2018 AASHTO BRIDGE COMMITTEE AGENDA ITEM: WAI 193

SUBJECT: Designing for stability of precast-prestressed bridge girders during handling and transportation

TECHNICAL COMMITTEE: T-10

☒ **REVISION**	☐ **ADDITION**	☐ **NEW DOCUMENT**
☒ **DESIGN SPEC**	☐ **CONSTRUCTION SPEC**	☐ **MOVABLE SPEC**
☐ **MANUAL FOR BRIDGE ELEMENT INSP EVALUATION**	☐ **SEISMIC GUIDE SPEC**	☐ **MANUAL BRIDGE**
	☐ **OTHER**	

DATE PREPARED: 5/10/2010
DATE REVISED: 2/22/2018

ITEM INFORMATION

Item #1

Revise the following Article:

5.5.4.3—Stability
The structure as a whole and its components shall be designed to resist sliding, overturning, uplift and buckling. Effects of eccentricity of loads shall be considered in the analysis and design.

Buckling and stability of precast members during handling, transportation, and erection shall be investigated.

Add the following Commentary:

C5.5.4.3

Stability during handling, transportation, and erection can govern the design of precast, prestressed girders. Precast members should be designed such that safe storage, handling, and erection can be accomplished by the contractor. This consideration does not make the designer responsible for the contractor's means and methods for construction, as discussed in 2.5.3.

Lateral bending stability analysis should be based on the "Recommended Practice for Lateral Stability of Precast, Prestressed Concrete Bridge Girders", Precast Concrete Institute, Publication CB-02-16-E. A detailed design example is presented in Seguirant, Brice, and Khaleghi, (2009).

Item #2

Add the following Article:

5.9.4.5 Temporary Strands

Temporary top strands may be used to control tensile stresses in precast prestressed girders during handling and transportation. These strands may be pretensioned or post-tensioned prior to lifting the girder from the casting bed or post-tensioned prior to transportation of the girder. Detensioning of temporary strands shall be shown in the construction sequence and typically occurs after the girders are securely braced and before construction of intermediate concrete diaphragms, if applicable.

Pretensioned temporary strands are debonded over the center portion of the girder. If pretensioned, the development length, measured from the end of the debonded zone, shall be determined as described in 5.9.4.3.3 No other provisions of 5.9.4.3.3 apply to temporary strands.

Debonded temporary strands shall be symmetrically distributed about the centerline of the member.

Debonded lengths of pairs of temporary strands that are symmetrically positioned about the centerline of the member shall be equal.

The effects of temporary strands must be considered when calculating camber and loss of prestress

C5.9.4.5 Temporary Strands

The stability of slender precast concrete girders is improved when lifting and transportation support points are moved away from the ends of the girder. The consequence of having a shorter span between support points is reduced dead load stresses to balance the stresses due to pretensioning and thus excessive tensile stresses in the top flange and compressive stresses in the bottom flange may develop. Temporary strands placed in the top flange of the girder reduce stresses and reduce the required concrete compressive strength at prestress transfer. Temporary strands in the top flange balance a portion of the primary prestressing and reduce camber and camber growth due to creep.

Temporary top strands reduce the effectiveness of the permanent prestressing. Therefore, detensioning of the temporary top strands is typically recommended. Access to pretensioned temporary top strands is typically provided through pockets in the top surface of the top flange. Detensioning must occur before the temporary strands become inaccessible. Casting deck concrete and installation of precast deck panels will typically cover temporary top strand access points in the top flange.

Detensioning of the temporary top strands results in an upward deflection of the girder. Typically, temporary top strands are detensioned one girder at a time. This results in a differential deflection between adjacent girders that can crack intermediate concrete diaphragms, if present. To mitigate this issue, temporary strands should be detensioned

after the girders are securely braced, but before intermediate concrete diaphragms are placed.

Sleeves used for debonding should be of sufficient inside diameter to mitigate binding of the strand during detensioning. Experience has shown that sleeves with inside diameter $^{3}/_{16}$" to ¼" larger than the strand diameter provide sufficient annular space. Access pockets should be protected to prevent water intrusion into the sleeves. Water in the sleeves can freeze and result in longitudinal cracking in the top flange that mirrors the location of the sleeves. Access pockets should be immediately patched and sealed after detensioning.

Item #3

Revise the following Article:
5.12.3.2—Precast Beams

C5.12.3.2.1

AASHTO LRFD Bridge Construction Specifications places the responsibility on the Contractor to provide adequate devices and methods for the safe storage, handling, erection, and temporary bracing of precast members. However, these preservice conditions may govern and should be considered in the design, as discussed in 2.5.3.

Item #4

Add the following to Article 5.15:

S. J. Seguirant, Brice, R., and B. Khaleghi, "Design optimization for fabrication of pretensioned concrete bridge girders: An example problem", PCI JOURNAL Vol. 54, No. 4, Fall 2009, pp 73-111

"Recommended Practice for Lateral Stability of Precast, Prestressed Concrete Bridge Girders", Precast/Prestrssed Concrete Institute, Publication CB-02-16-E

OTHER AFFECTED ARTICLES

None

BACKGROUND

The spans of pretensioned girders have been steadily increasing over the past decade. Record or near record breaking spans have been design and constructed in Washington, Nebraska, and Florida. These spans have been in excess of 200 ft. The stability of long span pretensioned girders is a serious concern and should not be ignored by the design engineer. Accommodations for stability often govern the girder design.

The use of temporary strands is a common design accommodation for shipping and handling of precast girders. The effect of temporary strands should not be ignored in

design. These strands could be pretensioned or post-tensioned depending to the producers' capability and girder types.

ANTICIPATED EFFECT ON BRIDGES

Improved safety and constructability

REFERENCES

S. J. Seguirant, Brice, R., and B. Khaleghi, "Design optimization for fabrication of pretensioned concrete bridge girders: An example problem", PCI JOURNAL Vol. 54, No. 4, Fall 2009, pp 73-111

"Recommended Practice for Lateral Stability of Precast, Prestressed Concrete Bridge Girders", Precast/Prestressed Concrete Institute, Publication CB-02-16-E

Lead State: WA
Industry: PCI
FHWA