



# Identification of Early Degradation Mechanisms in Zinc Coating on Cold-Formed Steel Sections Through Analysis of the Production–Storage Chain

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**Abstract.** Cold-formed steel hollow sections (CFS) with hot-dip galvanized coatings (e.g., DX51D + Z140) are widely used in window and façade systems, especially in urgent restoration contexts. However, premature degradation—despite conformity to EN 10346—raises concerns about long-term performance. This study examines early-stage corrosion risks of such sections, integrating coating thickness measurements, chemical surface analysis, and production history. Specimens were extracted from strip blanks and finished CFS. Coating thickness was measured using electromagnetic and gravimetric methods, while chloride, sulphate, and chromate residues were assessed via ISO-based chemical tests. Variability in coating thickness and the presence of chlorides and iron oxides were linked to sharp bending radii, excessive roll pressure, and lack of post-forming passivation. Key findings show that compliance with nominal Z140 specifications is insufficient to prevent early white rust or undercoating corrosion. A structured risk map was developed to identify root causes of degradation in sections with non-uniform coating, microcracks, and surface contamination, enabling targeted preventive measures. The study emphasizes the need for integrated process–logistics control: optimized forming parameters, systematic passivation, and ventilated packaging. These actions are critical to ensuring reliable corrosion protection in CFS, especially under accelerated post-conflict recovery conditions.

**Keywords:** Cold-Formed Steel · Galvanized Coating · White Rust · Coating Thickness · Passivation · Corrosion Resistance · Storage Conditions

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