INTERNATIONAL SOCIETY FOR TRENCHLESS TECHNOLOGY	**TRENCHLESS TECHNOLOGIES RESOURCE CENTRE**	
	TRENCHLESS TECHNOLOGY GUIDELINES	SECOND EDITION
	RENOVATION TECHNOLOGIES OVERVIEW	NEW VERSION SEPTEMBER 2005

OVERVIEW

Renovation Technologies normally involve cleaning of the pipeline followed by application or installation of an internal lining the lining may consist of an insitu applied coating of a cement or plastic based material or an inserted tube made from thermoplastic or thermoset resins..

DESIGN AND SELECTION

Renovation Technologies are defined as interactive because they form a structural composite with the existing pipe. The contribution of the lining to the structural performance of the renovated pipe can vary from minimal in the case of thin applied coatings to fully structural in which case the lining is capable of sustaining all of the applied loads independently from the hose pipe
The design and selection of the lining must take account of the following:

a) External loads caused by traffic fill and ground water pressure
b) Internal loads such as internal pressure and transient vacuum
c) Longitudinal and thermal loads
d) The effect of the liner on hydraulic performance
e) The effect of the liner on service connections and other fittings
f) Bends and junctions

In the case of gravity pipelines such as sewers, the most important loads are external and in most countries the hydrostatic load due to ground water is the main factor effecting liner thickness. In the case of pressure pipes such as water mains, sewer force mains and gas mains, the most important load is the internal pressure and external loads are normally only relevant when the line is depressurised.

The design of liners for gravity pipes is described in a number of national standards and guidelines. For example, ASTM F-1216 describes the design process for cured-in-place and similar liners using sewers. In Europe, the various national standards are gradually being replaced by a new series of CEN/ISO standards covering the whole range of types of pipeline and application.

The design of liners for pressure pipes involves classification of the liner into one of three types depending on structural performance.

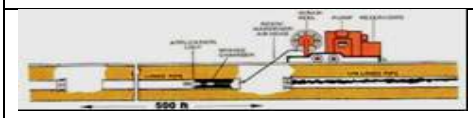
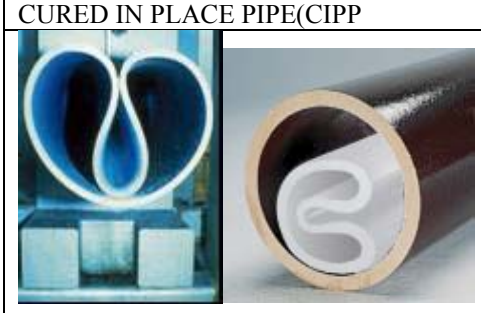
a) Non-structural – class 1
b) Semi-structural – class 2/3
c) Fully-structural- class 4

CONNECTIONS AND FITTINGS

In the case of gravity pipes, service connections (laterals) which are blocked by the installation of the liner are normally reopened using an internal robotic cutter. In some cases, the connection is subject to additional grouting or similar process to prevent infiltration.

In the case of pressure pipes the use of robotic reinstatement of service connections is made difficult by the need to seal the annulus to produce a water tight connection. Although some progress has been made in developing a suitable system, the current practise is to reinstate service connections via a local excavation and use of a special fitting.

The available technologies are listed below.

CLASS	DESCRIPTION	
 **IN SITU APPLIED COATINGS**	Involve application of a cement or polymer based coating to the pie wall, Mainly used as a on structural corrosion protection and renovation system for water mains Also used as a semi or fully structural lining system in man entry pipes	**thin non structural** **Thick semi or fully structural**
 CURED IN PLACE PIPE(CIPP	A Resin impregnated fabric tube is inserted in the host pipe and then cured to form a close fit pipe within a pipe. Most widely used renovation method for sewers and semi and fully structural variants for pressure pipes are now available New developments include light curable and glass fibre based systems and combined woven hose felt composites	Tube type Felt Reinforced Felt Glass Fibre Multi layer e
 CLOSE FIT THERMOPLASTICS	Involve insertion of a Polyethylene or PVC based pipe which has been temporarily reduced in diameter to allow insertion by passage through a circular die or by folding. After installation the liner is reverted to its original diameter/shape to form a close fit lining in the host. Variants for sewers and semi/fully structural lining of pressure pipes are available across a wide range of diameters The most recent development is a fully structural PVC based system for pressure pipes	Polyethylene based Polyester Reinforced PE (PRP) PVC based PE/UPVC alloys

SPIRAL WOUND  	Spiral wound lining comprises a method whereby a pipe or liner id formed in-situ by helically winding a UPVC strip into a pipe form within a host pipe normally from an existing access or manhole, which reduces or eliminates the need for a lead-in trench. To increase its stiffness, the strip 'joint' is ribbed with 'T-beams' on what becomes the outer surface of the new strengthen the liner further some systems offer a steel banding addition to the jointing for addition ring stiffness. A variant based on PE is now available	Grouted slipline Expanding close fit Steel reinforced
SECTIONALLINERS  *Spirally wound liner being installed in an egg-shaped pip*	Pre formed linners usually applied in gravity sewer situations, liner sections are available from minimum man-entry sizes, the size of which depends largely on the country in which the liner is to be applied and its regulations. However generally sizes between 825 and 6,400 mm have been available with liner section thicknesses from 10 to 30 mm. Section lengths are nominally between 0.5 and 1.5 m for installation in all shapes of pipe and may be WRc Type I or II Liners.	Grp Fibre cement