Auger: A flighted Drive tube having hex couplings at each end, to transmit torque to the cutting head and transfer spoil back to the machine. Used in auger boring.

Auger Boring: A technique for forming a bore from a drive pit to a reception pit, by means of a rotating cutting head. Spoil is removed back to the drive shaft by helically wound auger flights rotating in a steel casing. The equipment may have limited steering capability. Also known as Dry Boring.

Auger Machine: A machine used to drill earth horizontally by means of a cutting head and auger or other functionally similar device. The machine may be either cradle or track type.

Back Reamer: A Cutting Head attached to the leading end of a Drill String to enlarge the Pilot Bore during a Pull-Back operation to enable the Carrier or Sleeve or Casing to be installed. Used in directional drilling and slurry boring.

Backstop: Reinforced area of the entrance pit wall directly behind the track or jacking system.

Bentonite: A colloidal clay sold under various trade names that forms a slick slurry or gel when water is added. Also known as drillers mud. See Drilling Fluid.

Bent Sub: An offset section of drill stem close behind the drill head that allows steering corrections to be made by rotation of the Drill String to orientate the Cutting Head. Frequently used in Directional Drilling.

Bore: A generally horizontal hole produced underground primarily for the purpose of installing services. Can be made by any boring method.

Boring: The dislodging or displacement of spoil by a rotating auger or drill string to produce a hole called a bore.

Boring Pit: An excavation in the earth of specified length and width for placing the machine on line and grade.

Carrier Pipe: The tube which carries the product being transported and which may go through casings at highway and railroad crossings. It may be made of steel, concrete, clay, glassfiber reinforced polyester, plastic, ductile iron, or other materials. On occasion it may be bored direct under the highways and railroads.

Cased Bore: A bore in which a pipe, usually a steel sleeve, is inserted simultaneously with the boring operation.

Casing Pipe: A pipe installed as external protection to a Product Pipe or Carrier Pipe. Also known as encasement pipe.

Casing Pusher: The front section of a boring machine that distributes the thrusting force of the hydraulic cylinders to the casing and forms the outside of the spoil ejector system.

Closed-Face: The ability of a tunnel boring machine to close or seal the facial

opening of the machine to prevent or slow the entrance of soils into the machine. Also may be the bulkheading of a hand dug tunnel to slow or stop the inflow of material.

Conduit: A broad term that can include pipe, casing, tunnels, ducts, or channels. The term is so broad that it should not be used as a technical term in boring or tunneling.

Cutterhead or Cutting Head: The actual teeth and supporting structure that is attached to the front of the lead auger, drill stem or front face of the tunnel boring machine. It is used to reduce the material that is being drilled or bored to sand or loose dirt so that it can be conveyed out of the hole. Usually applies to mechanical methods of excavation, but may also include Fluid Jet Cutting.

Directional Drilling: A steerable system for the installation of pipes, conduits and cables in a shallow arc using a surface launched drilling rig. Traditionally the term applies to most crossings in which a fluid-filled pilot bore is drilled using a fluid-driven motor at the end of a bent-sub, and back reamed to the size required for the product pipe. The required deviation during pilot boring is provided by the positioning of a bent sub. Tracking of the drill string is achieved by the use of a walk-over system or a downhole survey tool.

Drill Bit: A tool which cuts the ground at the head of a Drill String, usually by mechanical means but may include Fluid Jet Cutting.

Drilling Fluid/Mud: A mixture of water and usually bentonite and/or polymer continuously pumped to the Cutting Head to facilitate cutting, reduce required torque, facilitate the removal of cuttings, stabilize the borehole, cool the head and lubricate the installation of the Product Pipe. In suitable soil conditions water alone may be used.

Drill String: 1. The total length of drill rods/pipe, bit, swivel joint etc. in a drill borehole. **2**. System of rods used with cutting bit or compaction bit attached to the drive chuck.

Drive Shaft/Entry Shaft/Drive Pit: Excavation from which trenchless technology equipment is launched for the installation of a pipeline, conduit, or cable. May incorporate a thrust wall to spread reaction loads to the soil.n See launch shaft.

Duct: In many instances, a term interchangeable with pipe. In the boring industry, it is usually used for small plastic or steel pipes that enclose wires or cables for electrical or communication usage.

Earth Piercing: The use of a tool, which comprises a percussive hammer within a suitable casing, generally of torpedo shape. The hammer may be pneumatic or hydraulic. The term is usually associated with non-steered devices without rigid attachment to the launch pit, relying upon the resistance (friction) of the ground for forward movement. During operation the soil is displaced, not removed. An unsupported bore may be formed in suitable ground, or a pipe drawn in, or pushed in, behind the tool. Cables may also be drawn in.

Entrance Pit: An opening in the earth of specified length and width for placing the machine on line and grade. See Boring Pit.

Entry/Exit Angle: In a Horizontal Drilling or Guided Boring System, the angle to the ground surface at which the Drill String enters or exits in forming the pilot bore.

Exit Pit: An opening located at the exit of the cutterhead, TBM, shield or casing.

Expander: A tool which enlarges a bore during a Pull-Back operation by compression of the surrounding ground rather than by excavation. Sometimes used during a Thrust Boring process as well as during Directional Drilling or guided Boring pull-back.

Fluid-Assisted Boring/Drilling: A type of Directional Drilling or Guided Boring technique using a combination of mechanical drilling and pressurized fluid jets to provide the soil cutting action.

Guidance System: The guidance system continuously confirms the position of the MBTM, bore head, TBM, shield or tunnel.

Guided Auger Boring: A term applied to Auger Boring systems which are similar to Microtunneling, but with the guidance mechanism actuator sited in the Drive Shaft (e.g., a hydraulic wrench which turns a steel casing with an asymmetric face at the cutting head). The term may also be applied to the auger boring systems with rudimentary articulation of the Casing near the head activated by rods from the drive pit. A patented system provides both line and grade control to the Auger Boring systems.

Guided Boring: A Term applied in Europe to Mini- and sometimes Midi Horizontal Directional Drilling. It is a steerable system for the installation of pipes, conduits and cables using a surfaced-launched drilling rig. A Pilot Bore is drilled using a rotating Drill String and is then enlarged by a Back Reamer or Expander to the size required for the Product Pipe. The necessary deviation during pilot boring is provided by a slanted face to the drill head, an asymmetric drill head, eccentric fluid jets or a combination of these.

Horizontal Directional Drilling (HDD): See Directional Drilling

Horizontal Rotary Drilling (Wet Boring, Mud Jacking, Bentonite Boring, Slurry Boring, and Rotary Boring): The mechanical installation of pipe or casing by rotating methods which do not use augers for the removal of spoil. Usually uses a fluid of water and Bentonite to remove spoil.

Impact Machines: A type of machine that pierces the earth (piercing tool) or rams an object to produce a bore (ramming machine).

Impact Moling: The use of a tool which comprises a percussive hammer within a suitable casing, generally of torpedo shape. The hammer may be pneumatic or hydraulic. The term is usually associated with non-steered devices without rigid attachment to the launch pit, relying upon the resistance (friction) of the ground for

forward movement. During operation the soil is displaced, not removed. An unsupported bore may be formed in suitable ground, or a pipe drawn in, or pushed in, behind the impact moling tool. Cables may also be drawn in.

Interjack Pipes: Pipes specially designed for use with Intermediate Jacking Stations.

Intermediate Jacking Station (IJS): A fabricated steel shield incorporating hydraulic jacks designed to operate between interjack pipes to provide additional thrust as necessary.

Jacking: The actual pushing of pipe or casing in an excavated hole. This is usually done with hydraulic cylinders (jacks), but has been done with mechanical jacks, air jacks, and just about anything else that man could imagine.

Jacking Pipes: Pipes designed to be installed using Pipe Jacking techniques.

Jacking Pit: (Entrance Pit, Bore Pit, Jack Pit): The excavation that the machinery is set into to install a casing or tunnel.

Jacking Shield: A fabricated steel cylinder from within which the excavation is carried out either by hand or machine. Incorporated within the shield are facilities to allow it to be adjusted to control line and level.

Jetting: A process using high pressure water to wash out the face of a utility crossing without any mechanical or hand excavation of the soils in the face. This process has also been used to remove the material in open pit mining.

Launch Pit: Also known as Drive Pit, Bore pit, Jacking pit, Shaft or other terms.

Locator: The electronic instrument used to determine the position and strength of electro-magnetic signals emitted from a transmitter in the pilot head of a boring system, in an impact moling tool, or from existing services which have been energized.

Midi-Horizontal Directional Drilling: Steerable surface-launched drilling equipment for the installation of pipes, conduits, and cables. Applied to intermediate sized drilling rigs. Tracking of the Drill String may be achieved by either a downhole survey tool or a walk-over locator.

Microtunnel Boring Machine (MTBM): The microtunnel boring machine (MBTM) refers to the microtunnel shield jacked through the earth which excavates the ground while simultaneously installing pipe, as spoil is excavated and removed. Personnel entry is not required for routine operation.

Microtunneling: A trenchless construction method for installing pipelines with the following features:

- Remote Controlled - the MTBM is operated from a control panel, normally located on the surface. It simultaneously installs pipe as spoil is being excavated and removed.

- Guided - The guidance system usually refers to a laser beam projected onto a target in the MTBM, capable of installing gravity sewers or other types of pipeline to the required tolerance for line and grade.
- Jacking Pipe - The process of constructing a pipeline by consecutively pushing the MTBM through the ground using a jacking system.
- Face Support - Continuous pressure is provided to the face of the excavation to balance groundwater and earth pressure.

Mini-Horizontal Directional Drilling (Mini-HDD): Steerable surface-launched drilling equipment for the installation of pipes, conduits, and cables. Applied to small sized drilling rigs. Tracking of the Drill String may be achieved by a walk-over locator. In Europe, it is called Guided Boring.

Mixed Face: A soil condition that presents two or more different types of material in the path of the bore.

Pilot Bore: The action of creating the first (usually steerable) pass of any boring process which later requires back-reaming or similar enlarging. Most commonly applied to Directional Drilling and 2-pass microtunneling systems.

Pipe Jacking: A system of directly installing pipes behind a Shield Machine by hydraulic jacking from a Drive Shaft such that the pipes form a continuous string in the ground. Usually personnel are required inside the pipe to perform the excavation or spoil removal process. The excavation can be performed manually or mechanically.

Pipe Pusher: A machine that pushes or pulls a rod or pipe to produce a bore by means of compaction without rotation or impact.

Pipe Ramming: A technique for installing steel casings from a drive shaft to a reception shaft utilizing the dynamic energy from a percussion hammer attached to the end of the pipe. A continuous casing support is provided and over-excavation or water is not required. This is a 2-stage process.

Pull Back: That part of a Directional Drilling process in which the Drill String is withdrawn through the bore to the Entry Pit, usually installing the Product Pipe at the same time.

Pull Back Force: The tensile load applied to a Drill String during the Pull-Back process. Directional Drilling rigs are generally rated by their maximum pull-back force.

Receiving Pit: 1. See Exit Pit. **2.** An opening in the earth located at the expected exit of the cutting head or casing. **3.** (Come out hole, come out pit) The pit that is dug at the end of the bore, opposite the jacking pit.

Remote Control System: The remote control system monitors and controls the MBTM, the automated transport system, and the guidance system usually from a fixed location in the drive shaft.

Restoration: The backfilling, compaction, and resurfacing of any excavation in

order to restore the surface and underlying structure to enable it to perform its original function.

Reverse: The counter-clockwise rotation of the auger as viewed from the machine end.

Roller Cone Bit or Reamer: A bit or reamer in which the teeth rotate on separate, internal shafts that are usually aligned perpendicular to line. Used for boring rock.

Rotary Rod Machine: A machine used to drill earth horizontally by means of a cutting head attached to a rotating rod (not an auger). Such drilling may include fluid injected to the cutting head through a hollow rod.

Segmental Concrete Tunnel Liners: Used the same way as Liner Plate except that they are made of concrete.

Shield: A steel cylinder at the face of a utility tunnel or casing, which may sometimes employ the use of a mechanical excavator and may be steerable, and provide hazard protection from the area covered.

Single Pass Tunneling: a method of tunneling that simultaneously excavates the tunnel and installs the final product in place. Pipe jacking of storm drains using Reinforced Concrete Pipe is a single pass method, as is pipe jacking of reinforced fiberglass pipe for water lines and sanitary sewers.

Slurry Boring: A technique that forms a borehole from a drive shaft to reception shaft by means of a drill bit and drill tubing (stem). A drilling fluid (i.e., bentonite slurry, water, or air pressure) is used to facilitate the drilling process by keeping the drill bit clean and aiding with spoil removal. It is a 2-stage process. Typically, an unsupported horizontal hole is produced in the first stage. The pipe is installed in the second stage.

Split Design: A boring machine having the capability of being broken down into two or more sections to reduce the lifting weight.

Spoil (Muck): Earth, rock, and other materials displaced by a tunnel or casing, and removed as the tunnel or casing is installed. In some cases, it is used to mean only the material that has no further use.

Steering Head: A moveable lead section of casing that can be adjusted to steer the bore.

Test Bore: Probing by auger or coring tool, usually vertically, at the site to determine soil conditions.

Trench Box: A preconstructed set of side plates and adjustable cross members to prevent the walls of the pit from collapsing.

Tunnel Boring Machine (TBM):

1. A full-face circular mechanized shield machine, usually of Personnel-Entry diameter,

steerable and with a rotary cutting head. For pipe installation it leads a string of jacked pipes. It may be controlled from within the shield or remotely.

2. (Mole, Tunneling Head) A mechanical excavator used in a tunnel to excavate the front face of the tunnel.

Tunnel Liner Plate: a support system of sectional steel plates that when bolted together form a circular ring. Tunnel liner plate can be utilized in both hand excavation and mechanized tunneling techniques.

Two Pass Tunnel: A method of tunneling in which as the earth is excavated an initial support system, such as tunnel liner plate, is installed to support the tunnel as the first pass. In the second pass, the final carrier pipe is then installed inside the initial support system.

Uncased Bore: Any bore without a lining or pipe inserted, i.e., self-supporting, whether temporary or permanent

Utility Tunneling: A 2-stage process in which a temporary ground support system is constructed to permit the installation of the product pipe. The temporary tunnel liner is installed as the tunnel is constructed. The temporary ground support system (liner) can be steel or concrete tunnel liner plates, steel ribs with wood lagging, or an all wood box culvert. Personnel are required inside the tunnel to perform the excavation and/or spoil removal. The excavation can be accomplished manually or mechanically.

Wing Cutters: Appendages on cutting heads that will open to increase the cutting diameter of the head when turned in a forward direction, and close when turned in a reverse direction. They are used to cut clearance for the casing pipe.

Wrapped Casing (Wrapped Pipe): A coating on pipe for protection from corrosion, usually composed of asphalt and asphalt coated paper. Some coatings may contain plastic, fiberglass, coal tar, or other materials. Also known as coated casing.