PROSHOT CONCRETE, INC.

SHOTCRETE CONTRACTORS & ENGINEERS

Concrete Restoration & Concrete Renovation

What is Shotcrete Or Gunite?

- Shotcrete is a process in which compressed air forces mortar or concrete through a hose and nozzle onto a surface at a high velocity

- Shotcrete projects also call for the same types of reinforcement specified for conventional concrete, including deformed bars, welded wire fabric, and steel

Shotcrete (Wet Mix)

What is Wet Mix?

Wet Mix: Shotcrete delivered via Ready Mix and all of the ingredients, except accelerator, are mixed prior to being introduced into the shotcrete pump

Gunite (Dry Mix)

What is Dry Mix?

- Dry Mix is when a Pre mix blend of dry cement and aggregate is propelled through a hose by compressed air to a nozzle
- Water is added to the cement/aggregate mixture at the nozzle and the mixed ingredients are projected onto the application surface
- Accelerators can also be added at the nozzle
- Fibers (Steel or Poly) can also be used

Shotcrete (Dry Rig)

Gunite/Shotcrete Materials

- Portland Cement
- Water
- Fine Aggregate
- Sand
- Fibers
- Admixtures

What is Shotcrete used for?

- Sewer Rehabilitation
- Ditch Lining
- Seawall and Piers
- Stadiums
- Seismic Retrofit
- Bridge Rehabilitation
- Culvert Rehabilitation

Damaged Culverts

- A major to concern to a growing number of cities and Department of Transportation officials is the effect of erosion and rust to previously installed Corrugated Metal Pipes in culverts and storm drains
- Many people are not aware of the use of Shotcrete in preventing the excessive cost of replacing these damaged pipes

Damaged Culverts

Culvert damage that goes unattended cause major road damage, safety concerns, and additional costly repairs

Damaged Culverts

Culvert wash out is a major concern on highways and roadways

Replace vs. Repair

- Replacement options often include digging, which causes disruption in traffic and other daily routines. Expensive cured-in-place liners or slip lining is not needed full-circumference and unnecessarily reduces flow capacity.
- Shotcrete creates a new concrete pipe inside the old one. This new pipe is not only structurally sound, but it provides highly effective corrosion protection that can add 50 years or more to the life of the pipe.

Replacement

Here we see what is involved in replacement of a CMP. Closure of roadways, disruption of traffic, and repair to roadway are just a few issues that come with the job.

Picture Courtesy of Auburn Township-*Geauga County, Ohio*

Replacement

Traffic disruption associated with culvert replacement can cause lane closures, traffic back-ups, and slowed commute time.

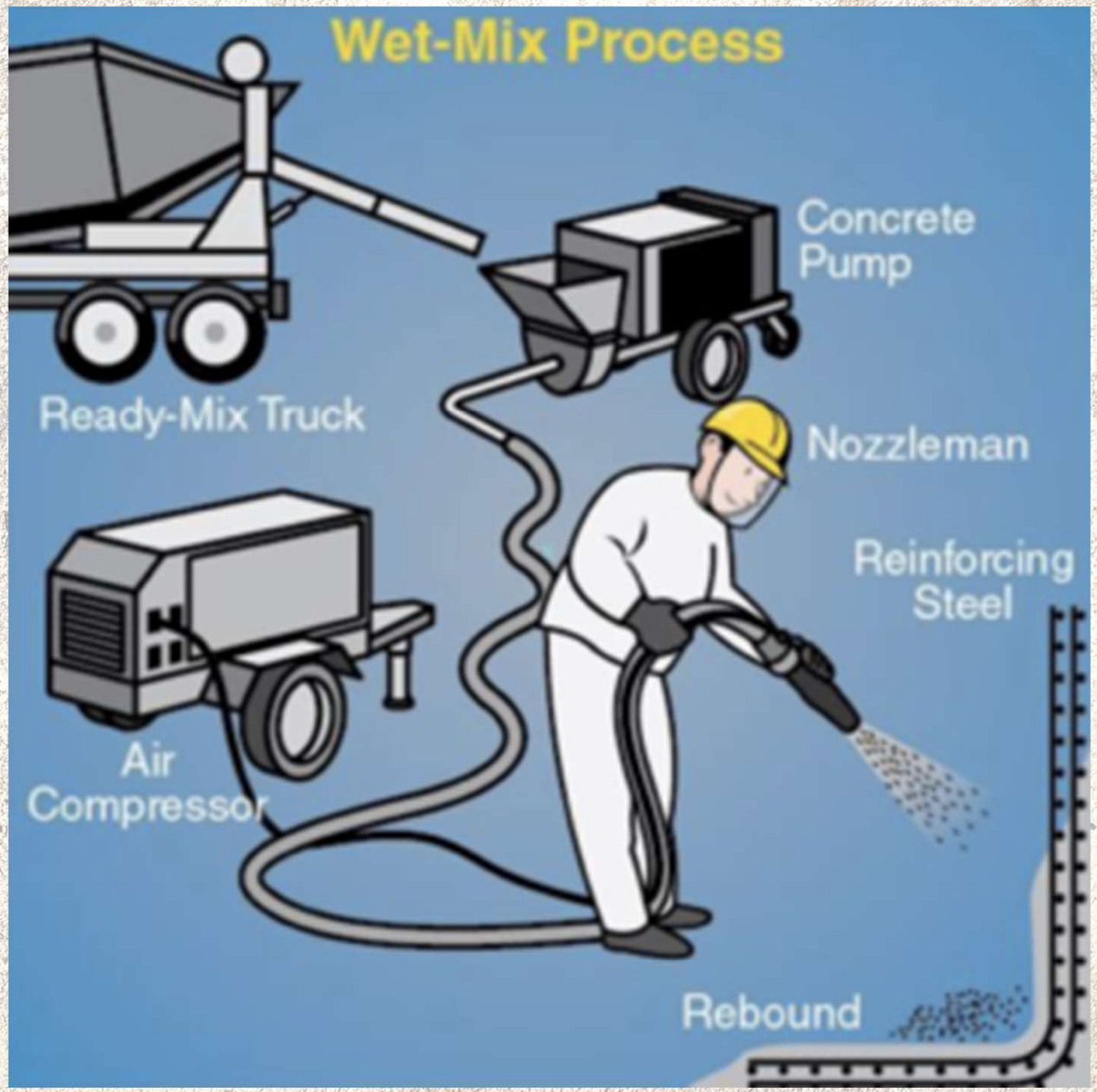
Solution

- Shotcrete is a structurally sound, extremely efficient, cost effective and a long-term solution to rehabilitating culverts / sewers ≥ 30” in diameter
- Shotcrete can be applied to:
  - Invert Only
  - Full Circumference
  - Individual Joints (typically in RCP’s)


SCHWING P 305


WARRIOR
WARRIOR
MODEL 3050HP

Ready Mix (Shotcrete) Discharging into Pump


Wet-Mix Process
Concrete Pump
Ready-Mix Truck
Nozzleman
Reinforcing Steel
Air Compressor
Rebound

Contracts throughout Maryland

- Harford County
- Baltimore County
- Howard County
- Carroll County
- Charles County
- Anne Arundel County (as a subcontractor)

- MDTA
- MD DOT (previous work), also in Frederick & Prince George Counties

Tasks involved for Installing Shotcrete

- Identify working area
- Stream Diversion
- Debris Removal
- Pressure Washing
- Installation of Reinforcing
- Shotcrete Installation
- Finish/Cure

Culvert Deterioration

Years of water, sand, gravel, and other debris take its toll on the bottom of Corrugated Metal Pipe.

This causes the water to run underneath the pipe and washing away any support; leading to the risk of the pipe collapsing on itself.

Culvert Damage

Deteriorated sewers that are in eminent danger of collapse can be restored permanently with shotcrete at a fraction of the cost of replacement. The extremely high compressive strength provided by shotcrete offers the solution to structural requirements often needed in badly deteriorated sewers.

Stream Diversion

Debris Removal

Pipe Prior to Installation

Wire Reinforcement

Finished Invert

Hoover Mill Road

Stream Diversion

Full Circumference Reinforcement

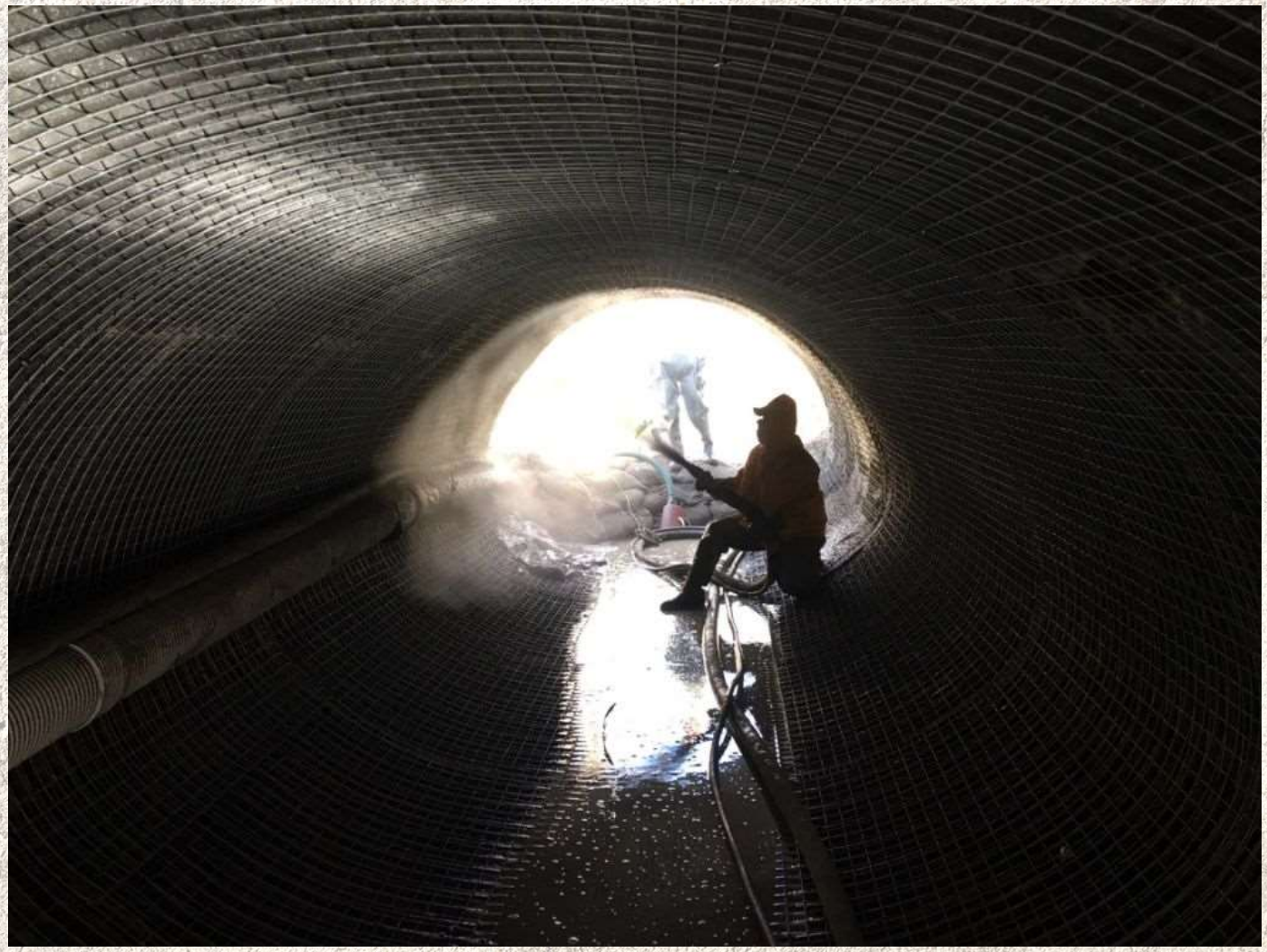
Installed Shotcrete

Finished Shotcrete

Hawks Hill Road – Deteriorating CMP

Stream Diversion

Shotcrete Application

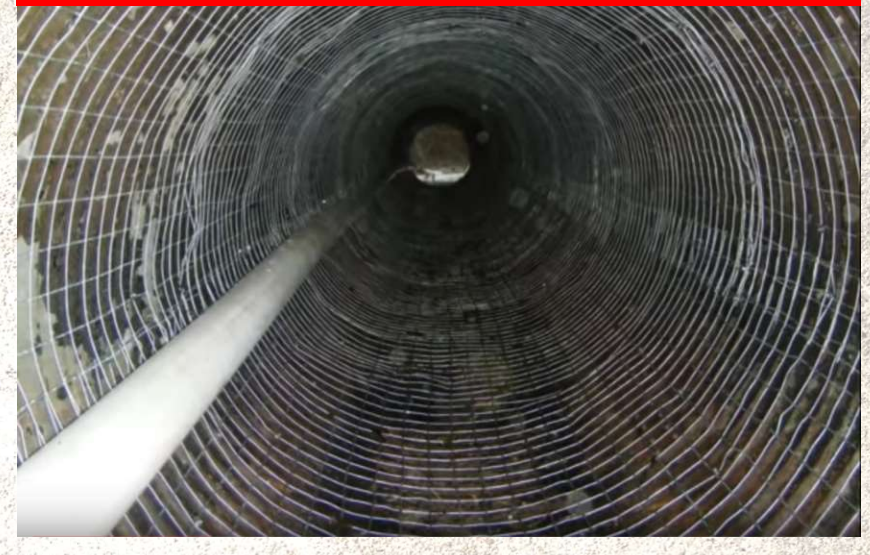


Finished Pipe

Hawk's Hill Road - Finished Pipe

Pipe Identified as needing repair

Wire mesh installed around pipe



Shotcrete is applied by Nozzelman

Repaired pipe is complete

Prospect Road – Harford County

Prospect Road – Harford County

Prospect Road – Harford County

Headwalls – Can be addressed as well – Prospect Road (Harford County)

Design Consideration

Manning's Roughness Coefficient

Corrugated Metal Pipe	-	0.022
Finished Shotcrete	-	0.012
Cast or Ductile Iron	-	0.012

Although a reduction in cross-section – increase in flow rate and carrying capacity.

PROSHOT CONCRETE, INC.
DC WATER
72 inch brick M-35600 to M-51549

outer radius	R_o	36 inches
shotcrete thickness	t	2 inches
inner radius	R_i	34 inches
concrete strength - psi	s	5000 psi

Poisson ratio = v = 0.15

$\S = [3*(1-v^2)/(Ri^2+t^2)]^{.25}$ $\S =$ 0.224231

$p=s*2*y/Ri*\S$ = 2,478 psi

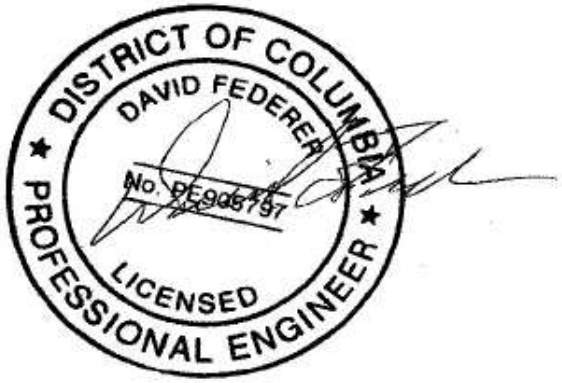
= 356,775 psf

ovality correction factor 11.5 31,024 psf

safety factor = 4 7,756 psf

equivalent OVB depth @ 120 pcf 65 Feet

REF: Roark - Formula for Stress and Strain
Timoshenko - Theory of Elasticity



Typical Pricing

- Per Square Foot - $22 to $28

This includes:

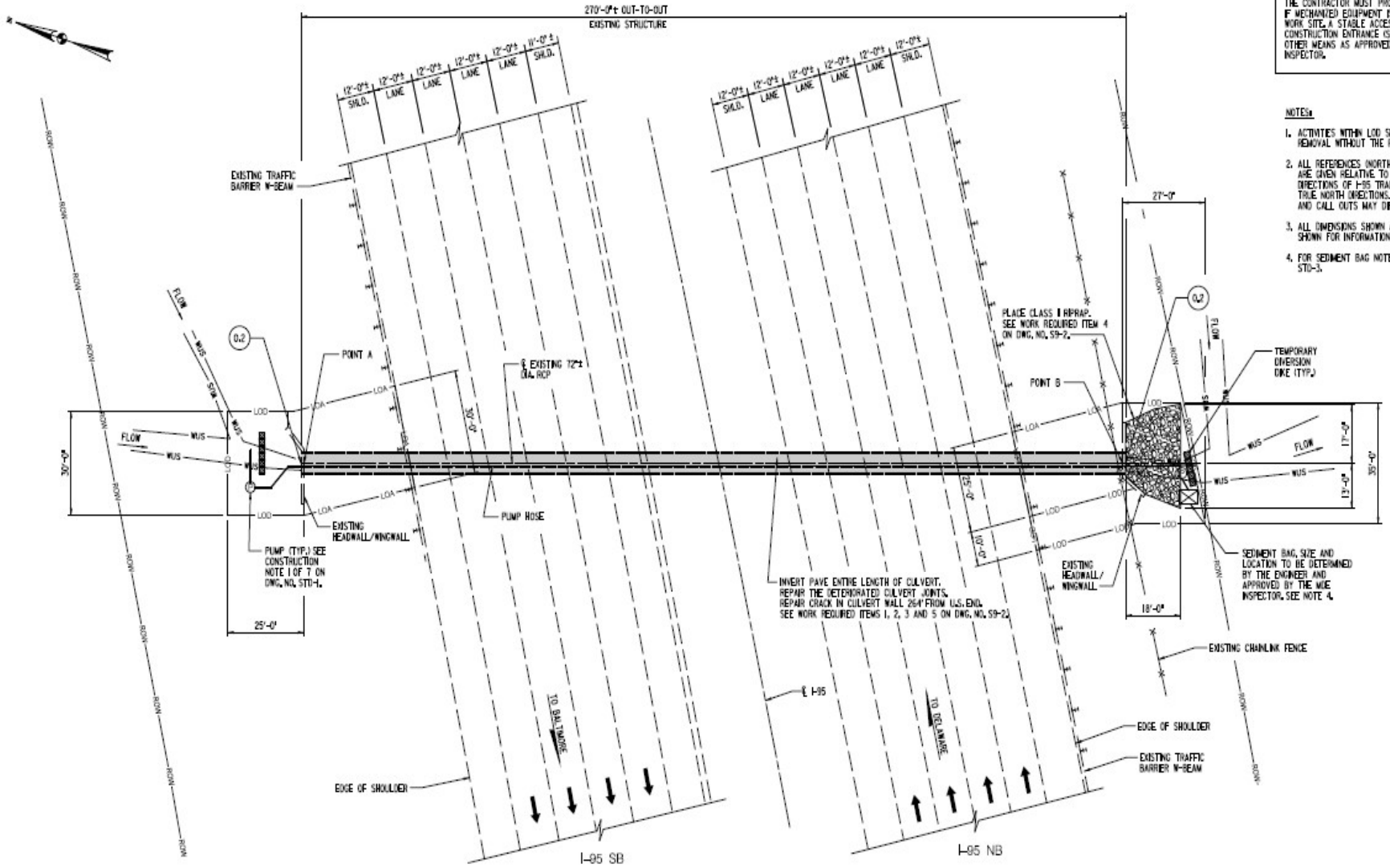
Stream Diversion

Installation of Reinforcing

Debris Removal – depends

Shotcrete Installation

-(2” minimum over tops of corrugations)



NOTE:
THE CONTRACTOR MUST PROVIDE A STABLE ACCESS POINT IF MECHANIZED EQUIPMENT IS REQUIRED TO ACCESS THE WORK SITE. A STABLE ACCESS POINT MAY BE A STABILIZED CONSTRUCTION ENTRANCE (SCE), TIMBER MATTING, OR OTHER MEANS AS APPROVED BY THE ENGINEER AND MDE INSPECTOR.

NOTES:

1. ACTIVITIES WITHIN LOD SHALL NOT INCLUDE TREE REMOVAL WITHOUT THE PRIOR APPROVAL OF MDTA.
2. ALL REFERENCES (NORTH, SOUTH, EAST AND WEST) ARE GIVEN RELATIVE TO NORTHBOUND AND SOUTHBOUND DIRECTIONS OF I-95 TRAFFIC AND ARE NOT BASED ON TRUE NORTH DIRECTIONS. NOTE THAT DIRECTIONS AND CALL OUTS MAY DIFFER FROM THE AS-BUILT PLANS.
3. ALL DIMENSIONS SHOWN ARE APPROXIMATE AND ARE SHOWN FOR INFORMATION PURPOSES ONLY.
4. FOR SEDIMENT BAG NOTES AND DETAILS, SEE DWG. NO. ST01-3.

LEGEND:
INDICATES LIMITS OF PIPE INVERT PAVING.

TABLE OF COORDINATES *		
POINT	LATITUDE	LONGITUDE
A	39°25'24.71"N	76°23'49.88"W
B	39°25'22.22"N	76°23'48.81"W

* COORDINATE LOCATIONS ARE APPROXIMATE.

NOTE:
(0.0) NUMBERS SHOWN CIRCLED ARE FIELD MEASUREMENTS OF STREAM DEPTH IN FEET, AS TAKEN ON MARCH 12, 2015.

PLAN
SCALE: 1/16" = 1'-0"
16' 0 16' 32'
SCALE: 1/16" = 1'-0"

ALA
ANNAPOLIS, LUNAR & ASSOCIATES INC.
Consulting Engineers Hallowell, Maryland

Maryland Transportation Authority
Engineering Division

ADDENDUMS & REVISIONS			
NO.	DESCRIPTION	BY	DATE

10/19/2016

FACILITY - WIDE CULVERT & PIPE REHABILITATION IN BALTIMORE CITY; ANNE ARUNDEL, BALTIMORE, CECIL, HARFORD & HOWARD COUNTIES

GENERAL PLAN - STRUCTURE NO. 8-X7122X01

DESIGNED BY A.T. | DRAWN BY J.F. | CHECKED BY D.W.
CONST. REVIEW BY | DATE SEPTEMBER 2016 | SCALE AS SHOWN

CONTRACT NO. MA2864-000-001
DRAWING NO. S9-1
SHEET NO. 32 OF 63

GENERAL NOTES

Specifications: SHA Specifications dated July, 2008 revisions thereof and additions thereto and special provisions for materials and construction.

Grout: Refer to Section 486.

Reinforcing Steel: Reinforcing steel shall conform to ASTM A615 or A706, Grade 60. Lap longitudinal reinforcing a minimum of 1'-0", where required.

Existing Structure: All dimensions affected by the geometrics, and/or location of the existing structure shall be checked by the Contractor, before any work is done, and before any material is ordered or fabricated. It shall be the responsibility of the Contractor to supply the Engineer with all field dimensions required to check all detail drawings. The (±) marks shown with dimensions do not indicate any degree of precision. These marks (±) indicate existing dimensions that may vary and do require field verification by the Contractor.

Existing structure shown in dashed lines.

Finished slope of the new paved surface shall match the existing.

Welding: All welding shall conform to 430.03.19 and 430.03.20. All field welding shall be done by the shielded metal-arc process. All requirements shall be adhered to except the requirements for radiographic and ultrasonic inspection may be waived if a visual inspection by the Engineer indicates the welds are satisfactory for the purpose intended.

Construction Joints: Entire face of any construction joint shall be coated with an approved epoxy bonding compound. Reinforcing steel shall be continuous through joint. All joints shall be bulkheaded to provide a vertical surface.

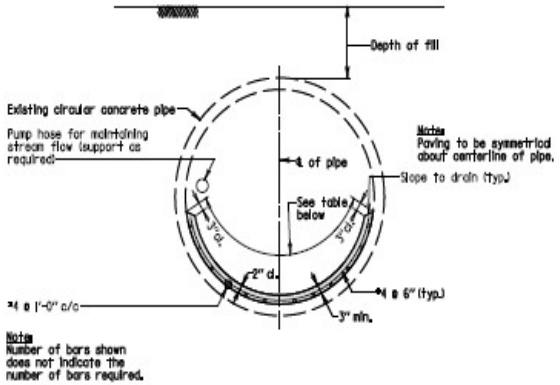
Erosion and Sediment Controls: All disturbed areas shall be stabilized at the end of each work day. No disturbed area shall be left unstabilized overnight unless the runoff is directed to an MDE approved sediment control device.

Maintenance of Traffic: Contractor may implement daily temporary shoulder closures following SHA Book of Standards for Highway and Incidental Structures, Standard No. 104.05-01. Any shoulder closures that will remain in place overnight must be protected by temporary concrete barrier installed in accordance with SHA Standard No. 104.01-23. Daily/temporary single lane closures (right or left) will be allowed in accordance with the schedule of allowable lane closures contained in SP 104.01 and in accordance with SHA Standard Nos. 104.05-07 and 104.05-08.

Work Required:

1. Pave the existing pipe invert with grout for its entire length.
2. Repair the deteriorated joint areas with Tamms Speed Crete Blue Line or approved equal at the locations shown in the RCP Joint Repair Schedule. See Typical RCP Joint Repair Detail, this sheet.
3. Epoxy inject 1/4" wide crack in north wall at 264' from upstream end. See Concrete Crack Repair Detail on dwg. no. STD-3 and special provisions Section 481.
4. Place Class I riprap (18'L x 30'W) at the downstream headwall. Refer to the Pipe Outfall Riprap Detail on dwg. no. STD-3.
5. Repair spalled and delaminated concrete as shown in Spall/Delamination Repair Schedule on this sheet. See special provisions section 400.02.

APPROVAL		STATE OF MARYLAND DEPARTMENT OF TRANSPORTATION STATE HIGHWAY ADMINISTRATION OFFICE OF STRUCTURES
DIRECTOR OFFICE OF STRUCTURES		
DATE		
REVISIONS: SHA	FHWA	INVERT PAVING OF EXISTING PIPE GENERAL NOTES
FHWA APPROVAL		STANDARD NO.
DATE:		SHEET ___ OF ___



Notes
Paving to be symmetrical about centerline of pipe.

Notes
Number of bars shown does not indicate the number of bars required.

TYPICAL SECTION (CIRCULAR CONCRETE PIPE)
Scales 3/8" = 1'-0"

Structure No.	B-X712X01
# of pipes to be paved	1
Length of individual pipes to be paved	270'-0" ±
Diameter of pipe	6'-0" ±
Depth of fill	20'-0" ±
Overall width to be paved	6'-0" ±

Notes
1. The invert of the pipes shall not be paved until unsound concrete is removed from existing invert.
2. Contractor to provide a smooth transition between pipe sections and/or structure transitions. The transition shall extend 3'-0" into or from the circular concrete pipe.
3. The elevation of the pipe invert shall be placed to avoid any ponding or disruption in the stream flow.
4. All open pipe section joints and/or voids shall be filled with grout.

APPROVAL		STATE OF MARYLAND DEPARTMENT OF TRANSPORTATION STATE HIGHWAY ADMINISTRATION OFFICE OF STRUCTURES
DIRECTOR OFFICE OF STRUCTURES		
DATE		
REVISIONS: SHA	FHWA	INVERT PAVING OF EXISTING CIRCULAR CONCRETE PIPE
FHWA APPROVAL		STANDARD NO.
DATE:		SHEET ___ OF ___

CONSTRUCTION NOTES FOR MAINTAINING FISH AND/OR AQUATIC PASSAGE THROUGH CULVERTS

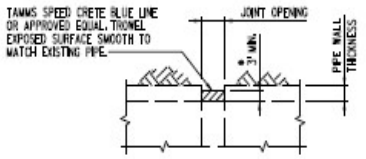
WHERE OUTFALL STABILIZATION BY ROCK PLACEMENT IS PROPOSED:

1. PLACEMENT OF STONE AND ASSOCIATED GRADING SHOULD MAINTAIN OR REDUCE THE WIDTH OF THE CURRENT BASEFLOW CONDITION. THIS MAY BE ACCOMMODATED BY CREATING A "V" IN THE ROCK APRON WHERE DIRECT INFLOW AND OUTFLOW WILL BE MAINTAINED.
2. PLACEMENT OF STONE AND ASSOCIATED GRADING SHOULD MAINTAIN OR INCREASE THE WATER DEPTH OF THE CURRENT BASEFLOW CONDITION. THIS MAY BE ACCOMMODATED BY CREATING A "V" IN THE ROCK APRON WHERE DIRECT INFLOW AND OUTFLOW WILL BE MAINTAINED).
3. APPROPRIATELY SIZED STONE PLACED AT THE CULVERT INLET AND OUTLET SHOULD HAVE THE VOIDS CHOKED WITH SMALLER STONE TO PREVENT LOSS OF WATER THROUGH THE NEWLY PLACED MATERIAL.

STRUCTURE NO. B-X712X01			
SPALL/DELAMINATION REPAIR SCHEDULE			
PATCH REPAIR	APPROXIMATE LOCATION FROM U/S END	SIZE (L x W x D)	QUANTITY
1	Downstream Headwall (North & South sides)	(2) - 1' x 5' x 1'	0.1 CF
2	246'	6' x 1' x 1'	0.1 CF

STRUCTURE NO. B-X712X01			
JOINT REPAIR SCHEDULE			
JOINT REPAIR	APPROXIMATE LOCATION FROM U/S END	REPAIR WIDTH	JOINT OPENING
1	138'	4'	1"
2	264'	4'	1"
3	270'	4'	1"

Note:
Joint numbers are numbered from the upstream end.



TYPICAL RCP JOINT REPAIR DETAIL
NOT TO SCALE

* IF 3" DEPTH OF REPAIR IS NOT POSSIBLE DUE TO MATERIAL CONFLICTS, PATCH DEPTH SHALL BE TO MAXIMUM DEPTH POSSIBLE.

ALA
ADKINSON, LYSTAD & ASSOCIATES INC.
Consulting Engineers — Bethesda, Maryland

Maryland Transportation Authority
Engineering Division

ADDENDUMS & REVISIONS			
NO.	DESCRIPTION	BY	DATE

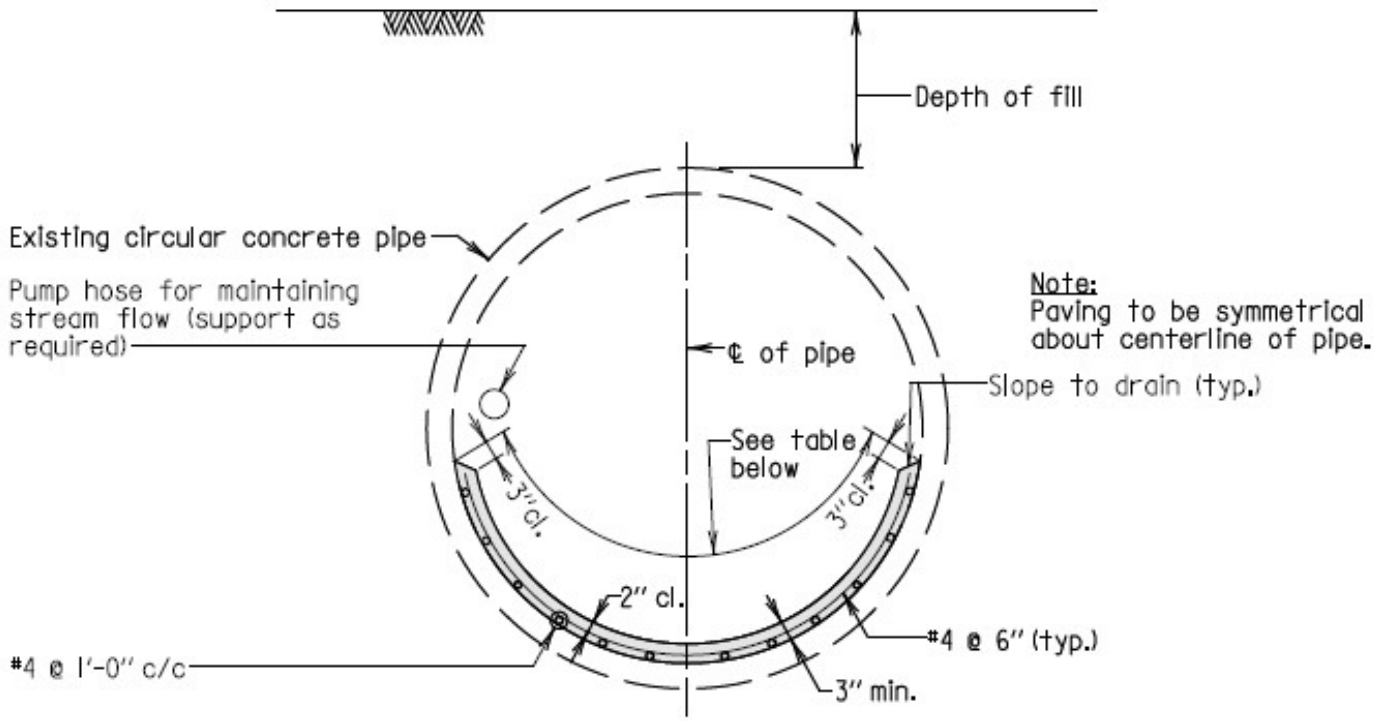
10/19/2016

FACILITY - WIDE CULVERT & PIPE REHABILITATION IN BALTIMORE CITY; ANNE ARUNDEL, BALTIMORE, CECIL, HARFORD & HOWARD COUNTIES

GENERAL NOTES AND TYPICAL SECTION - STRUCTURE NO. B-X712X01

CONTRACT NO. MA2864-000-001
DRAWING NO. S9-2
SHEET NO. 33 OF 63

DESIGNED BY A.T. | DRAWN BY J.F. | CHECKED BY D.W.
CONST. REVIEW BY ___ | DATE SEPTEMBER 2016 | SCALE AS SHOWN



Note:
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Structure No.	B-X712X01
# of pipes to be paved	1
Length of individual pipes to be paved	270'-0" ±
Diameter of pipe	6'-0" ±
Depth of fill	20'-0" ±
Overall width to be paved	6'-0" ±

Repair

Repairing a damage CMP causes no damage to roadways, minimum disruption of traffic, and is very cost effective.

Culvert Repair

The environmental benefits of using trenchless technology cannot be overstated when working near rivers, streams and environmentally sensitive areas such as wetlands which are very challenging to trench safely.

Culvert Restoration

- *Cost Effective vs. Replacement*
- *Provides structural integrity*
- *Improves flow by reducing the roughness coefficient*
- *Repair without interference with existing utilities*
- *Maintains flow in line while rehabilitation is accomplished*
- *Minimum disruption of traffic*
- *Environmentally Friendly*

Frederick County Dam

Frederick County Dam

Frederick County Dam

Frederick County Dam

Frederick County Dam

Frederick County Dam

Baltimore County Soil Nail Wall

Baltimore County Soil Nail Wall

Baltimore County Soil Nail Wall

Baltimore County Soil Nail Wall

Baltimore County Soil Nail Wall

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Baltimore County Soil Nail Wall

PROSHOT CONCRETE, INC.

SHOTCRETE CONTRACTORS & ENGINEERS

- While Shotcrete may not be a new process it is rapidly becoming a top choice for Engineers, D.O.T. , Companies, and City Officials. The Shotcrete industry is changing and expanding every day.
- Shotcrete can be seen anywhere from storm drains and sewers to theme park mountains and attractions. The applications of Shotcrete may not be known by everyone, but are seen by millions each day.

https://www.youtube.com/watch?v=-qljrF5BGpg

https://www.youtube.com/watch?v=XvmkL4abhnM