

## **Corrosion Detection In Highway Ancillary Structure Using Image Processing And Deep Learning Models**

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Highway ancillary structures such as high-mast light towers, cantilevered sign structures, overhead traffic signals, and luminaires play vital role in building effective transportation system. Therefore, the maintenance of these structures is important for the efficient management of intelligent transportation system. Manned inspection is commonly practiced by department of transportations in USA which could be burdensome, expensive, and unsafe. Although these structures are susceptible to different damages such as missing bolts, loosened bolts, fatigue cracks, etc., atmospheric corrosion is the mostly noticed defect. To reduce the maintenance cost, early corrosion detection needs to be done periodically. However, inspectors can be misguided by the variety of the color of corrosion. Therefore, it is the high time to shift the defect detection methodology to a smart inspection system. Unmanned aerial system (UAS) equipped with image acquisition and addition of corrosion detection algorithms could be a viable alternative to the current inspection system. The objective of this study is to develop image-based corrosion detection algorithms using conventional image-processing technique and deep learning convolution neural networks. In the first step, a novel image processing-based algorithm is proposed that passes through a series of pre-processing steps such as image adjustment for illumination control, enhancement of images in addition to the conversion to YCbCr color space for corrosion detection. Images of the corroded ancillary structures were acquired and annotated for corrosion by the research team, and the accuracy of the developed methods were analyzed. Compared to the ground truth, the highest accuracy and true positive rates are determined to be 90% and 70%, respectively. Later, a pretrained Alexnet Deep Learning Convolution Neural Network model in transfer learning mode is used for labelling the images with corrosion. In this model, cross validation is incorporated for improving the performance of the model. These results show that Alexnet can detect corrosion in the images with 95% accuracy.