

2021 INNOVATION CHAMPIONS CONTEST

Culvert Steamer

COUNTY: Stark County Highway Department

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PROBLEM STATEMENT: Corrugated pipes become plugged with ice. When this happens, the road and ditch acts as a dike and hold water. This typically occurs on the upstream side of the road. The road and subgrade become soft. Vehicles passing over the road cause additional damage to a road that is already soft. Hiring a qualified contractor that is readily available to open the culverts is a challenge. One year, the cost to clean out a couple of small pipes exceeded \$6,000.

SOLUTION: The road department designed and fabricated the culvert steamer to clean out corrugated pipe. The primary components of the culvert steamer are a power washer, a water heater, a 300-gallon water holding tank, and 150 feet of water hose. All of the components are housed in a trailer. The power washer is fueled by gasoline and the water heater is powered by kerosene or #1 diesel fuel. The power washer pump pulls water from the holding tank, through the power washer and continues on through the water heater to the hose with an attached sprayer gun, extension wand and jetter tip. The jet sprayer sprays heated water into the blocked corrugated pipe at 1,500 psi of pressure. The average time needed to open a blocked pipe is approximately 1 hour. A one-ton truck with a tank filled with water is used to tow the culvert steamer to the various sites. The culvert steamer is also ideal to clean mud, dirt and grime off of vehicles and other equipment.

The metal housing unit was welded together and mounted on a used 8'x14' 4-wheel trailer. The housing unit has a side door and dual doors on the rear. The rear doors are designed with holders so they stay open while working in windy conditions. The holding tank is tied down to the bed of the trailer. The water heater is mounted on the same platform as the power washer and also tied down to the trailer bed.

A 2-inch inlet pipe on the outer front of the trailer leads into the trailer to fill the water tank. When filling the tank, a 2" diameter flexible hose, stored inside the trailer, is attached to the inlet pipe and into the tank. An open/close valve is used to turn off the water between the holding tank and the heater/washer unit.

One-half inch diameter hoses connect the holding tank to the power washer, the power washer to the water heater, and from the heater back to the power washer sprayer. The exhaust system is designed to handle the fumes generated by the power washer and water heater, and keeps the housing unit free of exhaust fumes. The exhaust pipe is designed with a cover and is closed when not in use. Movable hangers were installed on the housing for hoses, nozzles, the jet tip, and any item needed for a pipe cleanout. Lights were wired on the interior of the housing to allow for use any time of the day. An exterior safety light was mounted on the top rear of the housing unit for work zone safety. Protective fabric was put the front of the housing unit and trailer fenders to prevent rock chipping.

EQUIPMENT, MATERIAL, AND LABOR:

Equipment used:

Shop tools
Welder

New Material:

Used flatbed 4-wheel trailer with fenders: 8x14', 5500 lbs.
Power washer: (1500 PSI) with wand extension
Jetter tip
300 gallon holding tank
150 feet of ½" water hose
Hose reel: (1) extended by welding more straight and circular rods onto original
Water Heater
Metal sheets: cut to (2) 80"x7' for front & back, (2)14'x7' for sides (approximate measurements)
Bevel metal sheet: (1) 80"x14' for roof (approximate measurements)
Metal door (1)
Double metal door (1)
Electrical wiring
Lights: (2) interior, exterior running lights, (2) turn signals (2) brake lights, (1) safety light on top of rear wall.
 (1) Standard vehicle electrical cord to connect towing vehicle to trailer
 (2) Tie downs: (4) on tank, (4) on heater/washer unit
(1) Inlet Pipe: 2-inch x 6'
(2) 2-inch flexible hose (used to fill water tank from inlet pipe)
(1) 2-inch hose (used to connect water source to inlet pipe)
(2) Latches (made in county shop)
(1) Shovel
(1) Exhaust pipe with adjustable cover

Total Labor Hours:

Design & discussion: 3 people, 2.5 hours each – 7.5 hours
Fabricate: 2 people, 40 hours each – 80 hours

COST SUMMARY:

Flatbed 4-wheel trailer with fenders	\$ 600
Power washer 300 gallon holding tank Water heater and connectors	\$ 8,000
Metal sheets Metal doors Bolts Electrical wiring Lights Latches Shovel Hose rack Exhaust pipe with cap Reflectors Power cord for trailer-power unit Tie downs Inlet pipe 150 feet of water hose Hoses Shovel, decals, etc.	\$ 2,500
Contract to sandblast, paint, apply rock chip shields (fabric) on culvert steamer (Includes paint and fabric costs)	\$ 5,000
Total Cost:	\$16,100 plus labor

SAVINGS AND BENEFITS:

With this innovation, employee safety has improved for this type of work. There has also been a savings in both time and money. With the culvert steamer, the work to clean out a plugged CMP is done by the department. Employees no longer try to open culverts with rods, poles, ice chippers, shovels and other existing tools. The challenge of finding a qualified contractor no longer exists. The department is able to complete the job themselves whenever a CMP needs to be cleaned out, so there is less delay and no cost to hire it out.

ANNUAL OPERATING COSTS:

Before using the innovation – The county first had to find a qualified contractor, then set up a time and date they would be available to clean out the CMP. At times, the work needed to be done immediately because of water over the road or collecting in the ditch; however the contractor may not have been readily available until later. The road subgrade would get soft and the road was damaged, creating a large repair cost. This situation also created safety issues for the motoring public. One job cost the county \$6,000 to open a couple of CMPs.

After using the innovation – With the culvert steamer, the county no longer has to spend time finding a contractor. Work to open a pipe can be done immediately as opposed to waiting for a contractor. The cost to open a couple of CMPs is the employee's cost, fuel to run the culvert steamer and the time it takes to drive to the sites.

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Note: Exhaust cap open. Lever handle on front of trailer can close exhaust cap when not in use.

Interior of culvert steamer - water holding tank



Power washer/water heater unit



Power washer/water heater unit tie down



Hose reel with hose.
Blue hose extensions connects the hoses, and the steamer to the reel.



Power washer sprayer with jetter tip



Flexible hose used to fill holding tank. Connects to inlet pipe.
Water heater exhaust pipe.



Inlet pipe (on outside of trailer) to connect to outside water source, to fill water holding tank. Open/close lever.



Hose used to connect outside water source to culvert steamer inlet valve.



Holders to keep rear doors open



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