



CDI
CONSTRUCTION
DRILLING

Reverse Circulation Drilling

REVERSE CIRCULATION DRILLING

Reverse Circulation, or RC Drilling, is a clean and environmentally friendly method of deep foundation installation.

Reverse Circulation Drilling employs dual-wall drill rods, comprised of an outer drill rod with an inner tube (fig. 1). As the sections of drill rod are screwed together, the inner tubes overlap and seal with O rings. This provides a continuous path for the drill tailings to be transported from the bit face to the surface.

During the drilling process, high pressure air is introduced to the annulus between the inner tube and the outer rod. The air flows through the drill steel and powers the drill tool. As the air exhausts, it serves as a circulating medium by carrying the cuttings from the surface of the bit directly through the inside of the drill steel (fig. 2). As it exits the top of the drill stack, the air is guided into a cyclone which slows the cuttings, separates them from the air and collects them while the remainder of the waste fluids are captured in an isolated, watertight containment bin. The material is stored in this bin until it can be scooped out and disposed of off-site.



UNDER-REAMER

Under-reaming bits and ring bits are used for drilling through overburden and unconsolidated ground.

Some systems are recoverable while others are permanent; there are various trade names and products on the market. They are all similar in that they use a steel ring welded on to the bottom of the casing. The down hole hammer and steel ring are locked together, and the hammer drives on the steel ring. Together, they drill a hole large enough to allow the casing to be pulled into the drilled hole. A rock socket can be drilled below an under-reamed pile. We have experience with every type, and choose them based on overburden type, rock type and cost.

Under-reamers are particularly useful in offshore applications. We have many hanging lead drill systems that can utilize various under reaming systems from 12" to 36".



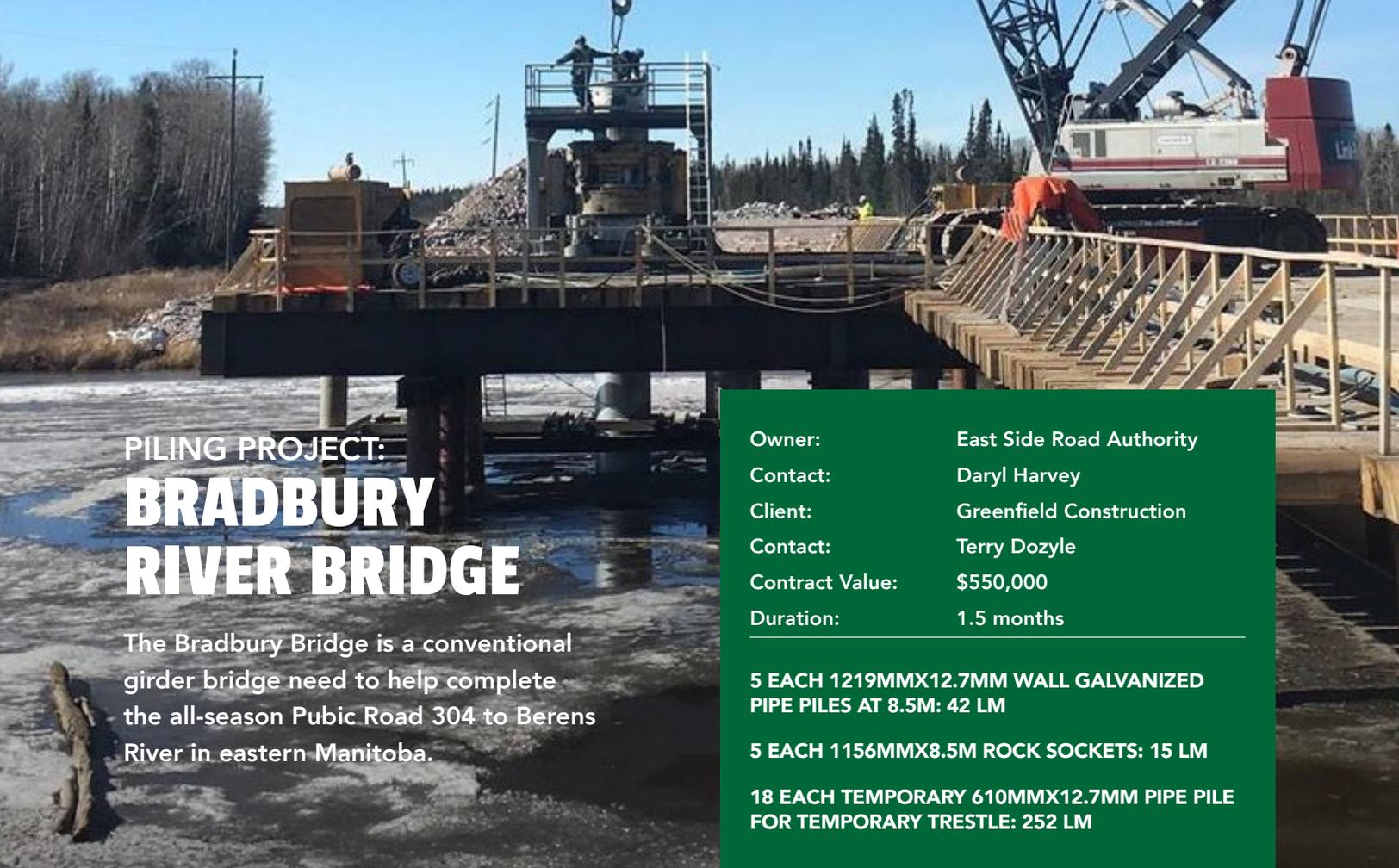
THE DOWN HOLE HAMMER

The down hole hammer is located directly behind the down hole hammer bit. The driller transfers feed force, and some rotation, to the bit through the drill pipe and top drive.

A compressor supplies air which travels through the drill pipe to the down hole hammer, where it drives the piston as it strikes the bit directly. This provides a very efficient transmission of impact energy through the bit into the rock, breaking the rock and drilling the hole.

Our drill bits are available in different sizes. We can drill a wide range of hole sizes from 6" to 50". For holes larger than 50" we recommend using a cluster drill or rotary head.





PILING PROJECT:
**BRADBURY
RIVER BRIDGE**

The Bradbury Bridge is a conventional girder bridge need to help complete the all-season Pubic Road 304 to Berens River in eastern Manitoba.

Owner:	East Side Road Authority
Contact:	Daryl Harvey
Client:	Greenfield Construction
Contact:	Terry Dozyle
Contract Value:	\$550,000
Duration:	1.5 months

5 EACH 1219MMX12.7MM WALL GALVANIZED PIPE PILES AT 8.5M: 42 LM

5 EACH 1156MMX8.5M ROCK SOCKETS: 15 LM

18 EACH TEMPORARY 610MMX12.7MM PIPE PILE FOR TEMPORARY TRESTLE: 252 LM

This bridge consists of concrete abutments with H-pile foundation piling, in water pier with reinforced concrete caissons with steel girders and a concrete deck.

This project required a temporary trestle, or work platform, to assist with pier foundations and access to both sides of the River. There were 16 piles total, 610mm diameter x 12.7mm wall thickness temporary piles drill drilled into bedrock with a down the hole hammer system (DTH) using a 54" hanging leads system that included a drill top drive system capable of reverse circulation. After pile locations were surveyed, a guide frame was installed in position to ensure precision location for the temporary steel casings. The work trestle was than completed to allow access to both abutments and the pier location.

After trestle construction was completed, CDI started work on the 1219 mm diameter x 8.5m long pier piles. Completion of the 5 pier piles for the Bradbury Bridge involved embedding a 1219mm diameter x 12.7mm wall thickness steel pipe 0.5 meters into bedrock, and then completing a 3 meter long rock socket. To accomplish this CDI utilized an RT150 Rotator to install the steel casing while simultaneously drilling the overburden and bedrock with a 54" hanging leads system, complete with DTH and four 1170 Ingersoll Rand compressors.





PILING PROJECT: **FMF CAPE BRETON – PHASE V**

The aim of this Shop Consolidation Project is to replace antiquated, outdated and deficient industrial facilities, and to enable a fundamentally critical transformation and modernization of the FMF Cape Breton's industrial workplace.

Owner: Department of National Defence
Client: EllisDon Kinetic – A Joint Venture
Contact: Mark Liudzius, Project Manager
Contract Value: \$7,500,000
Duration: 7 months

**SUPPLY OF PILING – 610 DIAMETER
STEEL PIPE PILES: 5520 M**

PILE DRIVING: 281 PILES

ROCK SOCKETS: 705 M

ROCK PROBES: 28 PROBES

This project is the fifth and final phase of a multi-phased project and comprises new construction, renovation, demolition and site works of the FMFCB buildings.

EllisDon Kinetic - A Joint Venture ("EDK") invited subcontractors to submit their bid for the Pile Work on the Fleet Maintenance Facility Cape Breton ("FMFCB") Phase V at HM Dockyard at CFB Esquimalt.

The project is based on 2 work packages (WP20 & WP22) with a total 65 piles for WP65 and 216 piles for WP22. The piles are 610mm diameter x 12.7mm wall casings and were supplied and installed through desiccated and blue marine clay and seated into 290 to 350mpa

granite bedrock. A 3m deep rock socket completed each pile. The average length of pile was 22.3m long though this length increased to 26.7m due to actual bedrock elevations. All rock sockets were video inspected and approved before full length reinforcing cages and 35 mpa tremie concrete were installed. Included in the contract were two load tests plus all necessary engineering, fabrication, surveying, materials, testing, inspection, QA/QC, off-loading, loading and disposal of all materials, insurance, taxes, licenses and permits.



PILING PROJECT:

PR304 TO BERENS RIVER ALL-SEASON ROAD PROJECT B5 PIGEON RIVER BRIDGE

Owner: Manitoba East Side Road Authority
Client: Innovative Civil Constructors Inc
Contact: Tammy Short
Contract Value: \$1,700,000
Duration: 3 months

**SUPPLY AND INSTALLATION OF
ACCESS TRESTLE PILES: 8 PILES**

**SUPPLY AND INSTALLATION OF 610MM
DIAMETER FALSEWORK PILES: 4 PILES**

**SUPPLY AND INSTALLATION OF 1220 MM
DIAMETER X 19MM WALL CASING
C/W 3M ROCK SOCKET PILES: 5 PILES**

The Pigeon River Bridge project was in a hyper-remote region of northern Manitoba and consisted of 5 drilled-shaft, 1219mm diameter permanently-cased piles seated into bedrock a minimum of 300mm with a total embedment into sound bedrock of 3000mm.

In order to access these piles, a temporary work trestle was required, spanning over 21m into the river. Piles were installed in bents of two at a time until a section of work platform could be lowered into position and welded onto the falsework piling. This procedure was repeated three times until the work trestle was completed, allowing the crane access to the pier pile locations.

Production piles were installed with a Nissha RT150 rotator, which required a falsework platform to be constructed first. The temporary trestle and falsework piles were installed with a reverse-circulation under reaming down-hole hammer (DHH) system. This reverse circulation drill system

is designed to contain drill tailings during operation while having the least environmental impact of any drill system designed to date.

Once piles were drilled, rebar and concrete were installed and the piles were approved by owner representative. The temporary work trestle was disassembled in reverse order of installation ensuring no environmental impact came due to operations.

This project involved very strict fisheries windows, extreme temperatures, and limited resources due to being in such a remote region. Supplies arrived via chartered plane or weekly barge sailings.



PILING PROJECT:

MUSSELWHITE MINE, NUMBER 2 SHAFT ACCESS COFFERDAM, VENT PLENUM COFFERDAM & FOUNDATION PILES

To construct a cofferdam around the recently extended mine shaft and vent shaft.

Owner: Goldcorp Canada Ltd.
Client: Sacchetti Construction
Contact: Paolo Sacchetti
Contract Value: \$1,600,000
Duration: 2010

916MM DIAMETER PIPE PILES,
13M DEEP #2: 60 EACH

916MM DIAMETER PIPE PILES, 13M DEEP
VENT PLENUM COFFERDAM: 37 EACH

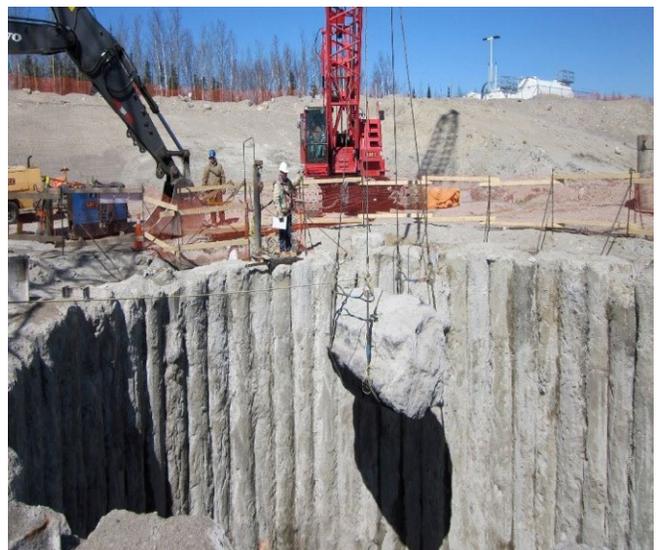
916MM Ø PIPE PILES, 13M DEEP VENT
PLENUM FOUNDATION PILES: 39 EACH

The purpose of this project was to design and install a ventilation access shaft through a sand and gravel esker.

The seat of the cofferdam was installed 2.5m into hard rock (Schist). The operations were made increasingly difficult by boulders and high volume water flow from the surrounding Opapimiskan Lake. A vent access shaft was blasted approximately 800 feet below the cofferdam into solid rock.



The vent plenum cofferdam was added on to the design due to ground conditions being so unfavourable that excavation for construction was not feasible. Foundation piles were added into the structures shear walls to anchor them down. These were added to help with wind loading due to unsuitable ground conditions.



PILING PROJECT:

FAIRVIEW CONTAINER TERMINAL BERTH EXPANSION PHASE II, NORTH DEVELOPMENT

The construction works associated with the developments of the new berth expansion, existing caisson wharf upgrade, new mooring dolphins, new empty containers stacking yard and new container storage yards.

Owner: Prince Rupert Port Authority (PRPA)
Client: Fraser River Pile & Dredge Inc.
Contact: Kristien Seabloom
Contract Value: \$850,000
Duration: 2015–2016

**916MM DIAMETER PIPE PILES,
13M DEEP #2: 60 EACH**

**916MM DIAMETER PIPE PILES, 13M DEEP
VENT PLENUM COFFERDAM: 37 EACH**

**916MM Ø PIPE PILES, 13M DEEP VENT
PLENUM FOUNDATION PILES: 39 EACH**

The Caisson Wharf piles consist of 63 each epoxy-painted piles with a diameter of 914mm and a 19mm wall thickness, seated into bedrock a minimum of 1000mm, complete with 7500mm rock sockets.

To prepare the casing, Carbide Cutting Teeth were supplied and welded onto the bottom of each casing. The carbide teeth allowed the casing to core through the overburden and bedrock. In addition each pipe was notched to accept the casing over sleeve to protect the painted/coated piles.

A series of guide frames / templates with each frame able to support the installation of 7 each piles, were preinstalled to position each pile. The guide frames were reinstalled sequentially along the pile line. The production piles were pre-installed in the frames with a vibratory hammer. The DTH hammer and drill string were then hoisted into the pile and secured.

CDI's casing rotator, was hoisted overtop of the pile containing the DTH hammer and pinned to the guide frame. The over sleeve was hoisted over the permanent pile and lowered through the rotator and the drive notches were engaged. Utilizing the dual rotary drill system, the CDI rotator advanced the casing into bedrock while drilling out the inner diameter of the casing. Once the casing was sufficiently seated into bedrock, the CDI top drive and DHH advanced the rock socket below the bottom of the casing for a depth of 7.5m. Once the drill head reached the required depth, the drill steel was disconnected and the top drive and leads were removed. The drill steel was hoisted out of the casing and transferred into the next casing. This process was repeated for all of the additional production piles.

Geotechnical / Pile length issues occurred, and CDI was retained to return to the site. CDI drilled out the concrete in two of the piles on land. CDI then mobilized the drilling equipment to a Marine derrick and completed 9 remaining piles from the water.

PILING PROJECT:

PR304 TO BERENS RIVER ROAD PROJECT B5 PIGEON RIVER BRIDGE

The pier on the Project consists of 5 drilled shaft piles with a 1219mm casing seated into bedrock a minimum of 300mm with a total embedment into sound bedrock of 3000mm including the socket.

Owner: Manitoba East Side Road Authority
Contact: Daryl Harvey
Client: Innovative Civil Constructors Inc.
Contact: Tammy Short
Contract Value: \$1,700,000
Duration: 3 months

**SUPPLY AND INSTALLATION OF ACCESS
TRESTLE PILES: 8 PILES**

**SUPPLY AND INSTALLATION OF 610MM
DIAMETER FALSEWORK PILES: 4 PILES**



A temporary access trestle was required from the east side of the river bank out (perpendicular to the east bank) approximately 21.26m over the river. CDI's crane and drill equipment was set up on the east bank of the river, on a leveled earth pad. The first bent was installed on the ground. The crane then hooked up the top drive and leads to load a pile. Each temporary trestle and falsework pile was installed with a reverse-circulation under reaming down-hole hammer (DHH) system. This reverse circulation drill system is designed to contain cuttings made while drilling, and has the least environmental impact of any drill system designed to date.

Once the DHH drilling had been completed, the pile was positioned and lowered until it contacted the ground. High pressure air was used to activate the downhole hammer (DHH). The top drive then began its rotation and advances the pile into the ground and bedrock. The tailings were vacuumed up the inside of the drill steel, through the top drive, and discharged through a hose into the waterproof bin. The pile was then advanced to the predetermined depth (approximately 3m below bedrock surface).

This procedure was then repeated for a second pile contained within the same bent. Once the first bent is installed a temporary guide frame was cantilevered from the river bank to the second pile bent. The crane was rolled on top of the guide frame to secure it in place during drilling. The guide frame was used to position the piling in the second bent. Two 914mmØ pipe sleeves were lowered into the guide frame to the river bottom to isolate the work area. The temporary 610mm Ø trestle piles were then placed inside the over sleeves and installed. The drill string, isolating pipes, and guide frame were all removed. The drilled piles were cut off at their appropriate elevation.

Once the second bent was in place, the header was placed on top of the piles and the main beams were positioned and secured between the two bents. The crane was then walked out onto the completed span, between bent 1 and 2. This process was then repeated to install the piles for the third and final bent.

The falsework support piles were installed using the same methodology as for the trestle support piles, including the isolating pipes.

PILING PROJECT:

FOOT OF LONSDALE SHORELINE STABILIZATION & DECK REPLACEMENT

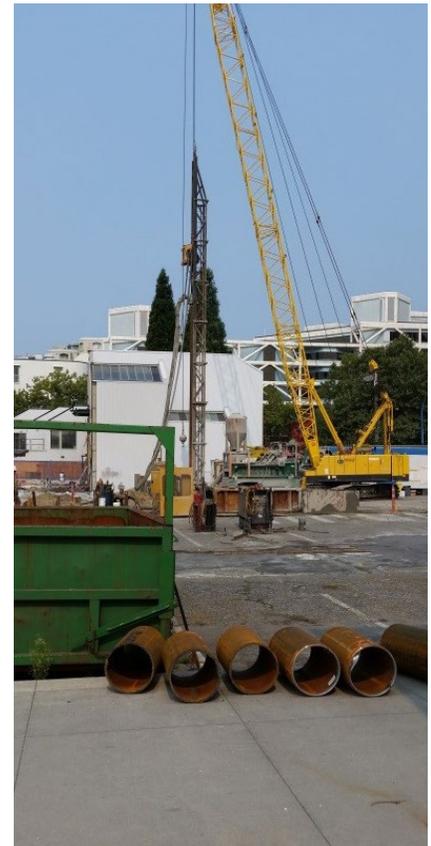
The project site is located at the southern terminus of Lonsdale Avenue where it intersects Carrie Cates Court in North Vancouver, BC. The Owner is redeveloping this site for creation of a future public space area. This contract will include demolition, bulkhead construction, deck construction, storm water extension and environmental remediation.

Owner: Corporation of the City of North Vancouver
Client: B&B Heavy Civil Construction Ltd.
Contact: Dave Pakozdi
Contract Value: \$2,500,000
Duration: 5 months

406MM DIAMETER OPEN ENDED STEEL PILES: 124 PILES

610MM DIAMETER OPEN ENDED STEEL PILES: 6 PILES

100 Ton Crane and drilling and pile driving equipment was provided, 406 and 610mm Ø pipe piles were supplied, ensuring that they were conforming to ASTM Specification A252. The pipe piles were fabricated with full penetration butt welds and supplied with under reaming drill shoes (Robits). Pipes were welded to conform in quality and workmanship to the latest CSA W59. The piles were installed within the 75mm horizontal tolerance at ground line and within the 25mm horizontal tolerance at cut off line. The piles were drilled in with a hanging lead drill system, the piles were drilled to overcome various manmade and natural obstructions. These obstructions making it impossible to drive the piles from the surface. The piles were then driven open ended to tip. Dredging work was also offered to the Contractor at a specified rate.





CONSTRUCTION DRILLING SPECIALIZES IN UNIQUE AND DIFFICULT DRILLING SOLUTIONS

Construction Drilling is a leading global provider of first-class drilling solutions and services designed to offer our valued clients with the safer, more efficient and reliable alternative.

Our company vision is centered on an unparalleled commitment to quality and yielding economic advantages for our customers and stakeholders.



www.condrill.ca



info@condrill.ca

British Columbia
250.746.4408

2958 Boys Rd,
Duncan, BC V9L 6W4

Alberta
780.955.9445

1711-9 Street,
Nisku, AB T9E 0R3



CDI
CONSTRUCTION
DRILLING



COMPLYWORKS
ADSC
MEMBER