

8-6 STAY-IN-PLACE PRECAST PRESTRESSED CONCRETE DECK PANELS FOR PRECAST CONCRETE GIRDER SUPERSTRUCTURES

Introduction

This memo addresses the applicability, design criteria, design example, quantity items, plans, and special provisions of Stay-In-Place Precast Prestressed Concrete Deck Panels (PDPs) used for construction of concrete decks on precast concrete girder superstructures. PDPs are partial-depth precast, pretensioned concrete deck panels that span between girders and are topped with cast-in-place (CIP) concrete to complete the deck.

Applicability

The decision to use PDPs is project-specific and requires approval at the Type Selection Meeting.

PDPs can be considered for use with superstructures that are over:

- Vehicular traffic;
- Rail traffic;
- Water way vessel traffic; or
- Environmentally sensitive areas.

PDPs must NOT be used in the following cases:

- Freeze-Thaw areas;
- Spliced precast girders that are post-tensioned after the deck pour;
- Deck bays that have longitudinal joints;
- Decks with cross slope greater than 5%; or
- Decks that require field drilling of PDPs (e.g. for utility supports).

Design Criteria

PDPs must be designed in accordance with Articles 9.7.4.1 and 9.7.4.3, and Section 5 of the *AASHTO LRFD Bridge Design Specifications*, and California Amendments, as well as the following criteria:

- PDPs must have a thickness of at least 3 1/2", maximum length of 9' 6", and width between 4 feet and 8 feet. The deck must have an overall thickness of at least 7 3/4".
- PDPs must use 3/8-in diameter, Grade 270 low-relaxation, prestressing steel strand. The maximum tensile stress in the prestressing steel at release must not exceed 70% of the specified minimum ultimate tensile strength of the prestressing steel. Strands must be placed at the centroid of the PDP cross section so that prestressing does not produce any eccentricity.
- PDPs must be prestressed in the direction of the panel design span, i.e., perpendicular to the longitudinal axis of the girders. The prestressing strands must be considered as the primary positive moment reinforcement in the deck slab for the initial stages at transfer and under construction loads within a non-composite section, and are permitted to be used as the primary deck slab reinforcement for the later stages of service and strength states for superimposed dead and live loads within a composite full-depth deck section. Reinforcing bars in the CIP portion of the deck must be designed to provide capacity in the negative moment regions. Prestressing strands in PDPs must be extended 4" into the CIP concrete portion of the slab.
- The upper surface of the PDPs must have a 1/8-in roughened finish to ensure composite action with the CIP concrete.
- When PDPs are used with standard precast, prestressed girders, stirrups in end blocks must be terminated below the top of girder and supplemental horizontal shear reinforcement must be placed at the girder centerline to avoid conflict between the stirrups and PDPs.
- Bridges with skews greater than 20° require special panel sizes and design at the abutment and bent regions. Short strands may be replaced with reinforcement. Minimum bonded strand length shall be 3'-6".
- PDPs for variable girder spacing should be avoided due to its increased panel manufacturing cost and construction complexity.
- In rare cases where epoxy-coated strands are used, a special design criteria for epoxy-coated strands must be developed based on testing of grit-impregnated epoxy-coated strand and approved by Caltrans.
- The cast-in-place portion of the deck shall be thick enough to provide the required cover and clearance to all reinforcement, including longitudinal deck bars on

continuous structures. The minimum clearance between longitudinal deck bars and top of the deck panels is 1".

Design Example

Chapter 9 of the *PCI Bridge Design Manual* provides a detailed design example (Design Example 9.10) in accordance with *AASHTO LRFD Bridge Design Specifications*.

Quantity Items

There are two estimating items to consider:

1. Furnish Precast Deck Panel (SQ FT)
2. Erect Precast Deck Panel (EA)

Plans

PDPs must be shown and detailed on the contract plans. The designer must review and authorize the shop drawings.

Special Provisions

Special Provisions, in conjunction with Standard Specifications, must specify the fabrication, furnishing, erection, and placement of PDPs in precast concrete girder superstructures and must indicate appropriate properties of camber strip material to ensure sufficient support.



References

AASHTO, (2012). *LRFD Bridge Design Specifications*, American Association of State Highway and Transportation Officials, 6th Edition, Washington, DC.

Caltrans, (2014). *California Amendments to AASHTO LRFD Bridge Design Specifications*, 6th Edition, California Department of Transportation, Sacramento, CA.

PCI. (2011). *PCI Bridge Design Manual*, 3rd Edition, Precast/Prestressed Concrete Institute, Chicago, IL.

Original signed by Amir Malek

Amir Malek

Acting Technical Manager

Supervising Bridge Engineer, Structure Policy & Innovation

Division of Engineering Services