

NAFLIC

National Association For Leisure Industry Certification

Standards & Related Documents Subcommittee

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074. "1001 Nights" Fatigue Damage

LTC Ltd and Wilson Consultants have provided us with details of an occurrence of severe fatigue cracking in the main arm of a 1001 Nights (single arm Magic Carpet type) ride manufactured by Weber in 1984. Although Weber are no longer trading we believe that Huss now have control of the design copyrights and may have built similar rides.

The rotating arm is a welded steel box section and the 40 seat gondola is carried by a slewing ring mounted in a housing fabricated into the end of the rotating arm. The main crack, which was found by LTC, initiated from the region of the welded connection between the slewing ring housing and the box section front plate (8 mm) and had propagated for about 500 mm in total. It is now thought that the arm was within weeks or hours of a failure which **could have led to multiple fatalities**.

In the fully assembled state the cracked region is hidden by guards and decorative cladding. It is therefore essential that periodic access to the area (for visual inspection and NDT) is achieved and LTC have insisted upon this. We feel that one of the lessons from this occurrence is the importance of ensuring that ride controllers permit strip down access to significant, inaccessible regions. The co-operation of the controller in the case of this incident was of importance in ensuring that the crack was detected.

There were also other lessons to be learnt from the findings of the investigation. Firstly, one of the secondary cracks that was close to joining up with the primary crack had initiated from a drilled hole which was not an authorised part of the design. The role of, even slight, changes to design in causing problems is regularly seen by NAFLIC members. Secondly, design calculations for rides of this general type (i.e. rotating in a vertical plane) frequently underestimate the range of the forces affecting fatigue. This stems from fundamental faults in ride dynamic analysis. Thirdly, the lack or inadequate assessment and calculation of fatigue life is a common failing. It was considered that, in this case, some combination of these last two factors meant that the original calculations had significantly overestimated the timescale for the cracking to develop.

The HSE suggest that persons operating similar rides should contact their ride examiners. Housings for both shaft and slewing ring types may experience problems of this type.

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