LANDFILL LEACHATE

TELESCOPIC LEACHATE SHAFTS

HDPE is the industry's recognised material for use within landfill for gas and leachate extraction.

The stress and strain imposed on vertical HDPE pipes in landfills is immense due to the large amount of settlement which occurs within the waste itself.

Vertical pipes are subject to the resultant of axial and radia stresses, but the axial stress is much higher and by far the most damaging.

The damage occurs because the axial strain and conseque stress exceeds the buckling strength of the pipe.

The axial stress is caused by 'skin friction' between the outside wall of the pipe and the surrounding waste as it settles. Loads as high as 100Tf are not uncommon.

If axial movement can be accommodated during settlemen then the axial stress is eliminated.

ACCOMODATION OF STRAIN = NO STRESS

To minimise the stress on a vertical shaft in landfill it must meet the following requirements:-

- **Move axially during settlement**
- **Act as a column and not as individual sections**
- **Have minimum lateral deflection at joints**
- **Able to accommodate settlement over the entire**
- **length including the bottom section**
- **Be built up in sections as fill occurs**
- **Accommodate settlement over 30%**

FEATURES

- **High ring stiffness HDPE pipe.**
- **Tested shear ring strength.**
- **Known shear pin strength.**
- **High penetration ratio.**
- **Minimal lateral movement at joint.**
- **Acts as a single column.**
- **Bottom section can move.**
- **Standard 3meter sections.**
- **Same wall thickness throughout.**
- **Easy to install.**
- **Granular fill only needed on base.**
- **Settlement over 30%.**
- **Diameters from 100 to 1600mm.**
- **Design calculations provided.**

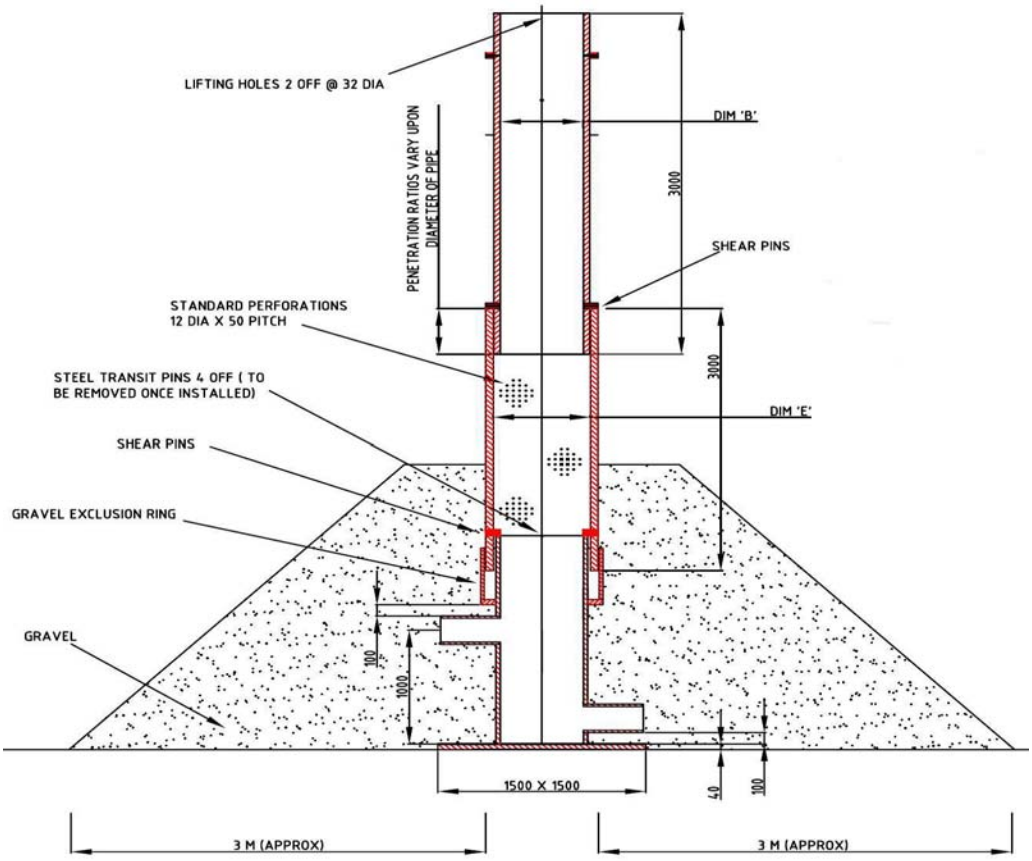
56 KOUMANIOTI str. 262 22 PATRAS GREECE
Tel: +30.2610.36.10.86 - Fax: +30.2610.36.10.87
E-mail: **info@tecon-group.eu** WEB**: www.tecon-group.eu**

TECON

LANDFILL LEACHATE

TELESCOPIC LEACHATE SHAFTS

Size (mm)	Sleeve outside diameter (mm)	Inner outside diameter (mm)
125/160	160	125
160/200	200	160
200/250	250	200
250/315	315	250
315/400	400	315



56 KOUMANIOTI str. 262 22 PATRAS GREECE
Tel: +30.2610.36.10.86 - Fax: +30.2610.36.10.87
E-mail: **info@tecon-group.eu** WEB**: www.tecon-group.eu**

TECON

LANDFILL LEACHATE

TELESCOPIC LEACHATE SHAFTS

THE CONSEPT

Quest: Why are shafts needed ?

Ans: To monitor and remove leachate within landfill sites.

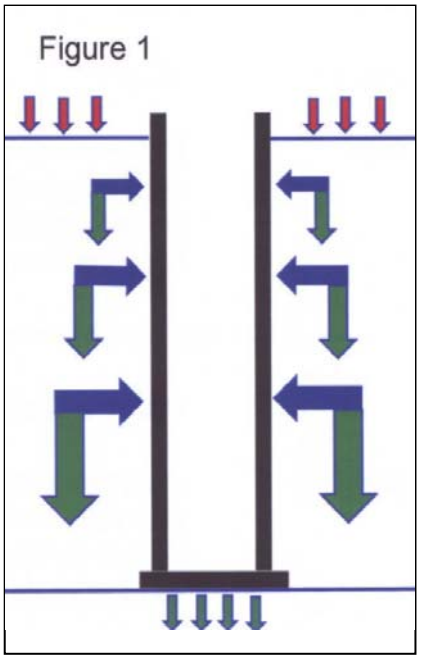
Ques: Why is telescopic required ?

Ans : To accommodate the settlement which occurs.

Ques: Why does settlement cause a problem?

Ans: As the waste settles the friction (skin friction) between the outside of the shaft and the waste is enough to cause the shaft to be compressed vertically ('drag-down') (figure 1).

LOADING ON CONVENTIONAL SHAFT



Ques: Does this compression really matter?

Ans: Yes since shafts are founded at the base of the landfill in solid material then this compression effect builds up to cause stress in the shaft, which in turn imposes large foundation loads.

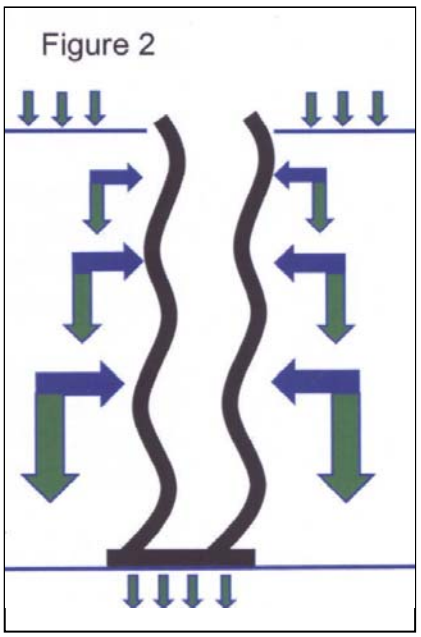
The scale of these forces can be sufficiently high as to either cause buckling of the shaft or failure of the foundation.

Consequences of these features are:-

i) Pump or monitoring equipment access lost

ii) Integrity of basal liner/sealing system severely compromised

BUCKLING DUE TO EXCESSIVE AXIAL STRESS



56 KOUMANIOTI str. 262 22 PATRAS GREECE
Tel: +30.2610.36.10.86 - Fax: +30.2610.36.10.87
E-mail: **info@tecon-group.eu** WEB**: www.tecon-group.eu**

TECON

LANDFILL LEACHATE 2

TELESCOPIC LEACHATE SHAFTS

Ques: **Do options other than telescopic not provide anadequate solution?**

Ans: **No!**

Ques: **Why?**

Ans: **If the shaft is non-telescoping then it must be designed to be strong enough to resist the exceptionally large forces imposed on it by the landfill settlement.**

This can be achieved by steel or concrete but…….

CONCRETE RINGS TILTING

PROBLEMS BY NON-TELESCOPING

Steel **Corrosion by leachate**
Heavy to handle
Needs to be welded on site (explosion!)
Exceptionally high foundation loads

Concrete **Corrosion by leachate**
Very heavy to handle
When subject to lateral deflection causes point loads at joints.
Above combined with axial loading will cause stress sufficient to fail concrete
(How many cracked rings have you seen?)

HDPE **Not strong enough to resist axial 'down-drag'**

Germans tried to counter-act the lack of strength
By placing a large gravel surround to the shaft and placing 'low friction' surfaces (geotextile or liner) around the shaft.

Disadvantages:
VERY EXPENSIVE
DIFFICULT TO CONSTRUCT AS FILL OCCURS
VERY THICK WALLED PIPE NEEDED

BUCKLING & FAILURES STILL OCCUR !!

56 KOUMANIOTI str. 262 22 PATRAS GREECE
Tel: +30.2610.36.10.86 - Fax: +30.2610.36.10.87
E-mail: **info@tecon-group.eu** WEB**: www.tecon-group.eu**

TECON

LANDFILL LEACHATE 3

TELESCOPIC LEACHATE SHAFTS

Ques: **How do telescopic shafts solve the problem?**

Ans: **The fundamental thing to realize that if there is no strain then there is no stress.**

STRESS CAUSES FAILURES.

The settlement of the landfill moves the shaft downwards and if this downward movement on a section of the shaft is not transmitted to the next section then there is no stress or load transferred through the entire shaft length (figure 3).

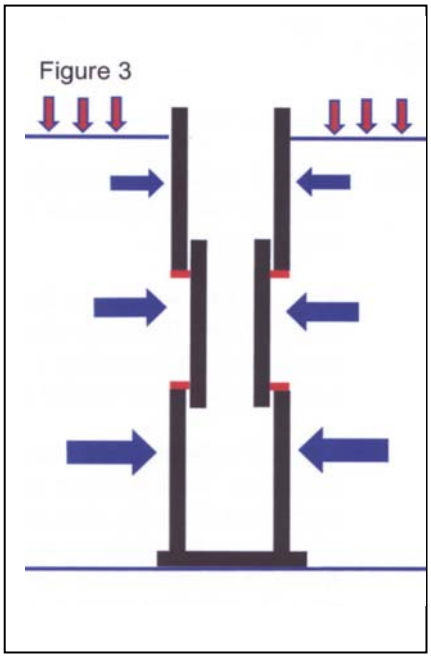
What this means is that there is very little axial (vertical) stress on the shaft so that the wall thickness can be substantially reduced provided it can withstand the radial (horizontal) stress.

The base section has the most loading on it irrespective of the type of shaft, as this is where there is a transition between the landfill, which is settling, and a firm immoveable foundation layer.

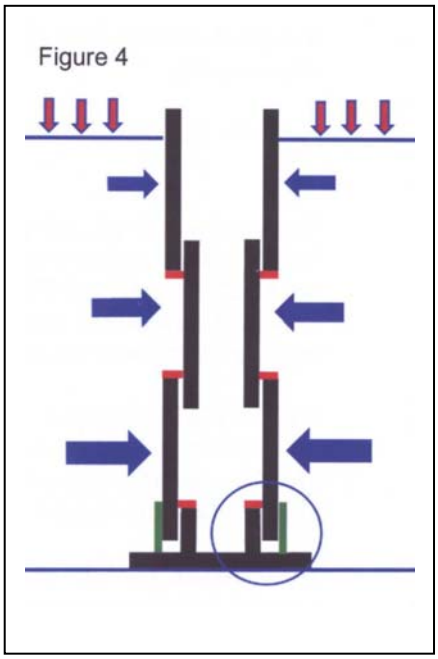
At this point the stresses are very large and there is also the potential for excessive foundation loads.

The base section which is normally perforated is surrounded by gravel which functions as a filter for the leachate but in addition acts to limit the settlement immediately adjacent to the shaft base section.

There is however a small amount of compression of the gravel due to the loading from the fill. In order to minimize stress and load on the shaft foundation it is essential that even this small amount of movement should be catered for (figure 4).



LOAD NOT TRANSMITTED TO BASE



LOAD TO BASE MINIMISED BY ADDITIONAL TELESCOPING AT BASE

56 KOUMANIOTI str. 262 22 PATRAS GREECE
Tel: +30.2610.36.10.86 - Fax: +30.2610.36.10.87
E-mail: **info@tecon-group.eu** WEB**: www.tecon-group.eu**

TECON

LANDFILL LEACHATE

TELESCOPIC LEACHATE SHAFTS

Ques: **What about lateral deflection?**

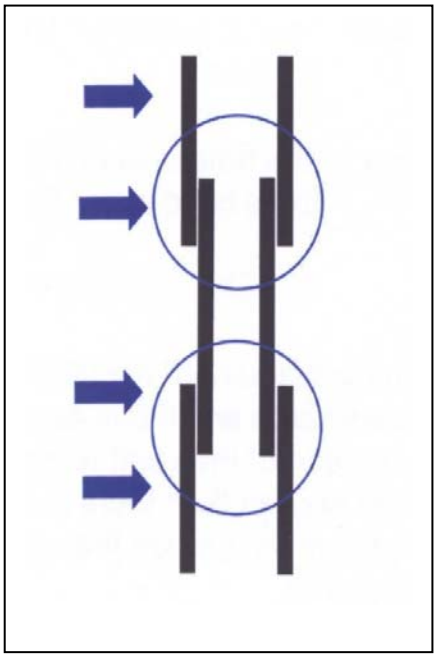
Ans: **Lateral deflection on any shaft is not desirable but the reality is that it will occur in landfill operations.**

It should however be minimized wherever possible by filling evenly around the shaft and at design stage making sure that they are not positioned close to the edges of the site.

Lateral deflection in itself causes a 'bend' of the shaft, which is not necessarily a problem provided that the pipe diameter is such that pumps or monitoring equipment will pass freely throughout the shaft length.

More important is to ensure that the shaft acts as a continuous column when subject to lateral forces. If the joints are allowed to bend then this has the effect of locking stress into the shaft system and prevents affective telescoping.

FLEXIBLE JOINTS – NO!

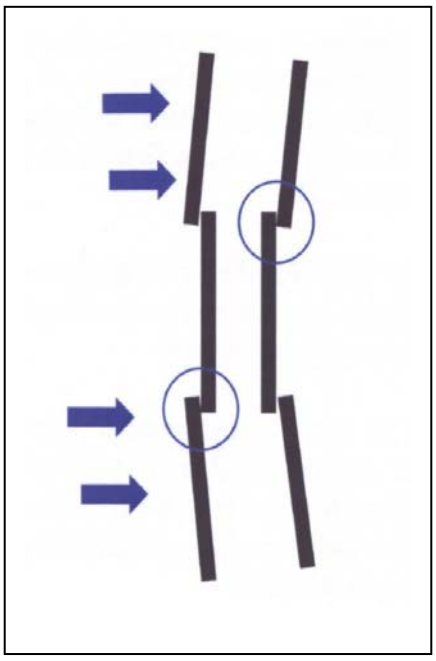


High penetration factor ensures Shaft acts as a 'single column'

To avoid the shaft being a series of independent components it is important that the shaft has a high 'PENETRATIONFACTOR' and a low ANGLE OF DEFLECTION between the inner pipes and sleeves.

'PENETRATION FACTOR' is defined as the ratio of the outside diameter of the inner pipe to its penetration length into the sleeve and should be more than 0.6 wherever possible.

The 'ANGLE OF DEFLECTION' should not exceed 3 degrees wherever possible.



Low penetration factor causes excessive lateral deflection, locking of units with resultant stress.

56 KOUMANIOTI str. 262 22 PATRAS GREECE
Tel: +30.2610.36.10.86 - Fax: +30.2610.36.10.87
E-mail: **info@tecon-group.eu** WEB**: www.tecon-group.eu**

TECON

LANDFILL LEACHATE 5

TELESCOPIC LEACHATE SHAFTS

Ques: What exactly does the telescopic shaft system actually comprise of?

Ans: A series of alternating HDPE inner pipes and sleeves in 3m sections that are free to move relative to each other but that act as a single column.

Ques: How does it fit together?

Ans: The base section always starts with a sleeve onto which the first inner pipe is fitted and comprises of:-

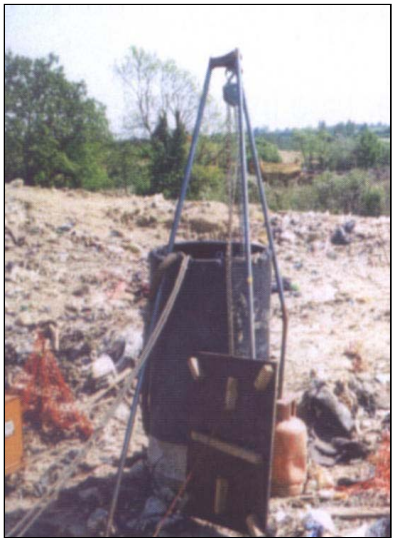
1. Base plate
2. Gravel exclusion ring
3. First telescopic sleeve

Ques: What stops the inner pipe from falling down into the sleeve?

Ans: Fitted onto each inner pipe is a shear ring held on by specially designed shear pins. The ring supports the self-weight of the pipe until such time that the 'skin friction' will act as a natural support.

Ques: When does the ring actually shear?

Ans: Once the axial loading exceeds the value of the shear pin. As the waste is actually supporting the pipe the amount of movement will only be the value at which the waste settles. The whole shaft is a suspended column supported by the waste and will move as the waste moves.



56 KOUMANIOTI str. 262 22 PATRAS GREECE
Tel: +30.2610.36.10.86 - Fax: +30.2610.36.10.87
E-mail: **info@tecon-group.eu** WEB**: www.tecon-group.eu**

TECON