

OPTIMAL SCHEDULING OF TUNNEL INSPECTION AND MONITORING FOR LEVELING YEARLY BUDGET

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Keywords: Scheduling, Tunnel, Inspection, Monitoring, Civil Engineering

Abstract: Many infrastructures were built in 1950's and 60's intensively in Japan, which was the highest economic growth period. They got older in half a century, and now it is an urgent task to inspect and maintain such aging infrastructures. In this research, we focus on the inspection and monitoring schedule of tunnels. In Japan, 130-meter-section of ceiling panels fell at Sasago tunnel (Yamanashi prefecture, Japan) in 2012. Three vehicles were crushed and nine people were killed in the incident. After that, the Ministry of Land, Infrastructure, Transport and Tourism (MLIT) renewed the manual of tunnel inspection. The renewed manual instructs that all tunnels must be inspected within every five years and its status of deterioration is graded. Moreover, if the grade of a tunnel falls below the predetermined threshold, the tunnel must be monitored within two years from the last inspection or monitoring. On the other hand, such inspections and monitoring activities need money. Generally, for tunnels which are the property of a local government, inspection and monitoring fee would be paid by that government. Therefore, the government must prepare a budget for such activities. However, if the number or total lengths of inspected and monitored tunnels are biased from year to year, then it is difficult to get enough budget for the year in which there are many inspected and monitored tunnels. In this research, we proposed an optimization model to level the yearly budget for tunnel inspections and monitoring activities. To tell the truth, the manual allows to accelerate the inspection schedule: for example, we can inspect a tunnel within four years. By using this allowance, we can resolve the bias and level the yearly budget gradually. On the other hand, this leveling procedure would increase the aggregate budget of a target period because the total number of inspections and monitoring activities may increase. So, in this research, we proposed an optimization model for making the optimal schedule of tunnel inspection and monitoring for leveling yearly budget within the predetermined aggregate budget in the period. Numerical experiments were conducted in this research: we use the practical data which include 270 tunnels in Hokkaido prefecture. The result shows that our proposed model works well and can find the optimal and practical schedule for Hokkaido area.