A periodic update for the clay drainage industry from the cpda

Issue 3

clay today

for sustainability tomorrow

Clay - The Environmentalist's First Choice in Sewer Materials

Environmental issues are moving up the agenda. Why is clayware such a fitting 'green' material?

Increasingly, environmental issues are affecting our purchasing decisions in all aspects of life. Political commitment to halving our CO_2 emissions by 2050 and carbon neutral construction form the framework in which policies and decisions will be made in the future.

In order to achieve these objectives, we will not only have to construct environmentally efficient buildings, but also to use environmentally friendly, sustainable products.

It is in this context that the environmental and long term sustainable characteristics of clayware pipes come into their own:

- These pipes are made from a natural material, in abundant supply, sourced from within a ten mile radius of the factories from quarries fully reinstated after use.
- The manufacturing process uses no harmful additives and recycles both waste heat and production waste within the process.
- Research in 1996 by leading European academic Professor Jeschar, demonstrated that clayware pipe production resulted in far less energy consumption and consequent CO_2 emissions per metre and with reduced emissions of both Nitrous Oxide and Sulphur Dioxide when compared with pipe made from other materials e.g. PVCu pipes. Since then, developments in kiln technology have reduced energy consumption even further.
- Clayware pipes have a proven longevity and with developments which increased crushing strength and improved flexible joint technology, these predicted life expectancies can be extended even further, to well in excess of 100 years. This results in longer replacement cycles and consequently lower demand on resources and lower social disruption costs.
- In most cases, the high crushing strength of the clay pipe alone will provide enough load bearing capability for the sewer structure. This provides the opportunity for

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Clay Fact:
Clayware pipes have the longest proven life expectancy

In this issue:

Cont'd from P.1

savings in financially and environmentally costly bedding and surround material and the ability to use narrower trenches in soft ground conditions.

- Reduced dig and fill costs mean less imported granular, less on-off site haulage and less spoil to landfill or to spread around the site.
- Clayware pipes have been third party certified for use with recycled material which is increasingly available as crushed material on "brownfield sites".
- Another feature is clayware's high chemical resistance, providing more protection than either PVCu or concrete against contaminants and aggressive ground or sewer effluents.
- On disposal, at the end of its long life cycle or more likely during redevelopment, this natural material, if not re-used, can simply be crushed and returned to the ground as aggregate or fill material without risk to the environment.

As concern for our environment grows, specifiers will become increasingly aware of the relative environmental merits of the available building materials. They will move towards the "greener" alternatives and away from those materials, such as PVCu, which have long since been highlighted by environmental activists, such as Greenpeace, as having harmful affects on our environment both during manufacture and on disposal.

In comparison, the natural sustainable benefits will ensure that clay achieves the title of "The Environmentalist's First Choice In Sewer Materials".

Clay Fact:
Granular surround can cost more than the pipe

Strength in every circumstance

Clayware Pipes Reduce Risk in Variable Ground Conditions

At up to 6.0m depth, and with some products even deeper, the load-bearing strength of clay pipes laid on a granular bed will provide the sewer structure without reliance on side support from either the surrounding material or the trench walls.

Conversely, in most situations, plastic pipes rely almost entirely on adequate side support to provide the load bearing structure, without which plastic pipe will deform excessively and, in the most extreme case, may even collapse.

This reliance by plastic pipes requires greater care to ensure the side support is achieved through proper compaction and that, once achieved, compaction is not lost through subsequent disturbance.

In soft ground conditions, or in variable conditions that might be anticipated on redeveloped sites, there is a greater risk that adequate side support is not achieved. Under these circumstances plastic pipes will be at greater risk and will require far more care on installation or by building in additional safety through design by insisting on substantially wider trenches. Wider trench widths are extremely costly through increased dig costs and extra granular fill and spoil disposal, not to mention the additional consequential environmental costs of excessive quarried aggregate. Even if such costly contingencies are built into the design , without supervision, there is no guarantee that the design will be delivered on site.

Clay Fact:
Clay pipes can be lai without granular surround

In such situations the risk can be avoided by using rigid clay pipes where the load bearing capacity is independent of side support . The load bearing structure is provided by the pipe which is certified ex-factory. This ensures that the specified structure is delivered on site, as it is not reliant on the side support, which in turn is dependent on the quality of installation and the surrounding soil conditions. This is another reason to specify rigid clayware pipes in soft or brownfield site conditions.

Wimpey assured a trouble-free handover with clay

Here we see clayware sewers, supplied by Naylor, being installed on behalf of major housebuilder, Wimpey in Colchester. Destined for adoption by Anglian Water, sewers must meet their 4000 PSI jetting requirement, which clayware easily exceeds. Clayware sewer pipes were also installed for Wimpey's Groby site in Leicestershire. With no risk of deformation and national acceptance in "Sewers for Adoption", Wimpey can anticipate a trouble free adoption by Severn Trent.

100mm clayware for luxury lodges

Clay Fact:
Every 10 metres of clay drainage can save over 2 tonnes of granular

Highfields Construction recently built four large lodges providing luxury accommodation at Airhouse Farm, Oxton in the Scottish Borders.

The cost of granular bedding for the drainage pipes and the removal of any surplus sub-soil from the site in this picturesque rural location had the potential to dramatically increase costs. Ground conditions at the site were of a gravelly subsoil material. It was loose enough to be trimmed with a spade and remained dry, due to its permeability.

SuperSleve 100mm vitrified clay pipe from Hepworth Building Products was the ideal choice. The high strength pipe enabled the contractor to minimise costs by laying it directly on to the trench bottom, taking advantage of the natural ground conditions on site, thereby excluding the expensive imported granular bedding and surround. In addition, the absence of haulage costs for both the granular to site and the sub-soil from site also helped to reduce expenditure.

Stevie Potter, Managing Director, Highfields Construction said: "When faced with the task of keeping costs down I remembered witnessing a previous demonstration by Hepworth laying clay drainage directly on to the trench bottom. The conditions at the farm seemed perfect so I contacted Hepworth to discuss the possibility."

"One of Hepworth's Technical Support Engineers visited the site at Oxton to discuss and give advice about the installation. He confirmed that ground conditions at Airhouse Farm were ideal for using clay drainage without any imported granular material."

"Laying SuperSleve directly on the trench bottom was a great success, saving time and money for everyone concerned. Now we are aware of the ideal conditions for this practice we will definitely use SuperSleve in similar situations again."

Sewers For Adoption 6th Edition Pipe Materials Table Summary

In this latest edition of Sewers For Adoption (SfA), the Water Companies have introduced a table summarising their requirements and restrictions with respect to sewer materials.

Notably there is no restriction on the use of rigid clayware pipes throughout England, Scotland and Wales. This is based on the Water Industry's long experience of this highly durable product with a long and proven life cycle.

This cannot be said for competing Structured Wall Plastic Pipes (SWP). Three Water Companies - Thames, Anglian and Southern - require that they must meet 4000 PSI jetting resistance, while most commonly available SWP can only achieve 2600 PSI.

Whereas all Water Companies expect plastic pipe installations to meet the BS 5955 (part 6) installation standard, which requires a maximum long term deformation of 6%, United Utilities has made it clear that they will test all plastic installations for deformation before adoption. Wessex advises contractors to "light line" inspect their installations and Severn Trent warns that they will be tested by physical means to ensure compliance with the standard.

These Water Companies recognise the importance that the quality of installation plays in a plastic sewer structure, particularly in an environment of varying site conditions. It also ensures that the risks associated with a poor installation are identified prior to adoption and placed firmly at the door of the developer/installer.

SfA also stipulates that all "stub" pipes leaving a manhole must be of rigid (in practice clayware pipe) material. Flexible plastic pipes have a tendency not to bond well at this point, creating a risk of infiltration or leakage.

Now certain Water Companies, such as Yorkshire and South West, actually specify rigid channels, again to ensure proper adherence to the concrete benching; in practice this means clayware channel work. All manufacturers supply a wide range of channels available through their merchant stockists.

Water Company	Restrictions on the use of Structured Wall Plastics for Adoptable Sewers						Stub pipes into structures & manholes	Restrictions on the use of clay for adoptable sewers
	Effective ban ?	Deformation limits	Jetting resistance	3m length	Usage restriction	Other		
Anglian Water	Yes	No	4000 psi*	Yes	Consult Water Company	-	Rigid (clay)	None
Welsh Water	Approved Products	No	2600 psi	Yes	Consult Water Company	450-900 dia sewers surface settlement calcs required	Rigid (clay)	None
Thames Water	Yes	No	4000 psi*	Yes	Consult Water Company	Further limitations for plastic pipes regards siting	Rigid (clay)	None
Southern Water	Yes	No	4000 psi*	Yes	Consult Water Company	450-900 dia sewers surface settlement calcs required	Rigid (clay)	None
Northumbrian Water	No	No	2600 psi	Yes	Consult Water Company	-	Rigid (clay)	None
United Utilities	No	5% by Light Profiling	2600 psi	Yes	Consult Water Company	-	Rigid (clay)	None
Yorkshire Water	No	6% by (design tables)	2600 psi	Yes	Consult Water Company	Plastic channels are not permitted	Rigid (clay)	None
Severn Trent Water	No	6% CCTV & Light Profiling	2600 psi	Yes	Consult Water Company	-	Rigid (clay)	None
Wessex Water	No	6% by Light Profiling	2600 psi	Yes	Consult Water Company	Fittings ID should equal pipe ID	Rigid (clay)	None
South West Water	No	No	2600 psi	Yes	Consult Water Company	Plastic channels are not permitted	Rigid (clay)	None
Scottish Water	No	No	2600 psi	6m	-	-	Rigid (clay)	None

* All commonly available structured wall plastics systems are unable to meet this requirement.
Source: WRc Sewers for Adoption 6th Edition 2006. Pipe materials table – 6th April 2006. www.wrcplc.co.uk/sfa/asp/documents.asp

Pipe Laying at Shallow Depths - Part 1

Pipes at shallow depths

Most specifications for drainage or sewerage pipelines contain similar general recommendations on minimum depths of cover, together with warnings that shallower pipelines require special protective measures to be taken. Some guidance is given in the Water Industry's design and construction guide for developers 'Sewers for Adoption' and 'Civil Engineering Specification for the Water Industry'.

Normal depths of cover

Sewers laid under highways should have a minimum cover of 1.2m, primarily to avoid interference with other underground utility pipes and cables, and secondarily to provide protection to the pipeline during construction, where the actual cover may only be to the formation level of the road.

Sewers laid under fields and gardens should have a cover of at least 0.9m so as not to interfere with land drainage or cultivation. This depth also gives a measure of protection before finished levels are achieved in these areas.

Since it is often difficult to maintain these ideal minimum depths of cover, particularly at the higher end of drainage and sewerage systems, precautions have to be taken where cover depths are shallower.

Shallow pipelines

Shallow pipelines may need to be protected by more than normal bedding and backfill materials, especially when laid at an early stage of a contract where the cover is less than that specified.

Two clear examples of this are:

1. When a sewer or drain is laid in a road which has only been brought up to formation level, where the pipe bedding has been designed assuming full depth of cover to finished road level.
2. Where building works are taking place close to a drain run previously laid to a specification suitable for 'fields and gardens' and the pipeline is subjected to unexpected loading due to delivery lorries, dumpers, fork lift trucks, etc.

Wherever possible, pipelaying should be the last construction activity, so as to be within the design conditions, otherwise the pipelines must either be isolated from site traffic by directing this away from pipe runs or temporarily bridging the trenches, or the pipes must be protected by stronger bedding constructions.

Taking into account the warnings given in various design tables for bedding construction, including those published by the CPDA and recommendations in BS 8301:1985 pipes can be safely laid using granular bedding without the need for a concrete bed or surround, provided that the effective depth of cover is at least 0.6m, the required bedding factors are achieved and there are no additional imposed loads.

Where the depth of cover is less than 0.6m, it is generally recommended that the pipeline is completely surrounded with well compacted good quality concrete, with a design strength of 20 MN/m^2 at 28 days – grade C20P or C20.

The flexibility of a pipeline bedded on, or surrounded with, concrete should normally be maintained by the provision of flexible construction joints through the concrete at pipe joints. These should be made from bitumen impregnated insulating board complying with BS EN 622-4:1997, or other equally compressible filler material such as expanded polystyrene. The board should be cut to fit the pipes, and placed at the face of the pipe sockets or at one end of sleeve joints. The joint material should be at least 18mm thick.

This procedure allows for flexible movement of the pipe joints, while retaining the strength given by the concrete surround and should normally be carried out at every joint as shown in Fig. 1, particularly in building drainage applications.

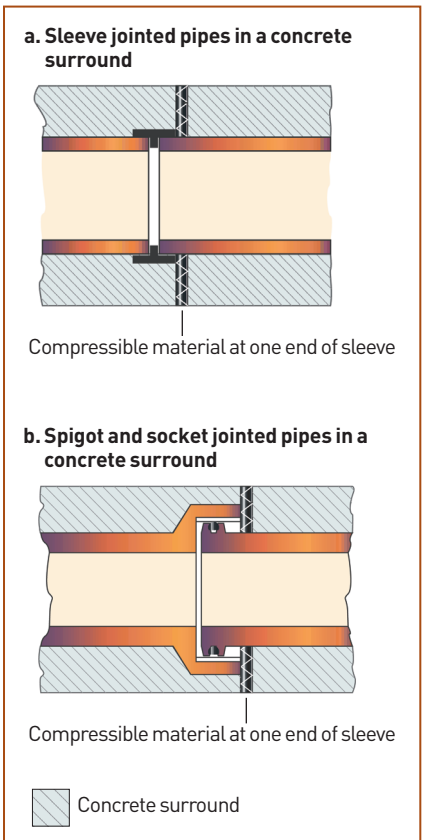

Fig. 1 Protection of a Shallow Pipeline

Where more uniform support of the pipeline is found, the construction joints may be less frequent. However, it is recommended that they are no more than 5m apart.

Backfilling should be carefully carried out as recommended in clause 11 of BS EN 1610:1998. Where concrete backfill to trenches is demanded for early permanent reinstatement, either using lean mix or foam concrete, care should be taken that this is not allowed to generate a high concentrated load on the pipes. It is therefore necessary to ensure that the concrete backfill is well supported by the trench sides. This can be achieved by the use of a stepped or battered trench. Concrete should not be placed between trench sheets which are subsequently removed since this would eliminate the friction between the concrete and the trench walls.

Part 2 of this Technical Note will describe the alternative method of protecting shallow pipelines by bridging over them.

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