

Result of the regular inspection of road tunnels

(Research period: FY 2015–2019)

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1. Objective of this study

The National Institute for Land and Infrastructure Management is examining ways to improve the efficiency of the inspection of road tunnels and rational designs, construction, and the methods of maintenance and management of tunnels based on the outcomes of inspections. This paper describes the analysis of the conditions of deterioration and damage and their tendencies based on the results of regular inspections conducted on road tunnels of national roads in FY 2014 and 2015 focusing on tunnels constructed with the sheet piling method (mainstream up to the 1980s) and NATM (upstream after the 1980s), which account for the majority of road tunnels in Japan.

2. Details of the study

This study focused on records of abnormalities (a general term for deterioration) in the concrete lining (walls and ceiling inside tunnels) among the results of regular inspections of road tunnels.

Abnormalities are categorized into three types, including external force, deterioration of materials, and water leaks. They are also categorized into five levels of countermeasures, including I, I**b**, IIa, III, and IV (IV being the worst condition).

To identify the number of years since the construction of a tunnel and conditions of abnormalities, the authors divided the number of years by decade and organized the conditions of recorded abnormalities by individual categories of abnormalities (figure 1). Since abnormalities in category I indicate conditions that do not require any repair, category I was removed from the data processing. The study targeted abnormalities in I**b** or worse conditions. Since the number of abnormalities varied depending on the number of tunnels and number of years since construction, the numbers were processed as the number of abnormalities per 100 meters of tunnels.

Figure 1 indicates that the number of abnormalities per 100 meters increase with the number of years since construction for both the sheet piling method and NATM. In particular, the numbers of abnormalities have significantly increased in the group of sheet piling aged 31 to 40 years and the group of NATM aged 21 to 30 years compared to younger age groups in each construction type.

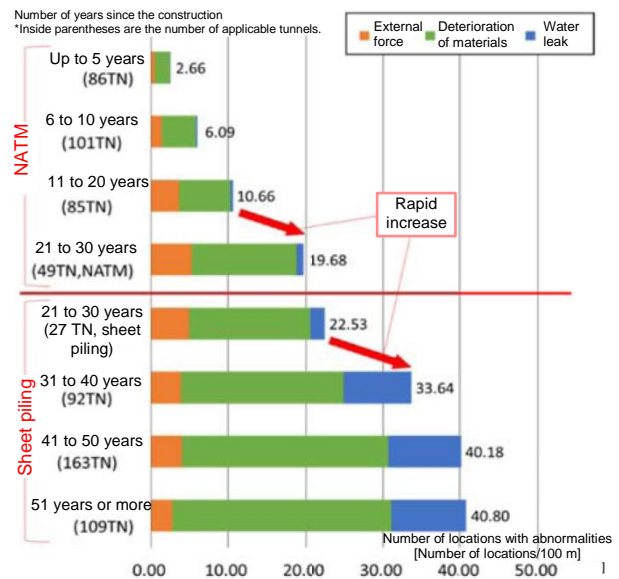


Figure 1: Conditions of abnormalities in category I**b** or worse conditions

Possible causes of this phenomenon include technological development and the effect of changes in social situations.

Material deterioration (green) accounts for the majority in the category of abnormalities in both the sheet piling method and NATM. Abnormalities of water leaks (blue) occurred significantly in tunnels constructed with the sheet piling method. In particular, tunnels older than 31 years accounted for about a quarter of all abnormalities. One of the causes is that the sheet piling method does not provide waterproofing.

4. In the end

The authors are going to continue inspections and studies to improve the efficiency of regular inspections of tunnels based on analyses using the results of regular inspections of road tunnels.

For detailed information

1) Road Tunnel Regular Inspection Procedures (June 2014, National Highway and Risk Management Division, Road Bureau, Ministry of Land, Infrastructure, Transport and Tourism)

http://www.mlit.go.jp/road/ir/ir-council/pdf/yobo3_1_9.pdf