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**Drainage!** **SUBSURFACE, INC**

- Up to date technologies
- Latest products
- Solutions for most applications
- Trenchless better, less expensive way to rehabilitate existing structures without the cost and inconvenience
- Not all culverts are the same, not all solutions are the same
- Over 125 years of combined experience
- Customers before contractors

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**Topics**

**SUBSURFACE, INC**

**Cleaning**  
**Lining**  
**RCP Joint Repair**  
**Void Filling/Soil Stabilization**  
**HDPE Slip Liners**  
**CIPP (Cured in Place Pipe)**  
**Rehabilitation of Large Diameter Steel Plate**

### **TERMS OR PHRASES USED IN THIS PRESENTATION:**

- Culvert, pipe, structure, bridge, conduit are all synonymous.
- Piping is the flow of water outside of intended conduit. In some cases the water can meander in and out of the conduit at will.
- Corrosion is the oxidation and/or deterioration of metal pipe allowing it to decompose and/or weaken to the point of failing to carry the loading.





- **Hydraulics** is the flow of a given structure at a given grade using “Manning’s” n value of the coefficient of varying surfaces.

Manning Numbers - Guide to Typical Values of n

Brick, old, good condition	0.015 - 0.020
Brick, old, poor condition	0.017 - 0.023
CIPP new and smooth	0.009 - 0.010
CIPP c/w wrinkles & Fins	0.011 - 0.013
Clay, new and smooth	0.010 - 0.011
Clay, old, cracks, joint issues	0.012 - 0.013
Concrete, new, smooth, good joints	0.010 - 0.011
Concrete, rougher, open/offset joints	0.012 - 0.014
CMP, CSP	0.015 - 0.023
HDPE & PVC, new and very smooth	0.009 - 0.010
HDPE & PVC, in service	0.009 - 0.010

- **Separated joint** is an RCP structure that has pulled apart as a result of freeze thaw cycles, vibration, piping, weakened bedding, poor installation and decomposing filter cloths







- **Energy dissipation** is the slowing of flow such as rip rap or other means to slow flow to help reduce erosion.
- **Infiltration/Exfiltration** is the passing of water and soils through separated joints and decomposed metal pipe.



- Weakened road bed is a road that has lost some of its compressive strength by the loss of soils surrounding the conduit through separated joints and/or through decomposing metal pipe.



- Voids are pockets outside of the culvert that have been surrendering soils over time. Think of an hour glass.









## ***CLEANING PIPE CULVERT***

- Generally bid per linear foot for each diameter of pipe. For example; clean pipe culvert 24" estimated quantity 200 lf and bid price \$24.00/lf
- Consider environmental issues:
  - Are you in a wetland?
  - How will you contain the spoils and keep them from going downstream and possibly contaminating waters of the state?
- Will the existing site work for disposal of solids? If not, where will they go and how do you keep track of it.
  - Contractor must submit a disposal site prior to construction
- Can the host pipe tolerate any cleaning method?





### THE SPEC WILL LOOK SIMILAR TO THIS

This work shall consist of cleaning out, removing and disposing of the earth and debris from within the existing culvert. This work shall be done in accordance with the applicable provisions of the DOT at the location shown in the plan and the following:

- **S-1** The culvert shall be cleaned to the satisfaction of the Engineer, DOT forces will inspect the structural condition of the culvert after cleanout to determine if any repairs are necessary. The Contractor shall make any repairs necessary to the culvert as directed by the Engineer and such repairs, if required, will be paid for as **extra work** as approved by the DOT.

- **S-2** Contractor shall submit disposal sites that are outside of the State Right of Way at the pre-construction meeting and before the commencement of work if it is required to be removed from the Right of Way. Suitable disposal sites within the Right of Way may be approved by the Project Engineer.
- **S-3** Contractor shall furnish and install approved sediment control for the containment of materials, spoils, excess water, debris and all material that is generated in jetting and cleaning of the culvert pipe.
- **S-4** Measurement will be made by the **linear foot for the diameter** of existing culverts cleaned as specified. Payment will be made under Item xxx(clean Pipe Culvert) at the contract bid price per linear foot, which shall be compensation in full for all costs relative thereto.

### LINING

#### *Questions to be answered in deciding on a solution;*

- What is my "host?" RCP-CMP
- Is the current conduit properly sized for the existing drainage area?
- How will this decision affect the hydraulics of the culvert?
- What is the depth to the invert?
- What is the length and grade?
- What kind of surface is above?
- What is the traffic count?
- How will the public be affected by the replace vs rehabilitate decision.
- How much will a detour cost?
- How much right of way is there on each side?
- Does cost matter?



## ***RCP JOINT SEALING AND REPAIR***

- What is the most common problem with RCP?
- What have we always done?
- ***STOP DOING THAT!***
- What if you could make them “better” without digging them up?
- How could I do that?
- Seal the joint from the inside and outside with a flexible adhesive long lasting polyurethane resin with a useful life expectancy of over 100 years!
- Replace lost soils and fill voids with another polyurethane product that is light weight, load bearing, highly expansive and also has a useful life of over 100 years.
- This process can be done on structures 36” and above.
- What about box culverts that have sheared?





DEPARTMENT OF TRANSPORTATION									
TABULATION OF BIDS									
LETTING : 14082000					CALL : 355		COUNTIES : ST LOUIS		
BIDDING DATE : 08/22/14 9:30 A.M.					JOB NO. : 140355		DISTRICT : 1		
STATE PROJECT : 0802-215					ROUTE : TN 35-103		LENGTH : 1		
CONTRACT NO. : 140355					START DATE : 09/02/14		COMPLETION DATE : 09/13/14		
=====									
LINE NO / ITEM CODE / ALT		QUANTITY	UNIT PRICE	AMOUNT	UNIT PRICE	AMOUNT	UNIT PRICE	AMOUNT	
ITEM DESCRIPTION									
=====									
0040 210601/0045		LAMP	35000.0000	35000.00	30000.0000	30000.00	75000.0000	75000.00	
TEMPORARY STREAM DIVERSION SYSTEM									
0050 221102/0050		6.000 C Y	50.00000	300.00	100.00000	600.00	50.00000	300.00	
AGGREGATE BASE (1 1/2) CLASS 5									
0060 250102/0016		13.000 EACH	1300.00000	17100.00	2000.00000	26000.00	1800.00000	24200.00	
REPAIR CULVERT JOINT									
0070 250103/0018		146.000 L F	362.00000	52852.00	260.00000	37960.00	550.00000	80300.00	
REPAIR CULVERT									
0080 250104/0019		250.000 GAL	250.00000	62500.00	220.00000	55000.00	45.00000	11250.00	
SHOULDER SHOULDER									
0090 251101/0048		440.000 S F	6.50000	2860.00	5.00000	2200.00	10.00000	4400.00	
4" CONCRETE BASE									
0100 257101/0019		200.000 L F	3.90000	780.00	8.00000	1600.00	15.00000	3000.00	
TEMPORARY FENCE									
0110 257102/0019		2.000 S Y	50.00000	100.00	40.00000	80.00	300.00000	600.00	
ROADSIDE TYPE LAWS									
SECTION TOTALS				\$ 218,245.00		\$ 195,260.00		\$ 236,890.00	
=====									
CONTRACT TOTALS				\$ 218,245.00		\$ 195,260.00		\$ 236,890.00	
=====									

RCP Joint Sealing is bid and paid for by the diameter and number of joints and gallons of resin pumped:

Repair culvert joint 48" 14 @ \$900.00 each  
 Repair culvert joint 72" 16 @ \$1,200.00 each

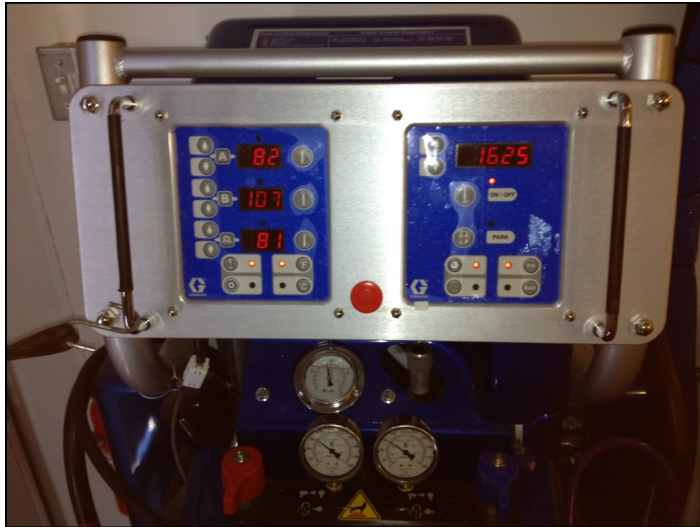
Gallons of Void Fill Resin Pumped 120 @ \$250.00 per gallon pumped

The Spec for Joint Sealing is quite detailed and must be understood by the field inspectors and adhered to.

### Polyurethane Resins

If cost does matter, then the temperature of the grout or resin matters!  
 Controlling the temperature is important from storage to the point of injection.

Heated storage  
 Heated drums  
 Heated hoses



### ***CURED-IN-PLACE PIPE (CIPP)***

**CIPP** is a trenchless rehabilitation method used to repair existing pipelines. CIPP is a jointless, seamless, pipe-within-a-pipe with the capability to rehabilitate pipes ranging in diameter from very small to very large (4"-110").

- Each CIPP liner is specifically designed for each individual host and site.
- Starts out as raw felt.
- Made to the thickness and diameter required.

- Sent to a wet out facility where it is impregnated with the resins needed for hardening.
- Wet out liner is then refrigerated to prevent premature curing.
- Shipped to site in refrigerated truck.
- Installed and cured on site.
- Does not bond to host.
- Structurally designed to be a load bearing pipe.
- Life expectancy of over 50 years.

### ***WHY CONSIDER CIPP ?***

- Good option when hydraulics are important in the decision.
- In an RCP host you can maintain a minimum of 100% of existing flow and in most cases gain a few points.
- Good for small diameter culverts.
- Farming and Ranching community like it because of flow characteristics.



- CIPP liners are bid per linear foot for each diameter of pipe you are lining.
- The engineer determines if it is a fully or partially deteriorated host for design purposes.
- The design of the liner must meet all ASTM 1216-09 appendix X1 for non-pressurized liners.
- Special repairs such as invert repair is generally a separate line item and paid for by the linear foot.
- Cleaning should also be a separate line item.



- **S-5 MEASUREMENT AND PAYMENT**

Separate measurement will be made by the length of each type of liner culvert pipe inserted as specified in linear feet. Payment will be made under Item xxx (Lining Culvert Pipe (\_\_\_")) at the Contract bid price per [linear foot], which shall be payment in full for all costs to complete the installation in-place, including but not limited to excavation, pipe liner, fittings, seals, specified joint system, and backfilling.

Separate payment will be made for Cleaning Pipe Culvert

Separate payment will be made for grouting under either Item xxxx (CLSM High Density or Low Density) as specified elsewhere in these Special Provisions.

LETTING: 14030800	CALL: 028	COUNTY: YELLOW MEDICINE
LETTING DATE: 03/28/14 9:30 A.M.		
JOB NO: 140328	ROUTE: TH 67-07	DISTRICT: 8
STATE PROJECT: 0707-02	START DATE: 05/27/14	LENGTH: 1
CONTRACT NO.: 140328		COMPLETION DATE: 1

LINE NO / ITEM CODE / ALT	QUANTITY	UNIT PRICE	AMOUNT	UNIT PRICE	AMOUNT	UNIT PRICE	AMOUNT
0030 210492/00000	11.000	EACH	200.0000	2200.00	225.0000	2475.00	2475.00
0040 211890/00010	2425.000	TON	15.75000	38193.75	20.00000	48500.00	14.75000 35768.75
0050 221101/00010	107.000	TON	102.41000	10957.87	176.00000	18932.00	130.00000 13910.00
0060 221890/00040	17413.000	S Y	0.56000	9749.68	1.24000	21588.40	1.30000 22633.00
0070 221890/00000	80903.000	S F	0.13000	10516.49	0.12000	12078.36	0.08000 8052.24
0080 230001/00010	15098.000	TON	56.83000	85642.88	47.98000	724609.28	53.00000 844608.00
0090 241361/00003	1600.000	S F	2.39000	3824.00	2.00000	3200.00	4.00000 6400.00
0100 240197/00017	11.000	EACH	210.0000	2310.00	225.0000	2475.00	225.0000 2475.00
0110 240197/00014	346.000	S F	80.00000	27680.00	73.00000	26178.00	73.00000 26178.00
0120 240197/00014	346.000	S F	80.00000	27680.00	73.00000	26178.00	73.00000 26178.00
0130 240197/00014	346.000	S F	80.00000	27680.00	73.00000	26178.00	73.00000 26178.00
0140 240197/00014	346.000	S F	80.00000	27680.00	73.00000	26178.00	73.00000 26178.00
0150 240197/00014	346.000	S F	80.00000	27680.00	73.00000	26178.00	73.00000 26178.00
0160 240197/00014	346.000	S F	80.00000	27680.00	73.00000	26178.00	73.00000 26178.00
0170 240197/00014	346.000	S F	80.00000	27680.00	73.00000	26178.00	73.00000 26178.00
0180 240197/00014	346.000	S F	80.00000	27680.00	73.00000	26178.00	73.00000 26178.00
0190 240197/00014	346.000	S F	80.00000	27680.00	73.00000	26178.00	73.00000 26178.00

## LARGE DIAMETER STEEL PLATE AND UNUSAL SIZES

- Sprayroq Polyurethane spray on liners.

