Outline of “Post-Installed Headed Rebar Anchor Method for Anchorage of New Structural Members”

「新設構造躯体を既存構造躯体へ接合するための後付け挿入型鉄筋定着工法」の概要




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1. Introduction

In the repair and retrofitting of a reinforced concrete (RC) structural frame involving extension and reconstruction, the main bars and slab reinforcement bars (rebars) of new members must be anchored to the existing frame. In this case, the anchors must reliably transfer the tension of the rebars to the existing frame. In the conventional general construction method, the existing concrete is removed, new rebars are set, and then concrete is cast. This method requires removing a considerable amount of existing concrete, which significantly affects the structural performance and results in extremely complicated construction work. As an alternative, a “post-installed anchor” can be considered as a method for anchoring structural members. However, the reliability and workability of post-installed anchors for anchoring structural members are yet to be sufficiently verified, and the scope of their application in buildings is currently limited under Japanese law. Therefore, the authors developed a new post-installed rebar anchor system (**Fig. 1**) that is highly reliable, primarily for architectural applications.

2. Development of Anchor System

(1) Details of Anchor System

The developed post-installed rebar anchor system minimizes the effect on the existing structural frame, enables labor and cost reductions in construction work, and can be used to anchor the main bars. The construction method of the anchor system is unique and reliable even under a long anchorage length and a large diameter. The design method of the anchor system ensures high structural reliability.

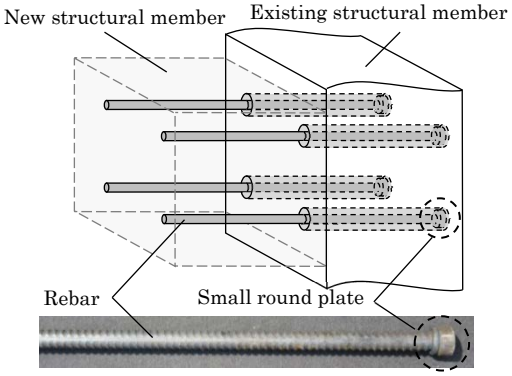


Fig. 1 Outline of anchor system

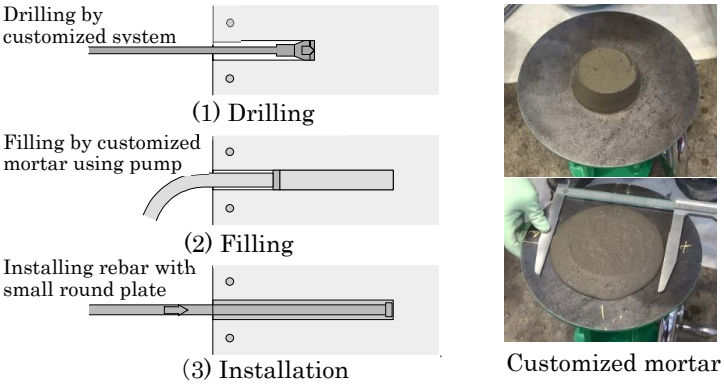
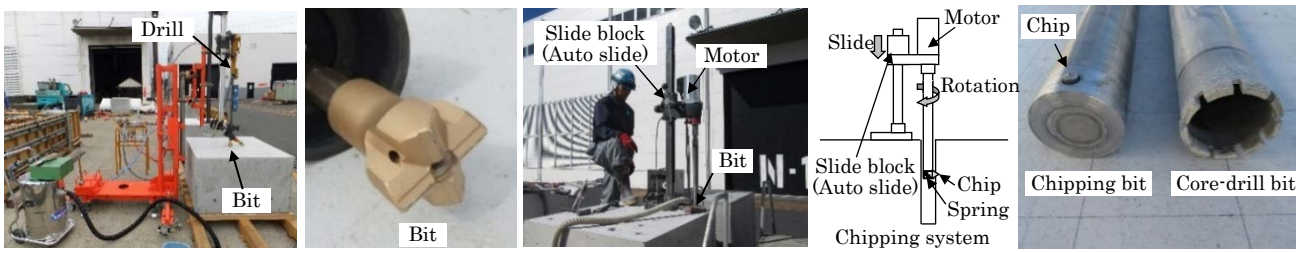


Fig. 2 Outline of anchor installation system



(a) Improved rock-drill system (b) Customized core-drill system

Fig. 3 Drilling system

(2) Construction Work

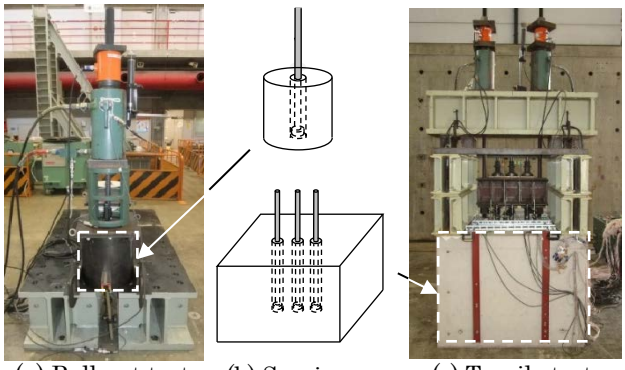
As shown in **Fig. 2**, in the proposed anchor system, a hole is first drilled using a customized drill. Then, the hole is filled using a customized mortar, and finally a rebar with a small round plate at leading end is inserted. The material and construction technique of this anchor system is improved the shear reinforcement method of existing RC structures[1]. Two drilling methods are typically used (**Fig. 3**): improved rock drilling [**Fig. 3(a)**] and customized core drilling [**Fig. 3(b)**]. Customized core drilling can be performed in a narrow space with minimal noise, but it results in a smooth hole, which necessitates the use of a customized bit to create unevenness after drilling. Meanwhile, because of its thixotropic nature, the customized mortar can be filled easily and densely in all construction directions from upward to downward.

(3) Structural Performance Validation

The structural performance of the anchor system was experimentally verified to be equivalent to that of cast-in-place rebar anchors. This enables a wide range of applications of the proposed system because it allows the design methods and details of cast-in-place anchorage to be applied. In this study, three experiments were conducted: (1) an experiment to estimate the double bond performance between the surface of the rebar and the surface of the hole wall[2], (2) a tension experiment based on the assumption of actual anchoring[3], and (3) an experiment to verify the structural performance when both tensile and shear forces are applied simultaneously on the rebar[4]. The experimental conditions for (1) and (2) are shown in **Fig. 4**. Design guidelines for the anchor system were established based on the experimental results.

3. Certification and application

The design and construction guidelines for the anchor system, which are aimed at increased versatility, have been certified by the Building Center of Japan, thereby allowing easy examination of the building regulations for extensions and renovations[5]. The anchor system has been applied in more than 40 cases and more than 13,000 rebars and has also been adopted in cases requiring high reliability, such as in nuclear power plants and earthquake restoration activities.



(a) Pull-out test (b) Specimen (c) Tensile test

Fig. 4 Setup of experiments

4. Conclusion

The authors have developed a new and highly reliable post-installed rebar anchor system and will continue to expand its applications.

References

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