

# Carbon Calculator Determines Trenchless Benefits

The benefits of trenchless construction are well known – at least by the manufacturers of equipment/products used for trenchless construction and rehabilitation and the contractors who use them.

Compared to cut-and-cover construction, trenchless methods minimize the amount of excavation required to bury pipe and cable, reduce damage to surface structures, cause less disruption of traffic and other activities on and around job sites, and allow installations to be made in areas where excavation is impractical or impossible.



David O'Sullivan,  
P.W. Trenchless  
Construction

A good case also can be made that trenchless procedures are more environmentally friendly because they can reduce dust, pollution and noise, and make installations through wetlands and other environmentally-sensitive areas possible.

The British Columbia Chapter of the North American Society For Trenchless Technology (NASTT-BC) has taken the environmental factor a step further, asserting that trenchless procedures actually reduce carbon dioxide (CO<sub>2</sub>) emissions compared to open-cut construction.

Trenchless methods for pipe replacement projects can reduce carbon emissions from 78 to 90 percent, said David O'Sullivan, past president and current board member of NASTT-BC and president of P.W. Trenchless Construction.

"Reducing the amount of open trench also reduces the amount of soil removal to dump sites and importing fill material to fill the trench, minimizing truck emissions," O'Sullivan continued.

## CO<sub>2</sub> savings

To provide a tool to emphasize the significance of CO<sub>2</sub> savings, NASTT-BC has developed a carbon calculator that estimates CO<sub>2</sub> "savings" by using trenchless construction compared to excavation. O'Sullivan said the

calculator is designed to be used with typical utility line replacement projects for pipe two inches in diameter and larger. The calculator is the first and currently only tool available that can compare carbon emissions of open-cut construction and trenchless construction.

The Carbon Calculator can be accessed on the NASTT-BC web site, [www.nastt-bc.org](http://www.nastt-bc.org). By entering basic project information, the calculator estimates the amount of carbon that would occur during open-cut construction and three categories of trenchless construction: horizontal directional drilling (HDD); sliplining and pipebursting; and cured-in-place pipe (CIPP) lining, point repair and grouting. O'Sullivan explained that methods are grouped in the three categories based on the amounts of carbon they produce.

The calculator is easy to use. Simply enter a project description and provide answers to questions about project details: surface conditions; length and depth of backfill that will be required; size of pipe; whether dewatering will be necessary and if so, number of pumps needed; traffic flow; distances from project to sites to pick up new fill; and fuel efficiencies of equipment to be used.

The calculator then estimates carbon emissions for each method of construction and projects carbon savings for each of the trenchless methods.

To try out the calculator, *Underground Construction* created a "test" project that required installation of 1,000 feet of 12-inch diameter pipe to be installed beneath asphalt. Asphalt thickness, depth of backfill and depth of bedding were entered. Dewatering was not required so no pumps were needed. Daily traffic flow was estimated at 10,000 vehicles per day and six days of traffic control were entered. Next were travel times from site to an asphalt plant if old asphalt is to be recycled or to a dump site if it is not, and travel time from a depot where new fill material is picked up for transportation to the job site.

The calculator uses default settings for fuel efficiencies and vehicles used for the project, but allows them to be replaced with

other values. Default fuel settings are based on current Caterpillar engines.

When all project information is entered, the calculator estimates CO<sub>2</sub> emissions for open-cut construction for traffic, trucks, machines, pumps and material (asphalt, gravel, fill) and provides the total CO<sub>2</sub> emission from the project.

## Results

For our fictional test, open cut was projected to release 708.5 metric tons of carbons.

Savings using all of the trenchless methods were significant:

	CO <sub>2</sub> Emissions	CO <sub>2</sub> Savings
HDD	35.4	637.8
Slipline/ Pipebursting	70.8	637.6
CIPP	14.1	694.3

(Emission quantities are in metric tons.)

O'Sullivan pointed out that the calculator showed impressive CO<sub>2</sub> savings for our fictional project, but that it is relatively small, and that a higher percentage of savings can be expected on larger projects which can amount to significant reductions in release of CO<sub>2</sub>.

A tip for first-time calculator users: be sure to enter all information requested. Under the equipment section, we made the mistake of deleting the default fuel efficiencies of machines we thought would be unnecessary on the project and the blank boxes prevented continuing to the next step.

The program selects the equipment necessary to match project information, so emissions from unnecessary equipment are not calculated.

O'Sullivan said the problem of carbon emissions is drawing increasing attention throughout the world, western provinces of Canada and many U.S. states. "By 2012, cities in British Columbia by law must be carbon neutral," said O'Sullivan.

## Initiative

The Western Climate Initiative (WCI) is an organization devoted to identifying, evalu-

ating and implementing collective and cooperative ways to reduce greenhouse gases in the region. WCI was launched in February 2007 by the governors of Arizona, California, New Mexico, Oregon and Washington to develop regional strategies to address climate change. A short time later, the governor of Utah and premiers of British Columbia and Manitoba joined the Initiative. Montana joined in January 2008. Other states in the U.S. and Mexican and Canadian provinces are participating as observers.

Recognizing that reducing levels of CO<sub>2</sub> released into the atmosphere has a positive impact on the environment, NASTT-BC contacted the University of Waterloo about undertaking research focusing on the quantities of CO<sub>2</sub> reductions that can be expected by using trenchless construction.

Conducted by Dr. Mark Knight and Rashid Rehan, the study demonstrated that large amounts of CO<sub>2</sub> are released due to traffic disruptions during utility construction along major roads. Using information available from traffic studies, it was concluded that the reduction in CO<sub>2</sub> emissions associated with trenchless construction is achieved primarily due to limiting disruption of traffic flow and shorter duration of projects using trenchless methods.

With research documenting carbon savings by using trenchless methods, NASTT-BC began planning ways to promote this important benefit. The carbon calculator was developed on assignment by fifth-year engineering student Liz Creelman at the University of British Columbia.

The calculator became available on the NASTT-BC web site in January 2008.

Envisioned as a tool for preparation of proposals by public works officials, consulting engineers and contractors, O'Sullivan said to date documentation developed by the calculator has been used by two entities for proposals submitted to provincial governments for funding available for carbon-friendly projects.

O'Sullivan said NASTT-BC is a multiple disciplinary organization devoted to advancing the science and practice of trenchless technology for the public benefit; to develop standards; promote education, training, research, development and information; and to promulgate through public forums the improvements and status of trenchless technology.

P.W. Trenchless Construction is one of the most experienced trenchless contractors in British Columbia, specializing in pipebursting and sliplining.

"We would like to see the day when trenchless construction is the default method of underground construction – not an option to consider when site conditions make excavation difficult," said O'Sullivan. "Using the carbon calculator to document

how trenchless reduces CO<sub>2</sub> emissions, is one more benefit we can cite to advance the trenchless industry."

**FOR MORE INFORMATION:**

- NASTT-B.C. Chapter, (604) 505-2084, [nastt-bc.org](http://nastt-bc.org).
- P.W. Trenchless Construction Inc., (604) 580-0446, [pw-trenchless.com](http://pw-trenchless.com)
- NASTT, (703) 351-5252, [nastt.org](http://nastt.org)