News Release

May 13, 2025

Achieving Pumped Placement of Carbon-Negative Concrete with High Powder Content ～Initiatives Enabling On-site Casting～

Toda Corporation (Head Office: Chuo-ku, Tokyo, President: Otani Seisuke) and Nishimatsu Construction Co., Ltd. (Head Office: Minato-ku, Tokyo, President: Hosokawa Masakazu) have been continuing joint development on environmentally conscious concrete with low CO_2 discharge since 2010. We have confirmed, through a demonstration test using a concrete pump truck, that on-site casting is feasible for high-powder-content carbon-negative concrete, in which calcium carbonate that absorbed and fixed CO_2 is used as a concrete material resulting in a calculated material-derived CO_2 emission ※1 of zero or less.

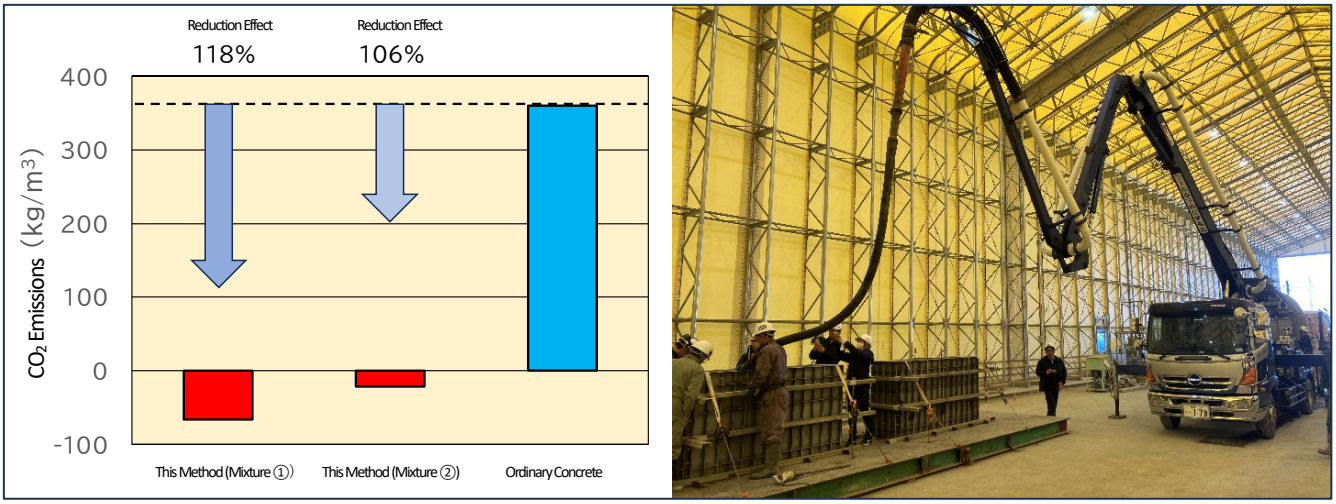


Figure 1 CO_2 Reduction Effect of Carbon-negative concrete ※2 and Photo showing pouring concrete

※1: Material-derived CO_2 emission : This is the CO_2 discharge amount calculated using the CO_2 emission factor of the materials used in concrete production. Depending on the additive amount of CCU (Carbon Capture and Utilization) materials, the absorption and fixation amount of CO_2 increases, causing the CO_2 discharge amount to become zero or less on a calculative basis.

※2 In Figure-1, ordinary concrete refers to concrete mixtures with strength levels equivalent to carbon-negative concrete. The carbon-negative concrete mixture ① and ② differ only in the production methods (substrate and CO_2 adsorption/fixation methods) of the used calcium carbonate.

1. Background to the development

In the construction industry, concrete is widely used as a primary material, and the total annual shipment volume of concrete within Japan amounts to approximately 70 million m^3 (2023)※3. It is generally estimated that the production of concrete emits approx. 270kg of CO_2 per m^3, which results in an estimated annual CO_2 discharge of approximately 19 million tons, signifying a vast amount. Therefore, reducing CO_2 discharge resulting from concrete production is an urgent issue in achieving carbon neutrality.

Together with Nishimatsu Construction Co., Ltd., we have jointly developed "Slagrete®," ※4 which can reduce CO_2 discharge originating from concrete materials by up to 85%. Building on this technology, we have been working on developing carbon-negative concrete. In the demonstration test conducted this time, the pumpability was confirmed, following the manufacturing verification of precast products conducted in previous years※5,

※3 Transition of Nationwide Shipment Volume, 2023 per Japan Federation of Ready-mixed Concrete Industrial Associations and Japan Federation of Ready-mixed Concrete Cooperative Associations :
https://www.zennama.or.jp/3-toukei/nenji/index.html

※4 Our Company's Release "Development of Low-Carbon Concrete 'SLAGRETE®'"
https://www.toda.co.jp/assets/pdf/20160208.pdf

※5 Our Company's Release "Commencement of Joint Development for Carbon-Negative Concrete"
https://www.toda.co.jp/news/2023/20231205_003291.html

2. Overview of this technology

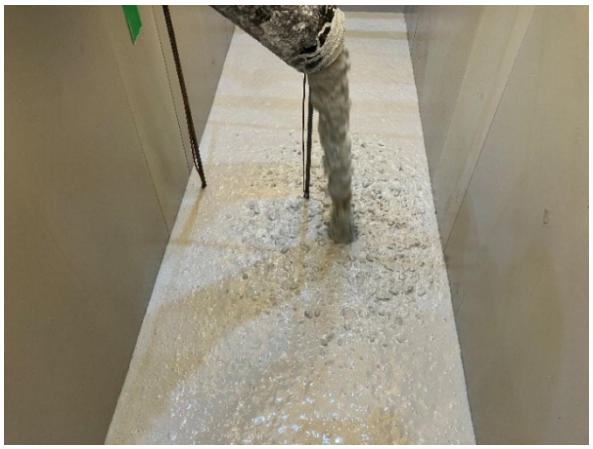
The technology is based on "Slagrete®," a low-carbon type of concrete, which replaces up to 90% of the cement used in the content mix with ground granulated blast-furnace slag, an industrial by-product. The carbon-negative concrete currently under development is based on a formulation of "Slagrete®" and further incorporates calcium carbonate that absorbs and sequesters CO_2. Depending on the additive amount, the CO_2 discharge originating from materials can be reduced to zero or less on a calculative basis.

Generally, concrete with a high content of powder, like the one used in this technology, tends to have high viscosity and hardens easily, making it unsuitable for pumping with a pump truck unless its fluidity is enhanced. In response to this, the technology employs a specially developed admixture during the mixing process to maintain the fluidity of the increased concrete.

3. Demonstration tests

Our company and Nishimatsu Construction Co., Ltd., as part of the technical demonstration trial, prepared two types of carbon-negative concrete mixtures using calcium carbonates produced by different methods and verified the following points through pumping and placement using a concrete pump truck:

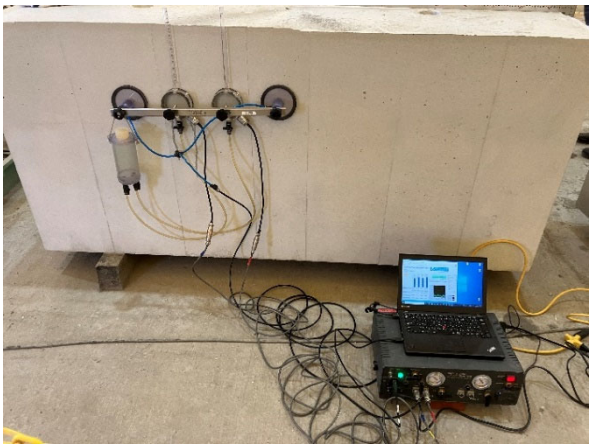
- Even with varying properties of calcium carbonate, it is possible to produce carbon-negative concrete that can be pumped using a concrete pump truck by utilizing special admixtures.
- The compressive strength manifests the same way as typical concrete, yielding a similar level of strength.
- Although the hue may differ depending on the manufacturing method of calcium carbonate, it is generally whiter compared to regular concrete.
- Surface quality is equal to or exceeds that of conventional concrete.



Picture 1: Outlet poring Carbon Negative concrete

Picture 2: Carbon Negative concrete test specimens

(1) Surface Air Permeability Test



(2) Surface Water Absorption Test

Picture3: Surface quality inspections

4. Future developments

Our company and Nishimatsu Construction Co., Ltd. are advancing development to broadly apply this technology in the fields of civil engineering and construction, aiming to achieve carbon neutrality and a decarbonized society by 2050.