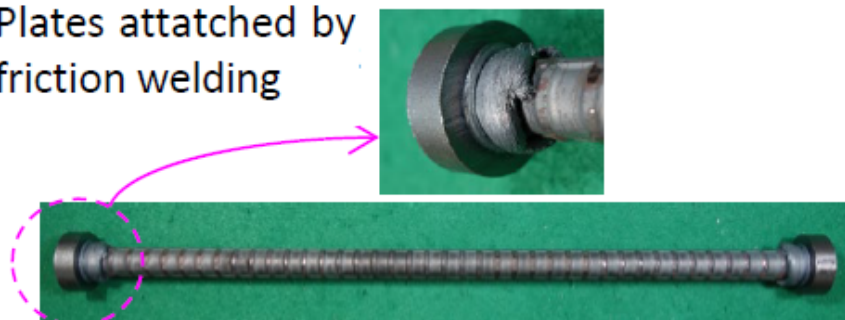


## Post-Head-bar Method

Shear strengthening method capable of constructing from inside of underground structures

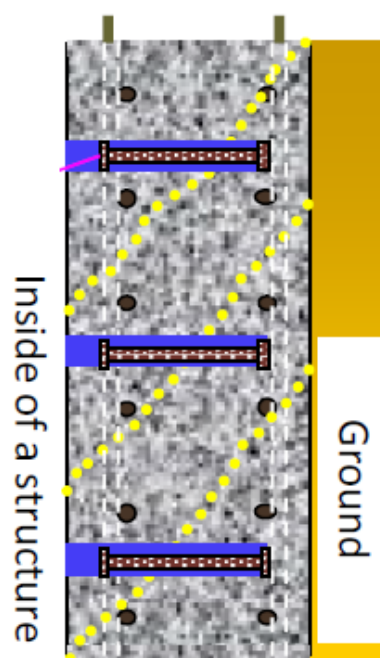
Plates attached by  
friction welding



Post-Head-bar Method (PHb)  
post-installed shear reinforcing bars



Flow test  
Mortar with excellent plasticity



Wall member  
of an underground  
RC-structure

Hazard

Earthquake

Solution Purpose

Prevention & Mitigation

Solution Theme

Infrastructure Technology Building Technology

Technology Subject

Coast Road Railways Airport Port Essential Utilities Urban Facility for Disaster Prevention Emergency  
Base & Back-up Facility Design & Construction of Resilient Building Resilience Improvement on Existing

## Advantages

- 1 Post-Head-bar method is a shear strengthening technique where post-installed shear reinforcing bars (Post-Head-bar, abbreviated PHb) are installed with specially designed mortar in a hole cored in an existing concrete structure. PHb is a rebar which has plates on its both ends attached by friction welding.
- 2 Even for underground structures which is surrounded by backfill, construction from only one side (inner space side) of the structure is possible.
- 3 By using a special core drill, retrofit work can be conducted in a narrow working space.
- 4 Since PHb is embedded in the existing member, it does not invade the inner space, and the resistance against corrosion is ensured by the concrete cover.
- 5 According to the construction condition, it can be chosen from one end rectangular plate type, both ends circular plate type, and mechanical joint type PHb, and efficient and effective shear reinforcement work is possible, because it corresponds to wide reinforcement type and reinforcement diameter.

## Solution Illustrated



① Exploration of reinforcing bars



② Drilling



③ Mortar filling



④ Inserting PHbs

## Background

When considering seismic retrofit of wall members against out-of-plane seismic force, there is a case in

which it is required to increase only shear capacity without increasing flexural capacity. One example is a wall member of underground box culverts in service, in which case this kind of seismic retrofit is necessary. However, since excavation of the ground requires enormous cost and construction period, development of a method which enables shear strengthening only from one side (the inner space of the structure) was desired. In addition, when strengthening a structure in service, it is often required to carry out the work in a narrow space without using a large heavy machine, because sufficient space for the work cannot be secured. The Post-Head-bar method was developed as a seismic retrofit technology which can be applied in such cases and can improve only the shear capacity.

## Exposition of the Solution

Before the construction, the position of rebars existing near the surface of the target structure is confirmed by radar detection. From the result, after confirming that it is a position which does not interfere with existing reinforcement, drilling is carried out using specially designed drill to the main reinforcement position. After drilling, the hole is filled with mortar and then PHb is inserted and fixed.

In this method, the construction is possible even in comparatively narrow working space, and it is possible to improve the shear capacity without increasing the cross section of the established member. Reinforcing bars with the diameter of 13mm to 32mm are applicable for reinforcement diameter of PHb.

## Achievements of Examples

Facility type		Achievements
Road, underpass network	Underpass, road bridge	57
sewage treatment plant (including pumping plant)	Settling tank, Pump room	463
Railway	underground station house, tunnel	11
water purifying plant	distribution reservoir	153
floodgate	Tsunami seawall	190
drainage pump station	drainage pump station	48
drainage channel	Underground drainage channel	22
Power plant, chemical plant	Reservoir, water channel	9

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