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Risk-based Maintenance Management of U.S. Public School Facilities

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Abstract

According to the U.S. Department of Education National Center for Educational Statistics (NCES) 1999 report, Condition of America's Public School Facilities, approximately one-quarter of the nation's schools, housing 11 million children, require extensive repair. According to the 2013 ASCE American Infrastructure Report Card, major knowledge gaps exist regarding the current state of our school infrastructure. Funding for school facilities has dropped by 50% since the start of the 2007 recession. The ASCE report emphasizes a need for the development of comprehensive preventive maintenance programs. This paper reviews the literature on risk-based maintenance management and compares this approach to condition-based management systems. The paper further describes an ongoing study to develop and validate a Failure Modes and Effects Analysis (FMEA) system for maintenance management risk analysis for public school facilities.

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2.0 Background and Motivation

2.1 The Current State of Our Public School Infrastructure

As with the bulk of the national civil infrastructure, the public school infrastructure is at risk of deterioration and in need of systematic

condition management. The American Society of Civil Engineers (ASCE) states in its 2013 Infrastructure Report Card that there has been no comprehensive assessment of the condition of the public school facilities in more than a decade.² Spending on the nation's schools grew from \$17 billion in 1998, to a peak of \$29 billion in 2004, only to drop by 2007, to \$20.28 billion. Since the start of the national recession in 2007, school facility spending has dropped by 50%, to 10 billion in 2012. The

National Education Association estimates the cost to renovate the school infrastructure to acceptable condition to be \$322 billion.⁷ The most recent comprehensive evaluations of the public school condition were performed in the late 1990's. In 1996, the United States General Accounting Office (GAO) reported on the condition of the national public school infrastructure and estimated that \$112 billion is required to repair or upgrade America's multibillion dollar investment in facilities to good overall condition.³

Approximately fourteen million students, distributed nationwide, are required to attend the one-third of schools that have inadequate conditions. According to a 2000 report of the National Center for Education Statistics (NCES), three-quarters of schools reported having facilities that were in fair or poor condition. Eleven million students were enrolled in schools reporting inadequate environmental conditions. These maintenance conditions varied by concentration of poverty: schools with the highest concentration of poverty were more likely to report



Figure 1: High school roof collapse, Blacksburg, VA, 2007

poor conditions.

Schools reporting poor facility conditions tended to be located in urban centers and rural regions.⁸ The condition of K-12 school facilities in the United States is primarily a local and state responsibility, and there is limited national information. Since the start of the 2007 recession, state funding for education has declined, with 35 states now providing less than 2008 funding levels. Additionally, 26 states provided less funding for 2012-2013 than the year before. In the years since the start of the recession, the funding for school facilities has continued to decline, from a modest \$16.4 billion in



Figure 2: Asbestos floor tile deterioration, Riner, VA, 2012



Figure 3: Asbestos thermal system insulation deterioration, Lexington, VA, 2012

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