

APPENDIX 'D'

**DESIGN REQUIREMENTS FOR CIPP AND GRP LINERS
(WRC TYPE 2)**

Appendix D - Design Requirements for CIPP and GRP Liners (WRc Type 2)

Thickness Requirements for Egg Shaped Structural Sewer Liners

Sewer Shape	Sewer Asset ID(s)	Street	Nominal Host Pipe Dimensions		Allowable Liner Type	Maximum Liner Outside Dimension*		Max Design Invert Depth (m)	Host Pipe Deterioration State	Live Load Model	Minimum Liner Design Thickness Requirements (mm) (Design thickness shall be the greater of Eq. 1 & Eq. 2)	
			Height (mm)	Width (mm)		Height (mm)	Width (mm)				Eq. 1: Long Term Flexural Strength in hoop direction (MPa)	Eq. 2: Long Term Flexural Modulus in hoop direction (MPa)
Egg	S-MA60010557	JESSIE AVE	1200	900	CIPP	1300	1000	7.90	Partially Deteriorated	N/A	$t = 145.7S_L^{-0.483}$	$t = 281.32E_L^{-0.322}$
					GRP	1200	900				$t = 134.43S_L^{-0.483}$	$t = 210.86E_L^{-0.324}$
Egg	S-MA60009676	JESSIE AVE	1800	1375	CIPP	1900	1475	8.05	Partially Deteriorated	N/A	$t = 215.48S_L^{-0.483}$	$t = 413.42E_L^{-0.322}$
					GRP	1800	1375				$t = 204.09S_L^{-0.483}$	$t = 319.25E_L^{-0.324}$
Egg	S-MA70014425	JESSIE AVE	2025	1550	CIPP	2125	1650	8.15	Fully Deteriorated	AASHTO HS25	$t = 278.9S_L^{-0.48}$	$t = 508.68E_L^{-0.32}$
					GRP	2025	1550				$t = 266.67S_L^{-0.48}$	$t = 396.53E_L^{-0.323}$
Egg	S-MA70019493 & S-MA70019487	PORTAGE AVE	2515	1930	GRP	2515	1930	10.00	Partially Deteriorated	N/A	$t = 323.16S_L^{-0.481}$	$t = 484.84E_L^{-0.323}$

Nomenclature and Design Parameters	
Design Method:	WRc Sewerage Rehabilitation Manual, Type 2 Design
Applicable Long Term Flexural Strength (S _L):	15.5 MPa - 200 MPa
Applicable Long Term Flexural Modulus (E _L):	862 MPa - 7000 MPa
Minimum Design Liner Thickness (t):	Greater of Eq. 1 and Eq. 2 (mm)
Lateral Earth Coefficient:	0.33
Soil Density:	18.85 kN/m ³
Assumed Water Table Depth:	2.0 m below ground elevation
Soil Stress Model:	Effective Stress
Factor of Safety on Applied Stresses:	2.0
Profile Coefficient:	0.5 for CIPP liners
	1.0 for GRP liners

*Maximum Dimension accounts for variability in the host pipe wall for close-fit liners.