NAFLIC

National Association For Leisure Industry Certification

Standards & Related Documents Committee

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249. Far Fabbri Booster Fatigue Lives

It has come to the attention of an ADIPS-registered inspection body during the design review of a Far Fabbri Booster ride that the German standards DIN 4132 and DIN 15018 have been used for the fatigue assessment of the design. This approach bases structural design on a limit of 2,000,000 loading cycles. Modern standards for fatigue of structural steels in general show that design needs to be based on appreciably lower stress range magnitudes for "infinite" life to be achieved.

While for many components 2,000,000 loading cycles can represent a reasonably long life, there may be many others for which it is quite short. So, for instance, in structural details for which the dominant stress range is repeated once per revolution of the ride, a rotational speed of 12 rpm represents perhaps 6000 operating hours.

There are other ride manufacturers who choose to design on the basis of these DIN standards and, bearing in mind that rotational speeds can be considerably higher than 12 rpm and some stress ranges can be repeated more than once per revolution, some components can effectively be limited to very short lives. It is important, therefore, to have an idea of the safe (i.e. pessimistic) fatigue life of different structural details so that in-service monitoring and maintenance may be adequately carried out. If a design life is limited and it has implications for safety, the designer has a duty under the law to provide adequate information (e.g. covering locations, inspection methods, NDT, or other means) about how the ride can be operated safely.

In order to achieve the design life limit in the case of some of the Booster components, the quality of the welding has been specified to be "special quality" as defined in DIN 15018, tables 31 and 24. "Special quality" will generally involve ensuring that the welds are smooth, even and free from any discontinuities and in most cases implies that this would be achieved by dressing i.e. either by being machined or by grinding. The categories for many of these joints would also require 100% NDT after welding. If the welding is not to this standard then the operating life would be reduced. If the welding was not dressed and of poor quality then the life would be further reduced. It is therefore important for these special welds that appropriate weld quality confirmation has been carried out. There are areas having limited fatigue life in

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the main rotating arms, the "C" frames and the gondola supports. The stress range in most if not all of the members in the lattice girder type arms is such that all parts of the arms may be susceptible to defects.

It is important that controllers operating this type of device should visually monitor the integrity of the welded connections, and this should be complemented by some NDT. Controllers and appointed inspection bodies may need to maintain a running estimate of the number of operating hours the ride has been subject to. Appointed inspection bodies obviously also need to take account of information about any structural details which design calculations (and Design Review) have shown to have fatigue limitations, and the extent of the predicted life.