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## Determining Bridge Deck Chloride Quantities Using Ground Penetrating Radar

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Chlorides from deicing salts attack the steel reinforcement in bridge decks which can ultimately cause delamination and deterioration of the concrete. For transportation agencies, the repair cost from these defects are estimated to exceed \$5B per year in USA and make up between 50% - 85% of bridge maintenance budgets. While, the removal and replacement of chloride contaminated concrete is the most long-lasting and cost-effective remediation, few methods exist to determine chloride content in bridge decks. This research describes an entirely new method for determining chloride quantity in bridge decks using ground penetrating radar (GPR) technology and establishes and quantifies the relationship between chlorides in concrete (which cause corrosion of reinforcing steel and delamination of concrete) and the effect on GPR signal propagation. Specifically, it shows that there is a deterministic relationship between radar signal attenuation and the amount of chloride and moisture in bridge deck concrete, and that when moisture content is known it is possible to estimate chloride quantity based on signal loss or attenuation measurements. Our research also demonstrates the practical application of this concept by utilizing GPR along with limited coring (three or more core samples) and laboratory chloride measurements to produce an accurate and quantitative, spatial mapping of chlorides in bridge decks.