Lightweight Steel Framing

March 1999

Technical BULLETIN

Report on:

Durability

Volume 2, Number 1

Durability oF Galvanized & Galvalume™ Steel Framing

One of the most frequently asked questions about steel framing is "Will my house rust?".

Metallic coatings protect steel framing used in residential and commercial buildings from corrosion. This coating is either galvanized (zinc) or Galvalume™ (zinc and aluminum). The coating designations used in North America and their corresponding coating weights and thickness are shown in Table 1.

The Canadian Sheet Steel Building Institute's (CSSBI) specification for steel framing used for load bearing applications (exterior & interior) requires a minimum Z180 for galvanized and AZ150 for Galvalume™.

How zinc protects steel

The corrosion of metals in a moist environment is purely electrochemical in nature. Chemical reactions between the metal and the surrounding medium (the electrolyte) release electrons at the points where the metal is corroding (the anodes). These electrons move into the metal (electrical current), reaching points (the cathodes) where they can be drawn into another chemical reaction with the medium. One of the variables that affect the capacity of a metal to enter into solution is the difference in the electrical potential established between the metal and electrolyte. Zinc has a higher potential difference, therefore, if a piece of zinc is combined with a piece of iron and they are submerged together in water, the iron will act as cathode and will be protected by the zinc from any corrosion. On the other hand, zinc acts as the anode and is "sacrificed". This phenomenon illustrates the mechanism of the cathodic protection of iron by a sacrificial zinc anode.

Metallic coated steel framing has been around and is performing well

Steel framing has been used in residential buildings for over 70 years. British Steel carried out a research program between 1986-1989 to determine the durability of galvanized steel components in domestic housing. Fifteen homes located in different environments across the United Kingdom were selected for the test program. Galvanized steel sample coupons were placed in confined spaces within these houses. The weight losses for galvanized coating after 1, 2 and 3 years were found to be insignificant: 0.44, 0.71 and 0.77 g/m^2 respectively. Based on this weight loss the coating on a typical framing member with a minimum of 150 g/mm^2 would last for over 100 years.

Steel framing has been used in Australia for many years, with well over twenty years of experience with current types of coating and

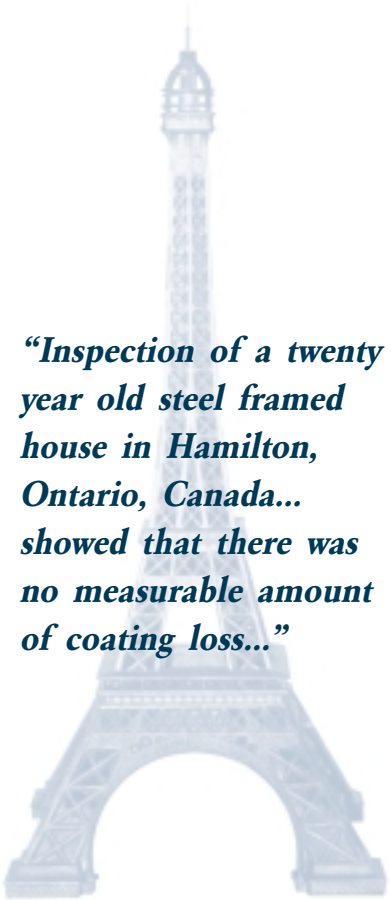
Table 1: Typical Coating Designations in North America

	Coating Designation	Minimum Coating Weight (g/mm^2)	Calculated Coating Thickness (µm)
Galvanized	Z275	275	20
	Z180	180	13
	ZF75	75	5
Galvalume	AZ150	150	20
	AZ100	100	13

Canadian Sheet Steel Building Institute
652 Bishop St. N., Unit 2A
Cambridge, Ontario N3H 4V6
Tel.: (519) 650-1285
Fax: (519) 650-8081
Web Site: www.cssbi.ca

Report on:

Durability



"Inspection of a twenty year old steel framed house in Hamilton, Ontario, Canada... showed that there was no measurable amount of coating loss..."

coating weights. There are over three decades of experience that show both galvanized and Galvalume™ coated steel frames have performed well in Australia. Weight loss data, based on up to seventeen years of exterior exposure in a range of Australian environment collected by BHP, was used to calculate the expected life of a 20 µm coating. The expected life in all but severe marine environment is well in excess of 100 years.

The result of a atmospheric exposure test in nine indoors and one outdoor site in Tokyo Japan estimates a 20 µm coating will last well over 100 years.

Inspection of a twenty year old steel framed house in Hamilton, Ontario, Canada, provided further evidence of the long term durability of galvanized steel framing members. Inspection of the framing members within an exterior and interior wall cavity showed that there was no measurable amount of coating loss in these members even though there was evidence that moisture had been present within the cavity.

Al though there is enough evidence around the world to suggest that galvanized and Galvalume™ steel framing is performing well, little detailed information has been available on the micro-climate to which these products have been exposed. In the past four years a number of programs aimed at understanding the building envelope climate have been started around the world.

In 1993 Australia's Commonwealth Scientific Industrial Research Organization (CSIRO) and various industry partners, including BHP, initiated a project which included monitoring climatic conditions such as temperature, humidity and time of wetness for houses in different locations in Australia representing marine, suburban and rural conditions. Exposure panels were inserted in the wall cavities and roof spaces, and will be removed annually.

In 1996 the International Lead Zinc Research Organization (ILZRO) sponsored a project to determine corrosion rates for galvanized and zinc alloy coated steel in residential structures and to correlate these rates with exposure conditions. Four homes were selected in North America: Miami, Florida; Leonardtown, Maryland; Margate, New Jersey; and Hamilton, Ontario. In addition Sollac and British Steel are contributing to this program by monitoring two homes located in France, two in the UK and one in Finland. The National Association of Home Building Research Centre based in Maryland, USA, will coordinate the monitoring of performance.

The objective of this project is to determine the minimum durability requirement so that the designers can specify the coating weight that will provide an acceptable minimum service life in a range of environmental conditions. Phase one of this program, which includes all sample and site preparation and installation, has been completed. Phase 2, which involves processing the environmental data, retrieving and analyzing samples and maintaining the sites, is currently under way.

A similar type of study as that conducted by CSIRO and ILZRO is also underway at the University of Tokyo in Japan.

As the benefits of steel framing become evident in residential construction, more research is being done globally to provide the necessary evidence which supports steel's claim as a superior construction material for residential buildings.

References:

1. Galvanic Corrosion of Zinc and its Alloys, X. G. Zhang , J. Electrochem. Soc., Vol. 143, No. 4, April 1996.
2. Performance of 55% Al-Zn Coated Steel Sheets Used for Residential Houses in Australia, David J Willis, InterZAC '98, Los Angels, CA, Aug. 29- Sept. 5.
3. 20 Years Inspection of LSF at DESH, L.J. De Meo, Dofasco, Hamilton, Canada.
4. Corrosion Performance Zincalume and Galvanized Coated Steels, BHP Building Product, Aug. 12, 1997, Australia.
5. Performance of Zincalume Coated steel in Residential Framing Applications, N.E Wallace and G.K Stark, BHP, PacZAC'97.

CSSBI