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The Fencing in Creek Area Face Decaying and Rusting Problem combating it by using Catholic Protection Method

Urvi Upadhyay[1], Saeedahemad G. Khokhar[2]
[1, 2]*Lecturer Parul University, Civil Engineering department, Assistant professor Parul University*

Abstract: ***Combating salt present in the atmosphere is biggest challenge in creek area (Ban Ganga, a 96 –km long estuary in the marshlands of Indus river Indus River Delta which segregate India and Pakistan from Sindh province of Pakistan).Fencings are solving division purpose for both the country, at the same time it also float the challenge of salty mudflats which is responsible for rusting and decaying of provided partition object over there. To face this challenge of the effective method of rusting erosion is required. Provided Routine maintenance is one of the traditional solutions for that but the effect of frequently coming desert storm is destructive and challenging to maintain durability of fence on creek area. Use of galvanising process is work here, although not effective in such cases where the fencing is existing. Apart from this one method which may play important role to restrict decaying and rusting of reinforcement is "catholic protection method". This document strongly advocate "catholic protection method" and at the same time this study involving the atmospheric parameter, type of challenges of atmosphere and the effect of provided solution on fencing with long term effect.***
Keywords: Estuary, galvanising, catholic, protection, parameter.

I. INTRODUCTION

In this problem water is not all effective parameter; here combating salt present in the atmosphere is biggest challenge. Regular maintenance is one of the traditional solutions for that but the effect of frequently coming desert storm is destructive and challenging to maintain durability of fence on creek area.I image of disputed land mark is pasted below.

Fig. 1 Map of Sir-creek area to get better idea about problem.[11]

Use of galvanising process is work here, although not effective in such cases where the fencing is existing. Apart from this one method which may play important role to restrict decaying and rusting of reinforcement is "catholic protection method". This marshy land is area of vipers and scorpions, which increase the difficulties of soldiers. June to September is monsoon season over here which comes with creek floods in low laying salty mudflats around it.

Sir-creek is mainly formed by Narerj Lake whose outlet joins the creek on its right bank on the other on the other side Sir Creek lies just to the west of the Great Rann of Kutch area of India. This particular site boundary less at many portion but the land area is having fencing which are facing problem of frequent rusting and erosion. This document elaborating different methods of corrosion resistance. Rust is formation orange-brown flakes of iron oxide that form on the surface of any metal containing iron that is exposed to air and water. It is highly destructive, as well as unsightly.

The rusting process begins when iron reacts with oxygen in the presence of water, saltwater, acids, or other harsh chemicals. As the iron oxide flakes off the metal surface, it exposes fresh iron molecules, which continue the reaction process. Eventually, large areas of rust form that may cause the entire metal structure to disintegrate. Prevent Scratches

Scratches or cracks in the metal expose more metal and hold water, allowing it to remain in contact with the iron. This is why cold rolled steel is more corrosion resistant than hot rolled steel, because cold rolling creates a smoother surface without texture that can trap and hold water,

Apply A Protective Coating:-Dipping metal objects, such as clocks, into a bluing solution of water, sodium hydroxide, and potassium nitrate, provides strong corrosion resistance. Commercially available rust prevention products in the form of aerosol sprays or cloth wipes also can protect metal objects, including tools, outdoor gear, vehicles, and large metal parts.

Use Stainless Steel:-Stainless steel alloys contain iron, but it resists rust because it also contains a high percentage of chromium which is even more reactive than iron. The chromium in the alloy oxidizes quickly to form a protective layer of chromium oxide on the metal surface which prevents oxygen from reaching the underlying steel.

Use Galvanized Metal:-Galvanization is a process used to preserve steel rust-free for many years. In the galvanizing process, a piece of steel is coated with liquid zinc. The zinc protects the steel in three different ways. First, the zinc coating acts as a barrier preventing oxygen and water from reaching the steel. Second, even if the coating is scratched off, the zinc continues to protect nearby areas of the metal through cathodic protection. And third, zinc is highly reactive to oxygen and quickly forms a protective coating of zinc oxide which prevents the iron from further oxidation. Because rust spreads quickly, it's important to scrape it off as soon as it appears. Then, scrub with warm water and soap and apply a metal conditioner or other protective coating to prevent further oxidation. If necessary, apply a new coat of paint to the area.

II. METHODOLOGY OF REMOVAL OF CORROSION

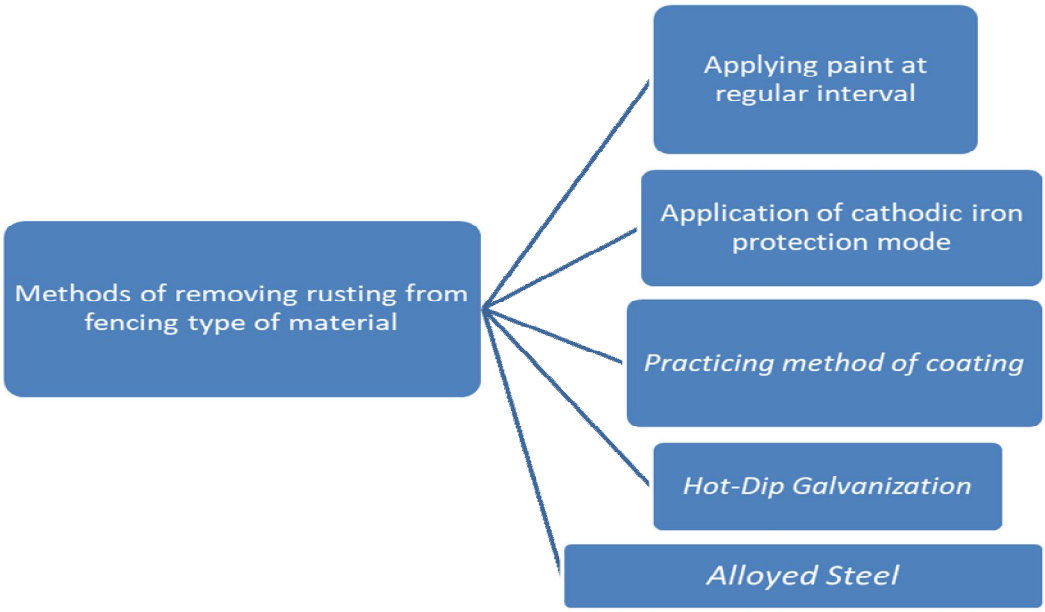
Corrosion is the step by step destruction of materials by chemical or electrochemical reaction with present weathering conditions. We all know that Creek border of India is highly affected by salty windy hurricanes. To resist harshness of atmosphere is big challenge to fencing material. Here, harshness of atmosphere is present over entire year and 24X7. Let us understand how? During winter reduction in temperature, and that is not only the challenge but temperature difference between day and night is creating tough job for those who are dealing with this issue. Metal fencing has its own advantage inform of economy, easy construction, low handling cost and many more. The chemistry of corrosion is deals with "electrochemical", "sulfide", or maybe even "oxide". It is electrochemical reaction and rusting is formation of iron oxides.In easy terminology corrosion process taking place when there is iron, is known as rusting. Pure metal corrode more rapidly compared to mixed alloy metal." Uniform corrosion" means a process takes place uniformly throughout the length of the object. Resistance technique for this type of corrosion is catholic protection which quite effective. Yes, that method is not tested on fencing still it is better than other solution. When corrosion attacks only part of the metal surface then other option of corrosion resistance to be studied. Environmental cracking corrosion, meaning that when environmental conditions are stressful enough, some metal can begin to crack.

A. Effect of Corrosion

Rusting of metal and decaying material is biggest disadvantage which can cause erosion of material. When the question is come about the thin section of metal like fencing then corrosion becomes devil and can be responsible for major damage and life reducting agent for that particular portion.

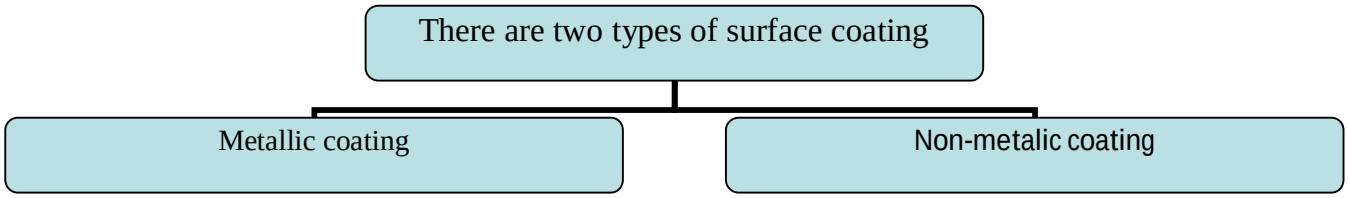
B. Solution

Rust is formation orange-brown flakes of iron oxide that form on the surface of any metal containing iron that is exposed to air and water. It is highly destructive, as well as unsightly. The rusting process begins when iron reacts with oxygen in the presence of water, saltwater, acids, or other harsh chemicals. As the iron oxide flakes off the metal surface, it exposes fresh iron molecules, which continue the reaction process. Eventually, large areas of rust form that may cause the entire metal structure to disintegrate.There are several methods to remove rusting on fencing. As shown below

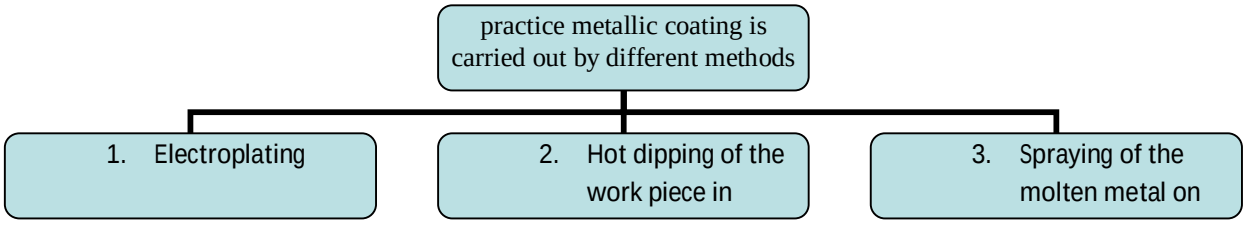


C. Applying Paint At Regular Interval Coating

One of the easiest and popular method for removal of corrosion is painting. Painting is working as extra coating on material or the provided fencing. This extra layer of coat prevents material against rusting and stoping further reaction on metal. The limitation which works with this method that this method is not long lasting. This protective layer needs to apply frequently. This method requires continuous supervision and alert. It evolves to much labour and effective supervision with our property, so there is necessity some another alternative method. The coating method divided further in two category as shown below. Both the method of coat are effective with their respective limitation. There are different material are used in the process of coating, like zink, chromium, aluminium coating etc. This methods are ecofriendly and also give stylish appearance to fencing.in our case the atmosphere of desert gives big challenge . The salination present in soil also causes a big challenge. Barrier coatings like paint, plastic, or powder. powders, including epoxy, nylon, and urethane, are heated to the metal surface to create a thin film.



D. Practicing Method Of Coating



E. Hot-Dip Galvanization

This process is dipping of steel in to hot molten Zink which create s tight bond between steel and Zink. This combination create alloy coating which serves as layer of protection. This is tradition process which is started 250 years ago to prevent sculptures and other equipment from corrosion. This method is much cost efficient and long lasting with good versatility. The limitations is the process of galvanizing is not possible on site, at the same time the equipment which are used for this process are simply too large and that is why no one could force companies to abandon the idea together. For better performance the process to be done as required. The high exposure to environment leading over maintenance and regular check-up. Then Zink which is use in this technique is toxic. The fume which is developed during this process are unhygienic.

F. Alloyed Steel

In this process of corrosion Nickel is used with combination to reduce the effect of environmental oxidation. The merging of different alloy provide resistance against different condition. For better results the atmospheric gases study and analysis are required.This whole flexibility of process and alloy making is economically not viable.Monitoring the surface condition which works with this method are critical. If crack are increase on layer of coating at the same time the the risk of corrosion increase are also increases.

G. Cathodic Procetion

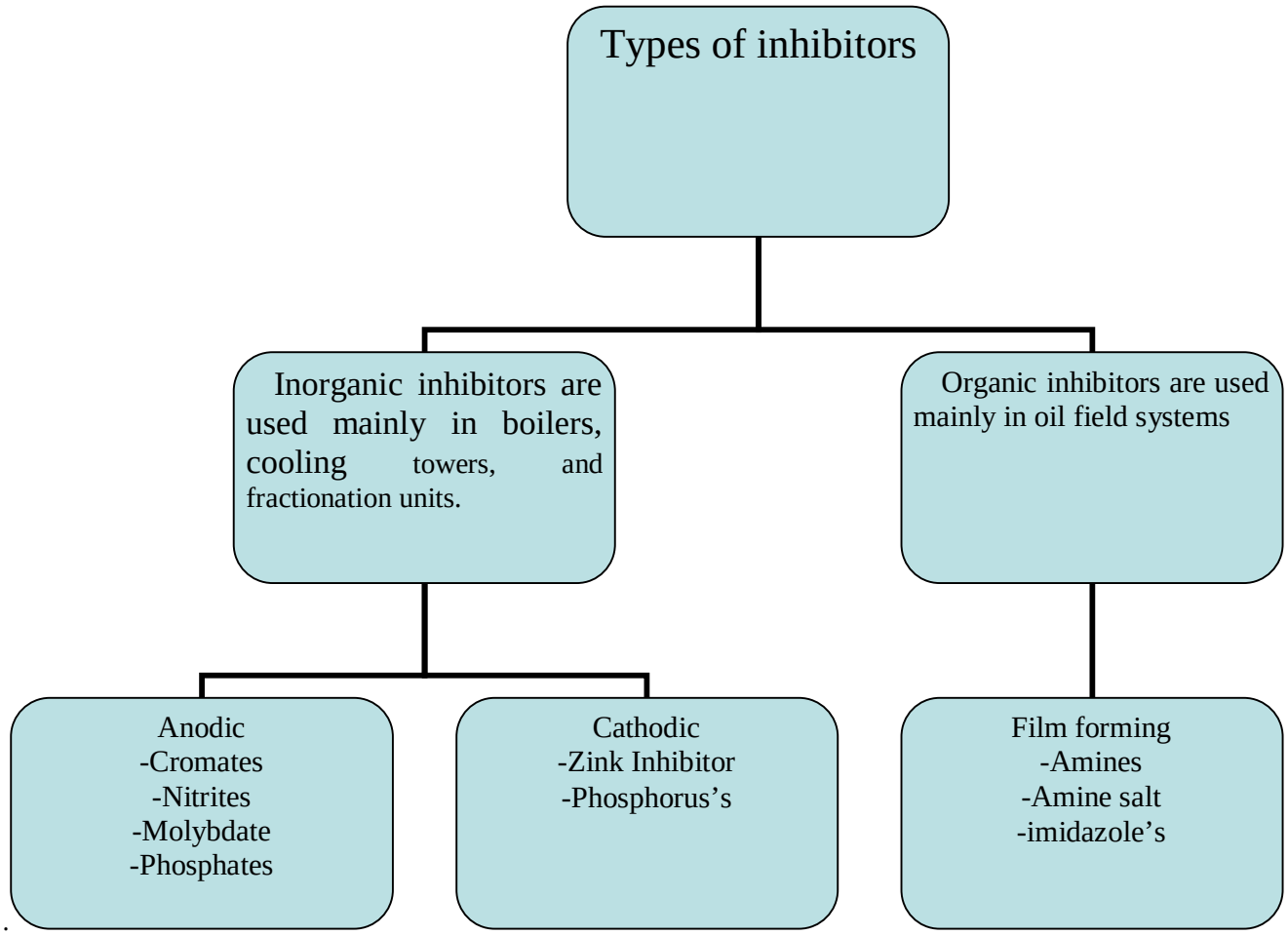
This method protect steel from galvanic corrosion this occurs when more the one metal are coming in to contact and exposed to a corrosive electrolyte. To protect this the active site f the metal is required to convert on passive site by providing extra electron from another metal. The galvanic anodes can attached with metals like aluminium, magnesium or zink. This method is widely used in underwater structure like ship and oil and gas sector. The disadvantage with this method is it increase the weight of existing metal. Still this method is preferred because of its long term effect. The effectiveness of this method is varies with the atmospheric challenge and anodes need to be checked at regular interval.

III. CORROSION INHIBITORS REQUIRED

A. Corrosion Inhibitors Required:

Definition:- A small amount of substance that are added around 0.1% on corrosive medium to abrupt corrosion process of to reduce speed of that corrosion process.

1) The mechanism applied on it are as follows:
2) The inhibitor are absorbed by metal and form a protective layer on surface.
3) Precipitation form visibly coat and protect metal surface.



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B. Catholic Inhibitors

The chemical compounds which inhibit the cathodic reaction of the corrosion cell is called Cathodic inhibitors.

1) Compounds such as
a) ZnSO4
b) MgSO4
c) Ca(HCO3)2
2) These compounds initiate the cathodic reaction by forming insoluble
a) Zn(OH)2 film
b) Mg(OH)2 film
c) CaCO3 film
3) With the cathodically formed ions (in neutral solutions) the insoluble film isolates the cathodic regions of the corrosion cells from the corrosive medium and stops corrosion.
a) These are compounds which react with dissolved oxygen and remove it from the neutral or alkaline corrosive environment such as sodium sulphite or hydrazine
4) Compounds such as
a) arsenic (As)
b) mercury (Hg)
c) antimony (Sb)

Salts which are added to acidic corrosive environments to slowdown the cathodic H2 evolution reaction. These compounds prevent the hydrogen atoms from forming hydrogen gas, and are called¬ cathodic poisons. Cathodic poisons are used advantageously as corrosion inhibitors by stifling the cathodic¬ reduction processes that must balance the anodic corrosion reaction.

C. Anodic Inhibitors

Compounds which inhibits the anodic reaction are called Anodic inhibitors
Anodic inhabitations are like
Na2CO3
Na3PO4

These substance create with the anodic ally formed Fe++ an undissolvable fvckl;e film of iron silicate or iron carbonate or iron phosphate which isolates the anodic sites of the corrosion cells from the corrosive solution.

$$Na_2Cr_2O_7 + 2Fe^{++} + H_2O \xrightarrow{yields} Cr_2O_3 + Fe_2O_3 + 2NaOH$$

$$NaNO_2 + 2Fe^{++} + 2H_2O \xrightarrow{yields} NH_3 + Fe_2O_3 + NaOH$$

:

Passivators: The agents which are oxidizing with chromate inhibitors (Na2Cr2O7) or nitrite inhibitors (NaNO2) which react with the anodically formed Fe++ to form a passive oxide film on the anodic sites of the corrosion cells. Chromate inhibitors are the most effective of the anodic inhibitors. These ingradients were using from years. in cooling towers and other recirculating cooling water systems; moreever, they are toxic to most organisms. Chromate inhibitors contain sodium chromate, Na2CrO4, or sodium dichromate, Na2Cr2O7. Chromate, or dichromate, ions accept electrons that are lost in ferrous iron oxidation reactions. This reduction reaction forms chromium (III) oxide (The chromium oxide combines with iron oxide to form a mixed oxide. This combination of iron oxide and chromium oxide makes chromium inhibitors effective. Normally, iron oxide deposits are loosely attached to metal surfaces. However, the combination of iron oxide and chromium oxide forms a deposit that tightly attaches to the metal surface.[1]

D. Organic Inhibitors

These are organic compounds which contain a polar group such as NH_2 (amino group), these compounds (RNH2) adsorb on the metallic surface and isolate it from the corrosive solution (usually acids).

Their effectiveness depends upon the following conditions:

1) On the electrical potential of the metal
2) On he chemical structure of the inhibitor molecule
3) On the size and shape of the inhibitor molecule

An organic corrosion inhibitor molecule contains hydrocarbon chain which is attached to a strongly to polar functional group. This hydrocarbon chain of the inhibitor molecule are soluble in oil. This continuation create a barrier that keeps impurities away for the metal surface.

IV. APPLICATION OF CORROSION PROTECTION METHOD

A. *Type of Material Used in Manufacturing of Fencing*

Fig. 2 Image of fencing at indo-pak border[11]

B. *Fundamental of Catholic protection*

The Catholic Protection system is working on determining the anode in a large corrosion cell for making the intended material as cathode overcoming smaller corrosion cells. Two methods are there for this and that are following.

1) Using Galvanic Series (sacrificial catholic protection)

2) Impressed current catholic protection (DC means a direct current is applied to opt this method of catholic protection)

C. *Working of Catholic protection*

Force of Direct Current is flow from an external source to the Structure. When the flow of this current is so adjusted to overpower corrosion current discharging from all anodic areas thereby providing complete Protection.

D. *Type of Catholic protection*

Catholic Protection with Galvanic Anodes: Magnesium Anodes, Zinc Anodes, Aluminium Anodes, Catholic Protection with Impressed current Anodes: High silicon chromium cast iron Anodes:-Mixed Metal Oxide Anodes,Graphite Anodes

This system sacrifie

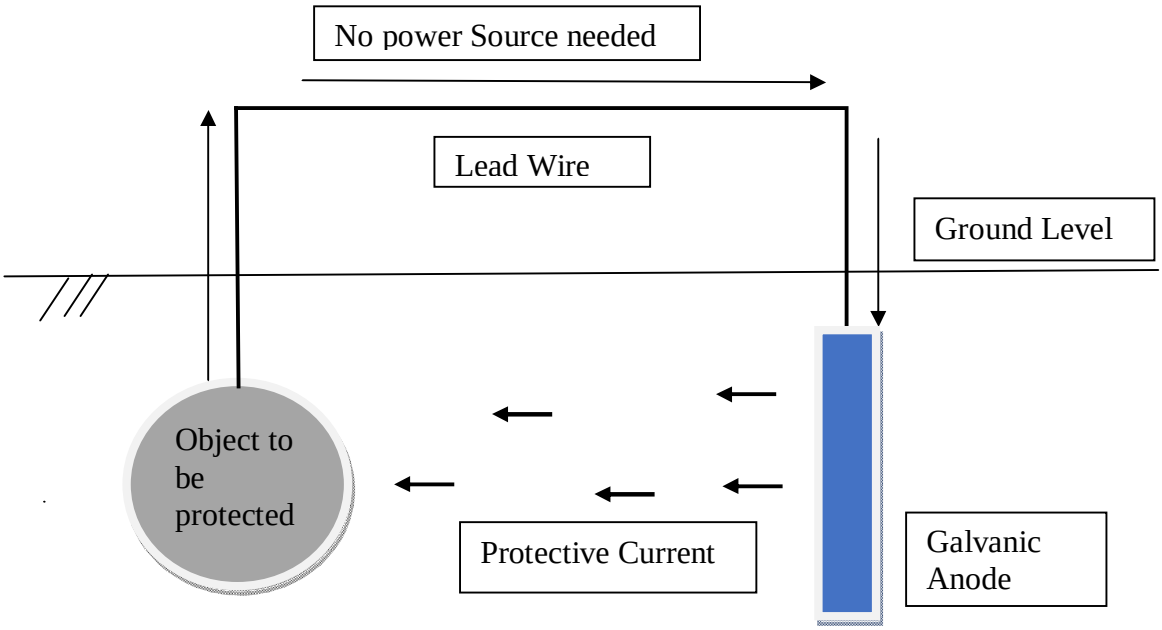

Fig. 3 Galvaninc Anode[10]

1) Advantages of Galvanic Anode System[3]

a) Easy Simple in Installation
b) There is no need of No External Power Source
c) Lesser maintenance No Maintenance
d) Less power mills No Power Bills
e) Easy to Design
f) No expensive accessories like cables etc
g) Economical for small structures

2) Limitation of Galvanic System
a) Low Driving Voltage
b) Poor performance due to passivation
c) Limited Current
d) Low life

Limitation of this method is advantageous for border fencing requirement.

V. IMPRESSED CURRENT CATHODIC PROTECTION METHOD

This method is known as ICCP method which is also known as sacrificial anode method. Impresed current cathodic protection is connected with external power source. In our working area we can use solar energy as direct source of energy because here we require DC power supply for particular arrangement. This provided DC current is is necessary to drive the electrochemical reaction required for chemical procreation. We can run whole system to AC power also with help of transformer-rectifier.This method is used for pipeline and tank but yes a new area is also possible and that is fencing provided on border area where salty air is big problem. This method protect ship from salty water. Same way it also can help regular material like fencing pole, cable etc. Proposed arrangement can be made as shown figure 3.

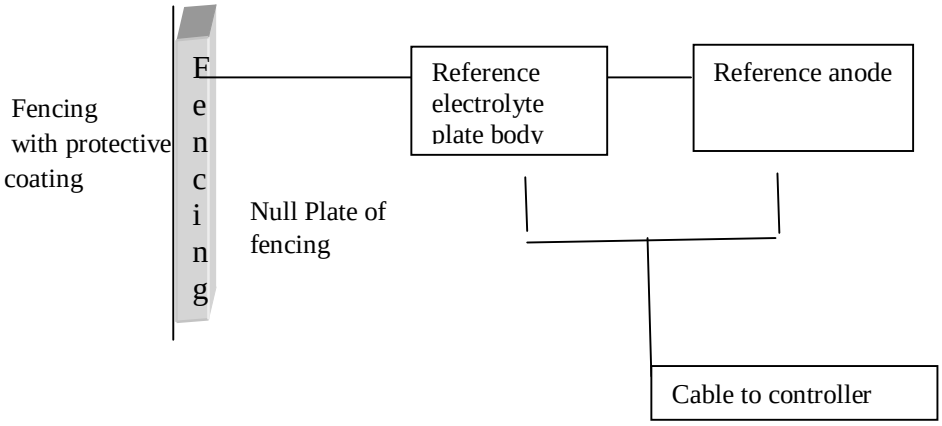

Fig. 4 Impressed current cathodic protection to Fencing

VI. CONCLUSIONS

The cathodic protection with impressed current method is not previously used for stopping rusting in fencing. The fact of high cost is not hidden but this method can prevent our structure till 5 to 6 years approximately. Adopting this method for creek area can solve the problem of corrosion for long time. This document gives idea about another alternative for corrosion protection in creek area. The issue of rusting due to salty wind and water can solve by this method or the option we can opt for experimental purpose. The connection shown here are planned as per the guideline given by the Authority. This connection is planed theoretically no practical was performed on base of it. The base of this technique is taken from ship. The ship is floating into the salty water where the fencing in creek area facing heavy salty wind. As per study of theory this method can defiantly work on practical field. Many work is pending before working in this tdirection but this idea can give someone to go further in this direction.

VII. ACKNOWLEDGMENT

I-HUB Gujarat and Indian defence problem statement is idea behind this An event Mind to market is organized by i-HUB Gujarat and this challenge is part of it. I would like to thanks all of who are working behind this. My students who supported me in working in this direction. My staff mats for their input in progressive direction.This paper is incomplete without , The cathodic protection with impressed current method is not previously used for stopping rusting in fencing. The fact of high cost is not hidden but this method can prevent our structure till 5 to 6 years approximately. Adopting this method for creek area can solve the problem of corrosion for long time. This document gives idea about another alternative for corrosion protection in creek area. The issue of rusting due to salty wind and water can solve by this method or the option we can opt for experimental purpose. The connection shown here are planned as per the guideline given by the Authority. This connection is planed theoretically no practical was performed on base of it. The base of this technique is taken from ship. The ship is floating into the salty water where the fencing in creek area facing heavy salty wind. As per study of theory this method can defiantly work on practical field. Many work is pending before working in this direction but this idea can give someone to go further in this direction.

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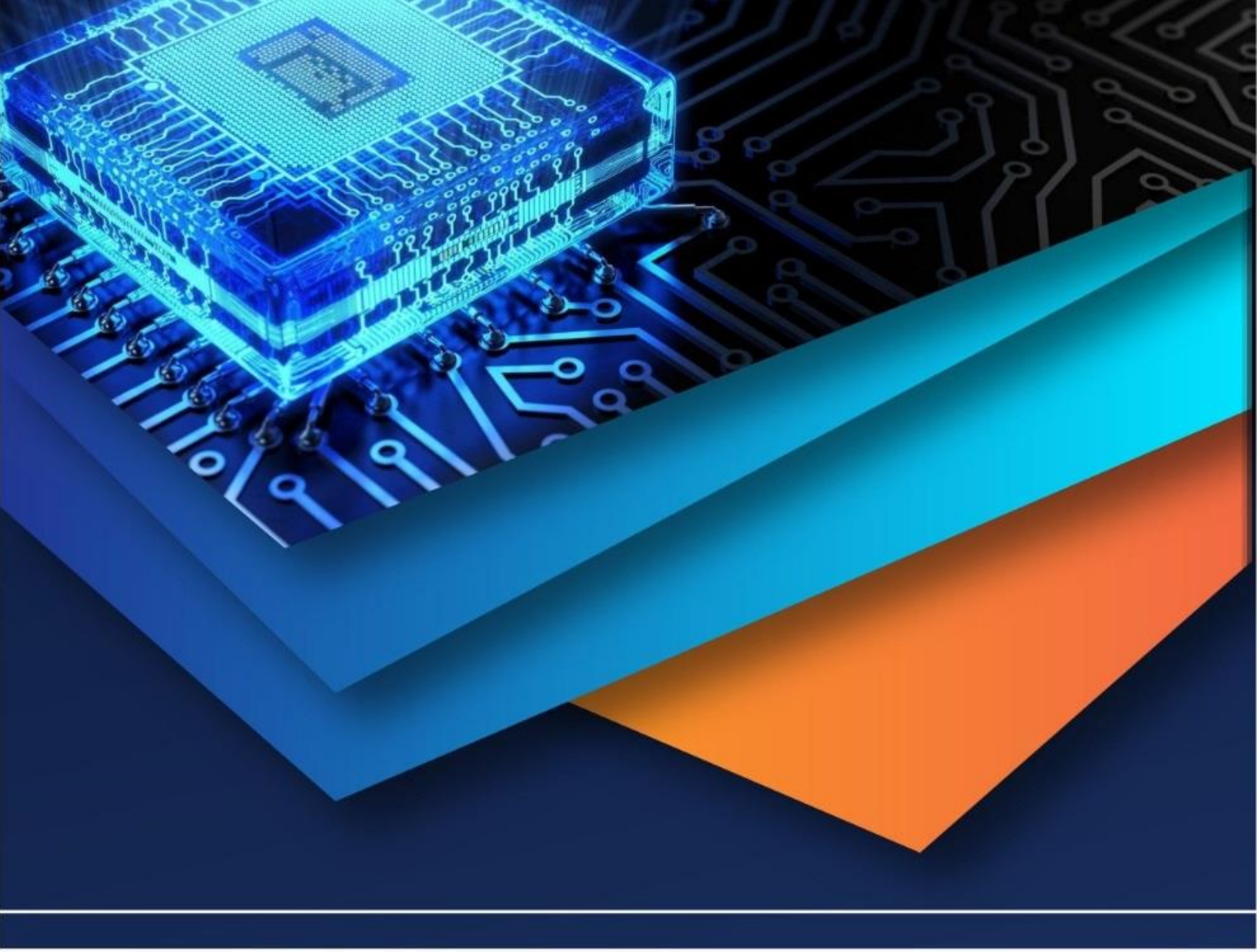

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