ABSTRACT

Lee, Sangwook. Ph.D., Purdue University, August, 2005. Digital Color Image Processing System for Civil Infrastructure Health Assessment and Monitoring – Steel Bridge Coating Case. Major Professor: Luh-Maan Chang.

Recently, in the civil engineering domain, digital image processing methods have been applied in various areas for the advanced infrastructure inspections and assessment. Conventional inspection methods mostly consist of visual human assessment. While a careful visual inspection can provide valuable information, it has inherent limitations in assessing the structural integrity and the level of damage of a facility. Therefore, many problems can be neglected until they become serious and require costly repair.

One of the current computerized technologies for advanced infrastructure inspection methods is the application of digital image processing, and this research addressed the application of digital image processing to steel bridge coating inspection methods.

Through the use of digital image processing methods, rust percentages on steel bridge coating surfaces can be objectively computed. Automated rust defect assessment methods can assist in the evaluation of the conditions of steel bridge painting surfaces accurately and quickly. In addition, machine vision-dependent inspections can provide more consistent inspection results than human visual inspections. The reliable results from the application of digital image processing methods can facilitate for bridge

managers to develop long-term cost-effective maintenance programs. With these goals in mind, digital image processing methods have been developed for objective rust defect recognition in the past few years. However, previous research efforts have shown that these methods have some limitations in processing coating images under particular environmental conditions, such as non-uniform illuminations, low-contrast digital images, and noises on painting surfaces.

Therefore, a rust defect assessment method was proposed in this research by exploring a digital color imaging system to effectively deal with those environmental conditions. Also, this research developed an automated processor to recognize the existence of bridge painting rust defects since most previous research projects solely focused on the computation of the degree of rust defects on the steel surfaces. The rust defect recognition method was created by characterizing a digital color space for statistical data acquisition and applying a multivariate statistical analysis. The recognition method can be combined with the rust defect assessment method, while creating an integrated system for objective painting surface condition processing and assessment.