

# Corrosion Awareness Day 2017

## What you should know about corrosion

**HOW IT OCCURS**  
Corrosion is degradation of the properties of materials due to interactions with their environment. It results in loss of function of the component or system. Most metals are susceptible to corrosion.

There are various types of corrosion based on the nature of attack as well as the type of environment to which the material is exposed. The corrosion product we see most commonly is the rust which forms on the surface of steel.

**HOW IT AFFECTS OUR EVERYDAY LIFE**

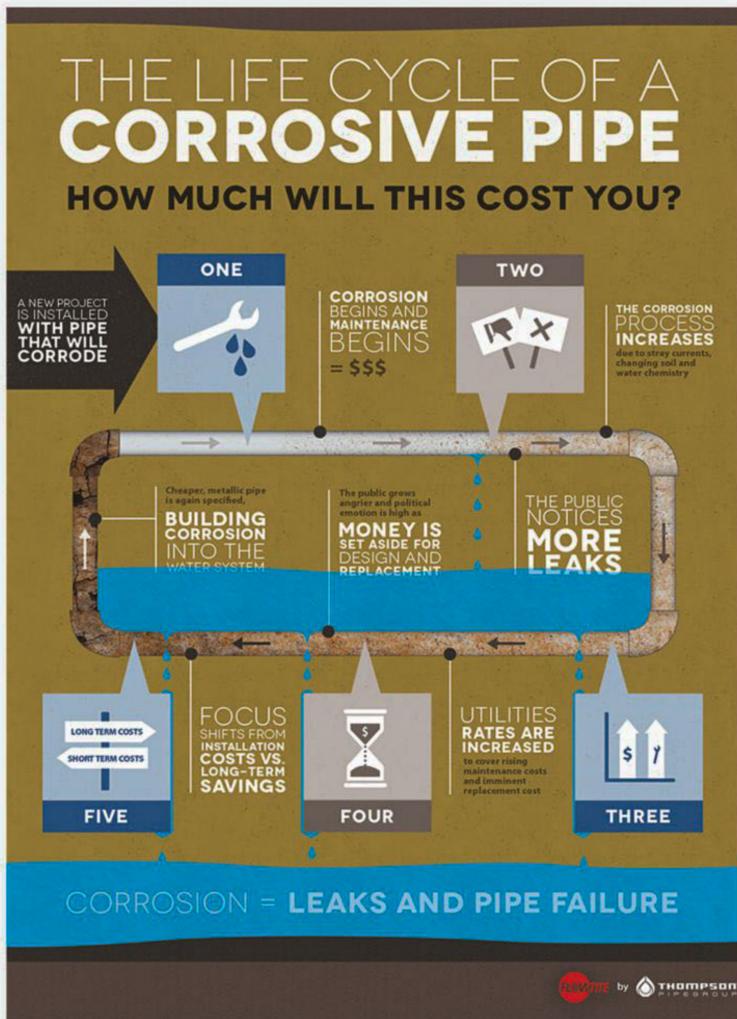
Corrosion is a massive deteriorating problem. It is way more damaging than you might think. Corrosion is everywhere. It is in the pipes that bring us water in our home; it destroys vehicles; it attacks tracks and bridges.

Though the cost of corrosion is high, we generally pay little attention to it except in high risk areas. The segments that are most vulnerable to the cost of corrosion are associated with utilities, transportation, and infrastructure. Several studies show that the annual direct cost of corrosion to an industrial economy is approximately 3.1 percent of the country's Gross National Product (GNP), and globally the corrosion cost is over 6 percent of the world's GDP.

There are also health and safety related hazards caused by corrosion such as pollution of supply water, collapse of buildings and factories, and so on.

**HOW IT CAN BE PREVENTED**

Like death and taxes, corrosion is something we hope to avoid, but ultimately it is something we must learn to deal with. Corrosion usually originates at the surface of the metal.



Therefore successful corrosion control methods ranges from painting the surface of steel or galvanising it to high-tech laser-surface melting. Corrosion can be controlled if we educate ourselves regarding this issue. It requires long-term

thinking about the life-cycle of a structure. Mass awareness about corrosion will make a major impact in preserving environment and resources, as well as protecting ourselves and our fellow human beings.

## Winning the fight against corrosion

In conversation with Prof. Dr. A.F.M. Saiful Amin, Civil Engineering Dept., BUET

**D**O you know why the Statue of Liberty looks blue-green in colour? Originally the statue was dull brown, reflecting the natural colour of its copper plates. It turned blue-green due to a natural weathering process in which air and water acted on the copper plates. With this anecdote, Professor Saiful Amin explained the science behind corrosion.

He added that the electrochemical oxidation of metal occurs in reaction with an oxidant typically in presence of moisture. This is a triangle. Rusting, the formation of iron oxides, is a well-known example of electrochemical corrosion. To prevent corrosion, we have to break this triangle by removing one of the legs. The whole idea of corrosion prevention is based on such a scheme. For example, we apply paint to keep metal away from water and air. This is a widely used corrosion-prevention technique.

Professor Amin continued that large structures such as steel bridges, locomotives and trains require regular painting to protect them from corrosion. Oils and lubricants are generally used to cover the moving metal parts from air. These are costly and harmful to the environment. To reduce costs and the harmful effects of these elements, and to ensure durability, we need to focus on design. The surface area should be kept to a minimum by using box-shaped units instead of using smaller sections of angular or complicated geometries. New generation paints are more durable. We have also seen the introduction of stainless steel in building infrastructure. Stainless steel provides better protection against corrosion. Further improvement has happened in this sector, and now we have weathering steel, which is

also called paintless steel. In this technology, some metals are used which, after being corroded, create a stable dense surface that prevents corrosion from propagating deep inside the steel. This is a beneficial use of corrosion. We have seen some projects in Bangladesh that are using weathering steel. This is a benchmark of development. Currently, a local steel company is producing epoxy-coated rebar,



which is a reinforced bar with upgraded corrosion-prevention technology.

In reference to the protection of concrete structures from corrosion, Dr. Amin emphasised the use of quality concrete. In most cases, due to the poor quality of concrete, cracks develop in a structure in a more intensive way than expected in design. This greatly reduces the lifetime of the structure. Using corrosion resistant steel reinforcement, and increasing concrete density and the thickness of concrete around steel reinforcement, are some simple approaches that can be followed to prevent corrosion. He underlined that we have to invest in the prevention of corrosion to save the whole structure. The investment must be made at the

initial stage. Though this additional investment decision is often dictated by the financial capacity of an owner, s/he should also consider the lifecycle cost of the infrastructure, opined the expert.

He elucidated the concept of the lifecycle cost of an infrastructure as an assessment of the total cost of the structure, which includes initial investment and operational and maintenance costs throughout its lifetime. It may increase initial cost but result in significantly reduced operating and maintenance costs in the longer term. Investment in prevention of corrosion is a part of this long-term thinking. Dr. Amin said that we have to make people aware about this good practice.

He also discussed the environmental factors of corrosion. In reference to the government's ongoing development works in coastal areas to exploit the potentials of the blue economy and maintenance of the infrastructure across the coastal belt, he emphasised the necessity of seriously considering the airborne salinity that readily and largely promotes corrosion in metals.

There are also other sources that exacerbate corrosive effects. Air pollution is one of these. He also pointed to the use of domestic and industrial wastes in landfills as an emerging concern. The gases released from such wastes have the potential to increase the rate of corrosion in metals and electronic equipment installed in the structure. Therefore, proper waste management is strongly connected to the prevention of corrosion.

Professor Amin concluded with the hope that both public and private sector will work together to create awareness about various aspects of corrosion and take necessary measures to protect our valuable structures.



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## BUILDING A RESILIENT INFRASTRUCTURE FOR A PROSPEROUS NATION BY 2030

Concrete reinforced with steel is the bedrock of modern construction. Homes, bridges and cities are built with steel reinforced concrete and steel is prone to oxidation, which means corrosion. Corrosion means gradual decay, decomposition and finally disintegration of a structure.

Modern steel reinforced concrete structures are built with an economic life expectancy of 80 years, but corrosion can render a concrete structure useless in as little as 5 years. It is an insidious process, which gradually creeps in, imperceptible at first and then alarmingly visible. According to the New York based World Corrosion Council, up to 3% of a Nation's GDP is destroyed by corrosion every year.

**FOR BANGLADESH WITH A GDP OF U.S. \$150 BILLION, THIS MEANS AN ANNUAL LOSS OF U.S. \$4.5 BILLION WHICH TRANSLATES INTO TK. 360 BILLION. THIS IS TK. 2400 FOR EVERY MAN, WOMAN AND CHILD EVERY YEAR, IN THE COUNTRY.**

Fusion Bonded Epoxy Coated or FBEC steel bars provide an easy and cost-effective solution to the corrosion problem. The epoxy coating provides an impermeable barrier which corrosive chloride and carbonate ions in the environment cannot penetrate. FBEC coated bars can effectively extend the useful life of a structure by 100 years.

In the United States, over 60,000 highway bridges and all significant marine structures in the coastal regions have used FBEC steel. In India over 1000 bridges and flyovers in the coastal cities have been built with FBEC steel.

Bangladesh's infrastructure building boom has just started in the coastal regions of Barisal, Chittagong and Khulna and BSRM has the appropriate FBEC coated steel 'BSRM Centura' which conforms to the demanding quality requirements of international standards such as ASTM 775 and ISO 14654.

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