



## STRUCTURAL SAFETY OF BUILDINGS AND PLANT

In June 1998 a rejects bin and steel support structure at a treatment plant collapsed when loaded to 80% of design capacity during commissioning operations. No injuries were sustained, however this collapse had the potential to kill several people had they been within the vicinity of the structure.

It appears at this stage that the absence of web stiffeners in the primary support beams led to the failure of the structure. The web stiffeners were included in engineering design calculations, but were not shown on the design drawings. This illustrates the importance of ensuring that design drawings accurately reflect engineering design calculations.

In May 1996 a loadout bin steel support structure at a treatment plant twisted and deformed at a loading below design capacity. This bin structure had been recently commissioned and no injuries were sustained during the incident.

The deformation of this structure was also caused by a design fault. The design engineer did not undertake calculations to check the need for web stiffeners in the primary support beams and therefore these stiffeners were not shown on the design drawings. The primary support beams buckled under load causing the structure to twist and deform.

**The duties of design engineers working on any plant proposed for a minesite are clearly defined in section 14 of the Mines Safety and Inspection Act 1994 and regulations 6.3 to 6.5 of the Mines Safety and Inspection Regulations 1995.**

**Design calculations prepared for a structure on a minesite should be independently checked by another appropriately qualified and experienced engineer. Design drawings for a structure should be carefully checked by the design engineer to ensure the intent of the design calculations have been fully complied with. The erection of structural steelwork and the placement of reinforcement in suspended reinforced concrete structures should be checked by an engineer to confirm that such structures fully comply with the drawings and specification.**

Another common cause of structural collapses is the corrosion of steelwork. In January 1998 a wharf walkway structure failed due to extensive corrosion when 6 men were walking on the structure. All men fell with the failed walkway structure 8 metres to the ocean, some suffering serious injuries.

An investigation identified that corrosion of the failed walkway truss was severe and some cross bracings in the truss had completely corroded through. It was further reported that in 1991 and 1993 structural engineering reports had been commissioned and these reports recommended that repairs be carried out to corroded members on several walkway structures including the structure which collapsed. At the time of the collapse, none of the rectification work identified in those reports for this walkway structure had been attempted. The investigation report concluded "the walkway truss failed as a result of the mine operators inadequately actioning reported recommendations by consultant engineers."

Treatment plants may also be very corrosive environments and there have been several incidents where steel floors have collapsed.

**Where corrosion in structural steelwork is more than merely a surface feature or where the corrosion may have diminished the original strength of the structure, a structural design engineer should be employed to assess the safety of the structure. If remedial work is recommended then such work should be carried out immediately, or in accordance with the priority timeframe identified in the consultant's report. Furthermore, employees should be encouraged to report cases of structural steelwork corrosion they identify. Periodic plate and weld thickness tests should be performed on all bins, silos and hoppers to ensure their structural integrity has not been affected by corrosion.**

Over the past five years there have been major structural collapses of two bucketwheel reclaimers and one stacker. These incidents resulted in two fatalities and one serious injury. The causes of these failures are complex; however a common major factor relates to modifications and upgrades being carried out over the life of a machine without consideration of the effect of those changes on the structural integrity of the machine. Such modifications and upgrades that may affect the structure of these machines include not only mechanical and electrical changes but also changes to maintenance procedures.

**A comprehensive risk management plan which assesses all potential hazards should be developed for all shiploaders, reclaimers and stackers. These plans should incorporate an assessment of the effect of all mechanical and electrical modifications and upgrades since commissioning to the structural integrity of the machine, and the development of an operator and maintenance personnel training program which ensures these personnel are aware of procedures which could affect the structural integrity of the machine.**

J M Torlach  
STATE MINING ENGINEER

13 August 1998