STRUCTURAL RESPONSE OF COLUMNS UNDER FIRE LOADING

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NARRATIVE SUMMARY

At a residential structure fire in Greenwich, Connecticut in May 2017, two cylindrical steel support columns catastrophically ruptured while enduring heavy fire loading. The failure of these supports precipitated significant structural damage to the residence and endangered the lives of firefighters operating in the direct vicinity. Analysis of the damaged columns identified the potential cause of failure to be a combination of rapid internal vapor expansion and a severely weakened steel body. To investigate these issues, a computer-aided structural analysis using ANSYS Workbench was conducted to examine the effects of loading, pressure, and temperature on an identical column geometry. Input data for the column model accounted for combustible fuel loading, temperature, duration of exposure, material properties, and material dimensions. Numerous computer-aided structural analyses were executed and collectively demonstrated that thermal stresses alone are unable to cause a column rupture. Further research is required to analyze the cumulative effects of internal pressure, loading, and temperature. Additionally, simulations and research identified areas worthy of further investigation: buckling behavior, the presence of a concrete core, and eccentric loading. Regardless of the specific failure mechanism, it is critical for responding fire personnel to apply water to columns to relieve thermal stresses and prevent a similar column failure.

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BIOGRAPHY

Adam Jakubowski is a senior pursuing a Bachelor of Science in fire protection engineering. Adam came to the University of New Haven in 2014 after graduating from Naugatuck Valley Community College with an associate degree in fire technology and administration. Adam is a member of Alpha Sigma Lambda honor society and plans to attend graduate school following the completion of his current program.