

Introduction

In September 2006, Anglian Water suffered a sudden and catastrophic failure of a concrete tank at a sewage treatment works in Lincolnshire.

A Safety Bulletin was issued to all Solutions staff, Delivery Partners and Associate Delivery Partners, followed by an initial Advice Sheet. This Second Advice sheet is being issued to inform of the results that were found.

Safety Bulletin: [031 – Catastrophic Failure of Concrete Tank](#)

Advice Sheet: [007\(a\) – Concrete Tank Failure Update](#)

What happened

Following the recent failure of a post tensioned pre-cast concrete tank there have been extensive efforts to discover the cause by several parties. Whilst the previous advice, to avoid any disturbance of these structures is still valid, it is now possible to conduct surveys of these structures to determine if they are safe to modify.

Before taking any steps please consult Paul Fowler (SWS) and Sandy Fernand (Mott MacDonald).

Preventing a re-occurrence

Issues that must be considered:

1. Was there any failure or deformation of the pre-cast concrete units during construction? (This may have been caused by lifting the sections without spreading the stress of the lifting point). (It appears from the information supplied that Ove Arup have reviewed the panel design and A-Consult have strengthened the vertical reinforcement to reduce the effects of this handling).
2. Manufacturing inaccuracies led to out of tolerance units being delivered to the site under investigation and may have affected the ability to achieve a good seal. (The EPDM gaskets used between panels are made from industry standard material which we rely on for almost every pipe joint. For this reason we don't think their performance is in question).
3. Remedial work was carried out to seal the joints using a 'Flexijoint System' which in turn was tested by applying a reverse water test by pressurising the tendon ducts. This was done twice as the first test failed.
4. A-Consult appear to blame this water test as the major factor leading to water ingress to the tendons which eventually led to the stress corrosion cracking failure of the tendons. *"if it is considered absolutely necessary to utilise pressurised water injection into ducts to establish water tightness then it is necessary to remove that tendon and replace it with a new one"*.
5. The tendon material and the grease which surrounds the tendons and is packed in to the anchorage joints where the clamps and exposed tendon ends are located should be checked.

(Motts made reference to tendons fabricated from Spanish steel, and particularly mentioned that all of the instances where corrosion was evident the tendons were made from this steel. They also said in their survey that tendons which used British steel did not show any signs of corrosion. Motts also mentioned that in laboratory tests the grease used with the Spanish steel emulsified in water. This could be a major factor in the creation of the corrosive conditions).

Tanks which are sufficiently partially buried would not pose any danger of collapse and could be considered as safe to use.



What has this incident highlighted

All parties who have investigated this incident agree that the ultimate failure was caused by stress corrosion cracking, but it is not possible with the limited information supplied to say exactly what caused it. Clearly pressure water testing the ducts will have put the water resistance of the tendons under extreme conditions and whether this was reasonable is questionable.

This design appears to rely on the grease and the sheathing to provide its corrosion protection and you would not expect the grease used for this purpose to emulsify in water! Unfortunately, it is impossible to form an opinion on this and as tanks of this nature, which are built above ground, rely entirely on the tendons for their structural integrity, I would still err on the side of caution and not recommend their use until this point is totally clarified.

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