

# Construction Period Shortened with Precast Concrete for Mountain Tunnel Lining

— South Side Construction of Tarutoge Tunnel, Chubu Odan Expressway —

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## 1. Overview

The Tarutoge Tunnel is a mountain tunnel of Chubu Odan Expressway which constitutes the Honshu (main island) crossing route, and an evacuation tunnel runs along the main tunnel. Among the 2,621m evacuation tunnel of the south side construction section, 500m section was constructed by "PCL method," a lining method using the precast concrete panels (PCa panels). The construction started in June 2011 and ended in January 2019, and the service began from March 2019.

## 2. Why PCL Method Was Selected

In order to achieve the service commencement goal of the expressway, it was necessary to shorten the lining process of the evacuation tunnel, which was considered a bottleneck. If the construction was to be carried out by on-site casting, it would be necessary to simultaneously set 3 formworks in the evacuation tunnel, but its cross-section was small, which restricted carrying in and out any vehicles, and so simultaneous setting was impossible (Fig. 1). Due to recent shortage of engineers, it was also difficult to secure engineers who could construct lining concrete. Thus, the PCL method using the precast parts was adopted because it enables simultaneous construction with on-site casting even in the tunnel with small cross-section. Also, the method ensures a certain level of quality without having highly skilled engineers on site.

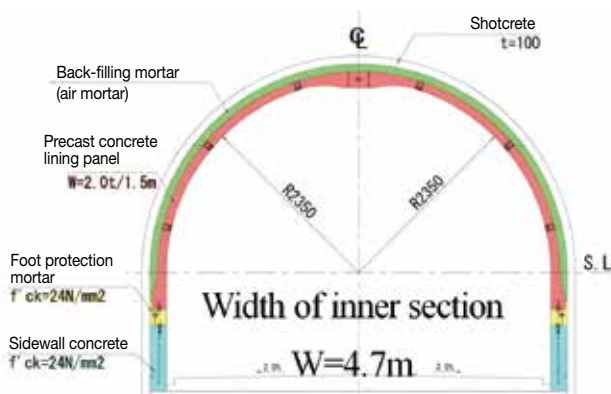


Fig. 1 Cross-section view of the evacuation tunnel

## 3. Characteristics of The PCL Method

PCL method is for interior work, finishing, repair or reinforcement of a tunnel. It is a lining method in which arc-shaped PCa plates divided in two in the tunnel transverse direction are installed on side walls constructed beforehand.

PCa plates used in this method are made in a factory, ensuring high quality. Their high stability is realized by backfilling between PCa plates and the bedrock. The process shortening is possible by adopting the mechanized construction with special machines, not requiring highly skilled engineers.

## 4. Construction Report

The construction was divided into three steps: (1) preparatory work, (2) installation of PCa panels, and (3) mortar casting. First, the sidewall concrete is constructed by on-site casting. Secondly, with the sidewall as a base, PCa panels divided into 2 parts are installed on top, in 20 minutes per piece (Fig. 2). Finally, the void between the PCa panels and the side wall, and between the panels and the bedrock were filled with mortar. The first and third steps were carried out concurrently with other works.

By adopting the PCL method, material cost increased, but the target process was secured with reduction of the number of workers for placing. Since the plates were factory-made, the risk of problems such as filling failure of concrete was reduced, and the surface finishing was very fine (Fig. 3). It is expected that PCa will be considered as an option of the design and construction method for mountain tunnel lining with various constraints.



Fig. 2 Construction in progress



Fig. 3 Construction in progress