

## PIPELINE DESIGN

### STRUCTURAL DESIGN

Restrain® Sewer Pipes are defined as flexible pipes. Flexible pipes will deflect when under load and hence rely on pipe stiffness as well as soil strength to oppose the vertical loads.

External soil and live loads on buried flexible pipes will cause a small decrease in vertical diameter and an increase in horizontal diameter. The horizontal movement of the pipe walls into the soil material at the sides develops a passive resistance within the soil to support the external load. The soil type, density and the existence of water table above the pipe will influence structural performance. The greater the effective soil modulus, the less the pipe will deflect.

### ALLOWABLE COVER HEIGHT

Restrain® Sewer Pipe is manufactured from SN16 Sewer Pipe and thus can accommodate larger fill heights compared with SN6, SN8 or SN10 DWV Sewer Pipe.

### PIPE GROUTING

In most situations Restrain® Sewer Pipe will be installed via trenchless methods – horizontal directional drilling (HDD), micro-tunnelling, pipe reaming, pipe eating, static pipe bursting or cracking, auger boring or guided boring.

Where it is necessary to pressure grout the annulus between the pipe and the hole it is important to ensure that the grout is introduced as evenly as possible in a manner not to damage the Restrain® Sewer Pipe. The grout must not exceed the pipes safe grout pressure.

For a circular ring subject to a uniform external pressure, the critical buckling pressure  $P_{CR}$  is defined by Timoshenko as:

$$P_{CR} = \frac{2 \cdot E}{((D - t)/t)^3}$$

Where:

$P_{CR}$  = critical buckling pressure

$E$  = short term modulus (3200 MPa)

$D$  = pipe OD

$t$  = wall thickness

**TABLE 4.1 – SAFE BUCKLING PRESSURE @ 20°C (FACTOR OF SAFETY = 2.5)**

PIPE DN	SAFE BUCKLING PRESSURE (KPA)
100	171
150	184
225	178
300	175

If necessary, the effects of grout pressures can be reduced by filling the pipeline with water prior to grouting. Alternatively it may be possible to stage the grouting process in two or three lifts, allowing the pipe to solidify in the annulus to the spring line before the top section is filled. Installers will also need to consider the effect of the grout’s heat of hydration on the pipe’s safe buckling pressure.

*The information contained in this document should serve as a guide only and is subject to change without notice. For more information please contact Iplex Pipelines Australia Pty Ltd.*

