

AEGIS[®] HIGH PERFORMANCE POLYMERIC LINERS FOR CULVERT REHABILITATION

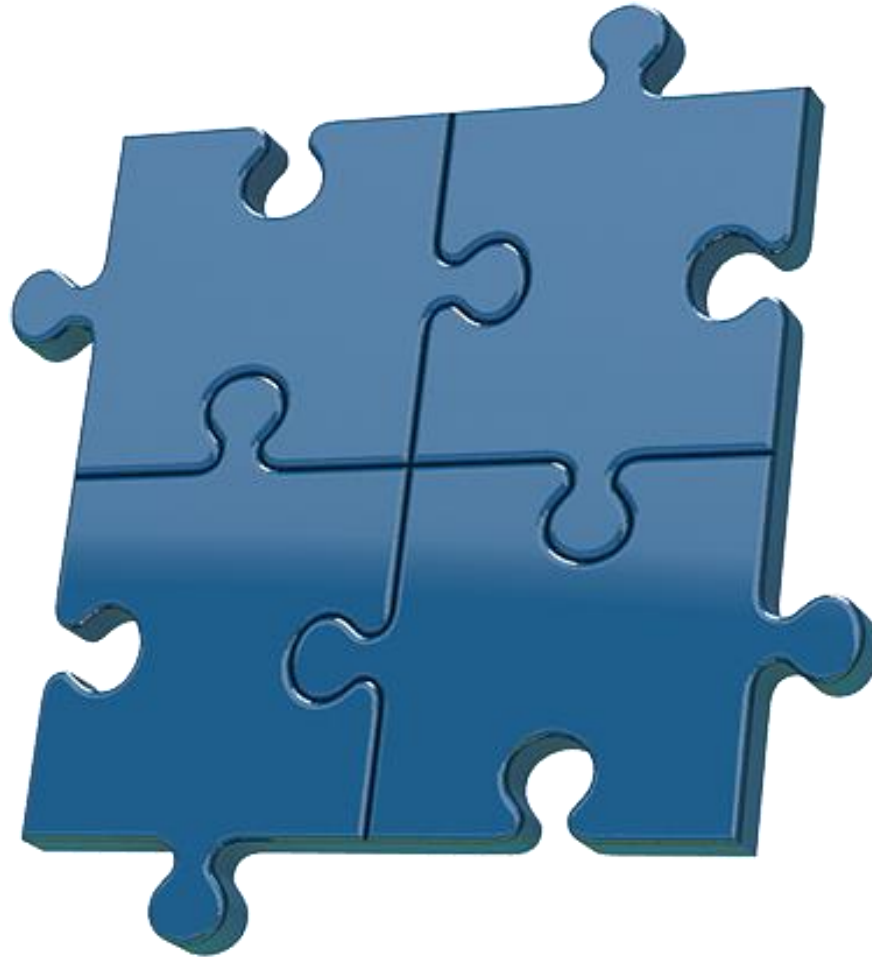
22 June 2022

NUKOTE'S AEGIS® SERVICE OFFERING FOR CULVERT RENEWAL



PRODUCT TECH

Material design for Spray-In-Place Pipe (SIPP) Class-I-IV anti-corrosion, semi-structural and full-structural liners. (Polyurea /Polyurethane, Hybrid Coatings)



EQUIPMENT TECH

State of the art delivery systems designed for speed, reliability and consistency that decreases waste and improves efficiency.

SPECIFICATION TECH

Working with our clients to develop new specifications based on engineering support, third-party test data and proven product performance. **Nukote's new QA/ITP APP ensures proper installation and provides documentation for product warranty.**

APPLICATION TECH

Nukote has an extensive network of distributors and trained contractors throughout North America that are trained in applying our product.

AEGIS® SIPP VALUE PROPOSITION



- Polyurea Liners/ Polyurethane hybrid coatings designed for semi- and full-structural applications.
- Liner performance can be tuned and balanced (structural and elastomeric properties) to provide the required engineering specification and thickness to withstand live loads with minimal deflection. (We have tested up to 108,000 psi in live loads)
- 4-5 second gel/30 second tack free allowing both forward and reverse application at high builds. Fast cure allowing for light traffic in 1 minute and back in service immediately.

Technical Data Sheet NUKOTE PP300



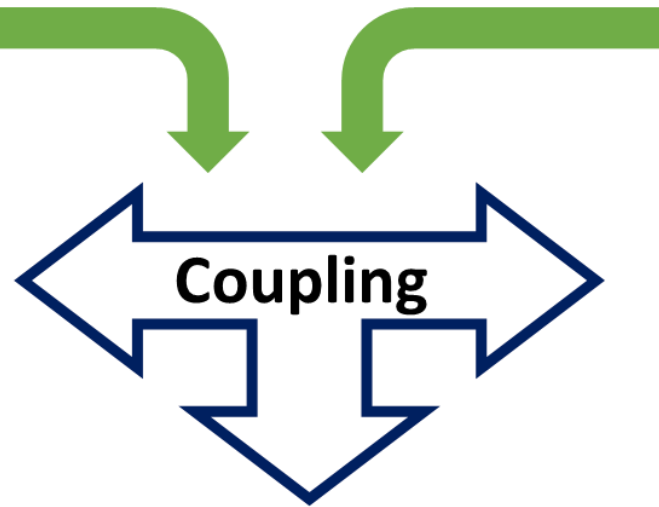
TECHNICAL DATA (All values @ 77 °F / 25 °C)	US	Metric
Solids by volume (ASTM D2697)	100%	100%
Volatile organic compounds (ASTM D2369)	0 lb./gal	0 gm/ lit
Theoretical coverage	40 ft ² /gal @ 40 mils	1 m ² /l @ 1 mm
Specific Gravity of materials (ASTM D792)	A:10.3, B:8.84 lb./gal	A:1.23, B:1.06 kg/ liter
Viscosity at 77 °F /25 °C in cps ±10% (ASTM D4878)	A-500 ± 20	A-500 ± 20
	B-1000 ± 500	B-1000 ± 500
Shelf life @ 77 °F /25 °C	12 Months	12 Months
Tensile strength (ASTM D412-C)	6000 ± 500 psi	42 ± 3 MPa
Elongation (ASTM D412-C)	3.5 ± 0.5 %	3.5 ± 0.5 %
Hardness (ASTM D2240)	80 ± 5 Shore D	80 ± 5 Shore D
Flexural Strength	10,730 psi	74 MPa
Flexural Modulus	290,000 psi	2,000 MPa
Compressive Strength (ASTM D695)	8,763 psi	60 MPa
Shear Strength (ASTM D732)	4,800 psi	33 MPa
Impact Resistance (ASTM G14), No Holidays	> 200 in-lbf	> 20 J (N-m)
Water absorption -24 hours (ASTM D570)	<0.5 %	<0.5 %
100% Elastic Modulus (ASTM D 638)	59500 psi	410 MPa
Rupture Modulus (ASTM D 638)	111,700 psi	770 MPa
Flash point Pensky Martin	>200 °F	>93 °C
Service temperature (Dry)	-20 °F to 200 °F	-30 °C to 90 °C
PROCESSING PROPERTIES (Under standard lab conditions)		
Mix Ratio V/V	1:1	
Gel time @ 160 °F /70 °C	5 - 15 seconds	Adjustable with catalyst
Tack free time@ 160 °F /70 °C (DFT & Temperature dependent)	20 - 60 Seconds	
Post cure time	24 hours	
<i>(The above properties and values are dependent on equipment settings, spray gun, mix chamber temperature, pressure and related parameters and variations are possible and expected). The above values are as per NCSI Standard lab practices & methodology at various film thickness)</i>		

NUKOTE'S COMPREHENSIVE 360 RINGTECH® OFFERING FOR THE SIPP INSTALLATION OF POLYMERIC LINERS



Process (Robotics, Software, Spray Gun Configuration)

- Cost
- Reliability (accuracy/ precision)
- Speed, fast return to service
- Variable culvert sizes & geometries
- Software/ data tracking
- Control & optimization (mixing/ spray deposition parameters)



Material Formulation

- VOC/ styrene free; environmentally friendly



Properties of Finished Cured Coating

Dimensional

- Surface finish maintains/ improves hydrolytic flow.
- Direct to substrate application

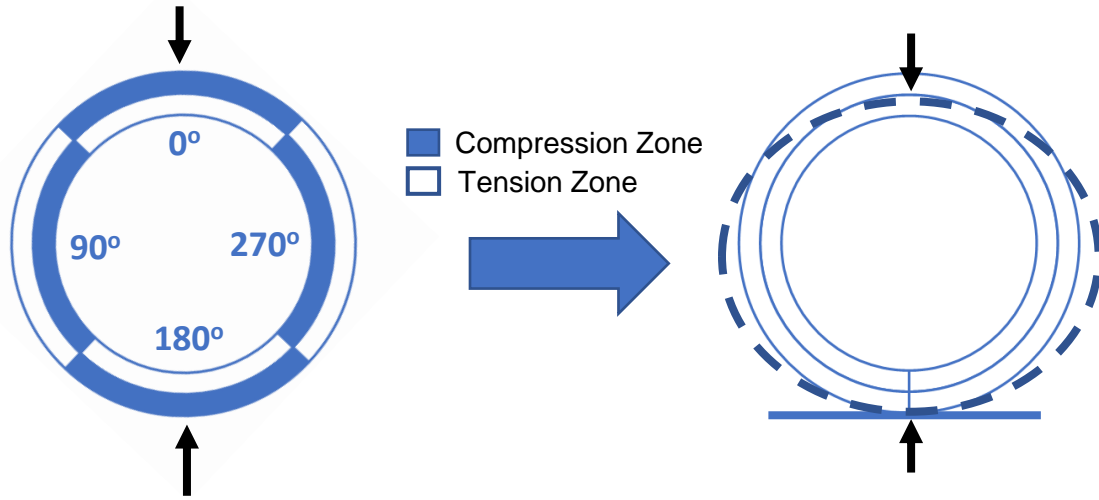
Chemical

- Weatherability (UV/ moisture resistance)
- Flame retardancy

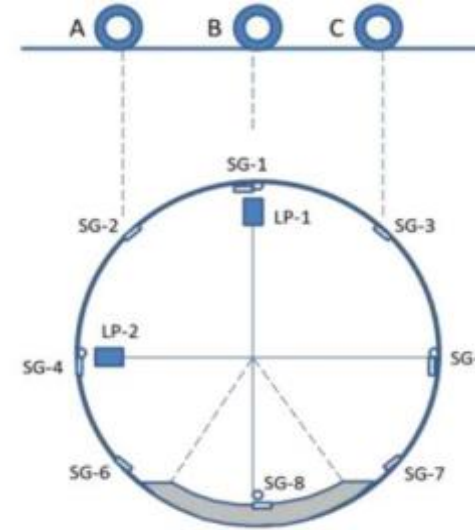
Mechanical/Structural

- Modular strength & flexibility/ compressive properties
- Hardness/ impact resistance
- Abrasion resistance
- Other specification criteria

NUKOTE'S AEGIS® LINERS CAN BE TAILORED TO ENHANCE LOAD CARRYING BEHAVIOR



Aegis® Liners ensure structural integrity high ductility without cracking



Aegis® Liner thicknesses can be adjusted to withstand a variety of soil, hydrostatic and live load environments.

Material	Standard shapes
Concrete, precast (Reinforced usually)	 1 CIRCULAR 2 PIPE ARCH 3 HORIZ. ELLIPSE 4 VERT. ELLIPSE 5 RECTANG. (BOX) 6 ARCH 7 FLAT TOP 3-SIDED 8 ARCH TOP 3-SIDED
Concrete, cast-in-place (Reinforced)	 1 RECTANG. (BOX) 2 ARCH
CMP, steel	 1 ROUND 2 VERTICAL ELLIPSE 3 PIPE ARCH 4 UNDER-PASS 5 ARCH 6 HORIZ. ELLIPSE 7 PEAR 8 HIGH PROFILE ARCH 9 LOW PROFILE ARCH 10 BOX
CMP, aluminum	 1 ROUND 2 ARCH
CM structural plate, steel or aluminum	 1 ROUND 2 PIPE ARCH 3 PIPE ARCH 4 UNDER-PASS

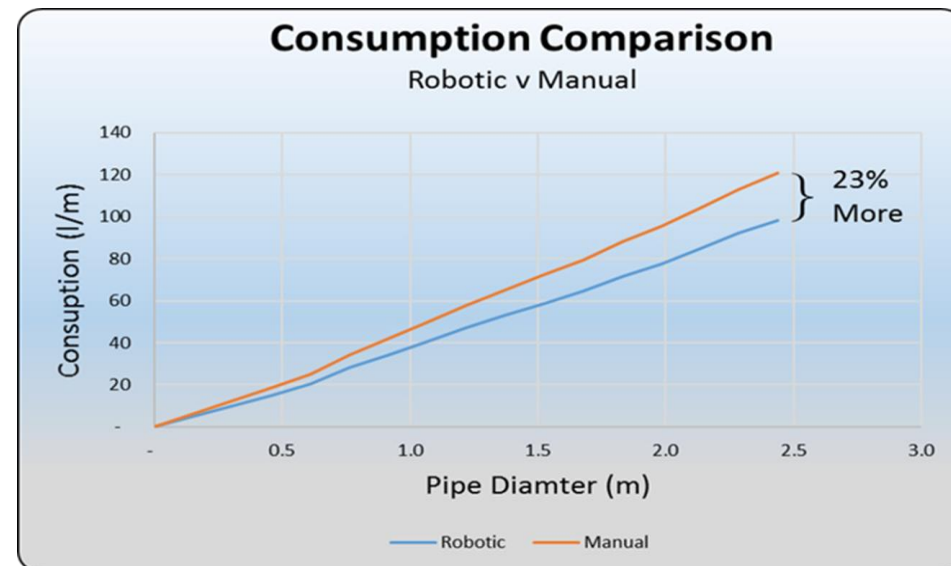
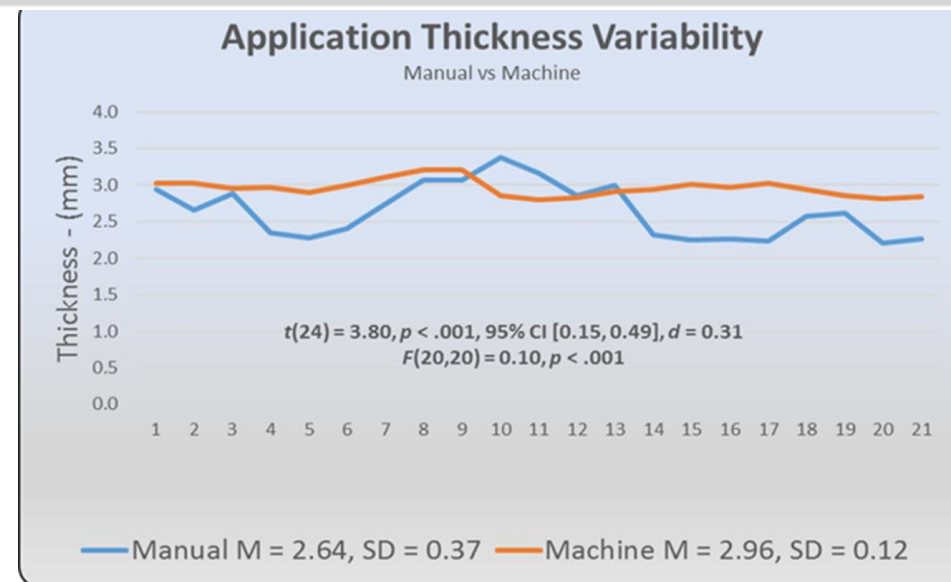
Aegis 360 Ringtech® platform has unique advantage of addressing multiple variations of culvert/arch substrate types, shapes and sizes.



ROBOTICS/AUTOMATION ENABLES TIGHTER CONTROL OF PROCESS, HIGHER QUALITY LESS WASTE



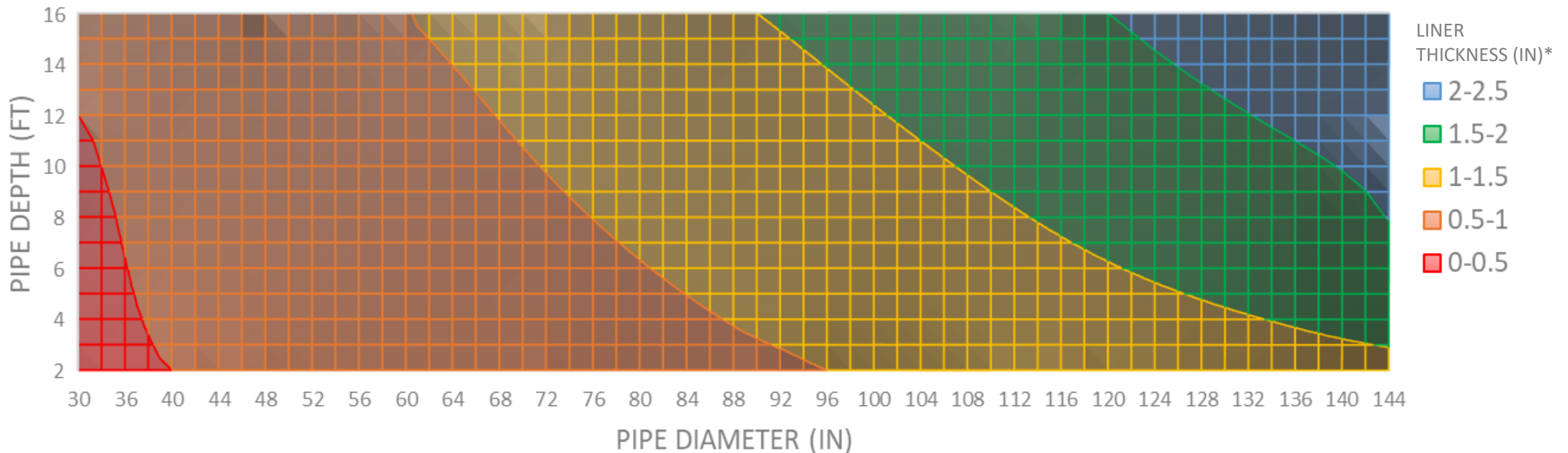
- 360 Degree rotational spray capability
- Fixed HD 360 Degree pan tilt camera assembly
- Records and converts application data to QA/ITP
- 4 Wheel drive steerable with two-wheel configuration
- PLC controls operated at station or portable touch screen
- Reach up to 420 feet /125 meters (extended reach 1142 feet/350 meters (optional))
- Suitable for diameters 36" to 108"



DEVELOPMENT OF STRUCTURAL DESIGN EQUATIONS



Aegis® and 360 Ringtech® enables clients and contractors to tune liner thickness to the specific design specification/requirement from feasibility study provided by Nukote's engineering service team. All modeling and calculations are performed on DOT approved CANDE software and meet F-1216 guidance and requirements.

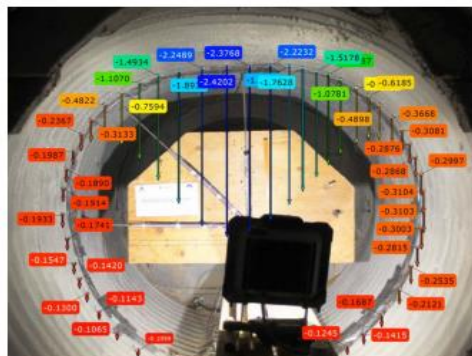


* This contour plot is used for demonstration purposes only and should not be used as a reliable guide to determine exact liner thickness values. Thickness of liner and consequent costs can vary greatly depending upon specific site location, soil type, total length of pipe, condition of host pipe, installer, number of bends and fittings and water service connections. For a proposal and quote for your specific project, please contact Nukote today.

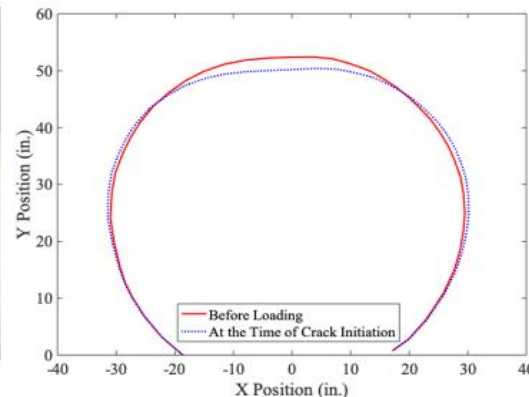
EXTERNAL PARTNERS EVALUATE AND QUALIFY POLYMER LINER PERFORMANCE IN REAL WORLD CONDITIONS



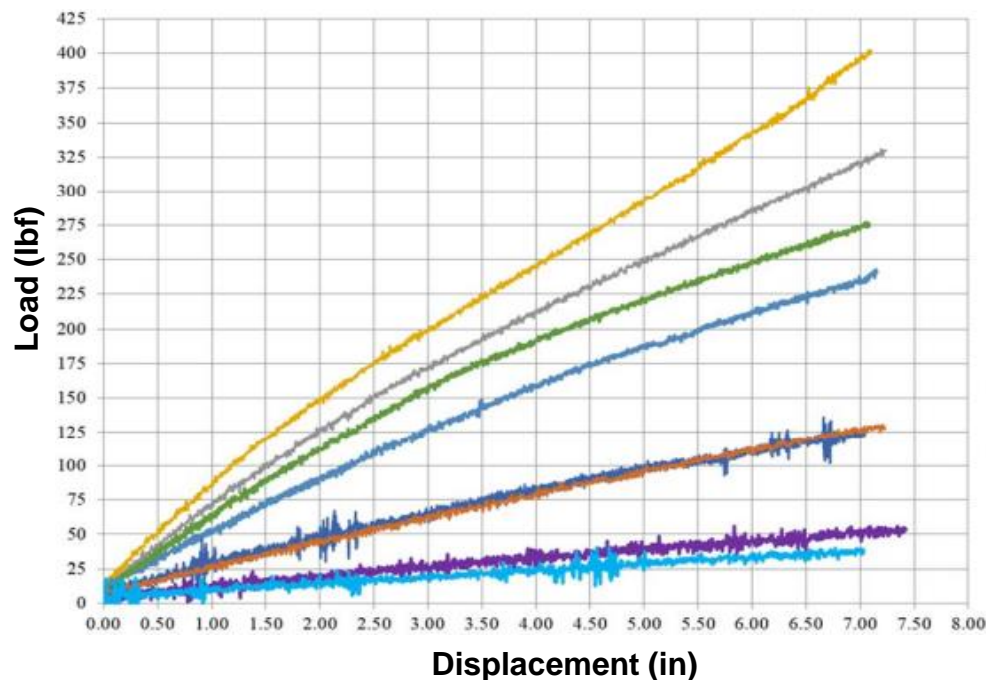
CUIRE Soil Box Set-up



Pipe profiling using digital image processing for Nukote® PP300 SIPP Renewed CMP.



Parallel Plate Loading Evaluation



ASTM D2412 Test Results



NUKOTE PROVIDES ENGINEERING SUPPORT FROM CONCEPT TO COMPLETION



SPRAY-IN-PLACE-PIPE (SIPP)
REQUEST FOR INFORMATION (RFI)



PLEASE COMPLETE THIS FORM AND SUBMIT TO NUKOTE'S ENGINEERING DEPARTMENT

PROJECT CONTACT	DATE
<input type="text"/>	<input type="text" value="2/21/2022"/>
PHONE	EMAIL
<input type="text"/>	<input type="text"/>
STATE/REGION	PROJECT NAME
<input type="text"/>	<input type="text"/>
COUNTRY	PROJECT GPS COORDINATES/ADDRESS
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CITY	PROJECT TYPE
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PROJECT INTRODUCTION

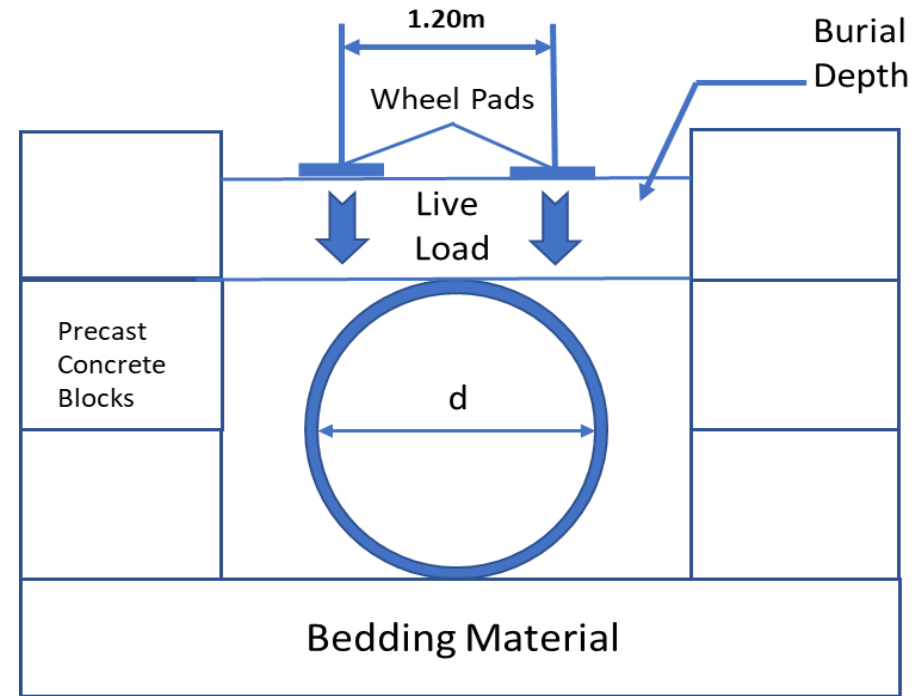
DIAMETER/WIDTH	LENGTH	UNITS	DEPTH OF BURY/HEIGHT
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LIVE LOAD REQUIREMENT	TYPE OF PIPE	USE OF PIPE	WARRANTY PREFERENCE
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
ELEVATED SERVICE TEMPERATURE	INTERNAL PRESSURE		
<input type="text"/>	<input type="text"/>		

ADDITIONAL NOTES

You may send attachments with an email in lieu of attaching them to this form.



Leveraging culvert experience and knowledge: operations, materials, codes and standards, regulatory approvals.



Preliminary Project Specification

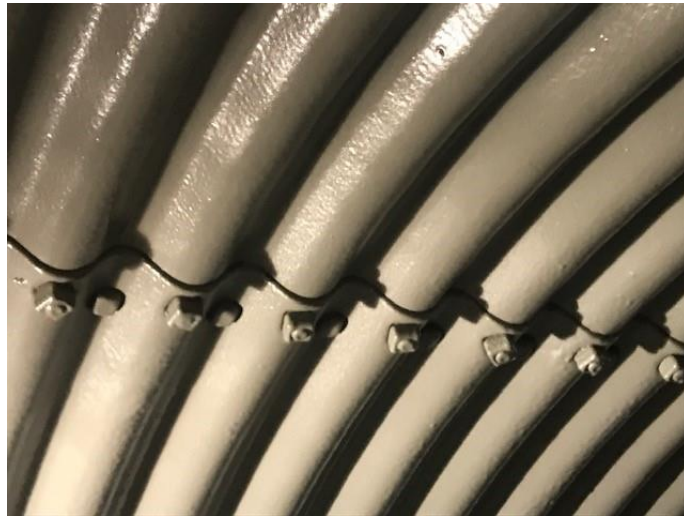
- Initial Assessment
- Product and Installation Recommendations
- Surface Preparation, Repairs, Substrate Conditioners and Ancillaries
- Material Consumption and Price Matrix
- Proposed Project Timeline

CASE STUDY: COST EFFECTIVE SOLUTION FOR CULVERT REHABILITATION



Virginia Department of Transportation

These projects were designed to renovate culverts under bridges as full structural liners that deny ingress or egress and carry the entire bridge loading to DOT standards. Diameters range from 48" to 144" and shapes include; round, arch and oval. Complete specification approval by multiple state DOT's. Liner Thicknesses vary depending on size, depth of bury and loading standards defined



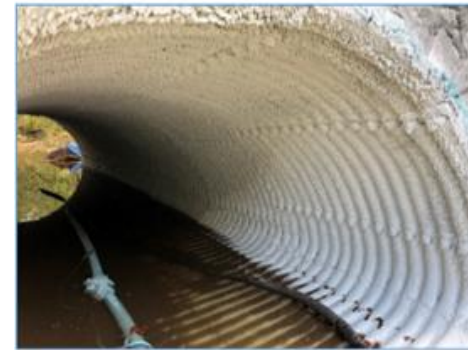
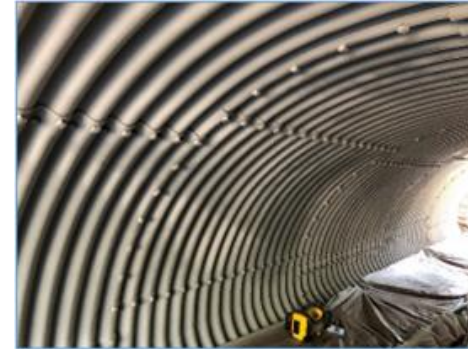
Currently, the rehabilitation of storm water pipelines and culverts is estimated to be 15 - 20% of the overall trenchless rehabilitation marketplace. Many of the nation's 4 million miles of culverts in need of repair or replacement.

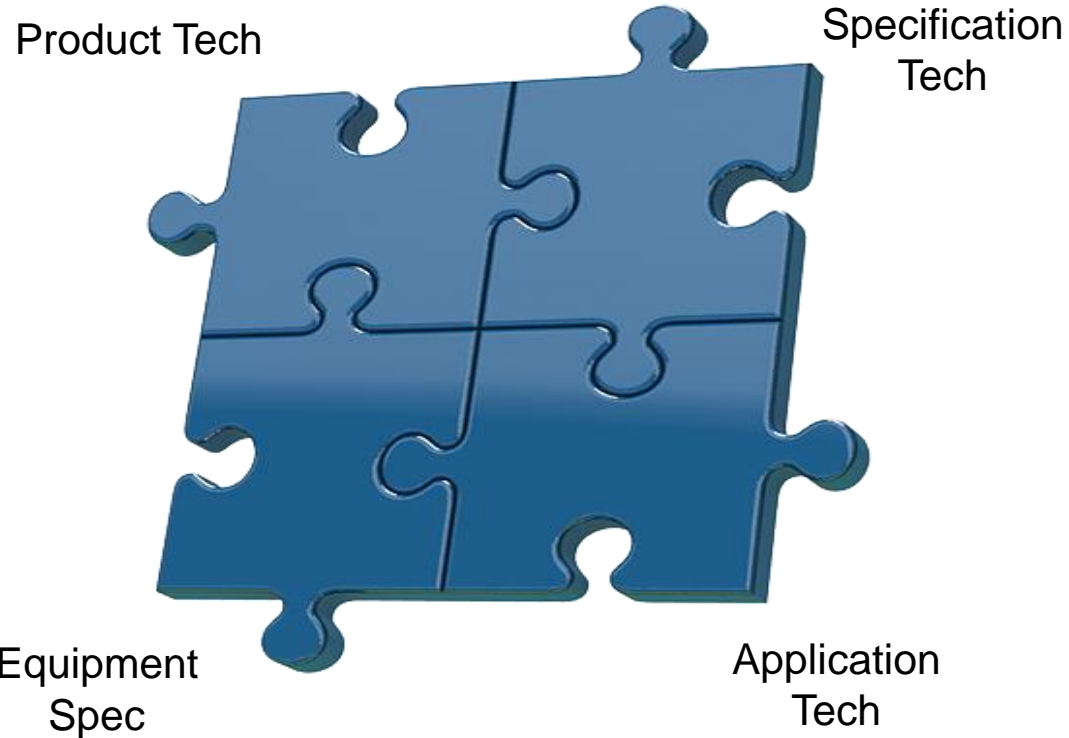
ATLANTIC INDUSTRIAL COATINGS LLC ACOMPLISHMENTS IN LINING CULVERTS WITH AEGIS PRODUCTS FOR 2021/2022



Over 40 culverts rehabilitated

- Lengths ranging from 40-600 ft
- Diameters ranging from 18-103 in
- Multiple culvert shapes and geometries have been lined (boxed, circular, arch, horseshoe)
- Covered by Nukote's product warranty.





Nukote's Aegis[®] Offering

- Nukote's Aegis[®] product line offers a unique and superior performance for structural and barrier liner solutions in the rehabilitation of culverts.
- Nukote provides engineering and QA/ITP support for both our clients and contractors from concept to completion. Nukote provides warranties on Aegis[®] offerings.
- 360 RINGTECH[®] robotics/automation enables tighter control of process, higher quality result and less waste.
 - Consistency, reliability and speed
 - Seamless solution to rehabilitate complex geometries in a cost effective and time effective manner.
- Smaller equipment and operational footprint to service both urban and remote locations.