

## Utilisation critical in tower crane selection

The Construction Plant hire Association (CPA) has warned companies to be more considerate of the actual work to be carried out when selecting a tower crane. The association's Kevin Minton said: "Tower cranes are not a 'one size fits all' solution, principal contractors and tower crane suppliers need to ensure that the cranes specified are suitable for the actual use to which they are put. Accelerated wear - and risk of collapse - can occur as a result of trying to use a crane for more intensive work than it was designed for."

The design of any crane is based on its intended usage. A crane which

regularly lifts loads, which are close to its maximum capacity, will need to have a more durable structure than one that mostly lifts loads that are well within its capacity. This relationship of average loads to maximum loads is the Load Spectrum Factor. The other factor affecting design life is the number of hoisting cycles anticipated over the life of the crane. A harbour crane carrying out high cycle work loading and unloading ships will complete many more cycles than a typical tower or mobile crane, and will consequently be designed with a higher Load Spectrum Factor and greater number of anticipated hoisting cycles.

## A combination of corrosive environment and intensive use can be lethal

Metal fatigue is a complex subject and needs to take into account a number of other factors, such as the environment.

However, when the design life (combination of Load Spectrum Factor and Load Cycles) is approached, the probability of fatigue cracking starts to increase. These factors are very evident in the difference in design and build of a dockside crane compared to a general construction crane. The combination of intensive use and a corrosive environment brings a need for further diligence, as the combined effect of stress and corrosion are generally greater than the effects of stress and corrosion acting sparsely. As well as more frequent thorough examinations, they may require more frequent

*Cranes designed for high load cycle duties, such as harbour cranes are designed and constructed differently*



non-destructive testing to detect possible fatigue cracks, and material loss through corrosion.

The CPA's Tower Crane Interest Group is working with HSE, inspection bodies and contractors to draft guidance on this subject which is expected to become available later this year.

## Increasing the average load by 25% will halve the crane's expected lifetime



**Most cranes used in construction are designed to meet the requirements of a relevant standard such as those produced by FEM, DIN and more recently CEN - the European standards organisation.**

These provide parameters for relating the Load Spectrum Factor and hoisting cycles, to the desired design life for the crane. A recent position paper from FEM - the European Materials Handling Federation, gives examples of the effect of average load and number of load cycles on the expected 20

year design life of tower cranes. One example shows that increasing the average load by 25 percent will halve the crane's expected lifetime. Similarly if the crane was specified for five eight hour shifts a week, and is then double shifted - with two 10 hour shifts, six days a week - the life of the crane will be reduced by a factor of three! From this it is clear that if a crane is used more intensively than its designer intended, its life can be significantly reduced, leading to fatigue and cracking of the structure far earlier than expected.

## Double shifting can reduce a crane's life by a factor of three!

The implications of this begin at the planning stage for principal contractors and crane suppliers. If a tower crane is to be used for a high-intensity application, then a suitably sized crane should be specified from the outset. High load, high frequency operations include skipping concrete, moving spoil, or for use on civil engineering sites such as bridges, shafts and tunnels. An intensive use for a mobile crane could be dockside loading and unloading of oil rig supply vessels.

In the first instance, the duty to address these issues falls on the principal contractor, but advice from the crane supplier is also needed, and it is essential that full consultation takes place. PUWER requires that work equipment is suitable for the work intended,



particularly Regulation 4: the LOLER Approved Code Of Practice says that the selected lifting equipment should not be unduly susceptible to any of the foreseeable failure modes likely to arise in service, for example fracture, wear or fatigue. This applies not only at the start of the work, but must also take into account any changes in usage of the crane during the lifetime of the job.