STEEL WATER PIPE

George Ruchti, Sales Manager

American Spiral Weld Pipe Co., Puntagorda, FL 33950

While steel water pipe has been used throughout the country for over 140 years, it is relatively new to the Houston area.

Steel pipe has long been recognized for its excellent resistance to high internal pressures but has been questioned regarding its ability to resist external loading and buckling. In the early 1940's, Iowa State University under Dr. Spangler began the first effort at determining how steel pipe acted as a non-pressurized buried conduit. His graduate student, Reynold Watkins, subsequently modified his formula in the 1950's.

This revision saw the initial development of the term E', the Modulus of Soil Reaction. However, values associated with this factor varied considerably by the individual designer because this formula was never meant to predict deflection; rather it was intended to back-calculate the effect of the compactive effort. It took until the 1980's for a study by the University of California, Berkeley, to establish realistic values of E' by equating it to the Modulus of Constrained Soil, M_s, through an extensive study of previous papers and reports. Through this study it was realized that E' not only varied with compactive effort, it varied with the depth of cover as well.

Underground buckling now was left as the one primary condition requiring an adequate structural analysis. While members of our industry recognized that buckling had never posed a problem with buried steel pipe in the municipal water works industry, many designers wanted structural analysis verification. Consequently, a study undertaken by the fiberglass pipe industry during their development of AWWA C950 provided the required analysis. Although originally mistakenly establishing overly conservative factors of safety for steel pipe, the advent of the C950 formula solved the designer's dilemma.

With confidence in the structural benefits of steel pipe, corrosion was essentially the last concern left uppermost in many designers' minds. In the 1940's and 1950's, passive corrosion resistance was believed adequate for corrosion control of many metallic water pipeline materials. Cement mortar was, for a while, considered a cure-all for external protection. The chemical passivation afforded by the alkaline environment had worked well for internal corrosion resistance for many years. Why shouldn't it work as well for external corrosion control? Unfortunately, external corrosion had many other extenuating conditions; such as differential electrolytes, stray DC current, imperfect autogenous healing, etc.

While cathodic protection was applied to numerous structures in the latter part of the nineteenth and early part of the twentieth century, it took the recognition of the petroleum industry in the late 1950's to initiate a proactive corrosion prevention approach for steel pipe. Although the results of a leak in the pipelines of these two industries entailed far different levels of risk, investigation of corrosion potential and prevention became a more common practice in the steel water pipe industry than had previously been experienced.

For cathodic protection to be especially efficient, coatings had to be developed which would be effective and competitive.&#65533; Coal tar enamel had been functional for many years, but OSHA and EPA limitations, as well as installation difficulties, showed that improvements in coating materials were required.

The first, and arguably still foremost, of these was polyethylene/butyl rubber tape coating systems conforming to AWWA C209 and C214.&#65533; The thin-film liquid epoxies, particularly those that are coal tar based, have also been effective.&#65533; Polyurethane coatings have more recently also been accepted as an effective thin-film coating.&#65533; For field joints, both cold applied tape and heat-shrink tape coatings have been very efficient for all exterior coating applications.

With cathodic protection requirements as low as 3 microamps per square foot of total surface area, these coatings, with and without the application of cathodic protection, have provided excellent external corrosion protection for steel water pipe.

If you have any questions, please contact **Dr. C.Vipulanandan**