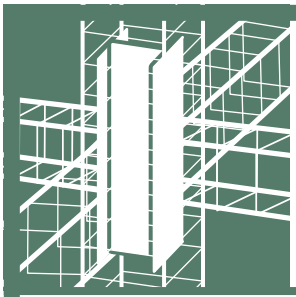


Hb-RC
(Hybrid RC)

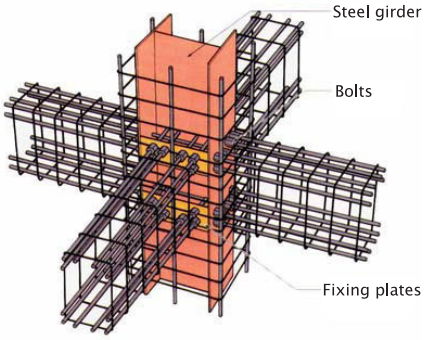
Hb-RC is a novel framework system designed to reduce structural costs with levels of performance matching those of conventional steel reinforced concrete (SRC) structures. The approach allows the construction of highly rational and high-quality reinforced concrete (RC) structures with RC beams and steel-frame reinforcement for columns only, and has been applied in the design and construction of four mid- and high-rise residences. The technique is now considered applicable to mid-, high- and even super-high-rise residential complexes based on technical guidance from the Building Center of Japan's High-Rise Steel Reinforced Concrete Structural Technology Guidance Committee.

Characteristics

Hb-RC is characterized by the formation of column-beam joints with girders in the core of RC columns and main reinforcement with threaded bars in a bolted steel frame. This reinforcement supports seismic structural resistance to axial and shear forces and helps to prevent the lower piloti part collapse widely experienced in RC structures during the Hyogo-ken Nanbu Earthquake. Effectiveness is indicated by the absence of seismic damage from this tremor at Oak Square Seishin 4-bankan (Nishi-ku, Kobe), which was designed and constructed using the Hb-RC approach.

Advantages

① **Labor saving in reinforcement work** based on prefabrication of column/beam parts
② **Construction precision** based on the ability to check the vertical trueness of columns/beams
③ **Homogenization and improved efficiency in joint work** based on the use of mechanical joints as main reinforcements
④ **Superior concrete filling** based on reinforcement via column-beam joints
⑤ **Labor saving in reinforcement bending** due to elimination of the need for fixing anchors in main-beam reinforcement
⑥ **Reduced need for temporary facilities** such as high scaffolding thanks to ground-level assembly of column/beam parts

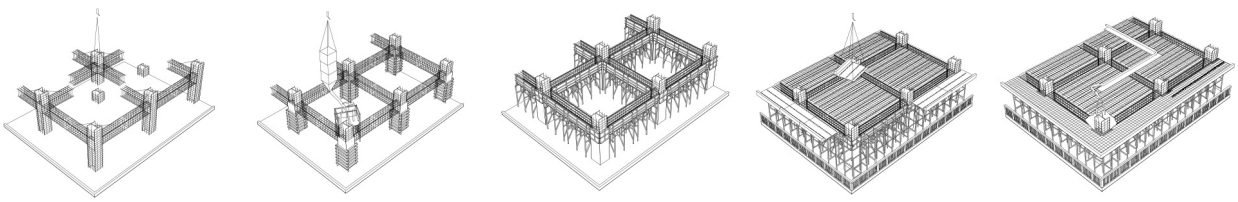


Technical outline

Cycle process

Cycle duration can be reduced to seven days for super-high-rise buildings based on swift installation of column/beam parts assembled at ground level using cranes, laying of concrete separately for vertical and horizontal parts, and application of half PCa boards for the system form and balcony/floor slabs. Application of a set for column reinforcement in two levels of a mid- or high-rise building takes 24 days (13 for the first and 11 for the second).

Construction procedures



① Column/beam erection
② Column formwork and concrete placement
③ Beam framework
④ Half PCa board suspension/ slab reinforcement
⑤ Beam slab concrete placement

Constructions

GH Hikarigaoka Block B-17 residence

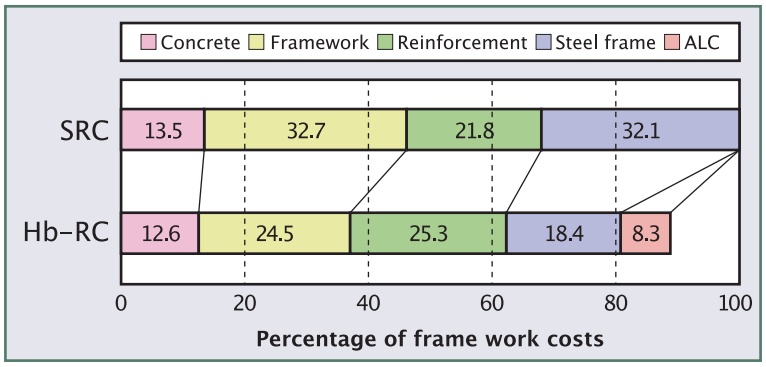
Oak Square Seishin 4-bankan

Tokyo Waterfront City Daiba Block AL, Buildings A1/A2

Frame costs

Frame costs are around 10% lower than those of conventional SRC structures for mid- and high-rise buildings, with savings depending on building scale, shape and other factors.

Comparison of costs for major frame types (Oak Square Seishin)



Eligible structures

① Mid- and high-rise buildings with a piloti-style base and various earthquake-proof structures usually characterized by SRC structures (e.g., Seishin 4-bankan)
② Mid- and high-rise buildings with lower levels used for commercial facilities rising to higher levels (e.g., GH Hikarigaoka, Daiba)
③ Super-high-rise residential complexes with 20 to 30 levels and pure-frame structures on long and short sides

Related considerations

① Design takes two to three months longer than conventional construction, requiring a couple of months for evaluation by the Building Center of Japan and around a month for Ministry of Construction approval.
② Ground-based column/beam assembly requires appropriate space and storage facilities.
③ Installation of column/beam parts assembled on the ground requires stationary or crawler cranes with a lifting capacity of approximately 4 tons.

October 1, 2019

■ Contact ■
Dai Nippon Construction
Construction Technology Division, Construction Headquarters Tel : 03-5479-4784 E-mail : tec_info@dnc.co.jp
Renovation Group, Tokyo Branch Tel : 03-5326-3824
Renovation Group, Nagoya Branch Tel : 058-277-5233
Renovation Group, Osaka Branch Tel : 06-6632-7093