Rethinking protection strategies for boat landings

Repeated crew transfer vessel impacts are exposing a recurring weakness in offshore wind asset protection. By reconsidering how boat landings are protected from wear-corrosion, operators may be able to extend coating life and reduce offshore intervention.

As offshore wind projects mature and move into longer-term operation, increasing attention is being directed towards the integrity of secondary steel structures. While the condition of primary structural components such as monopiles, transition pieces and towers is extensively monitored, secondary structures often receive comparatively less scrutiny despite their critical operational function.

Among these, boat landings represent one of the most heavily utilised and mechanically challenged interfaces on an offshore wind turbine.

Designed to facilitate safe personnel transfer between crew transfer vessels (CTVs) and turbine access systems, boat landings are exposed to repeated berthing loads throughout the life of the asset. Although these interactions are anticipated during design, their cumulative effect on protective coatings and corrosion performance is increasingly becoming apparent across ageing offshore fleets.

The degradation observed is not simply a corrosion problem; it is a wear-corrosion problem. Understanding this distinction is important when selecting appropriate mitigation strategies.

Secondary structures in the offshore environment

Secondary steelwork encompasses a range of components including boat landings, ladders, access platforms, handrails and external support brackets. Unlike primary structures, these elements are often characterised by relatively complex geometries and frequent human interaction.

Boat landings are particularly demanding environments because they are simultaneously exposed to cyclic mechanical loading, direct vessel contact, splash zone immersion, wetting and drying cycles, salt deposition, ultraviolet exposure, variable tidal conditions and elevated oxygen availability.

The combination of these factors creates one of the most aggressive corrosion environments encountered on an offshore wind turbine.

While offshore coating systems are designed to withstand prolonged marine exposure, their performance assumptions typically rely on maintaining the integrity of the protective barrier. The repeated removal or disruption of that barrier fundamentally changes the corrosion mechanism.

The influence of CTV operations

Crew transfer vessels are essential to offshore wind operations. Routine inspections, scheduled servicing and corrective maintenance all depend on safe and efficient personnel transfer.

An offshore turbine may experience repeated vessel approaches throughout its operational life. In large wind farms, particularly those entering mid-life phases where maintenance interventions become more frequent, the frequency of these approaches can increase.

During berthing, the vessel applies thrust to maintain contact with the boat landing while technicians transfer onto the structure. Energy is transmitted through the vessel fendering system into designated contact areas of the secondary steelwork.

Although each event may appear relatively minor, the cumulative effect is significant.

Repeated contact can lead to localised abrasion of coating systems, mechanical damage to protective layers, progressive thinning of paint films, surface gouging and deformation, exposure of bare steel substrates and increased susceptibility to corrosion initiation.

This process is analogous to tribological wear mechanisms observed in industrial machinery, where protective surfaces degrade under repeated frictional loading. In offshore wind applications, however, these mechanisms occur within a highly corrosive marine environment.

The result is an interaction between wear and corrosion that accelerates deterioration beyond what either process would achieve independently.

Wear-corrosion: more than a coating failure

Conventional corrosion models often assume relatively intact coating systems with occasional defects arising from impact or manufacturing imperfections. Boat landings challenge these assumptions.

Once mechanical abrasion removes a coating locally, freshly exposed steel is subjected to oxygen-rich seawater within the splash zone. Corrosion products begin to form rapidly. Subsequent vessel contact can then remove these corrosion layers, exposing new steel and perpetuating the cycle.

This phenomenon, commonly referred to as wear-corrosion or tribo-corrosion, has been widely studied in other marine sectors but has received comparatively limited attention within offshore wind.

Several characteristics make tribo-corrosion particularly problematic on boat landings, including:

Accelerated material loss: mechanical wear continually renews exposed surfaces, preventing stable protective layers from developing.

Localised attack: damage tends to occur in concentrated impact zones, resulting in highly localised deterioration that can be underestimated during general visual inspections.

Increased maintenance frequency: repeated coating repair campaigns may be required to restore damaged areas, often under difficult offshore conditions.

Reduced predictability: traditional coating life models may not accurately reflect degradation rates where mechanical interaction dominates.

As offshore wind assets age, understanding tribo-corrosion behaviour is becoming increasingly important for accurate lifecycle planning.

Challenges associated with offshore repair

Repairing coating damage offshore presents both technical and logistical difficulties.

Effective coating restoration requires appropriate surface preparation, environmental controls and application procedures. Achieving these conditions in the splash zone of an operating offshore turbine is inherently challenging.

Operational constraints include restricted weather windows, access limitations, vessel availability, specialist personnel requirements, safety considerations associated with working over water and potential disruption to planned maintenance schedules.

Consequently, even relatively minor areas of coating damage can generate disproportionately high repair costs.

From an asset integrity perspective, reducing the occurrence of damage may therefore offer greater value than improving repair efficiency alone.

Preventative protection through sacrificial interfaces

One emerging approach involves the introduction of sacrificial protective interfaces designed to absorb mechanical wear before it reaches the underlying coating system.

Rather than expecting coatings to fulfil both corrosion protection and impact resistance functions, these systems separate the two requirements.

In practice, protective interface materials are installed over designated contact areas of the boat landing. During vessel berthing, mechanical loads are transferred into the sacrificial element instead of directly abrading the painted steel beneath.

The underlying corrosion protection system remains intact, while the wear component is managed independently.

This philosophy reflects practices already adopted in sectors such as port infrastructure and marine transportation, where sacrificial wear components are routinely employed to preserve critical structural elements.

Within offshore wind, the approach has the potential to extend coating life, reduce intervention frequency and improve predictability of maintenance requirements.

Integration into new-build and existing assets

An important consideration is the adaptability of such systems.

For new-build turbines, protective interfaces can be incorporated following completion of the coating process during fabrication. Early integration allows vulnerable contact zones to be protected from the commencement of operations.

However, the concept is equally relevant to operating wind farms.

Inspection campaigns have identified coating degradation on boat landings across numerous existing assets, particularly within high-contact areas. Retrofittable protective systems offer the opportunity to address ongoing wear without requiring replacement of the underlying steelwork.

As operators increasingly explore life-extension strategies beyond original design assumptions, retrofit solutions capable of reducing future degradation may become increasingly attractive.

Material selection and sustainability considerations

Alongside technical performance, the offshore wind industry is placing growing emphasis on material sustainability.

The principles of extending asset life, reducing replacement frequency and minimising waste align closely with broader environmental objectives. Consequently, the materials selected for protective systems warrant careful consideration.

Recent developments indicate that sacrificial protection components can be manufactured using recycled and renewable feedstocks while still meeting functional requirements.

Buoyant Works says protective interface materials are available using 100% recycled feedstock, with approximately 50% bio-based content.

The use of such materials may offer several potential advantages.

Extending the service life of existing secondary structures can reduce demand for replacement steel and the associated manufacturing emissions.

Reducing the frequency of offshore repair campaigns may also decrease the logistical burden associated with maintenance activities.

The incorporation of recycled and bio-based constituents can also support the circular economy objectives increasingly reflected in offshore developers' environmental and procurement strategies.

Material sustainability should not supersede technical suitability, but there is an opportunity to improve durability while reducing the environmental impact of the protection system.

Implications for future offshore wind design

The offshore wind industry has evolved rapidly over the past two decades. As projects transition into extended operational phases, the focus is shifting from installation efficiency towards whole-life performance optimisation.

Boat landings exemplify this transition.

Historically viewed as relatively straightforward access structures, they are now recognised as components subjected to complex interactions involving mechanics, corrosion science and operational behaviour.

Addressing tribo-corrosion in these areas may require a change in design philosophy: moving away from relying exclusively on coating systems and towards layered protection strategies that acknowledge the realities of repeated vessel contact.

The implementation of sacrificial wear interfaces is one example of this approach.

By recognising that coatings and mechanical protection fulfil different functions, designers and operators can improve durability, reduce maintenance burdens and enhance confidence in long-term asset performance.

Protecting whole-life performance

The accelerated deterioration of boat landings highlights an emerging challenge within offshore wind asset integrity management. Repeated CTV berthing introduces wear mechanisms that compromise protective coatings and initiate localised corrosion processes not adequately captured by conventional corrosion models.

Understanding these mechanisms as a form of tribo-corrosion rather than simple coating failure provides a more accurate framework for mitigation.

Preventative strategies based on sacrificial protective interfaces offer a technically credible means of interrupting the wear-corrosion cycle. Whether incorporated during fabrication or retrofitted onto existing assets, these systems have the potential to preserve coating integrity and extend the useful life of secondary structures.

As the offshore wind sector seeks to maximise reliability, optimise operational expenditure and strengthen its sustainability credentials, greater attention to the protection of secondary structures will be essential.

Boat landings may represent a relatively small part of an offshore turbine, but protecting them effectively can reduce repeated repair work and contribute to more predictable long-term operation.

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