Composite Sandwich Panels for Above Ground Storage Tank Construction and Repair.

Sandwich panel construction has been used for decades within the aviation industry, and advances during the 1990's developed sandwich panel as a means of steel rehabilitation, repair and construction for the Marine, Offshore, Oil & Gas, Bridge and Civil Engineering Sectors.

However, this technology has much wider applications and is now being looked at as a means of Above Ground Storage Tank (AGST) repair or construction. Sandwich panel construction consists of two metal plates which are bonded to a compact polyurethane elastomer core. The elastomer provides continuous support to the plates and prevents local plate buckling, greatly reducing eliminating the need for stiffening.

(Pic 1).

The in-plane and flexural stiffness and strength of sandwich construction can be tailored to the particular static and dynamic structural requirements of an application by selecting the thicknesses of the sandwich elements, (core and plating). The metal faceplates are generally steel, although other metals and sheet materials may be used, and the elastomer cores are a specific class of polyurethanes, which provides the material with greater resistance to point and high loads – that is, the sandwich panels behave elastically over a larger range of loads than conventional steel panels. The injection process of a typical sandwich panel section takes only a few minutes to complete.

Sandwich panels can be used in new construction and also for the permanent repair and strengthening of structures using sandwich panel overlay. This method allows the existing steel surface to be used as one plate of the sandwich; it is then overlaid with a new steel top plate and the elastomer injected to form a composite sandwich panel. Design details have been developed for a wide range of configurations to help minimise the design and approval time.

Leakage from storage tanks may lead to extensive environmental pollution and be a financial loss to owners. Sandwich panels address this problem of tank leakage caused by loss of integrity. Such loss is almost always caused by deterioration of the tank bottom. If the sandwich panel plates corrode, then the elastomer acts as a barrier to prevent product outflow, in essence a "*triple protection barrier*".

Sandwich Panel - Overlay Application

Overlay application is carried out in a few simple steps. First, the corroded surface is cleaned by blasting (hydro or grit). Then, perimeter bars are welded (or glued in "No Hot Work" applications), above primary elements to create a suitable size of cavity for the injection of the elastomer. The height of the perimeter bar is dictated by the thickness of the core. Afterwards, the top plate is laid on top of the perimeter bars and welded or adhered to them – this becomes the new wearing surface. The process is then completed by the injection of the elastomer.

(Pic 2).

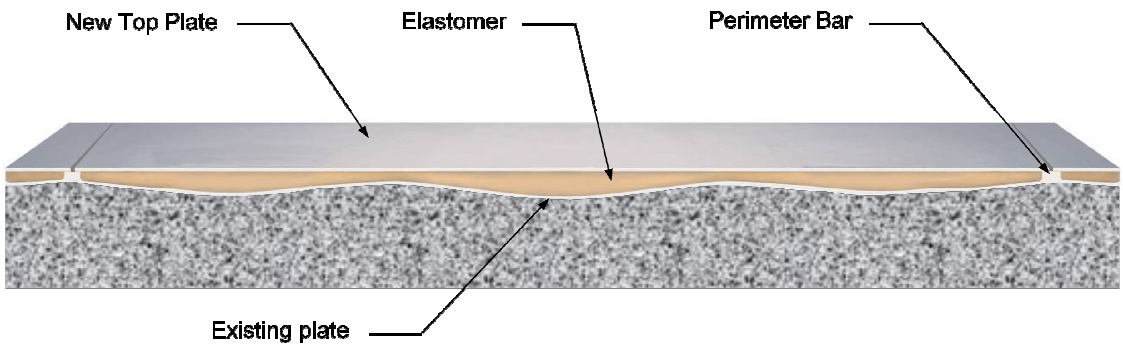
The benefits of Sandwich Panel Overlay

Sandwich panels have number of inherent properties that make it an attractive option for Above Ground Storage Tank floor or roof reinstatements. The main advantages of the Sandwich panel overlay concept are an increased resistance to product outflow due to the triple barriers of Steel-Elastomer-Steel. Surfaces remain flat and could reduce the build up of debris and increased efficiency in unloading due to the flat surface. The energy absorption capacity of Sandwich Panels under loads is superior to conventional steel construction. More important may be that the core material redistributes the applied load over a larger area than conventional single steel plate construction. Because of this, sharp bending of the plate at the site of load application, such as knuckle joints is reduced and thus delays the point at which failure strain of the plate material is reached.

Recent projects have included the use of “No Hot Work “Sandwich panel repairs using offshore oil and gas industry standards to a floating roof in service. This resulted in prevention of water ingress to the floating roof, reducing the likelihood of it sinking or capsizing. The tank remained in service and avoided costly out of service costs. (pics 3/4/5/6/7)

Pictures courtesy of Intelligent Engineering (www.ie-sps.com)

(Pic 1).

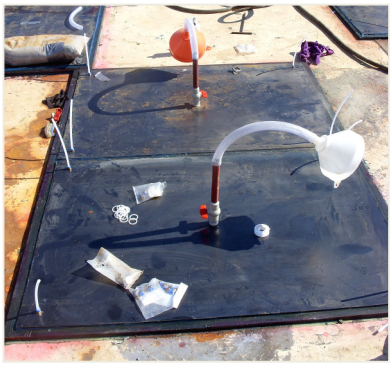


(Pic 2.).

(Pic. 3).

(Pic 4.).

(Pic 5).



(Pic 6.).

(Pic 7.).