8. Do not use permanent steel bridge deck forms in panels where longitudinal deck construction joints are located between stringers.

9. Secure forms to the supporting members by means other than welding directly to the member.

400-5.7.3 Materials:

400-5.7.3.1 Metal Forms: Fabricate stay-in-place metal forms and supports from steel meeting the requirements of ASTM A653 having a coating designation G165. Do not use form materials that are less than 0.03 inch uncoated thickness.

400-5.7.3.2 Polymer Sheeting: Use polymer sheeting comprised of at least 85% ethylene acrylic acid copolymer capable of being applied to both G165 and G210 steel sheet as described in ASTM A742. Ensure that the polymer sheeting has a nominal thickness of 12 mils (0.012 inch) as manufactured and a minimum thickness of 10 mils (0.010 inch) after lamination to the steel sheet. Ensure that the polymer sheeting remains free of holes, tears and discontinuities and sufficiently flexible to withstand the forming process without any detrimental effects to durability or performance. Ensure that the polymer sheeting is UV stabilized and contains antioxidants. Ensure that the as-manufactured polymer sheeting (prior to application) has an Oxidative Induction Time (OIT) of 60 to 75 minutes at 170 °C in air when tested according to ASTM D3895. Perform additional OIT tests on samples taken from the finished product (polymer sheeting applied to forms) resulting in a minimum OIT according to ASTM D3895 of 32

minutes at 170 °C in air. Ensure that the polymer sheeting adheres to galvanized metal sufficient to prevent undercutting at penetrations made through the polymer sheeting or metal forms to the satisfaction of the Engineer. Ensure that edges subjected to shear cutting are coated by the form manufacturer with two coats of a compatible liquid coating repair material before delivery to the site. Ensure that steel used to produce polymer laminated metal forms is appropriately cleaned and prepared per NCCA (National Coil Coating Association) standard continuous coil coating practices. Ensure that pretreatment for use in conjunction with the manufacturer's polymer sheeting material is approved as compatible by the polymer sheeting manufacturer. Apply pretreatment in accordance with the polymer sheeting manufacturer's procedures. Apply polymer sheeting in accordance with the manufacturer's recommendations and procedures. Ensure that all steel has the polymer sheeting applied prior to fabrication of the stay-in-place forms and accessories.

Ensure that the screws to be used in the fastening of the stay-in-place laminated metal forms have a corrosion resistant cladding that will not have an adverse effect to the system due to the contact of dissimilar metals.

400-5.7.3.3 Certification: Provide a written certification from the manufacturer stating the product meets the requirements of this specification along with the delivery of the coated forms to the job site. Ensure that the certification conforms to the requirements of Section 6. Ensure that the manufacturer has a quality control program conforming to ISO 9001:2000 standards.

400-5.7.3.4 Polystyrene Foam: Use polystyrene foam comprised of expanded polystyrene manufactured from virgin resin of sufficient density to support the weight of concrete without deformation. Extrude the polystyrene foam to match the geometry of the flutes and provide a snug fit. Use polystyrene foam that has a density of not less than 0.8 lbs/cubic foot. Use polystyrene foam that has water absorption of less than 2.6% when tested according to ASTM C272. Provide a written certification from the manufacturer stating the product meets the requirements of this specification along with the delivery of the product.

400-5.7.4 Construction: Install all forms in accordance with approved fabrication and erection plans.

Do not rest form sheets directly on the top of the stringer of floor beam flanges. Fasten sheets securely to form supports, and maintain a minimum bearing length of 1 inch at each end for metal forms. Place form supports in direct contact with the flange of the stringer or floor beam. Make all attachments for coated metal forms by bolts, clips, screws, or other approved means.

400-5.7.4.1 Form Galvanizing Repairs: For any permanent exposed steel where the galvanized coating has been damaged, thoroughly clean, wire brush, and paint it with two coats of galvanizing compound in accordance with Section 975 to the satisfaction of the Engineer. Do not touch up minor heat discoloration in areas of welds.

400-5.7.4.2 Polymer Sheeting Repairs: Inspect and identify areas for damage to the polymer sheeting and repair with liquid polymer coating similar and compatible with respect to durability, adhesion and appearance in accordance with ASTM A762,as furnished by the stay-in-place form manufacturer. Ensure that the inspection includes checking the polymer sheeting for cuts, tears, cracking, surface pits,

peeling, dirt, grease, oil, stains, rust or bare areas. Reject any panels that show coating blistering, peeling or cracking. Repair all polymer sheeting damage according to the following:

a. Surface Preparation: Ensure that all surfaces to be repaired are clean and free of any deleterious substances. Remove all traces of dirt, soil, oil deposits, greases, and other surface contaminates in accordance with the polymer sheeting and coating manufacturer's written specifications prior to touch-up and recoating.

b. Application Procedures: Ensure that the liquid polymer repair coating is applied to a clean dry surface and in accordance with the manufacturer's written specifications.Apply the repair coating using a suitable paintbrush or other means acceptable to the Engineer. Apply a first coat of product to the surface at 2-4 mils in thickness. Let the first coat air dry. Apply a second coat to form a complete layer and increase the thickness, immediately after verifying the first coat is dry to the touch (15 - 25 minutes depending on the local air drying temperature and atmospheric conditions). Apply the second coat at the same coating thickness as the first at 2-4 mils. Ensure that the total dry film thickness of the two coats is not less than 6 mils. Apply additional coats in this same manner until desired coating thickness is achieved.

400-5.7.5 Placing of Concrete: Vibrate concrete to avoid honeycomb and voids, especially at construction joints, expansion joints, valleys and ends of form sheets. Use approved pouring sequences. Do not use calcium chloride or any other admixture containing chloride salts in the concrete.

400-5.7.6 Inspection: The Engineer will observe the Contractor's method of construction during all phases of the construction of the bridge deck slab, including the installation of the metal form system; location and fastening of the reinforcement; composition of concrete items; mixing procedures, concrete placement, and vibration; and finishing of the bridge deck. Should the Engineer determine that the procedures used during the placement of the concrete warrant inspection of the underside of the deck, remove at least one section of the metal forms in each span for this purpose. Do this as soon after placing the concrete as practicable in order to provide visual evidence that the concrete mix and the procedures are obtaining the desired results. Remove an additional section in any span if the Engineer determines that there has been any change in the concrete mix or in the procedures warranting additional inspection.

If, in the Engineer's judgment, inspection is needed to check for defects in the bottom of the deck or to verify soundness, sound the metal forms with a hammer as directed by the Engineer after the deck concrete has been in place a minimum of two days. If sounding discloses areas of doubtful soundness to the Engineer, remove the metal forms from such areas for visual inspection after the concrete has attained adequate strength. Remove metal bridge deck forms at no expense to the Department.

At locations where sections of the metal forms have been removed, the Engineer will not require the Contractor to replace the metal forms. Repair the adjacent metal forms and supports to present a neat appearance and to ensure their satisfactory retention and where they are polymer sheeted, coat all exposed surfaces of stay-in-place metal form system elements that are not coated or are damaged with a field applied liquid polymer coating as specified in 400-5.7.4.2 . As soon as the form is removed, the Engineer will examine the concrete surfaces for cavities, honeycombing,

and other defects. If irregularities are found, and the Engineer determines that these irregularities do not justify rejection of the work, repair the concrete as directed, and provide a General Surface Finish in accordance with 400-15. If the Engineer determines that the concrete where the form is removed is unsatisfactory, remove additional metal forms as necessary to inspect and repair the slab, and modify the method of construction as required to obtain satisfactory concrete in the slab. Remove and replace all unsatisfactory concrete as directed, at no expense to the Department.

If the method of construction and the results of the inspections as outlined above indicate that sound concrete has been obtained throughout the slabs, the amount of sounding and form removal may be reduced when approved by the Engineer.

Corrosion of assembly screws will not be considered a structural or aesthetic problem and is considered acceptable.

Provide the facilities for the safe and convenient conduct of the inspection procedures.