Research Problem Statement

ODOT Research Section
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I. TITLE

[Provide a unique title that represents the research idea]

17-058 Influence of Magnesium Chloride on Long-Term Bridge Performance

II. PROBLEM

Historically, the Oregon Department of Transportation (ODOT) did not apply deicing salts to roadways in winter maintenance operations. By not using salt to deice roads, ODOT has maintained a large population of older bridges that limited corrosion deterioration mainly to coastal structures due to wind-borne ocean salts. Maintenance practices have changed recently and ODOT now principally deploys magnesium chloride ($MgCl_2$) to improve roadway safety, improve efficiency of plowing, and minimize environmental impacts. It is generally believed that magnesium chloride has less potential for causing corrosion than sodium chloride, but this and other forms of deterioration to concrete structures (such as pavements, decks, girders, etc.) must be considered. Magnesium chloride can react with the concrete to produce a calcium oxychloride that is expansive and result in concrete damage and cracking. The long-term effects of magnesium chloride use on the service life of reinforced concrete and prestressed concrete bridge components are uncertain. The kinds of damage expected in bridge members and the corresponding influence on safety of the components as well as the associated costs need to be identified to enable effective policy recommendations and asset management decisions. Further, innovations to concrete mixes and structural designs may to best enable long-term performance and minimize lifecycle costs for transportation infrastructure subjected to magnesium chloride deicing chemicals.

III. PROPOSED RESEARCH, DEVELOPMENT, OR TECHNICAL TRANSFER ACTIVITY

Analytical and experimental research is proposed. Surveys of transportation agencies will be conducted to identify common magnesium chloride damaged infrastructure issues. Key mechanisms for damage and condition deterioration in superstructure elements (bridge decks and girders) will be a focus of the work. It is expected that joints, cracks, and ends of main members near joints will be most impacted. Prestressed girders, widely used in Oregon, will be studied to assess the influence of magnesium chloride induced damage on strand transfer length and member strength. Full-size bridge decks will also be studied. For both specimen types, $MgCl_2$ induced damage will be accelerated and the damage progression will be identified and quantified. Visual assessments will be compared with the corresponding structural performance. Based on the research results, alternative mix and design details will be proposed to mitigate $MgCl_2$ induced damage.

IV. POTENTIAL BENEFITS

This is a project that will enable ODOT to understand the long-term effects of using $MgCl_2$ for winter maintenance operations on reinforced concrete infrastructure and to make effective engineering design, policy recommendations, and asset management plans. Without this research, the damage to reinforced concrete and prestressed concrete infrastructure from $MgCl_2$ use will not be known until damage is observed in the field and then it will be too late to prevent or minimize the effects.

V. IMPLEMENTATION

Meetings and workshops will be held with ODOT Bridge section personnel to present research findings in-progress as well as summary findings. Background information and findings will be described in reports, papers, and peer-reviewed journals. Design examples will be provided for the methods developed. Web-based access to in-progress test data and images, analytical methods, and summary findings will be available on-line where appropriate.

VI. LIST OF REFERENCES *(optional)*

[List the references you identified when you searched for completed and current research.]

VII. CONTACT INFORMATION

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