Physics and Chemistry of the Earth 128 (2022) 103231

Contents lists available at ScienceDirect

Physics and Chemistry of the Earth

journal homepage: www.elsevier.com/locate/pce

Application and effect of SCL film and SK polyurea in aqueduct roughness reduction transformation project

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ARTICLE INFO

Keywords:
Roughness coefficient
HEC-RAS
SCL impermeable Film
SK spray Polyurea
Roughness reduction and flow increase

ABSTRACT

In order to explore the recommended roughness value and application prospect of SCL impermeable film and SK spray polyurea in reducing roughness and increasing flow in water conservancy projects, the prototype observation test is carried out in the typical aqueduct of the pumping irrigation area in Ningxia, and one-dimensional constant flow model based on HEC-RAS is built. The roughness value before and after the engineering transformation of the aqueduct is compared to test the effect of different roughness reducing materials. The results show that:the roughness value of the original concrete aqueduct is about 0.0131, the roughness value of SCL is 0.0115, and the roughness value of SK is 0.0098. The effective reduction of roughness of SCL impermeable film is 12.21%, However, the SK spray polyurea effectively reduced the roughness rate of 25.19%. The effective flow increase of SCL impermeable film is 13.91%, while the effective flow increase of SK scrap polyurea is 33.67%. According to the effect of roughness reducing, flow increasing, and construction technology of the tow different materials, SK spray polyurea will be more suitable for application of water supply and distribution channel renovation project with less cost, easier construction, and more effective.

1. Introduction

China is a major country with agriculture, among which the irrigated area accounts for about 50% of the national arable land area. Water transmission and distribution in irrigation areas mainly depend on channels, aqueduct and other hydraulic buildings. Due to the cold and dry climate in northern China, the original channels lined by concrete and other materials are easy to be damaged by freezing and swelling. After a long time of operation, the channels appear surface peeling off, which increases the roughness value of the side wall of the channel. Thus, the overflow capacity is reducing, and the economic benefits of the irrigation area cannot be fully played. In the past, the engineers usually expanded the cross section to improve the flow capacity of water transmission and distribution projects. However, due to the particularity of the aqueduct structure restricted by the tensile performance of concrete structure, it is a slightly ideal to increase the flow capacity merely by expanding the cross section. The value of the roughness coefficient is one of the key technical parameters of engineering design and operation, and it is also one of the key factors affecting the channel discharge capacity (LI, 1989), therefore, reducing roughness is another effective measure for water supply and distribution channel renovation project. The research can be originated in the 1930s. But until the mid-1960s, the research turns to reducing surface roughness with the implicit assumption that smooth surfaces had minimal resistance. The resistance reduction technology can be divided into several types including ribbon drag reduction (Zhang et al., 2020), viscosity drag reduction, bionic drag reduction (Ma et al., 2016), wall vibration drag reduction, paintcoat drag reduction, etc. Although many researches have been made on the roughness value of water transmission channels or inner lining channels, there are few studies on the change of the roughness rate of new materials in water conservancy projects. Through the study of new materials at home and abroad, impermeable film and hydrophobic coating is

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https://doi.org/10.1016/j.pce.2022.103231
Received 18 June 2022; Received in revised form 12 July 2022; Accepted 23 August 2022
Available online 6 September 2022
1474-7065/