
REFERENCE CARDS

KEYWORDS: analysis; beams; bridges; camber; cracking moment; deflections; Monte Carlo Simulation; precast concrete; prestressed concrete; prestress losses; probabilistic method; statistical method.

ABSTRACT: Camber and long-term deflections are directly linked to the loss of prestressing force, a characteristic of all prestressed concrete members. In this investigation, the effects of the inherent variability of the parameters used to estimate prestress loss was studied for two typical bridge beam cases using several prestress loss predictive methods at final service conditions. A parametric study was conducted to assess the general effect of single parameter variation on the calculation of prestress loss. Monte Carlo simulations were used to assess the distribution of prestress loss considering the variability of all parameters simultaneously. Results of the Monte Carlo simulations were also used to evaluate the impact of loss variability on deflection and cracking moment calculations. Results show that the variability of parameters has a notable effect on prestress loss variation and that this variation significantly influences the estimated deflection and cracking moment of prestressed concrete beams. Indeed, the variation in camber between beams cast on the same prestressing bed can be partially explained through the variability of materials and predictive methods used.

REFERENCE: Gilbertson, Christopher G., and Ahlborn, Theresa M. (Tess), "A Probabilistic Comparison of Prestress Loss Methods in Prestressed Concrete Beams," *PCI JOURNAL*, V. 49, No. 5, September-October 2004, pp. 52-69.

KEYWORDS: bridges; construction; design (structural); deck panels; high performance concrete; precast concrete; prestressed concrete; NUDECK system; research; Skyline Bridge.

ABSTRACT: The poor condition of many stringer type bridges on U.S. roadways is due to the cracking and deterioration of concrete decks. Concrete shrinkage, temperature changes due to heat of hydration, and differential creep in relation to the support beams often result in cracking of cast-in-place concrete decks shortly after placement. The NUDECK system, a full-depth precast/prestressed concrete bridge deck panel system developed by the University of Nebraska-Lincoln, is presented in this article. The design and construction of the Skyline Bridge in Omaha, Nebraska, is the first implementation of this bridge deck system. The deck is pretensioned in the transverse direction and post-tensioned in the longitudinal direction. Using a combination of high performance precast concrete – where little creep and shrinkage occur after the deck is made composite with the girders – and two-way prestressing ensure continued compression of the deck during its service life. This low maintenance deck system can be used for both concrete and steel bridges and results in significantly reduced construction time and traffic disruption.

REFERENCE: Fallaha, Sam, Sun, Chuanbing, Lafferty, Mark D., and Tadros, Maher K., "High Performance Precast Concrete NUDECK Panel System for Nebraska's Skyline Bridge," *PCI JOURNAL*, V. 49, No. 5, September-October 2004, pp. 40-50.

KEYWORDS: abutments; bridges; design (structural); displacement; integral abutment bridges; lateral load tests; piles; precast concrete; prestressed concrete; research.

ABSTRACT: Four prestressed concrete piles, 14 in. (356 mm) square, were driven 36 ft (11 m) into undisturbed clay soil in a research project sponsored by the Tennessee Department of Transportation (TDOT). Each pile supported a simulated integral abutment 3 ft (0.91 m) thick. The abutment was 10 ft (3.05 m) wide and was cast integrally with an abutment slab which was 2.5 ft (0.76 m) thick. The slab-abutment system was pulled horizontally, displacing the pile laterally and thus inducing moments and shears along a portion of the pile. The abutment slab was restrained against free rotation in a way to simulate the behavior of an abutment in an actual bridge. Each pile was subjected to a number of lateral load tests to a displacement of 1.0 in. (25.4 mm), consistent with TDOT's design criteria, and then cycled approximately 100 times to a displacement slightly more than 1.0 in. (25.4 mm), and another pile was pulled laterally to failure. The results of the tests clearly indicate that prestressed concrete piles are appropriate for use in integral abutment bridges and that the TDOT design criteria are conservative.

REFERENCE: Burdette, Edwin G., Deatherage, J. Harold, Goodpasture, David W., Howard, Samuel C., Ingram, Earl E., Tidwell, J. Brandon, and Wasserman, Edward J., "Lateral Load Tests on Prestressed Concrete Piles Supporting Integral Abutments," *PCI JOURNAL*, V. 49, No. 5, September-October 2004, pp. 70-77.

KEYWORDS: architectural precast concrete; buildings; construction; design (structural); loadbearing wall panels; office buildings; wall panels.

ABSTRACT: An architectural precast concrete loadbearing wall panel system not only saved costs but also provided the desired aesthetics for a four-story, Class A office building in Jacksonville, Florida.

REFERENCE: "Deerwood North Building 300, Jacksonville, Florida," *PCI JOURNAL*, V. 49, No. 5, September-October 2004, pp. 136-139.

KEYWORDS: ACI Building Code (ACI 318-05); changes; building codes; design (structural); precast concrete; prestressed concrete; post-tensioned concrete; reinforced concrete.

ABSTRACT: Significant changes made since the publication of the 2002 ACI 318 Building Code, which are reflected in the upcoming 2005 edition of the Code, are summarized. In addition to changes impacting conventionally reinforced concrete, provisions affecting precast/prestressed concrete including post-tensioned concrete are enumerated. Changes in Appendix D, Anchoring to Concrete, are not discussed in this Part 1 article.

REFERENCE: Ghosh, S. K., "Significant Changes in the 2005 ACI Code Including Changes Affecting Precast/Prestressed Concrete – Part 1," *PCI JOURNAL*, V. 49, No. 5, September-October 2004, pp. 92-97.

KEYWORDS: design (structural); jointed system; NEHRP Provisions; non-emulative design; precast concrete; prestressed concrete; PRESSS structural systems; seismic design; shear walls; validation testing; walls.

ABSTRACT: The 2003 Edition of the NEHRP Provisions permits, with validation testing, the use of structural (shear) walls of jointed construction in regions of high seismic risk. Acceptance criteria for such validation testing, accompanied by background and commentary, are presented in this article. Lastly, the future direction of non-emulative design of precast concrete walls is discussed.

REFERENCE: Hawkins, Neil M., and Ghosh, S. K., "Acceptance Criteria for Special Precast Concrete Structural Walls Based on Validation Testing," *PCI JOURNAL*, V. 49, No. 5, September-October 2004, pp. 78-91.

KEYWORDS: aesthetics; bridges; cable-stayed bridges; construction; design (structural); post-tensioned construction; precast concrete; precast segmental bridges; prestressed concrete; segmental concrete bridges; segmental construction.

ABSTRACT: How did precast concrete segmental construction become a major player in the modern American bridge industry? While the continuing growth in market share for precast, prestressed concrete systems can be attributed to numerous competitive advantages, this article presents an overview of the proliferation of segmental bridges in the United States based primarily on five advantages — economy, construction efficiency, durability, design innovation and aesthetics.

REFERENCE: Figg, Linda, and Pate, W. Denney, "Precast Concrete Segmental Bridges — America's Beautiful and Affordable Icons," *PCI JOURNAL*, V. 49, No. 5, September-October 2004, pp. 26-39.

DISCUSSION NOTE

The Editors welcome discussion of reports, articles, and problems and solutions published in the *PCI JOURNAL*. The comments must be confined to the scope of the article being discussed. Please note that discussion of papers appearing in this issue must be received at PCI Headquarters by February 1, 2005.