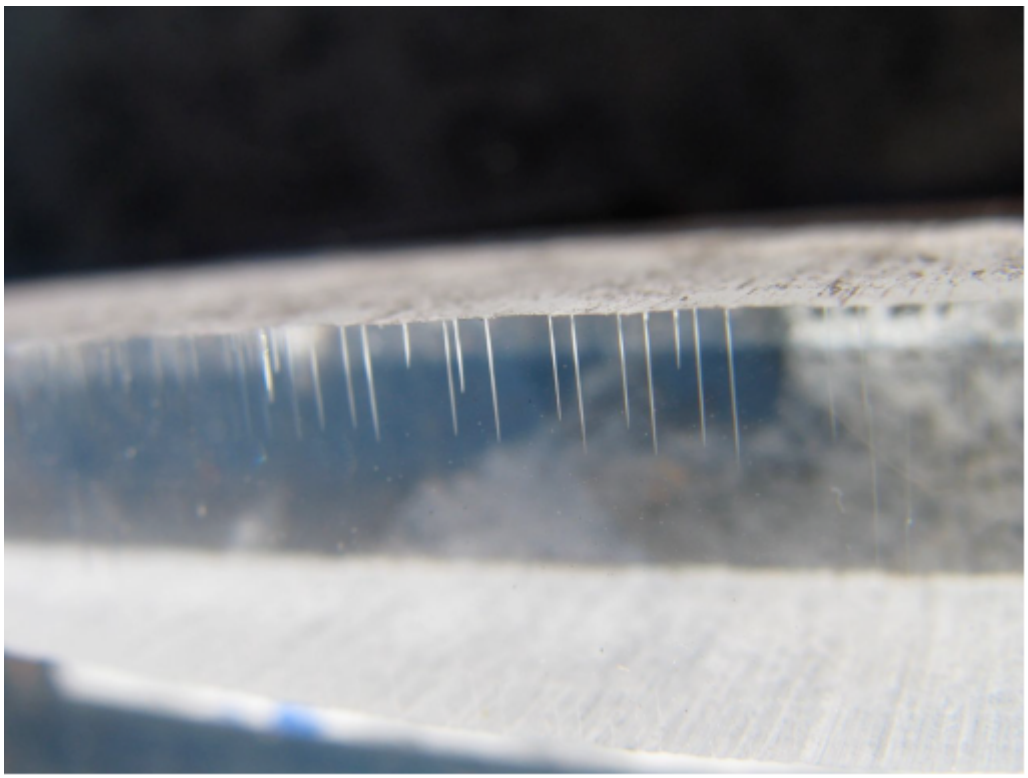
1-4

Acrylic – Panels

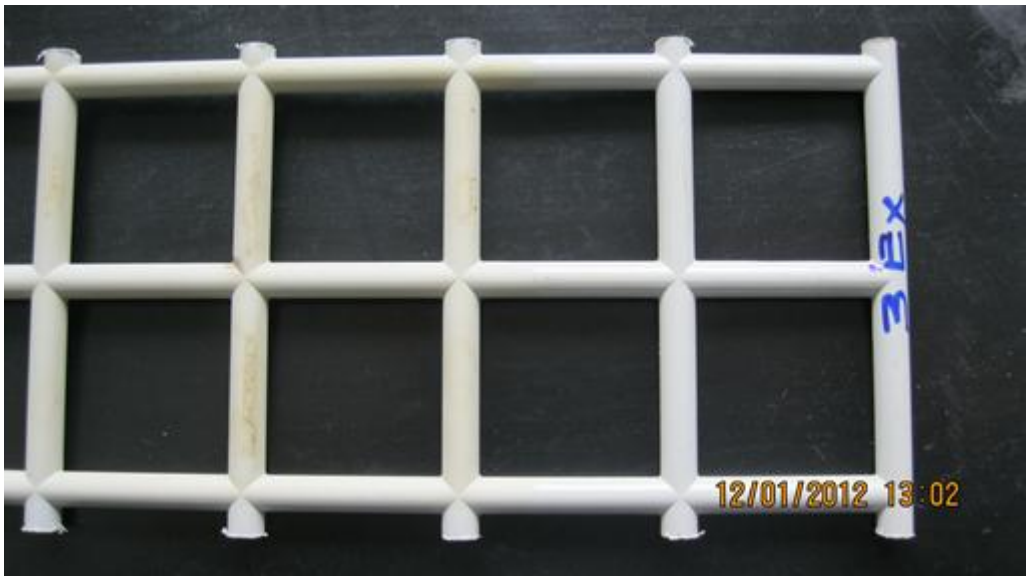
Title	CRACKED ACRYLIC PANELS
Date	2012
Objective	To investigate the root cause of cracking of acrylic panels used as decorative cladding panels on a foot bridge in NZ.
Photo	 Figure 1. Cracking around mounting holes

	 Figure 2. Resistance to ESC. Cracking observed on bent strip only where adhesive film was applied
Testing Undertaken	Failure Analysis Methodology (Scheirs 2000) Determination of Resistance to Environmental Stress Cracking (ESC) ISO 22088-3: 2006 GC/MS
Failure Analysis	Cracking of the acrylic sheet was typical of ESC and Cyclic Stress Loading (CSL). Computer modelling showed that the panels were subjected to high strains concentrated around the mounting holes due to thermal stresses andwind gusting in service. The adhesive backed decorative film applied to the acrylic panels was the most likely root cause of the stress cracking owing to the various potent stress cracking chemicals detected in it.

Acrylonitrile butadiene styrene (ABS) – Mesh for work platforms

Title	UV RESISTANCE TESTING
Date	2012
Objective	To further study the UVResistance of two different supplied plastics samples

Photo



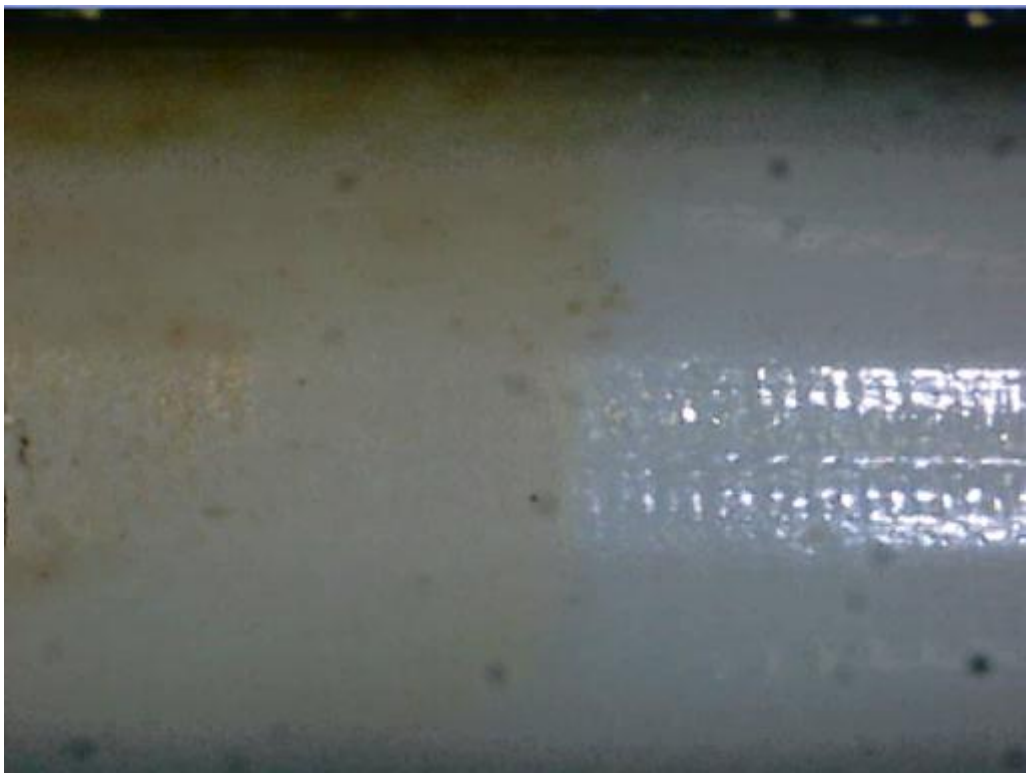
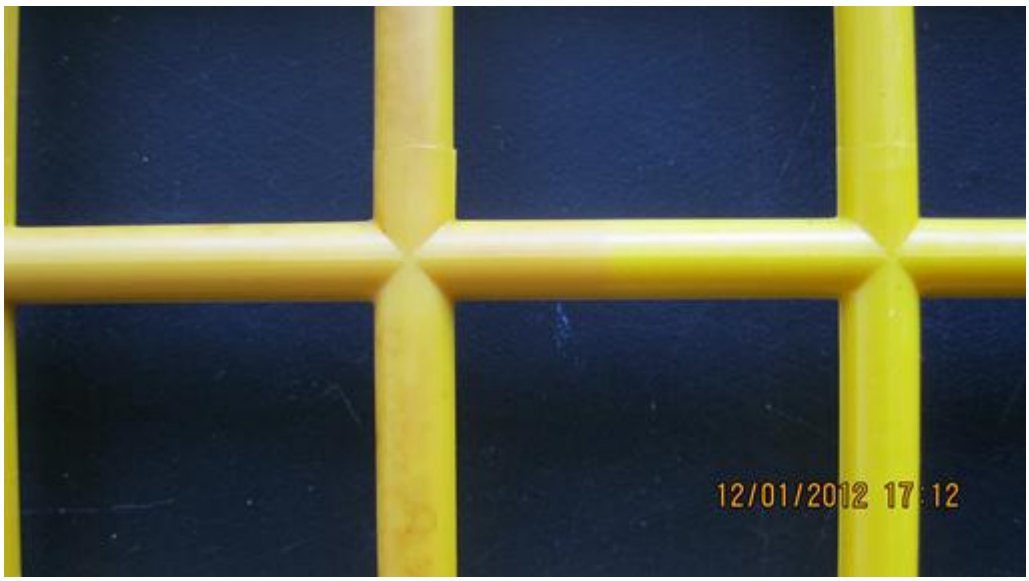
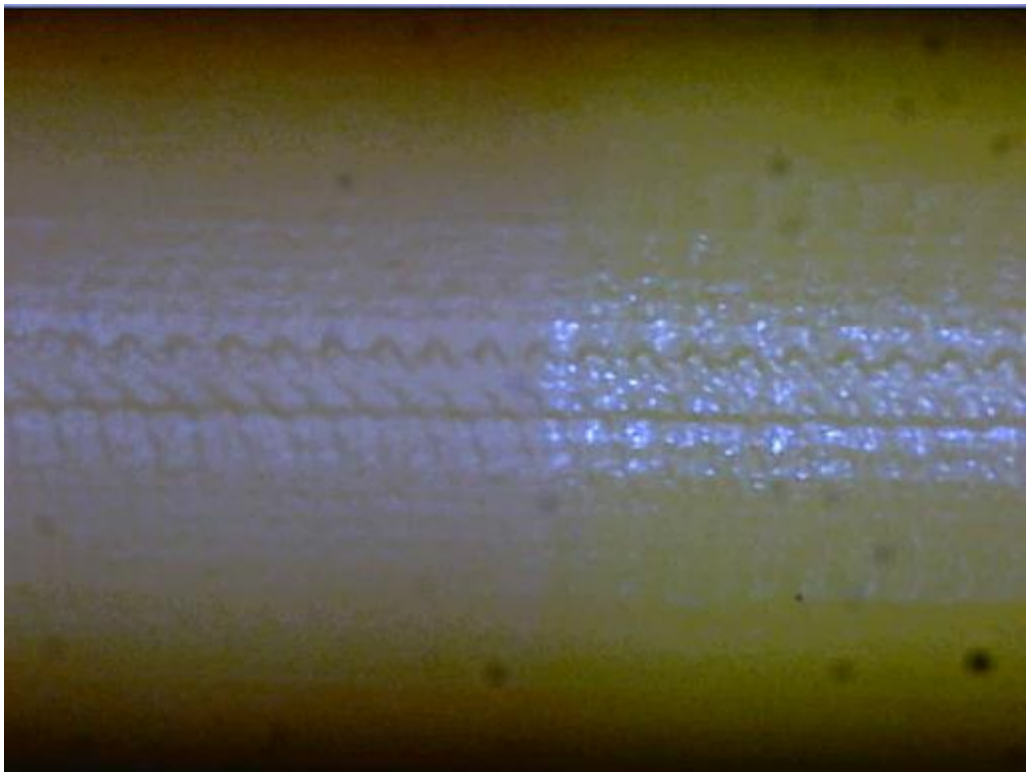
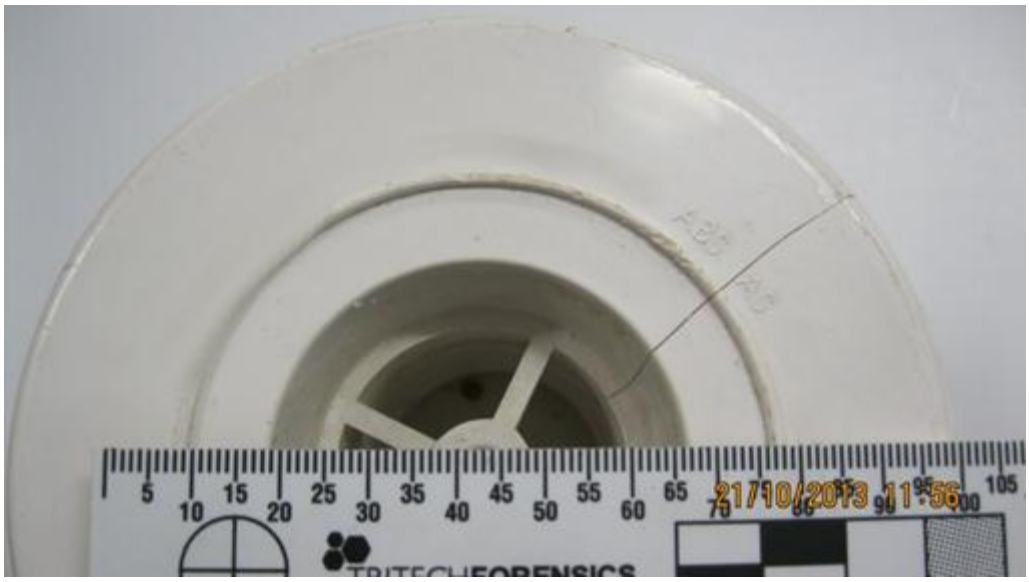
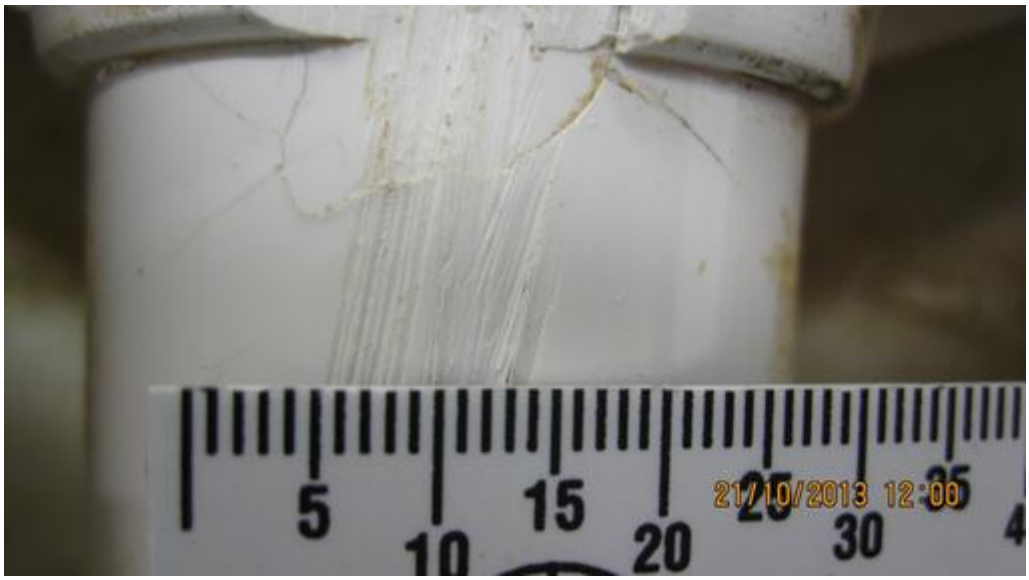


Figure 1a and 1b. Grey Mesh after UV exposure showing slight discolouration

	  Figure 1a and 1b. Yellow Mesh after UV exposure showing slight discolouration
Testing Undertaken	Strips of mesh that had previously undergone accelerated UV aging were re-loaded into a QLabs UV Weatherometer and exposed to a second period of accelerated UV aging. The samples were then visually inspected.
Failure Analysis	Visual inspection of both the grey and yellow mesh samples showed some dis-coloration but no evidence of substantial polymer degradation.

Acrylonitrile butadiene styrene (ABS) – Mouldings (1 of 3)

Title	CAUSE OF CRACKING ON AN ABS ASSEMBLY
Date	2013
Objective	To determine the cause for the cracking of an ABS drain assembly
Photo	 Figure1. Sample showing major lateral crack  Figure 2. Sample showing cracks at side of moulding

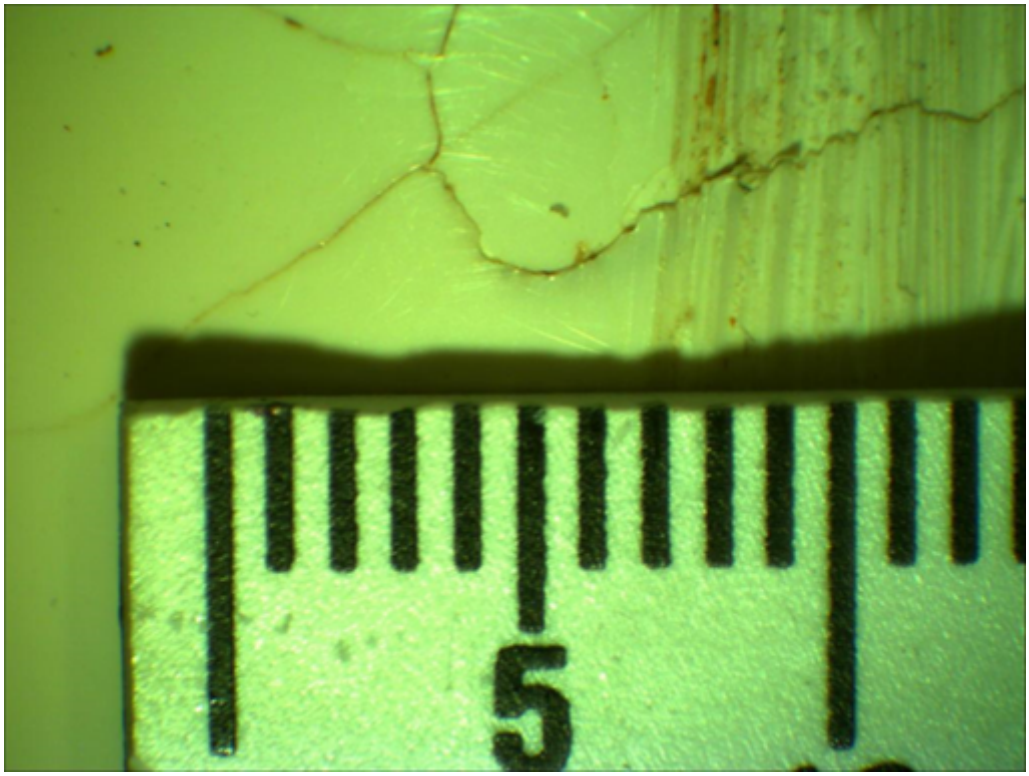


Figure 3. Magnified image of side cracks

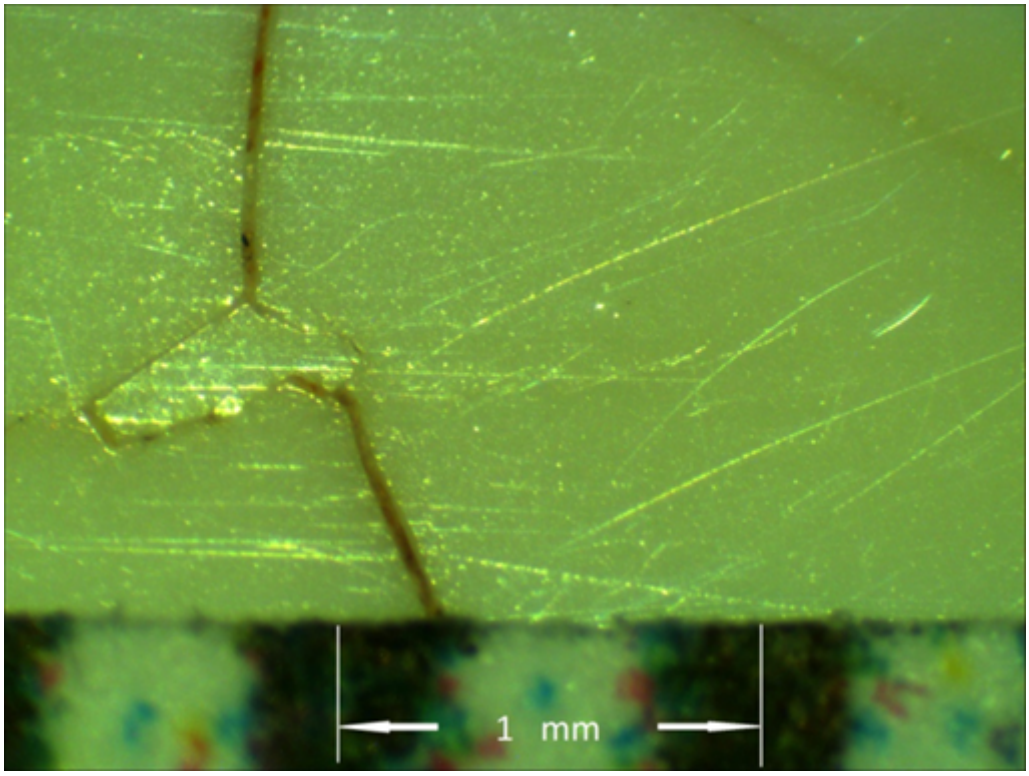
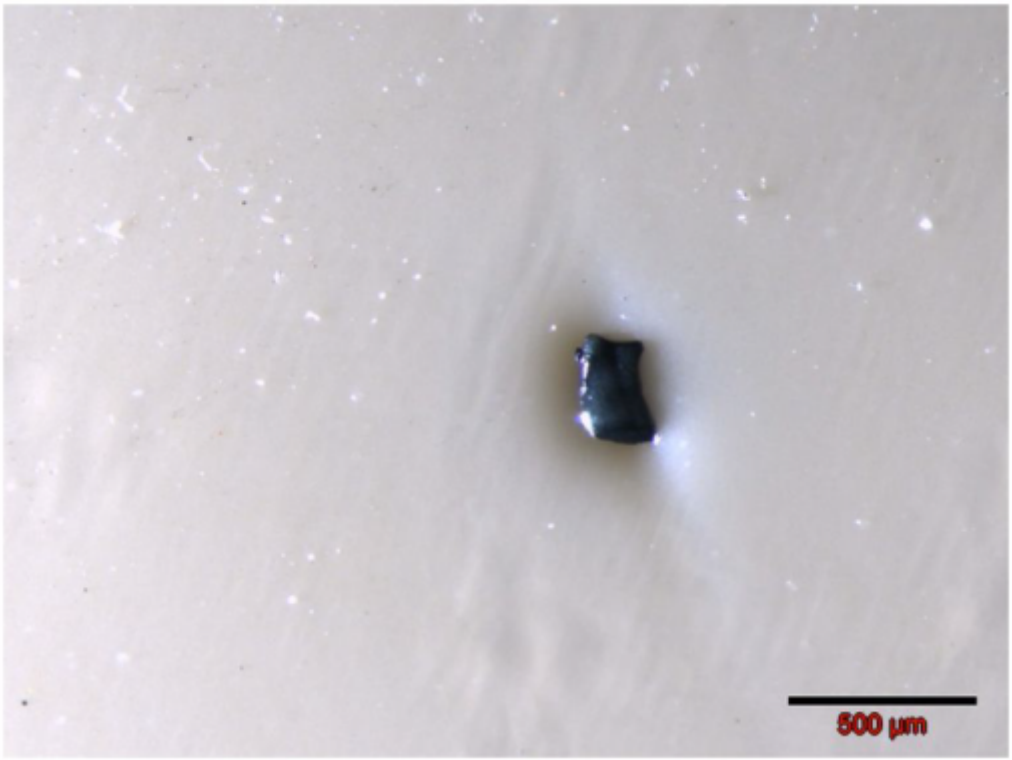


Figure 4. Detailed image of crack structure

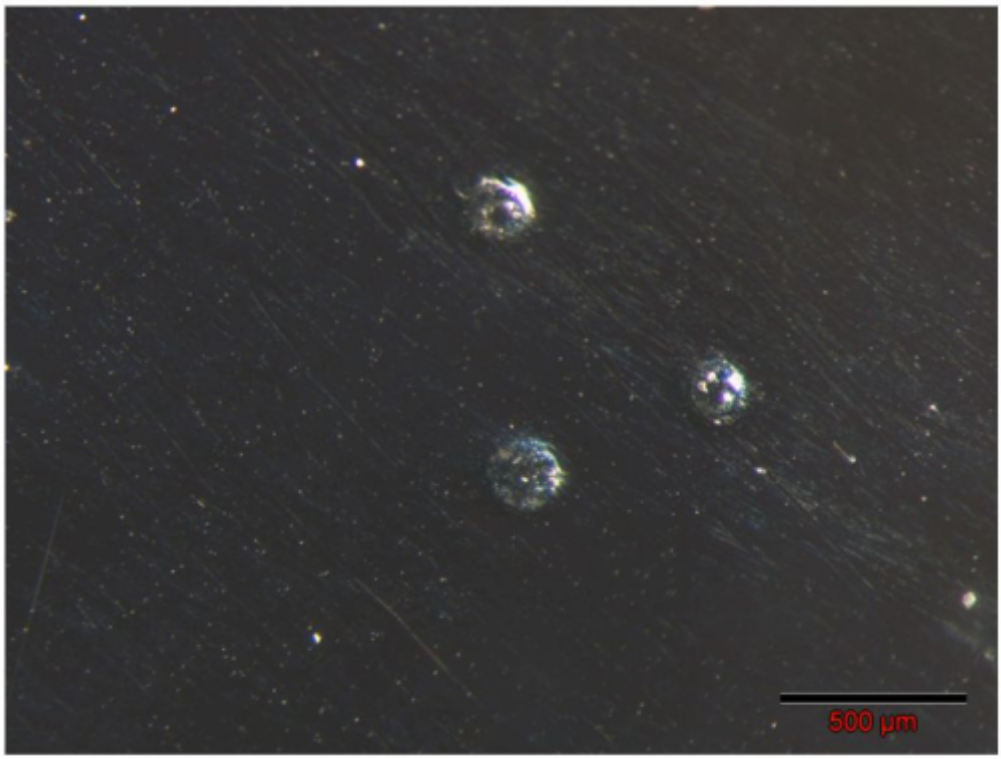
Testing Undertaken	Infrared measurement to determine relative quantities of acrylonitrile in materials Visual assessment of nature of cracks using microscope at various magnification.
Failure Mode	The moulding cracked due to environmental stress cracking caused bycyclohexanone in the adhesive used during assembly.

	IR-spec indicated no deficiency in acrylonitrile content.

Acrylonitrile butadiene styrene (ABS) – Mouldings (2 of 3)

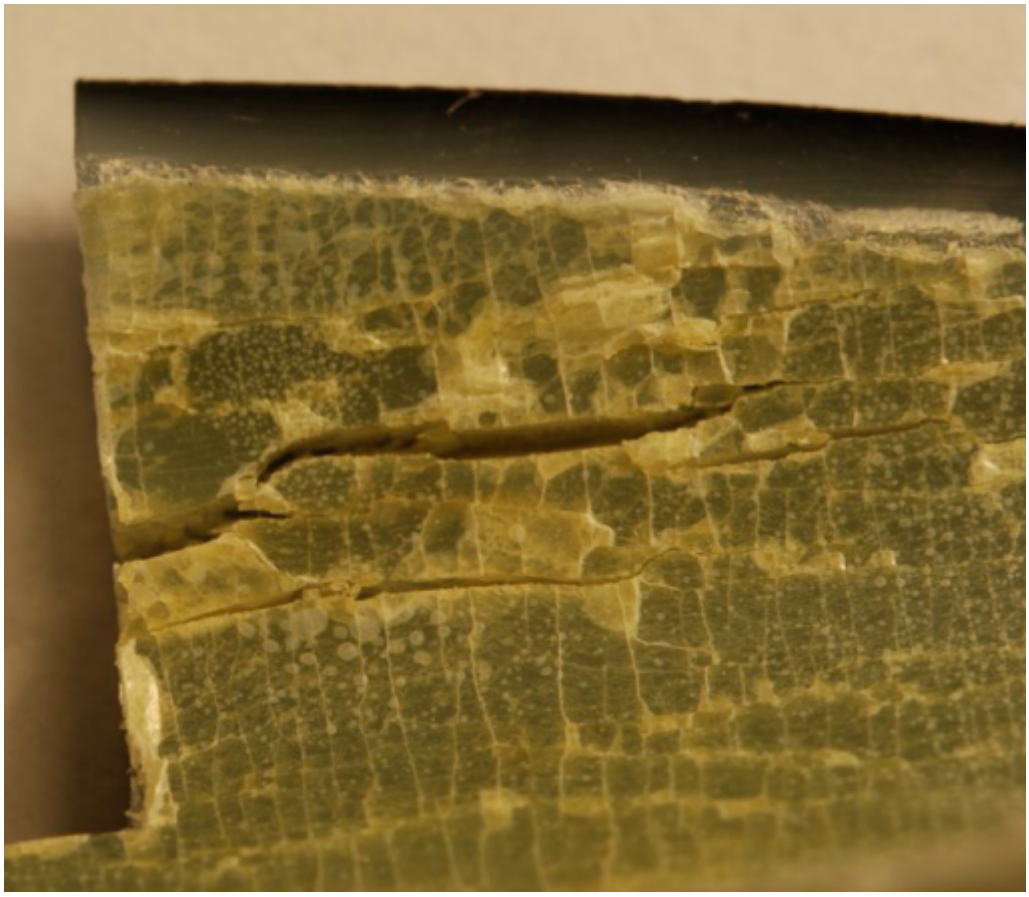
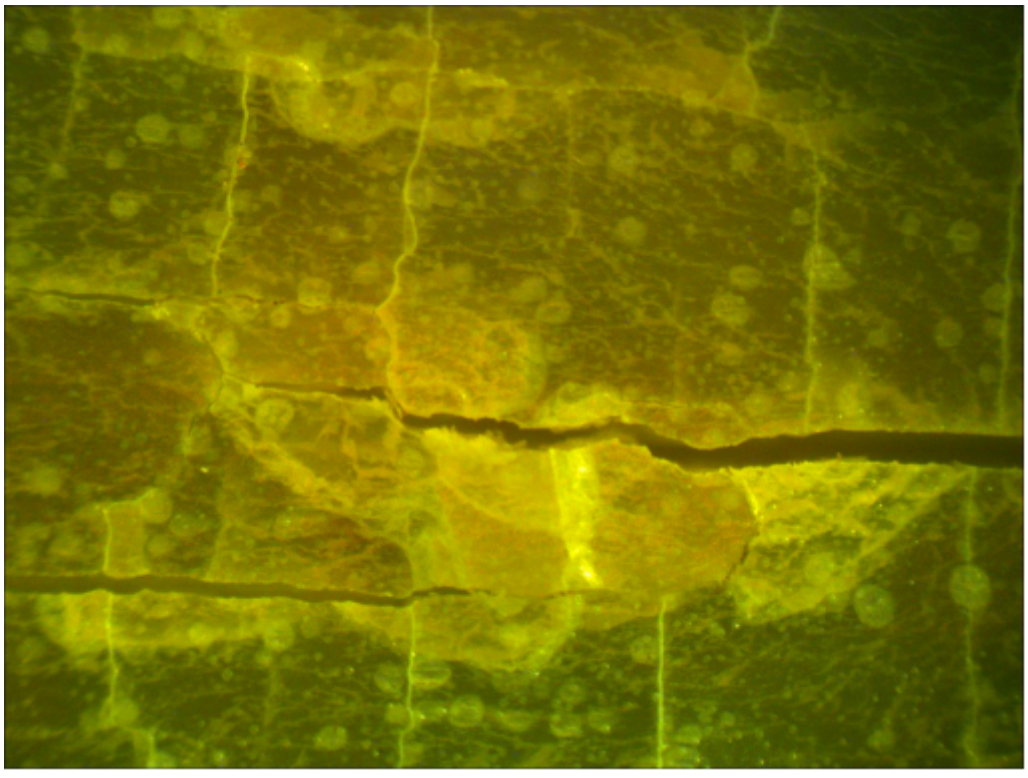
Title	DEFECTS IN ABS USED FOR PLATING
Date	2013
Objective	To investigate the origin of defects in ABS mouldings used for plating
Photo	 Figure 1. Sample 5
Testing Undertaken	Microtoming Grazing Angle Optical Microscopy (GAOM) SEM Microprobe Elemental X-ray Analysis (EDAX)
Failure Analysis	The defects in the ABS mouldings and plated ABS could be attributed to: carbonized black specks rich in bromine (poorly purged extruder), and blue pigment particles based on ultramarine blue (poorly purged extruder). The black specs may also be related to the use of recycled ABS which has additional heat histories

Acrylonitrile butadiene styrene (ABS) – Mouldings (3 of 3)

Title	DEFECTS IN ABS USED FOR PLATING
Date	24 May 2013
Objective	To investigate the origin of defects in plated ABS mouldings.
Photo	 Figure 1. Sample 26 (Chrome Plated)
Testing Undertaken	Microtoming Grazing Angle Optical Microscopy (GAOM) SEM Microprobe Elemental X-ray Analysis (EDAX)
Failure Analysis	The defects in the plated ABS could be attributed to: pimples formed by surface bubbles (due to gas evolution from surface contamination or hydrogen bubbles) and silica or sand contamination (on one sample).

Crosslinked polyethylene (PEX) – Hot water pipe (1 of 2)

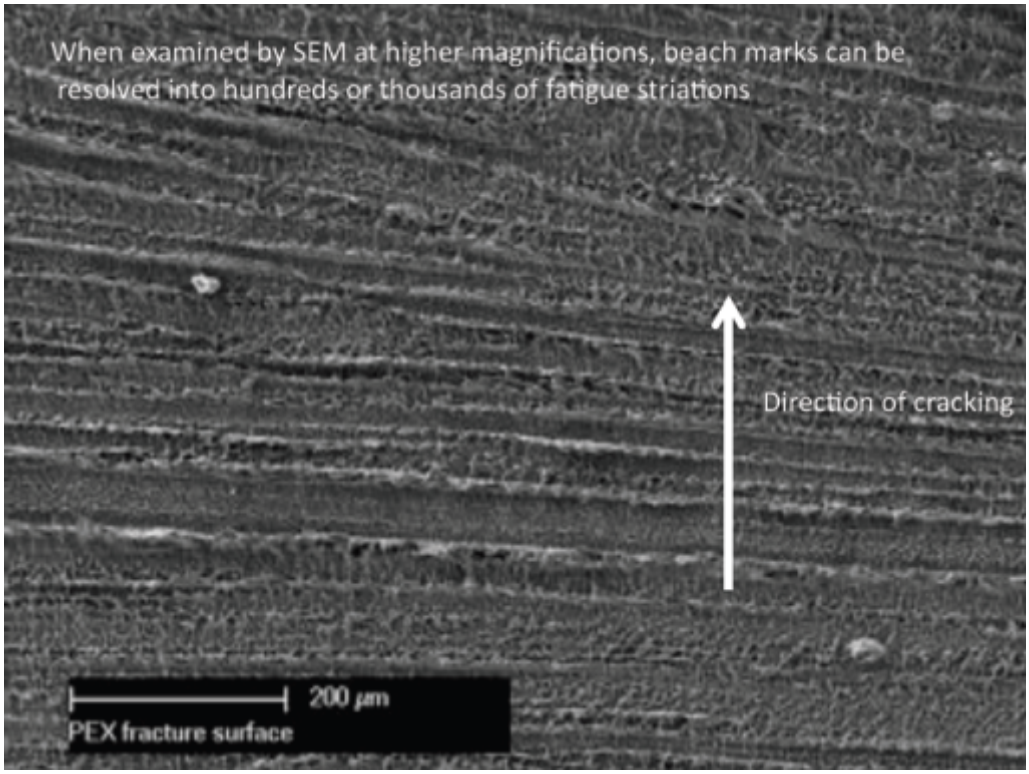
Title	FAILURE ANALYSIS OF PEX HOT WATER PIPE

Date	2013
Objective	To conduct a failure analysis on samples of PEX pipes that have cracked in service (a hot water system)
Photo	 Figure 1. Sample internal surface (Low Mag.)  Figures 2. Internal cracks on sample (40x Mag.)

Testing Undertaken	Wall thickness measurements Photomicroscopy ATR-FTIR Carbonyl Index per ASTM F2102 OIT by DSC per ASTM D3895 Degree of crosslinking per AS2492
Failure Mode	The inner surface of the PEX pipe is totally degraded and embrittled down to ~ 2/3rd total wall thickness. The PEX pipe has undergone a Stage III failure which is caused by depletion/extraction of its antioxidants.

Crosslinked polyethylene (PEX) – Hot water pipe (2 of 2)

Title	CRACKING OF PEX HOT WATER PIPE
Date	2013
Objective	To investigate the cause of failure of a sample of PEX black hot water pipe
Photo	 Figure 1. Pipe showing brittle slit failure



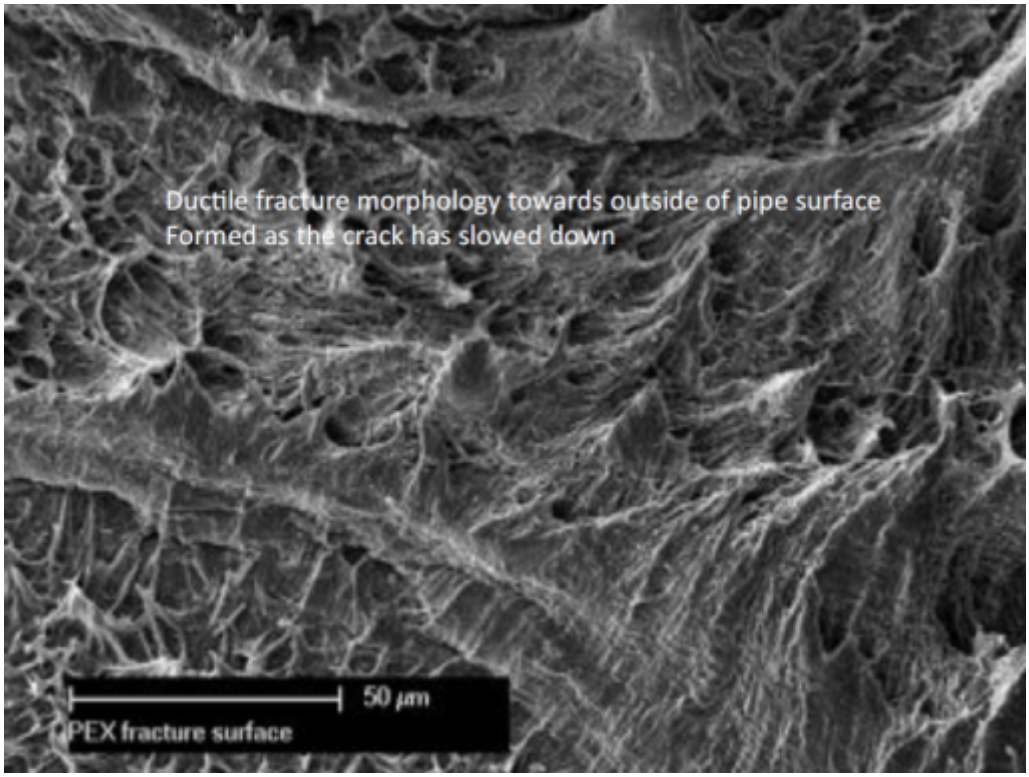
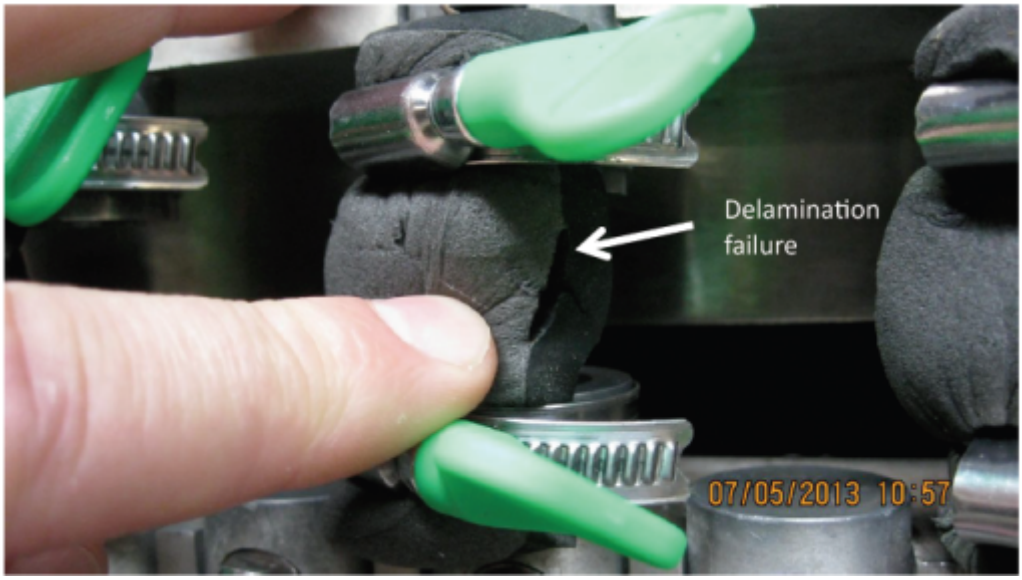


Figure 2a and 2b. SEM Photo of fracture surface through wall of pipe

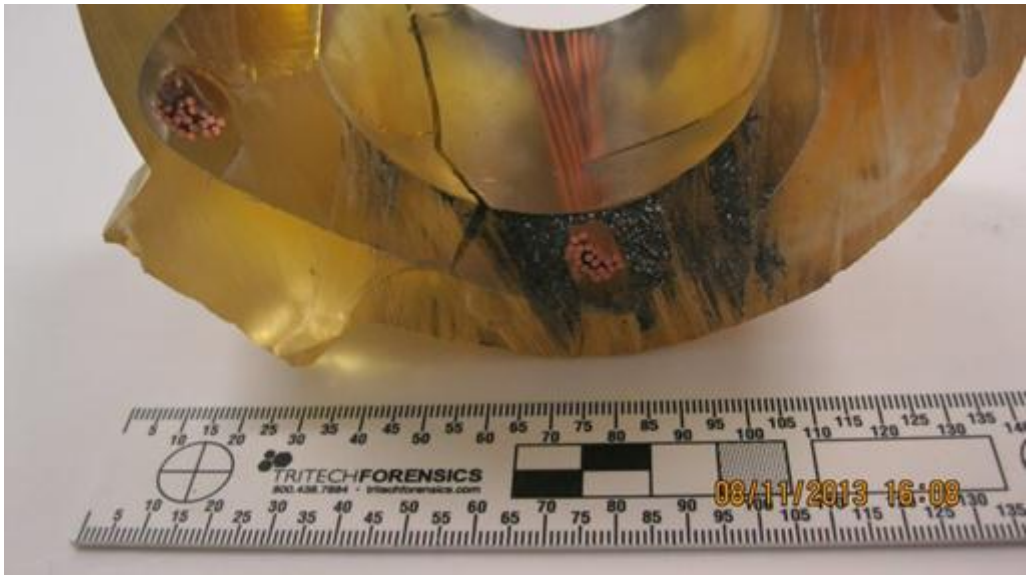
Testing Undertaken	SEM Fractographic analysis OIT (per ASTM D-3895)
Failure Analysis	The pipe failed prematurely by Fatigue Crack Propagation initiated at the inner surface.

Elastomer – Safety wear (kneepads)

Title	FLEX CRACK TESTING OF KNEEPADS
Date	2013
Objective	To investigate the flex fatigue crack resistance of two kneepads.
Photo	 Figure 1. Failure after 1,000,000 flex cycles
Testing Undertaken	Flex cracking resistance of rubbers and elastomers by AS 4878.9-2001
Conclusion	Delamination failure was observed for the rectangular knee pad at the interface between the black rubber and the grey foam after 1,000,000 cycles.

Epoxy – Castings

Title	ASSESSMENT OF A CRACKED EPOXY CASTING
Date	2013
Objective	To assess the cause of cracking in a moulded epoxy casting.
Photo	

	 Figure 1. Crack in Casting  Figure 2. Close up of crack in moulding
Testing Undertaken	Failure analysis
Failure Mode	Temperature at time of mixing components estimated to be as high as 50°C, possibly causing the reaction to proceed four times faster than normal and generate four times as much heat. This could create a crack due to the thermal stresses generated.

Epoxy – Sewer Pipes

Title	FAILURE ANALYSIS OF COLLAPSED POLYMER LINER IN SEWER PIPE
Date	2012

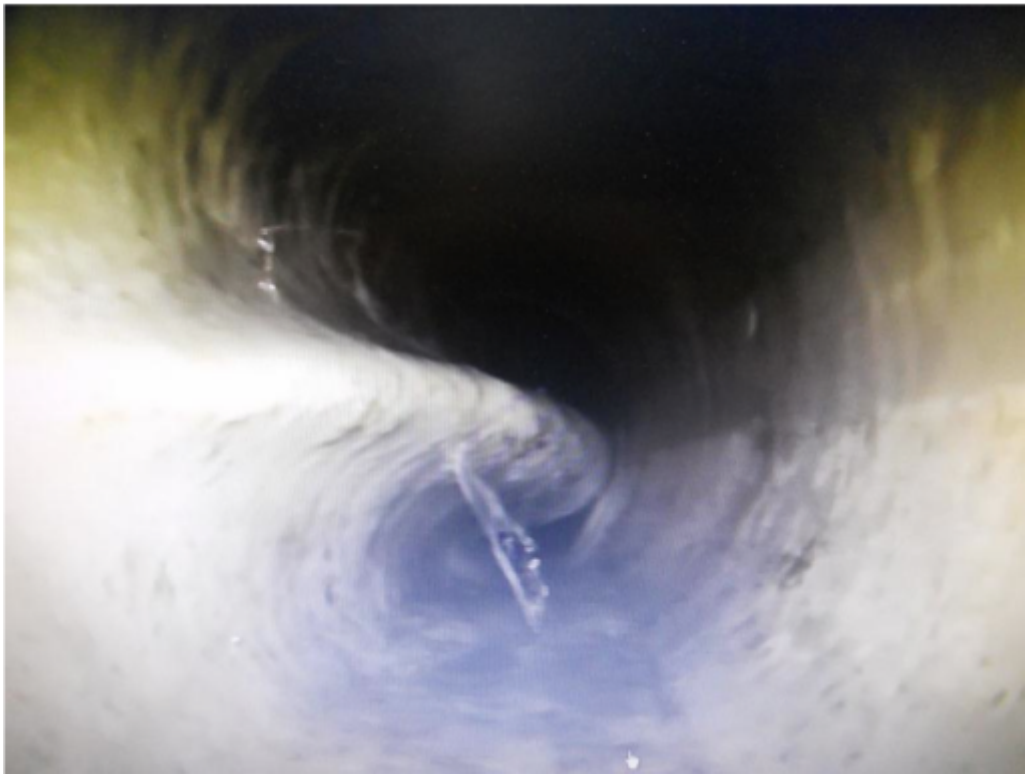
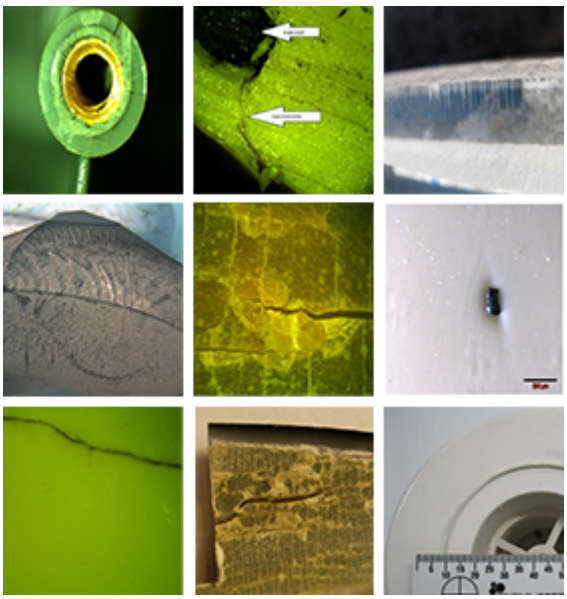
Objective	To investigate the cause of failure of an epoxy liner in a sewer relining application
Photo	 Figure 1. Photograph of failed liner in situ  Figure 2. Photograph of cured reference liner

	 Figure 3. Photograph of recovered liner section
Testing Undertaken	DSC Thermal Analysis IR-Spec Durometer Shore D Hardness Measurements
Failure Analysis	There were some dry felt areas on the recovered liner, thus indicating resin poor zones suggesting the liner may not have been properly impregnated with epoxy resin. The cured liner has limited stress resistance and thus should not be in a load bearing service application as it lacks ring crush resistance and buckling resistance

Accreditation

Gallery



Contact Us

Polymer Testing (Division of ExcelPlas)

274 Wickham Road
Highett VIC 3190

Postal Address
PO Box 147
Moorabbin VIC 3189

e. info@polymertesting.com.au
p. 03 9532 2207

www.polymertesting.com.au

Back to Top