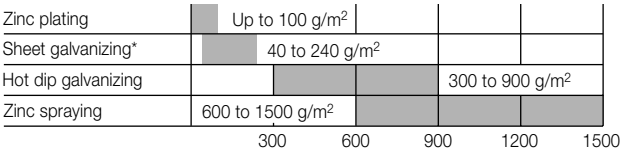
Zinc coating mass comparisons

The range of zinc coating mass which can be applied efficiently and economically by various zinc coating processes is given below. As the protective life of any zinc coating is proportional to thickness, the figures show that galvanizing has an advantage for many applications in that 600 g/m² is the normal coating mass on fabricated articles, as detailed on page 13. Heavier coatings can be applied by zinc spraying at greater cost but the coating lacks many of the characteristics of a galvanized coating which is alloyed to the base steel.

Zinc coating mass applied by commercial processes, g/m²



* Manufacturers of continuous sheet galvanized products quote coating mass as the total coating mass on both sides of the sheet. To provide a valid comparison figures given here are for coating mass on one side only.

Corrosion rates of steel and zinc

Exposure tests by The American Society for Testing and Materials show that panel weight loss – a measure of the rate of corrosion – is much lower for zinc than for steel in a wide range of exposures. Galvanized coatings are consumed at rates between one seventeenth and one eightieth that of steel, so that even in aggressive environments, hot dip galvanizing provides long life.

Corrosion rates, Steel:Zinc

Test panel weight loss in various exposures

Arid	Phoenix, Arizona	17:1
Rural	State College, Pa	22:1
Light Industrial	Monroeville, Pa	28:1
Industrial	East Chicago, Ill	52:1
Marine	Kure Beach, NC	80:1

Protective life of galvanized coatings

The protective life of a metallic zinc coating on steel is roughly proportional to the mass of zinc per unit of surface area regardless of the method of application. The graph at right below demonstrates this by the results of tests conducted by British Iron and Steel Research Association at Sheffield Corrosion Testing Station, UK, on different masses of zinc coatings applied by sherardising, zinc plating, galvanizing and zinc spraying.

The graph shows that the period of corrosion protection provided in a given environment is proportional to the mass of zinc in the coating, and that the protective life of a coating is therefore directly determined by the environment to which it is exposed.

The following notes are offered for general guidance. An indication of the life of a galvanized coating in a particular environment may be given by the performance of existing galvanized structures; more detailed information on coating life for specific applications is available from your galvanizer, or from Galvanizers Association of Australia.

Performance in various environments

The excellent corrosion resistance of galvanized coatings in the atmosphere and in most natural waters is due to the formation of a protective layer or patina which consists of insoluble zinc oxides, hydroxides, carbonates and basic zinc salts, depending on the environment. When the protective patina has stabilised, reaction between the coating and its environment proceeds at a greatly reduced rate resulting in long coating life.

In the atmosphere

The appraisement of the protective life of a galvanized coating in a particular location must take into account factors such as climatic conditions, the presence in the atmosphere of contaminants introduced by urban or industrial activity, and chlorides in the air due to proximity to the sea. Environments which appear to be generally similar often produce considerable differences in corrosive conditions due to relatively minor variations such as the effects of prevailing winds, proximity to corrosive effluents and general atmospheric conditions.

In warm dry atmospheres the stability of zinc is remarkable. The zinc oxide film formed during initial exposure remains intact and prevents further reaction between the galvanized coating and the air, and protection continues indefinitely

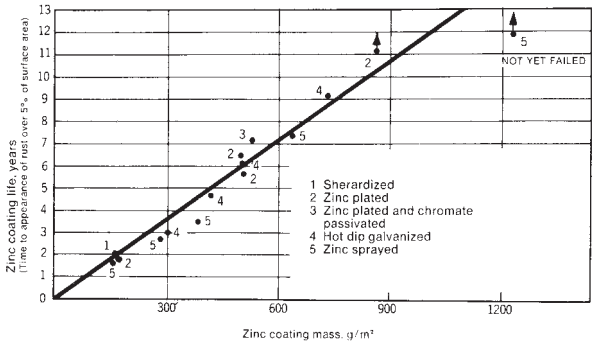
In the presence of atmospheric moisture the zinc oxide film is quickly converted to zinc hydroxide, and carbon dioxide normally present in the air reacts to form basic zinc carbonates. These stable inert compounds resist further action and ensure long life for the protective galvanized coating.

In rural areas the life of galvanized coatings may be reduced due to the effects of aerial spraying of fertilizers or insecticides. In dry form most fertilizers and insecticides are harmless to zinc coatings but when wetted by rainwater or irrigation spray water, aggressive solutions can be formed which will attack galvanized coatings until washed off by further wetting.

Near the sea coast the rate of corrosion is increased by the presence of soluble chlorides in the atmosphere. The performance of galvanized coatings relative to other protective systems is outstanding however, particularly when used as part of a duplex galvanizing-plus-paint system.

In industrial areas the presence of atmospheric impurities such as sulphurous gases and chemicals results in the formation of soluble zinc salts. These are removed by moisture, exposing more zinc to attack. In light industrial areas galvanized coatings give adequate protection, but in

Service life test results, various zinc coatings



Note. These test results were obtained in an extremely corrosive environment, and should not be taken as a guide to coating life for applications under normal conditions.