철도교량에 거동발생 시 응력분포 분석에 따른 적정 방수재료 선정을 위한 평가 방법

Waterproofing Material Evaluation Method based on Stress Dispersion Analysis due to Displacement in Railway Bridges

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Abstract

To measure the effect of the stress-strain dispersion across the installed waterproofing layer on the concrete surface, a strain gauge was attached to the gap between the waterproofing layer and the concrete structure at specified points of upper, center and bottom of the load-displacement simulation specimen, and the peak stress-strain at the displacement interface were measured and compared with stress-strain at other areas to analyze each material types' stress-strain dispersion ratio properties. Based on the results of the testing, it was shown that materials with high load-displacement resistance performance accordingly had high stress-strain dispersion ratio results, and the materials from highest performance to lowest performance were; CAS, SAS, PUC and CSC.

키 워 드 : 철도교량, 하중, 응력분포, 방수재료, 평가방법
Keywords : railway bridge, load, stress dispersion, waterproofing material, evaluation method

1. Introduction

1.1 Purpose

Design codes in railway bridges are lacking of test methods and evaluation standard of waterproofing materials, resulting in inappropriate usage of waterproofing materials for railway bridges. This study proposes a new evaluation criteria for waterproofing materials by stress dispersion resistance analysis.

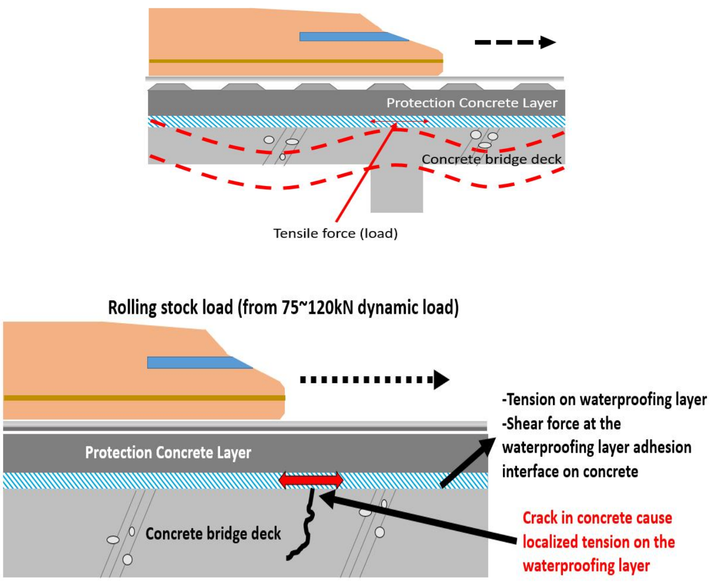

Figure 1. Railway bridge deck displacement due to vehicular load

2. Theoretical Discussion

2.1 Stress-strain evaluation of waterproofing material by railway load-displacement

In this evaluation, strain gauges are attached a waterproofing material installed specimen for displacement resistance testing, and the stress-strain applied to the waterproofing by displacement is measured. Stress is measured by the principles of resistance value R and ⊿R as is shown in the following equation.

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$$\varepsilon = \frac{\Delta L}{L} = \frac{\Delta R/R}{K}$$

Where, ε : strain
R : gauge resistance
K : gauge ratio
ΔR : deformation resistance, K

2.2 Evaluation Process

The strain gauge is attached to the waterproofing material adhesion surface. Strain generated in each measurement object passes through the base of the strain gauge and transmits the strain to the resistor.

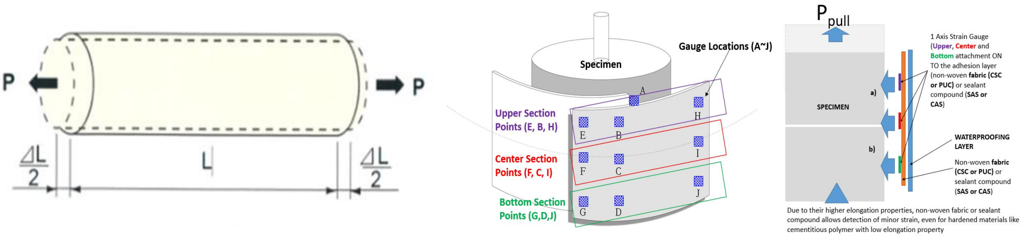

Figure. 2 Strain detection concept for waterproofing materials on displacing surface

For this testing, 4 types of waterproofing systems were selected; 1) Cementitious slurry coating (CSC) in cementitious membrane system, 2) polyurethane spray coating (PUC) in liquid applied membrane system, 3) self-adhesive asphalt sheet (SAS) in asphalt sheet system, and 4) composite asphalt sheet (CAS) in asphalt sheet system.

3. Experimental Results

Stress transmission analysis during displacement showed that CSC is 93.5 to 221 MPa, PUC is 20.5 to 109 MPa, SAS is 1.18 to 1.5 MPa, and CSC is 0.043 to 0.209 MPa. Based on these results, it was shown that CAS based waterproofing material can alleviate force from is suitable for waterproofing for joints with large displacement width and many movements. The results demonstrate that longer resistance and lower stress measurement (among the tested materials, the CAS waterproofing material) are deterministic factors for expected life cycle and durability in railway bridges.

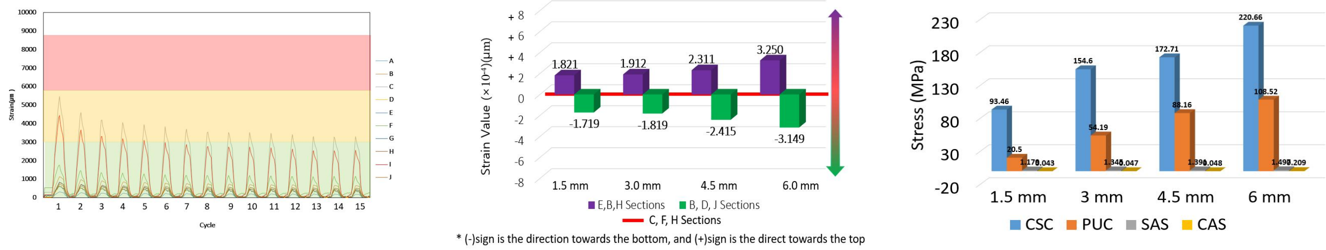

Figure 3. Stress dispersion ratio derivation process and result

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참 고 문 헌

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