

REFERENCE CARDS

KEYWORDS: bridges; design (structural); precast concrete; prestressed concrete; transportation structures; tunnels.

ABSTRACT: This article is the sixth and final paper in the series of articles on Boston, Massachusetts' mammoth Central Artery Tunnel Project. The first five articles discussed the various innovative ways in which precast/prestressed concrete is playing in the successful construction of this project. This concluding article summarizes the major precasting techniques being utilized and outlines the project milestones planned and accomplished so far, which are already having a beneficial impact on the transportation needs of the people of Boston.

REFERENCE: Chandra, Vijay, and Ricci, Anthony L., "Central Artery/Tunnel Project: Boston's Engineering Marvel – Where We Are Now," *PCI JOURNAL*, V. 46, No. 2, March-April 2001, pp. 14-21.

KEYWORDS: aesthetics; architectural precast concrete; architecture; buildings; construction; design (structural); façade; justice facility; precast concrete; wall panels.

ABSTRACT: Designers for the Federal Metropolitan Detention Center in downtown Philadelphia, Pennsylvania had to balance the need for a highly secure appearance against the facility's location in a historic district. They also had a constrained site and budget requirements with which to work. These challenges were met with the use of precast concrete insulated panels with several finishes, including polished concrete at the base, a cut-stone appearance on the first two floors and varied sandblasting on the upper levels. This article presents the architectural precast features of the structure as well as the erection highlights.

REFERENCE: Appelquist, Tom, Yoder, Kevin, and Lorah, Douglas L., "Precast Panels Provide Secure Historic Look for Philadelphia Federal Detention Center," *PCI JOURNAL*, V. 46, No. 2, March-April 2001, pp. 22-33.

KEYWORDS: buildings; codes; design (structural); earthquakes; India; poles; precast concrete; railroad ties; seismic design.

ABSTRACT: This report is based on the author's first-hand observations from the earthquake scene as well as other sources. He describes the seismological/geotechnical aspects of the earthquake and discusses the performance of engineered buildings. Bridges, non-engineered buildings and other structures are excluded from the scope. Precast concrete construction, including non-building uses of precast concrete, is discussed. In conclusion, the building code situation in India is briefly commented upon.

REFERENCE: Ghosh, S. K., "Observations From the Bhuj Earthquake of January 26, 2001," *PCI JOURNAL*, V. 46, No. 2, March-April 2001, pp. 34-42.

KEYWORDS: aesthetics; architectural precast concrete; architecture; buildings; cladding; color; design; façade; finishes; precast concrete; texture.

ABSTRACT: Aesthetics is playing an increasingly important role in the design of building façades. In North America and Europe the concept that aesthetics (form) must follow function is well established. This article demonstrates the enormous potential of architectural precast concrete applications. The abundance of possibilities gives rise to a multitude of different forms, colors, surface finishes, and architectural designs. Technological innovations in concrete composition, molds, and finishes have increased the quality of this material, enabling it to compete with the most exclusive façade claddings. It is the architect's responsibility to exploit these varied possibilities.

REFERENCE: Freedman, Sidney, "Design Factors Influencing the Aesthetics of Architectural Precast Concrete," *PCI JOURNAL*, V. 46, No. 2, March-April 2001, pp. 44-60.

KEYWORDS: aesthetics; bearing devices; bridges; connections; design (structural); girders; I-girders; jointless bridges; piers; precast concrete; prestressed concrete.

ABSTRACT: Elimination of expansion joints in bridge decks results in initial economy and long-term durability. It provides a smooth-riding surface, minimizes maintenance cost caused by water leakage, and provides a relatively high span-to-depth ratio of the superstructure. This paper presents a summary of the results of a project whose dual objectives were to reduce the cost of bearing devices used in jointless bridges and to optimize the girder/pier joint details for economy, constructability and aesthetics. Criteria for selection of bearing devices as a function of load levels, translational and rotational capacities, simplified diaphragm details, simplified fixed and expansion bearing details, and enhancements of bridge aesthetics are presented. Cases where a sharp skew exists in the bridge are covered. With the large bottom flange of modern I-girder shapes, it is shown how girder ends are produced with a skew to minimize the pier width.

REFERENCE: Badie, Sameh S., Tadros, Maher K., and Pedersen, Keith E., "Re-Examination of I-Girder/Pier Connection in Jointless Bridges," *PCI JOURNAL*, V. 46, No. 2, March-April 2001, pp. 62-74.

KEYWORDS: beams; carbon fiber reinforced polymer; design (structural); flexural strength; prestressing tendons; research; testing.

ABSTRACT: Fiber Reinforced Polymer (FRP) tendons are being considered for design in structures exposed to aggressive environments or where non-metallic properties are desired. FRP tendons require considerable attention to detail during the design process. This paper presents a unified approach for the flexural design of beams with FRP tendons. Equations for flexural strength are presented, failure modes are defined, calibrations with test data are presented, and strength reduction factors are recommended. A test program validates the design approach and provides some serviceability data. Conclusions from the test program and design recommendations are provided.

REFERENCE: Burke, Chad R., and Dolan, Charles W., "Flexural Design of Prestressed Concrete Beams Using FRP Tendons," *PCI JOURNAL*, V. 46, No. 2, March-April 2001, pp. 76-87.

KEYWORDS: analysis; anchorage; carbon fiber reinforced polymer; finite element method; friction; performance; prestressing tendons; research; testing.

ABSTRACT: This paper presents the results of laboratory testing and mathematical modeling which describe the performance of a stainless steel wedge anchorage system for Carbon Fiber Reinforced Polymer (CFRP) tendons under static loading conditions. It was found that as the presetting load increased, the displacement of the rod and sleeve decreased. A finite element model (FEM) consisting of three contact surfaces was applied to simulate the anchor components and successfully model the displacement of the rod. An analytical model based on thick cylinder analogy was used to verify the contact pressure on the CFRP rod determined by FEM. A parametric study was conducted using FEM to investigate the effects of varying the presetting load and coefficient of friction between the anchor components. It was found that the effect of the coefficient of friction at the wedge barrel surface was minimal in comparison to the effect of the presetting load and coefficient of friction between the rod and sleeve.

REFERENCE: Al-Mayah, Adil, Soudki, Khaled A., and Plumtree, Alan, "Experimental and Analytical Investigation of a Stainless Steel Anchorage for CFRP Prestressing Tendons," *PCI JOURNAL*, V. 46, No. 2, March-April 2001, pp. 88-100.