

MINIMUM AND MAXIMUM COVER EUROFLO[®] CULVERT PIPE

Pipe coverage is a very important factor when calculating the load carrying capacity of the pipe installation.

The most common pipe coverage concerns are the minimum amount of cover in areas of vehicle movement and the maximum height above the top of the pipe. The information in this document is designed to provide quick access to many questions covering height with a degree of conservatism.

MINIMUM COVERAGE

The basic assumption of the following table is that the compaction of the soil around the pipes is above 85% (Proctor compaction test). Other properties that have effect on the pipes deflection are the cover's height, pipes ring stiffness and live load (according to EN124).

The following table describes the theoretical deflection according to different conditions; the actual values are almost 25% from the calculated value.

The pipe diameter has minor effect on the deflection, thus the values are for all diameters.

Group	Loading Description	EN124 CLASS	EN124 Test Load	Pipes Ring Stiffness	Minimum Cover (Meter)
1	Areas inaccessible to motor vehicles	A15	15kN	8	0.2
2	Footways, pedestrian areas	B125	125kN	8	0.3
3	Gully tops in curbsides channels of roads	C250	250kN	8	0.4
4	Carriageways of road (Heavy Duty)	D400	400kN	8	0.5
5	Area imposing high wheel loads	E600	600kN	8	0.6
6	Area imposing particularly high wheel loads	F900	900kN	16	1.5

MAXIMUM COVERAGE

Maximum coverage is significantly affected by the compaction method. The following table describes the recommended maximum level of coverage for different diameters and different compaction method.

Pipe Diameter (OD)	Soil Compaction Method	
	> 90% proctor	<90 proctor
MM	Meter of cover	
1300	12	5
1500	12	5
1700	12	5
1900	8	3
2100	8	3

DEFLECTION AND LOADS

The following explanation describes the theory and practical tests which certify the EUROFLO® culvert pipe to be laid below traffic load.

The following calculation certifies the pipe to stand a live load of 85 KN/m 0.60 meter minimum cover from the top of the pipe.

The calculation is based on the assumption that the installation is per ENV 1046 and EUROFLO® Installation guide, furthermore the compaction should have a Proctor index equal to 90–92%.

The Calculation is based on the Spangler formula which is used in various forms in most flexible pipe standards.

$$\Delta y = (DL * (Wc + Wl) * K / 8 * SN + 0.061 * E')$$

ΔY – Vertical Deflection

DL - Deflection Lag Factor = 2.1 K – Embedment factor

Wc- Static load (soil and building) ~8 KN/m Wl- Live load (traffic) – 50 KN/m

SN – Ring stiffness grade – 8 KN/m

E' - Soil reaction module 20700 KN/m

Based on the Spangler formula the vertical deflection of the pipe should be 0.59%, a specifier will add assuming an additional statistical deviation of 0.5% for additional safety corresponds to the a maximum vertical pipe deflection rate of 1.09% inner diameter of the pipe.

The standards allow a deflection of 5-8%.

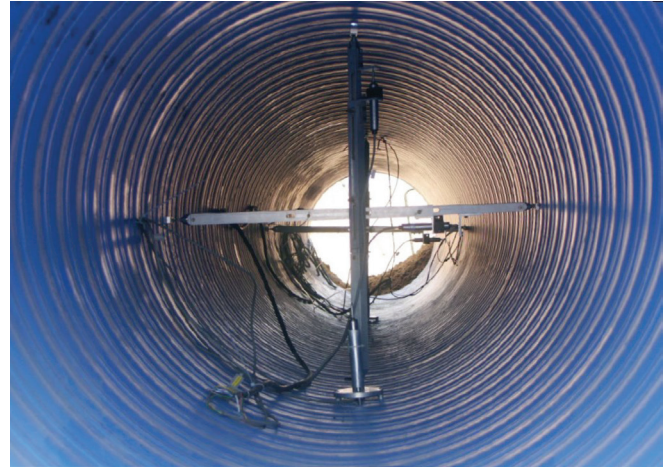
Below is a summary of a deflection test which was conducted on a EUROFLO® culvert pipe.

The test was performed and managed by Ph.D Mark Talesnik from the faculty of Civil Engineering in the Israel Institute of Technology.

<http://www.technion.ac.il/~talesnik/index.html>

The test was performed in several steps as described:

- Sensors were placed in and around the pipe placed in vertical and horizontal positions in order to measure soil pressure and deflection of the pipe walls.



- The soil cover above the pipe crown was only 45 cm. Different dynamic loads (vehicles of varying weights) were tested in order to simulate different situations.



- The maximum weight of vehicle that passed over was a fully loaded TEREX truck with a total weight of 50.4 ton. The deformation was measured at 0.18%

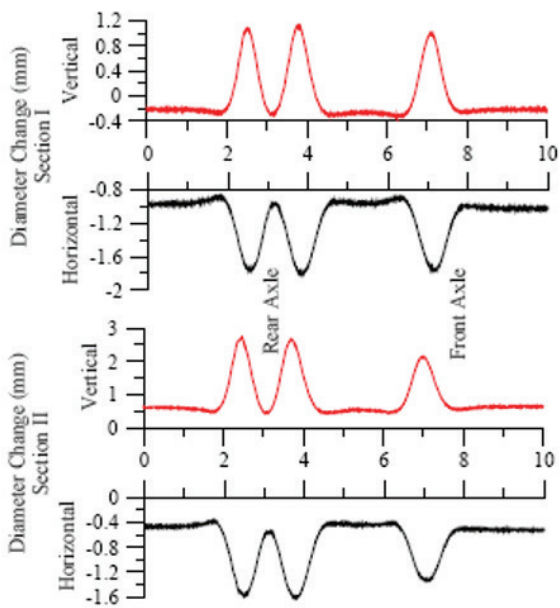


Figure 12 – Pipe response to the passage of the fully loaded hauler/dumper (50.4 ton), crown cover = 0.45 m, fully compacted.

- Based on these parameters the calculations according to the Spangler formula should be 1.0% which is more than 5 times then the actual deflection.

Another test was done (not recommended but shows it is possible) with a coverage of 0.3m, uncompact soil and a live load of 90 ton.

