



**LE Erosion case study – G.V Palli\_Andhra Pradesh**  
**Blade Model : GE 50.2mtr**

**Summary :**

The aim of this report is to provide information of blades LE erosions at G.V Palli site Andhra Pradesh.

**Windfarm Information :**

- Location : G.V. Palli
- OEM : GE
- Capacity :1.7mw
- Blade type: GE50.2mtr.

It is observed that there are action to be taken care off. Major findings are found and minor damages etc.

**Leading edge erosion on Blades :**

What does it mean?

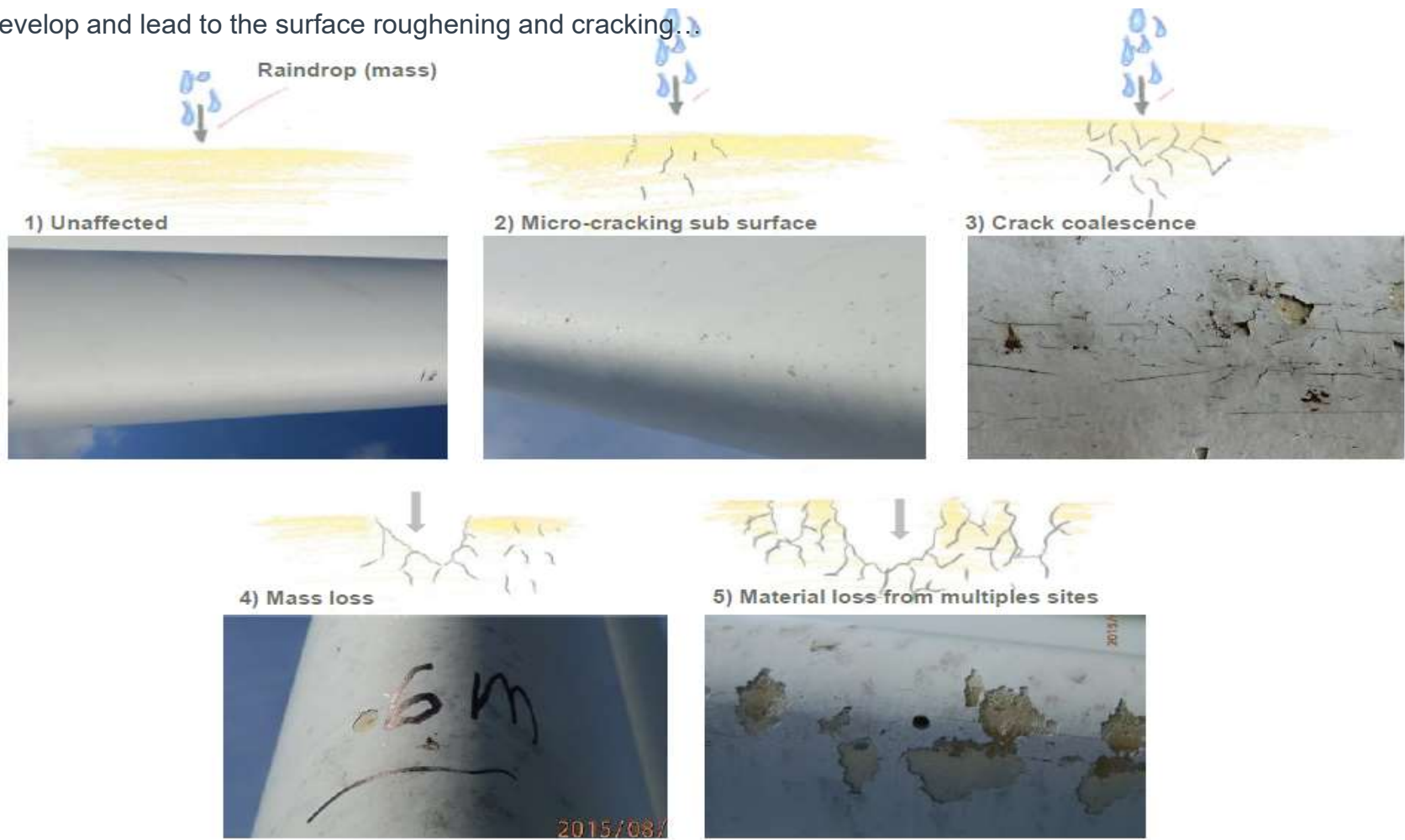
**Degradation of the blade leading edge due to continual impacts from airborne particulates during turbine operation.**



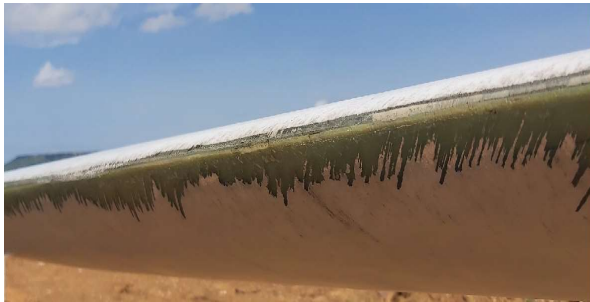
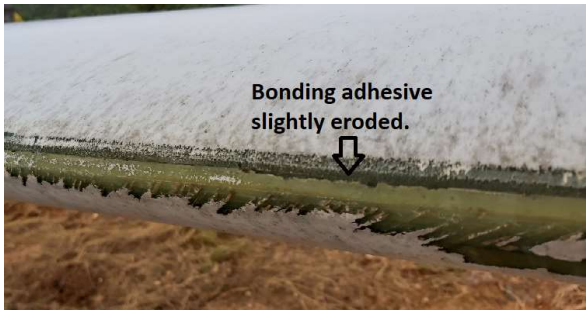


# How does it occur?

- Rain droplets/dust/bugs hit the surface in the blade coating...
- Stress waves are spread in the material and after several hits, microcracks form...
- Microcracks develop and lead to the surface roughening and cracking...



Atria G.V.Palli blades Leading Edge erosion observations:



## Factor affecting Degradation

- Age of blade/Turbine
- Blade size ----Tip speed
- Blade design
- Materials
- Thickness of leading-edge protection applied
- Capacity factor
- Operating condition / environment.
  - Coastal side
  - High rainfall
  - Impact velocity
  - Cold climate
  - Farmland/ Desert

Category	Example	Definition	Consequence
1		Microcracking of surface layers	Weakening of surface layers
2		Isolated loss of surface layers	Minor reduction in AEP and increase in noise
3		Coalescence in loss of surface layer.	Increased reduction in AEP and increase in noise.
4		Complete loss of surface layer and laminate exposed	As above + degradation of blade materials.
5		Structural laminate / bond line damage	As above + reduction in structural integrity.



## Impact on Performance

An unrepaired damage on leading edge can generate

- Visual differences
- AEP loss
- Additional noise
- UV degradation of materials performance
- Structural damage

**AEP loss (surface)**



**Paint**



**Steps in LEP**



**Dirt/bugs**



**Mild erosion**



**Moderate erosion**



**Severe erosion**

## Types of Leading-Edge Protection

Solution	What is it?	Advantages	Disadvantages
LEP- Paint	<ul style="list-style-type: none"> <li>• 1 or 3 component liquid paint</li> <li>• May be applied in multiple layers</li> </ul>	<ul style="list-style-type: none"> <li>• Material cost</li> <li>• Ease of installation</li> <li>• Repairability/refurbishment</li> </ul>	<ul style="list-style-type: none"> <li>• Typically, lower erosion resistance</li> <li>• Operator dependent quality</li> </ul>
LEP-Tape	<ul style="list-style-type: none"> <li>• Self adhesive tape</li> <li>• Standard width roll</li> </ul>	<ul style="list-style-type: none"> <li>• Good erosion resistance</li> <li>• Ease of installation</li> </ul>	<ul style="list-style-type: none"> <li>• Operator dependent quality</li> <li>• Potential tip issues</li> <li>• Potential noise issues if damaged</li> </ul>
LEP-Shield	<ul style="list-style-type: none"> <li>• Pre-cast shield bonded to blade leading edge</li> <li>• Single or multiple sheet construction</li> </ul>	<ul style="list-style-type: none"> <li>• Excellent erosion resistance</li> <li>• Less dependent on surface quality /operator skill</li> </ul>	<ul style="list-style-type: none"> <li>• Material cost</li> <li>• Installation process cost</li> <li>• Repairability</li> </ul>

**We recommend for LEP paint – Mankiewicz make LEP9 or LEP 10.**

# Blade Management Program - Planning , Execution and Resources :

Due to Faster inspections cycles by Drones, we can follow PDCA Technique in Services as well.

- Season Based Planning for Inspections and helps your repairs program
- Execution Of Plans
- It helps your resource deployments based on priority

