

History of plastic ducts for corrosion protection of internal post tensioning tendons

General Information

Due to significant failures of corrugated steel ducts in the use for corrosion protection of internal PT-tendons the idea for an effective protection based on a corrosion resistant and leak tight encapsulation of the tendon became popular.

First Generation

Since the early 1990's specific corrugated plastic duct systems for bonded post-tensioning have been introduced on the market. These duct systems, when combined with suitable accessories such as connection details and anchorage caps, provide a complete encapsulation of the post-tensioning tendon. If the prestressing steel is sealed the ingress of water and chlorides from the outside into the tendon will be blocked and tendon corrosion is not possible even if there were some voids in the grout.

Due to limited experiences circular corrugated HDPE pipes with wallthickness of about 2.0 mm with a corrugation design close to the plastic ground anchor protection ducts were produced in the early 1990's.

Project experiences partly showed problems with these ducts being too flexible between tendon supports, deformed under lateral loads and the remaining wallthickness after tensioning was limited to less than 1.0 mm.

Second Generation

The second generation of plastic ducts have been introduced in 1996 using HDPE in a circular flat corrugated design with increased wallthickness for better performance.

During increasing number of projects using plastic ducts, more and more experiences and tests show different performance of the pipes relating to installation temperatures, distance of tendon supports, minimum radius of curvature in relation to duct sizes and tendon forces etc...

Third Generation

With these experiences FIB started preparation of a technical report bulletin 7 with requirements for the third generation of ducts finally released end of 2002.

In addition FDOT (Florida Department of Transport) releases final drafts for the USA requirements in 2003, very close to the FIB technical report.

The new requirements specify dimensional duct tolerances, flexural behaviour, duct flexibility, lateral load resistance, longitudinal load resistance, leak tightness, wear resistance, bond behaviour and test recommendations.

To comply to the new specification, most of the ducts are now produced in PP (Polypropylen) material, a polyolefin material close to HDPE (High Density Polyethylen) but more stiff and rigid and applicable for higher temperatures.

No minimum wallthickness and minimum radii of curvature are specified in the FIB technical report, but due to experiences the pipe wallthickness average now is 3.0 mm to comply with the required minimum wallthickness of 1.0 mm after stressing even on projects with minimum radii of curvature lower than 10.0 m.

Internal PT-pipes in HDPE material are still produced for cold installation temperatures close to 0°C as well for applications with requirements regarding low radii of curvature and tendon forces as the material price is lower than PP.

PESTEC has started supply of duct of the first generation in the early 1990's and now provides PP ducts complying with the latest recommendations in different pipe wallthickness as well as HDPE ducts in a big variety.