



Development of "CUCO-CO₂ Fixed Ground Improvement", a ground improvement method that reduces CO₂ emissions

— First application for ground improvement of temporary road surfaces for construction at Osaka-Kansai Expo to be held in 2025 —

As part of the NEDO*¹ Green Innovation Fund Project titled "Development of Concrete and Other Manufacturing Technologies Using CO₂" (hereinafter referred to as the "Project"), Takenaka Corporation (President: Masato Sasaki), in collaboration with Kajima Corporation (President: Hiromasa Amano) and DENKA Corporation (President: Toshio Imai), is managing the CUCO consortium to implement this project. The consortium is developing carbon-negative concrete*² that emits virtually zero or less CO₂ during the production process.

Through this project, Takenaka Corporation has developed "CUCO-CO₂ Fixed Ground Improvement," which uses carbonated fine powder recycled from concrete demolition debris (CCU material*³). This innovative approach reduces CO₂ emissions by approximately five percent compared to conventional ground improvement construction methods.

The developed method was applied to ground improvement work for the Mitsubishi Miraikan, which was designed and supervised by Mitsubishi Jisho Design for the 2025 Japan International Exposition (Osaka-Kansai Expo). It served as a temporary road for large heavy machinery during the building construction. This marks the first time of the method being used for actual ground improvement, and it has been confirmed to meet the necessary performance requirements.

*1 NEDO: New Energy and Industrial Technology Development Organization

*2 Carbon-negative concrete: Concrete that reduces, fixes, or absorbs more CO₂ than the amount of CO₂ emitted during its production.

*3 CCU materials: CCU stands for Carbon Capture and Utilization, which in this technology refers to materials for concrete produced by utilizing (fixing) CO₂ as a resource.

■ Background of Application

Ground improvement is a technology that strengthens the ground to enhance the bearing capacity of structures and the stability of slopes. In Japan, approximately 20 percent of domestic cement demand, around eight million tons per year, is utilized for ground improvement. Promoting ground improvement through the developed method is expected to significantly reduce CO₂ emissions and is essential for achieving a carbon-negative society.



Rendering of the completed Mitsubishi Miraikan



Ground improvement work in progress

■ Overview of Technology

CUCO is developing carbon-negative concrete that incorporates technologies to "reduce, fix, and absorb" CO₂. The developed ground improvement method includes a technology that "fixes" CO₂ by incorporating it into the calcium content of construction waste, such as concrete demolition debris and demolition materials from ground improvement bodies. These are further reused as aggregates for the new concrete and CCU materials, thereby effectively storing CO₂.

■ Results of the Development

The developed method was first applied in the ground improvement work of Mitsubishi Miraikan, which was designed and supervised by Mitsubishi Jisho Design for the Osaka-Kansai Expo 2025. It served as a temporary road for large heavy machinery during construction. This method was applied to approximately 200m² of the total 600m² ground improvement area, demonstrating satisfactory performance. The amount of CO₂ fixed during this process was about 160kg, which resulted in approximately a five percent reduction in CO₂ emissions compared to conventional ground improvement methods.

■ Future Development

In addition to rebuilding and demolishing structures, the demolition process of the improved ground generates large volumes of concrete debris and waste from ground improvement bodies. Recycling these materials is an urgent issue that the construction industry must tackle.

We will use the results from this application to investigate the long-term strength and CO₂ fixation of ground improvement. Our goal is to apply the developed method to ground improvement projects aimed at liquefaction control and other purposes by 2030.

CUCO will work with NEDO to develop and improve CO₂ reduction, fixation, and absorption

technologies to achieve carbon negativity, contributing to the transition to a decarbonized society.

Reference URL : <https://www.takenaka.co.jp/news/2022/01/04/>

Reference URL : CUCO website <https://www.cuco-2030.jp/english/>