ISOQAR REGISTERED

UKAS MANAGEMENT SYSTEMS 0026

Hot Dip Galvanized Reinforcement Steel Bars

Vishal Engineers & Galvanizers Pvt. Ltd.

Fabricators & Galvanizers

Galvanized Rebar

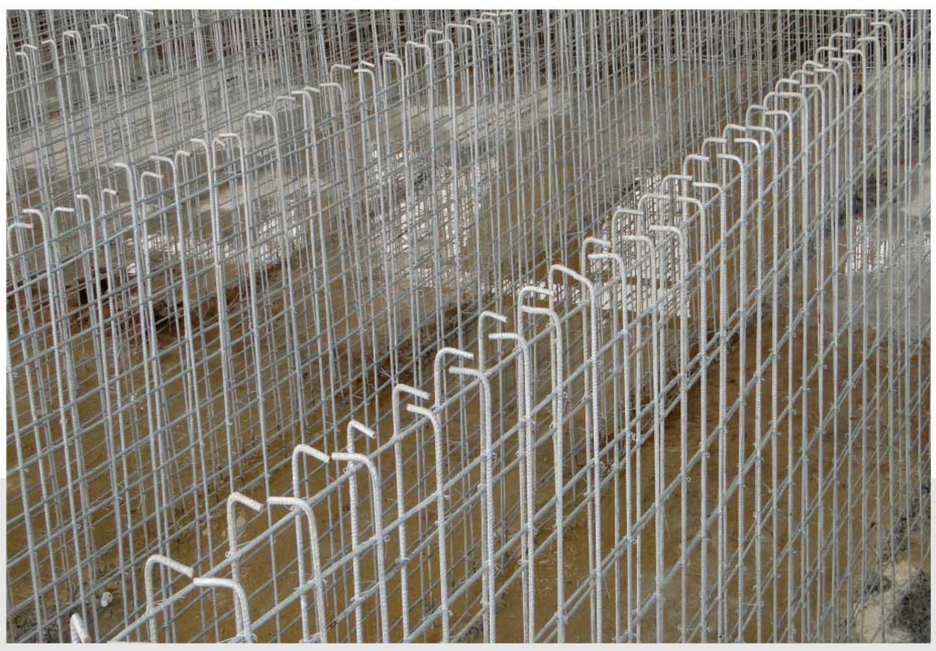
Vishal Engineers & Galvanizers Pvt. Ltd. is the first company in India to introduce Hot Dip Galvanized reinforcement steel bars (Galva Rebars) as a readily available standard product. The company also undertakes job work of Hot Dip Galvanizing of MS Reinforcement bars and TMT bars. The rebars are galvanized according to Indian Standard IS: 12594-1988.

It would be worthwhile mentioning that the reason behind the collapse of buildings is not earthquake but expansion of steel due to corrosion, by up to three times its original diameter. This leads to cracks in the surrounding concrete, resulting in weakening of structure. The Hot Dip Galvanizing is a corrosion protection process which results in metallurgical bonding by completely enclosing the steel & sealing it from the corrosion impact of the atmosphere, without any effect to the properties of steel. This process is secure & reliable and has emerged technically superior and cost effective in the long run. It increases life of the TMT Bars (Galva Rebars) by more than 300%.

We all observe common galvanized structures like Telecom Towers, Wind Mill Towers and Power Transmission Towers, etc. which were erected in open atmosphere 30 to 60 years ago. They still have some of their original coating & are expected to be corrosion free for years.

Many great Infrastructures in the world have used galvanized steel like the Changi Airport of Singapore, Lotus Temple in New Delhi, Sabarmati Riverfront in Ahmedabad.

The Infrastructure development today needs to keep pace with demand of new world to sustain the current impacts of nature & polluted environment. Iron & steel is most important material for infrastructure development. Unless protected, it will corrode & lead to weakening of structures. Galvanized steel is the best way to build environment sustainable, cost effective & long lasting structure.



Why Galvanized Rebar?

- Corrosion products of steel are over three times the volumes of original steel.
- Higher volume of corrosion products exerts greater tensile disruptive stress on the surrounding concrete.
- The structure would have spalling on concrete, suffer loss of durability and serviceability, and would require early remediation, repair and even demolition.
- Corrosion of steel reinforcement bars is a key reason for damage to concrete.
- Many regions in India accounting for 20-25% of rebar use require corrosion protection that is not provided by the concrete cover.
- Of the several corrosion protection technique tried and tested over long periods, galvanized reinforcement bar have emerged technically superior and cost effective. Further galvanized reinforcement bars are economical.
- **Galvanization increases reinforcement bar life by more than 300%.**

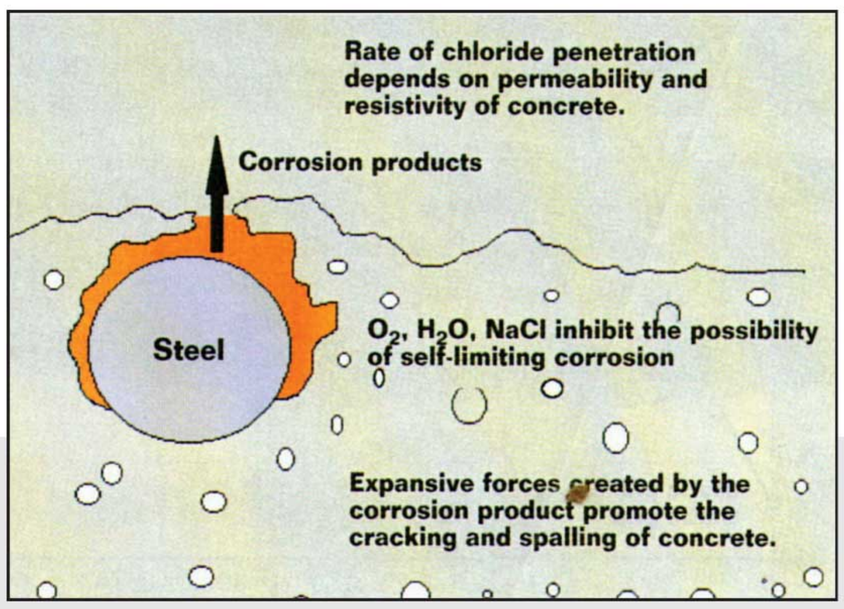
Bond Strength

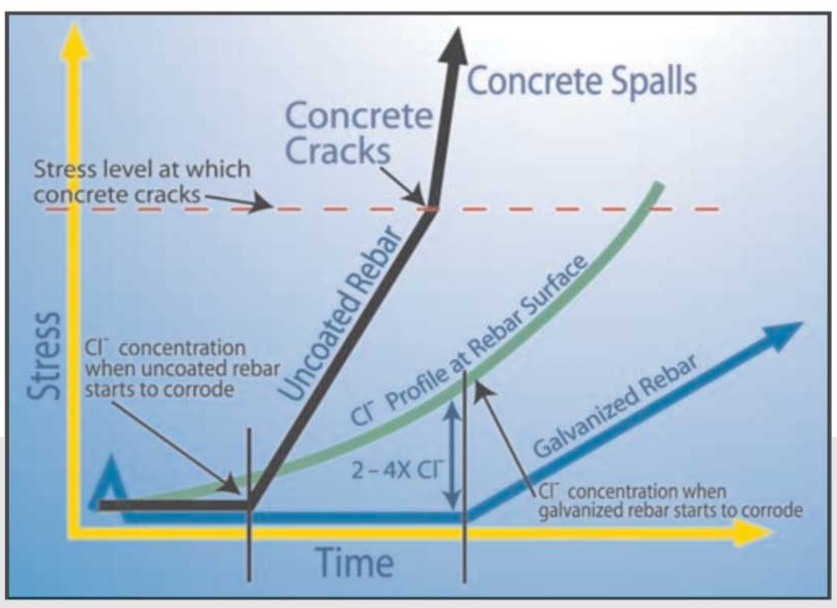
Galvanized reinforcement bars show equal or better strength in all conditions in both plain and deformed types.*

***Structure Engineering Materials Laboratory University of California**

Major Benefits of Galvanized Rebars

- Protection to the steel during storage and construction, prior to placing in the concrete.
- Diminished effect of variations in concrete quality.
- Safeguards against poor workmanship, especially misplacement of reinforcement, poor compaction and inadequate curing.
- Delayed initiation of corrosion and the onset of cracking.
- Reduced likelihood of surface staining.
- Increased structural life of concrete, particularly where chloride contamination is likely.
- Chloride ion concentration required to start corrosion of zinc on galvanized release is 3 times the threshold concentration for plain rebars.
- Zinc corrosion products do not damage concrete but block pores in concrete, reducing the chloride ion diffusion.
- Zinc provides cathodic protection even to areas that become uncovered due to zinc corrosion.
- Zinc does not allow contact between chloride ions and steel.





Advantage of Hot Dip Galvanized Rebar over Epoxy Coated Rebar

1. Special Handling

- The zinc coating of HDG rebar is harder than the steel itself. Bundling, dragging, and rough treatment prior to and during placement have no detrimental effect.
- ECR requires delicate handling to prevent damage to the epoxy coating. Any damage to the coating prior to placement will compromise the corrosion protection.

2. UV Damage

- HDG rebar is unaffected by UV ray exposure during field storage and installation period.
- ECR coatings break down under UV ray exposure.

3. Touch-up

- HDG rebar coatings are tenacious and resistant to scratching and chipping during shipping and placement.
- Only cut ends need touch-up in the field because of cathodic protection ability of zinc.

4. Overlap Lengths

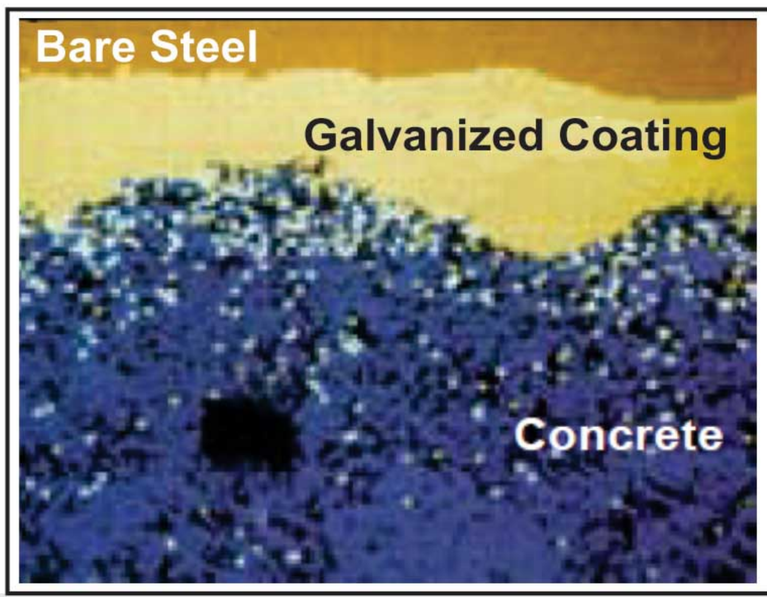
- Laboratory tests show no significant difference in the slip for HDG and black rebar in loaded bars.
- American Concrete Institute (ACI 318) recommends 20% more overlap when using ECR.

5. Holidays / Pinholes (Coating Inconsistencies)

- HDG specifications allow for zero uncoated surface area. The HDG process ensures 100% of the bar is coated with zinc.
- ECR specifications allow for a percentage of the bar to have holidays and pinholes, compromising its protection mechanism before it reaches the job site.

6. Bond to Concrete

- There is no significant difference at ultimate load between the bond strength of ribbed galvanized and black rebar.
- ACI Code requires the basic development length for ribbed epoxy-coated bars to be increased due to the loss of bond strength as a result of the epoxy coating.



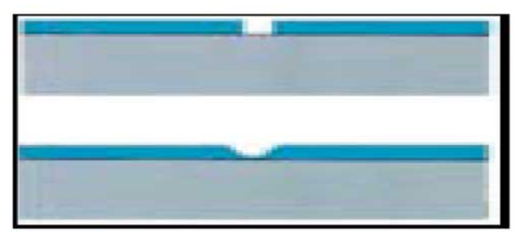
Elemental map of Galvanized Rebar
The corrosion products of Galvanized Rebar are less dense and do not build up pressure to cause concrete spalling (unlike the dense corrosion products of bare steel). The zinc corrosion products (depicted left, in white), migrate away from the Galvanized coating and disperse into the concrete matrix.

7. Fabricate After Coating

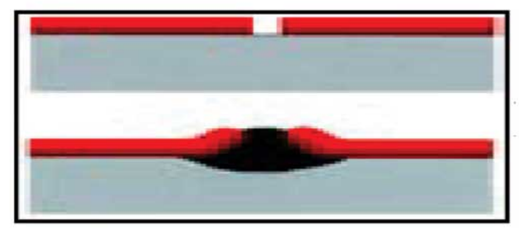
- HDG can and is often fabricated / bent after coating.
- ECR is not practically fabricated after coating as the epoxy will crack / flake.

8. Underfilm Corrosion

- The zinc of HDG rebar is self-healing and impermeable. If HDG rebar is damaged, there is only small, localized corrosion.



- ECR coatings are permeable and once corrosion begins, it spreads throughout the bar underneath the epoxy film.



9. Cathodic Protection

- HDG offers sacrificial protection to the substrate steel. HDG prevents corrosion in chloride ion concentrations 2 to 5 times greater than what causes corrosion of black rebar. HDG also provides barrier protection.
- ECR offers only barrier protection that is compromised by allowing a percentage of pinholes and holidays in the coating.

10. Abrasion Resistance

- HDG rebar coatings (alloy layers) are harder than the substrate steel with a hardness ranging from 179 to 250 DPN (Diamond Pyramid Number).
- ECR must be handled with extreme care to avoid all contact and scraping against other ECR bars in order to avoid coating damage.

11. Installation Conditions

- HDG can be handled in all temperatures.
- ECR coatings may crack when handled in temperatures less than 50 F.

12. Accelerated Performance Tests

- Real-world performance (>30 years) shows HDG passivates after curing of concrete, producing zinc corrosion products that migrate away from the concrete matrix (no cracking / spalling pressure is created) and has a higher threshold for chloride corrosion.
- Estimates of epoxy-coated rebar (ECR) performance is largely based on accelerated salt spray test data. The artificial conditions of salt spray tests accelerate only one parameter and monitor corrosion current, which does not mimic real world conditions.

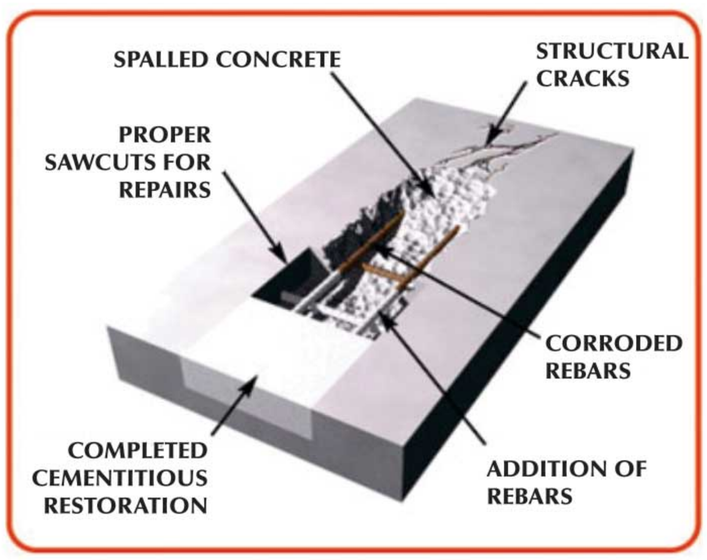
Life Cycle Cost

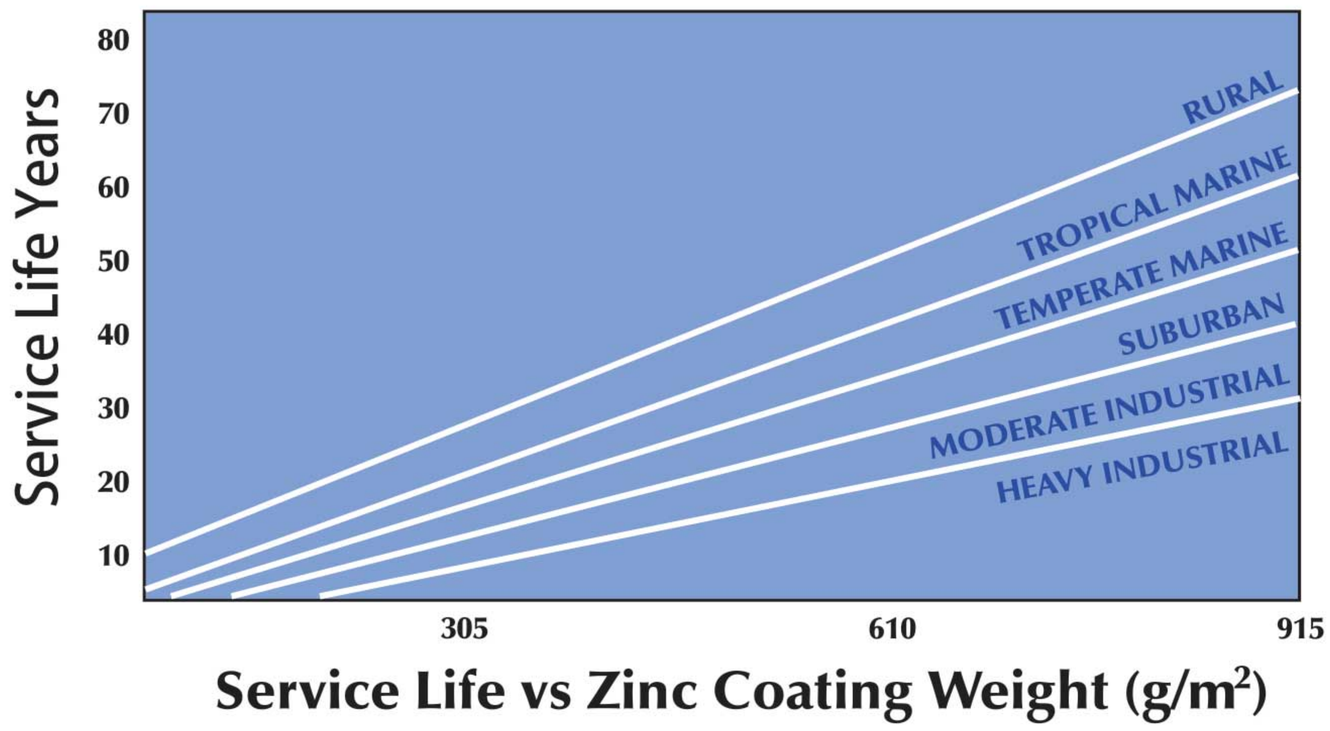
Let's understand the life cycle cost by using three types of coated TMT, in the same environment, at the average cost in Rupees Per Metric Ton of Steel.

	Hot Dip Galvanizing	Epoxy Coating	Painting
Year 00	15000	14000	11000
Year 05	0	0*	11000
Year 10	0	14000	11000
Year 15	0	0*	11000
Year 20	0	14000	11000
Year 25	0	0*	11000
Year 30	0	14000	11000
Year 35	0	0*	11000
Year 40	0	14000	11000
Year 45	0	0*	11000
Year 50	End of Life		
Life Cycle Cost	15000	70000	110000
		About 4.5 Times	About 7 Times

* Only if the coating is not damaged before or while concreting.

For simplicity we have not calculated inflation & other hidden costs like replacing interior appearance, addition of steel etc. The maintenance cost of Fusion Bonded Epoxy Coating & Painting is much more in the long run, while Galvanizing is virtually maintenance free.





Tests Performed on Galvanized Reinforcements

Technical studies on Galvanized Rebars - Torsteel Research Foundation in India. The tests were done to analyze the relative performance of galvanized rebars in comparison with uncoated rebars. The tests conclusively prove that in terms of corrosion protection galvanized rebars have emerged highly superior to uncoated steel. At the same time the bond strength and bending properties remained unaffected.

Tests by IIT Mumbai

The investigations clearly showed that the galvanized and galvanized chromate reinforcement resulted in a several fold increase in the corrosion resistance capability compared to the plain black steel. It was also observed that an improvement in the grade of concrete has improve the corrosion resistance significantly.

Central Electrochemical Research Institute (CERI) in Karaikudi, India. Galvanized and galvanized chromated performed better than black in every set of test and under all conditions.

Galvanized and Chromated performed better in most environments Galvanized specimens seem to perform best in rich (M30) concrete with no chloride contamination while galvanized and chromated performed best in lean (M15) and in contaminated (1% Chloride) concrete.

CINVESTAV Final Report

The study shows that zinc can be used to protect reinforcing bars from corrosion in tropical marine environments by using local materials and also that this application can be monitored using local resources.

Source & for further details : www.galrebars.com
Hindustan Zinc Ltd.

"Give 3% more & Get 300% Extra Life"

We Also Undertake Job Work Of Galvanizing

VEG

Vishal Engineers & Galvanizers Pvt. Ltd.

Correspondence Address
B-14, Nirman Complex, Opp. Havmor Restaurant,
B/h Navrangpura Bus Stand,
City : Ahmedabad - 380 009.
State : Gujarat, Country : India

Phone : +91 - 79 - 2644 7474 / 2642 7722
Fax : +91 - 79 - 2656 0719

Website : www.vegtower.com
E-mail : info@vegtower.com

Factory Address
73, Ashwamegh Industrial Estate,
Sarkhej-Bavla N. H. 8A,
Changodar - 382213,
Tal-Sanand, Dist. Ahmedabad,
State : Gujarat, Country : India

Phone : +91 - 2717 - 250255.
Fax : +91 - 2717 - 250266.