

APPLICATION OF NEG ARG FIBRE

Nippon Electric Glass
Ref. No. 015

GRC in Sewer Relining in the U.K.



Beneath all major cities in the U.K. are miles of man entry sewers. Many are built from double skin brickwork and date from Victorian times. Although skillfully built by craftsmen they are now in need of rehabilitation. Providing the sewer has not collapsed relining provides an efficient solution with minimum disruption to traffic on the street above.

GRC (glass fiber reinforced concrete) has been used to produce preformed GRC sewer relining segments for over 20 years and although there are many rivals it has proven to be cost effective and the most versatile of the competing systems.

GRC sewer relining segments

Manufacture

The quality of all materials used in sewer relining is controlled by the Water Research Council, WRC. For GRC, the important parameters are 28 days flexural strength and skin thickness to ensure consistency. "Mouldform" GRC is manufactured by the "Machine Spray Dewatered" technique. Using a high water cement ratio and sulphate resisting cement, the GRC is sprayed onto a dewatering mold by means of an auto traverse. The sprayed GRC is vacuum dewatered and cut to the required size.



The cut sheet is lifted using a specially designed lifting pad and located on the mold. The mold is manufactured from a site produced template which ensures the best possible fit to the sewer.



The GRC sheet is compacted against the mold and is given a rolled finish to improve the bond between the GRC and the grout. Flanges are then placed and grout holes made.



Test boards cut from the main GRC sheet are immediately tested for glass content and at 7 and 28 days for flexural strength.

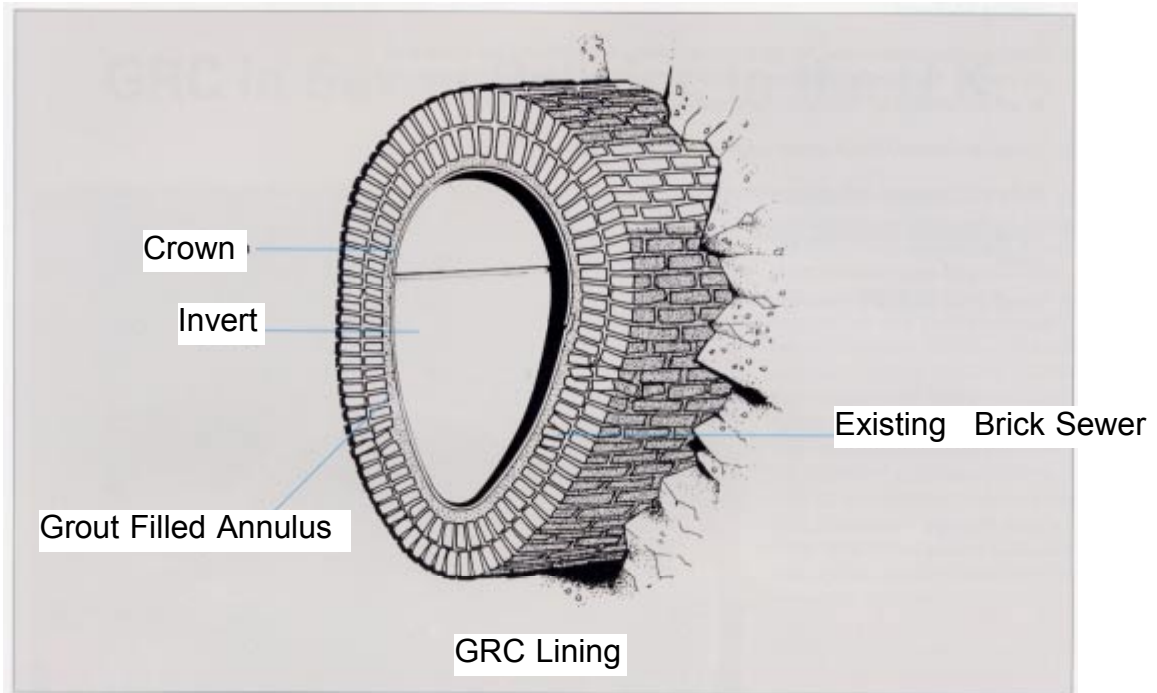


After a 7 day moist cure the segments are stored awaiting dispatch. Mock-ups ensure there will be no fitting problems and allow for early client inspection.



Design

The requirements of sewer relining systems are laid down in the Sewer Rehabilitation Manual published by the WRC. Each individual sewer must be subject to separate design.



Typical Design

PARAMETERS

Pressure on sewer (p)

$K = 0$ voids suspected
 0.4 voids not suspected

Crown bending moment coefficient (C)

Mean width of existing sewer (d)

Wall thickness of existing sewer (t_2)

Estimated minimum annulus thickness (t_1)

Lining thickness of GRC (t)

Long term tensile stress (s)

CALCULATIONS

Lever arm $t_d = 0.67t_2 + t_1 + 0.5t$

Crown bending moment $M = Cp d^2/4$

Lining tensile force $F = M/t_d$

Lining tensile capacity $T = St$

Check factor of safety $T/F \geq 2$ OK

Installation

1. Survey sewer, manufacture templates. Clean sewer and replace any large areas of missing brickwork.
2. Starting at the upstream end, lay the invert sections to line and level and repeat with the crowns. The jointing system will allow for slight bends but tighter bends can be accommodated by cutting or using specially made curved segments.
3. Using mechanical fixings secure joints at 300 mm centers.
4. Make any necessary side entry connections.
5. Isolate length of completed section by forming mortar around circumferential joints
6. Install grout through preformed grout holes in the linings.