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In design of pretensioned PC beam under harsh environment, designers acknowledge wide advantages of PC beam with epoxy-coated PC strands, but it is not widely adopted because bond performance and load carrying capacity of the beam are not fully investigated.

This paper presents the technical development on practical application of the highly durable pretensioned PC beam. Test beams BS4-E (4m length) and BS12-E (12.5m length) with epoxy-coated strands and BS12-N (12.5m length) with normal strands were provided for investigation of bond performance and load carrying capacity. Two test beams BS12-E and BS12-N were designed for B type live load in the Japanese Bridge Code and the same hollow slab section was applied.

Figure 1 shows the induced strains in concrete of BS12-E by embedded strain gauges and BS12-N by mold gauges just after prestressing. The strain distribution of BS12-E tends to be constant just after the transfer length (65 μ). By using the value of strain at the point 2000mm, the induced stress of BS12-E is calculated as 12.3 N/mm². At the same point, the design stress is specified as 10.8 N/mm². Comparing these stresses, one can assure that the beam with epoxy-coated strands satisfies the design stress requirement.

Figure 2 shows the relation between load and strain at upper and bottom surfaces. The figure shows that the strains of two beams are almost same up to the actual crack load. And this result indicates that two test beams show the same bending performance.

During the bending test of two beams, deflections at mid point and 1/4 point of the span were also measured and two beams showed almost same deflections at both points. From the test result, one can conclude that the two beams have the same bending performance.

Reached the ultimate load 367 kN over the design load 361 kN, the upper edge concrete of BS12-E has yielded ultimate strain and the pressure break has started. Along with this failure, the test beam has shown total failure.

The induced stresses at transfer length have been examined for the PC beams with epoxy-coated strands and normal strands. The beams have shown more induced stresses than design stresses. Also, bending test on the two beams has confirmed that both beams have equivalent load carrying capacity.
Keywords: rigid frame bridge, strut, high-strength prestressing strands, consideration for surrounding environment, angle cut cylinder earth retaining method

The Gunkai-gawa bridge is located 3 km east of the Toyota-higashi junction on the new Tomei Expressway. This bridge is 740 m long and the structural type is the seven-span continuous rigid frame box girder with prestressed reinforced concrete (Fig.1). The contract for construction of it is including planning and design. This ordering system is requiring structural feasibility, reduction of maintenance work, and consideration for surrounding environment. This bridge is decided to construct as the fully concrete structure and the rigid frame type was selected to eliminate bearings, which are one of the major maintenance positions, except both ends of the girder. And Lightweight superstructure method is adopted to enable the structure rationally.

As shown in Fig. 2, the cross section of the main girders is around 15 m wide, so a single-cell box girder section with an extended slab reinforced by struts was adopted. Moreover, to reduce the number of external tendons in the narrow box girders, high-strength prestressing strands were used.

The large diameter caisson foundations were constructed for all bridge piers, a spread foundation for the A1 bridge abutment and a caisson pile foundation for the A2 abutment. And angle cut cylinder earth retaining method was adopted at some foundation. Thereby, Area of the excavation was able to achieve minimum.

As shown in Fig. 3, the cross section of all bridge piers are 5.0 x 5.0 m hollow shape, which have double arranged D51 (SD345) reinforcing bars in maximum as axial reinforcements and D29 hoop ties were provided.

This paper presents the planning of this bridge and the construction of foundation, pier, abutment, strut and pier head.
The report introduces Grade separation near Keikyu – Kamata Station Area – Main Line Civil and Building Works.

Continuous flyover crossing of railway is now widely recognized as the efficient countermeasure for chronic traffic jam in urban area. Generally, viaduct construction of continuous flyover crossing is executed at vacant area after temporary shifting the track beside. However, especially in densely populated area, land acquisition for temporary detour of the railway is difficult in many cases often causing stagnations and delays of the project.

Recently, as a solution of the problem, the method elevating the track directly above the operating railway (hereinafter referred to as “Overhead Method”) is widely attracting attention. However, due to its construction difficulties (e.g. erection and removal of falsework, high risk of accident by working above operating railway for long period, etc.) only few cases have actually been executed by this method. Half Precast Method is a method developing conventional Overhead Method for construction of rigid frame viaduct composed by pre-cast columns, beams and slabs. No falsework and intermediate support is necessary during the construction since the half pre-cast components function as both form and support itself. Reduction of such works above operating railway will minimize accident risks and shorten construction period.

Specifically, the structure is composed of quake-proof half pre-cast column and camber controlled half pre-cast beams and slabs. The pre-cast component is manufactured under high quality control to ensure long term durability. Each component is assembled at the site and integrated with cast-in-place concrete. (Fig.1)

This latest technology is expected to be the solution to solve many issues concerned in viaduct construction to improve the urban functions safely and effectively.

The method may also be advantageous for the following indirect effects. (Pic.1)

- Reduction of accident risks by omitting falseworks and intermediate support works
- Improvement of structural durability by using half-precast components manufactured under high quality control in plant
- Low construction noise for environmental effect
- Shortening of implementation period for the whole project

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