Under the patronage of **H.E. Dr. Abdullah Belhaif Al Nuaimi -** Minister of Infrastructure Development

CONFERENCE
OMAINTEC
2019
EXHIBITION

17th Edition

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Under the Theme:
Enhancing Maintenance Through Big Data Management

Tower Leg Foundation Corrosion Causes and Solutions

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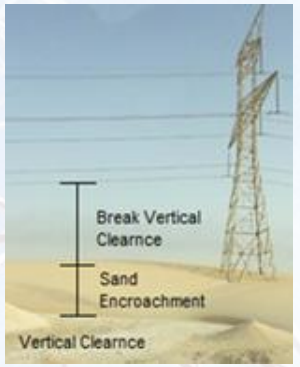
INTRODUCTIO N

(GCC) countries' climate conditions cause sand movements through the whole year and create sand dunes in these lines middle span and structure pad. Sand accumulation on towers legs will corrode stup angle. Hence, this will affect the network reliability and decrease the foundations service time.



CHALLENGES OF SAND ACCUMULATION

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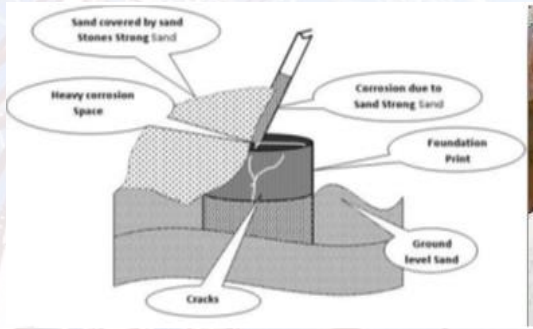
CHALLENGES

One of routine operation and maintenance duties for GCC countries is implementing sand removal activities throughout the year for accumulated sand on access road and structure pad and this kind of work repetitive and very costly. On other hand repair and rehabilitation rusty stup angles that effects by sand accumulation on towers foundations however corrosion will not stop and loses thickness of affected tower members



CHEMICAL REACTION FOR STEEL LEG WITH SAND

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REACTION

Soil corrosion as deterioration of metal brought about by chemical, mechanical and biological action by the soil environment. The metallic reaction releases electrons whereas the oxygen/chemical water part of the reaction takes in electrons [2] as shown below in chemical formula:

Metallic (anodic reaction)
$2Fe \rightarrow 2Fe2+ + 4e$

Oxygen/water (cathodes reaction)
$2H2O + O2 + 4e \rightarrow 4OH+$

Combined
$2Fe + O2 + 2H2O \rightarrow 2Fe(OH)2$

CHEMICAL REACTION FOR STEEL LEG WITH SAND

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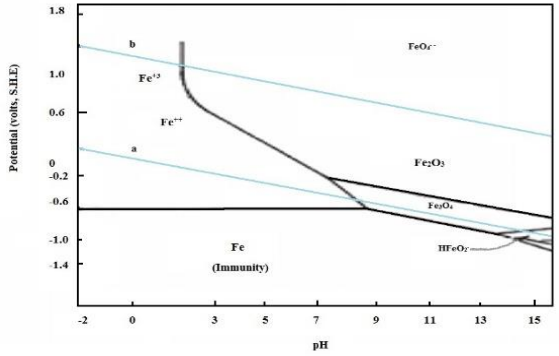
REACTION

Soil resistivity has opposite proportional with moister and chemical species. The soil with high moister consider as conductor between the iron and oxygen. The electrons will transfer from anode (iron) to cathode (oxygen). Moisture represents the significant electrolyte required for electrochemical corrosion reaction. Soil with highest moisture content has high value of corrosion rate than the soil with low moisture content. Iron in neutral water (pH 7) develops a potential of -0.5 V, which is inside the corrosion region (Fe+2)



GEOTECHNICAL INVESTIGATION

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INVESTIGATION

Geotechnical investigation of new project alignment area during the early stages of a project present insight into the soil types likely to be encountered and their respective Engineering characteristics. The recommendation of soil investigation will determine appropriate type of foundation and the proposal of improvement the subsurface. In below table an example of soil investigation that shows some soil properties for one specimen of soil were taken from eastern province in Saudi Arabia. High salt concentration such as chloride and sulphate increase corrosion rate. The PH must be control to control corrosion

Item	Properties	Soil Sample
1	SO_4 (%)	0.0180
2	pH	7.9
3	CL- (%)	0.4785

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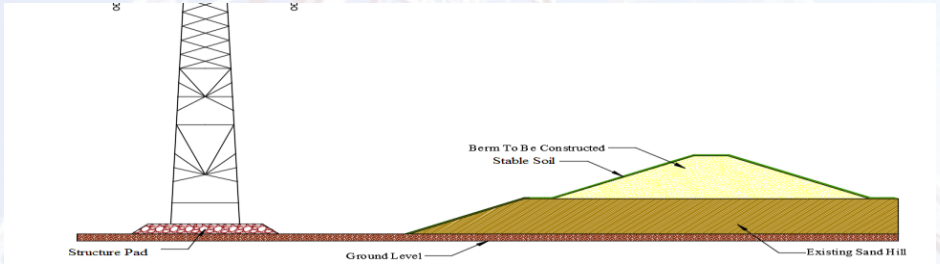
COUNTERMEASURES

A SAND CONTROL

Method of soil stabilization such as polymer treatment shall be used per geotechnical consultants' recommendations. Spray area shall not be less than 20 m or as manufacture recommendations radial distance from the edge of structure pad. Design a berm depending on weather conditions, soil type and distance from structure pad. The berm must be perpendicular with wind blowing direction on the side of structure pad. Stabilize the berm using base course or polymer technology to tower of transmission line from migrating sand and the safety hazards they cause



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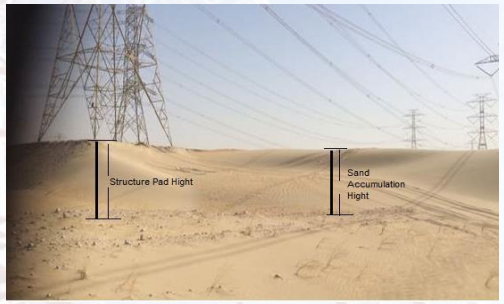
B Structure Pad Height

The structure pad level must be upper than sand within radius from the edge of structure pad. The minimum height of structure pad must be 1.5m on Sabkah area or sand encroachment area in order to protect the wearing surface from detrimental effects of capillary movement of the ground water and erosion [4]. Protect structure pad with rip rap in areas flooded with water



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C Structure Pad Slop Protection

Provide smooth riding surface to avoid accumulate sand on structure pad with specific vertical and horizontal slopes. The maximum side slope shall be 4 horizontal to 1 vertical. Structure pads shall be graded to drain water away from structure foundations with slope of 1.5 to 2 percent.

CONCLUSION

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A. The possibility of sand accumulation on stup angle for transmission lines towers can be significantly reduced by proper design of structure pad and sand control during the design phase.

B. Earth and civil works for structure pad must be endorsed and govern by geotechnical consultants.

C. Careful planning, execution, and revision of the geotechnical and civil work will improve the overall probability of the program's success.

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“THANK YOU„