SPECIAL CONDITIONS FOR HORIZONTAL AUGER BORING (HAB)
October, 2006

1 Materials

1.1 Pipe - Pipe used in this method includes an external steel casing pipe and may include a variety of interior carrier pipe materials.

Casing pipe shall be used within the entire roadbed influence area. The roadbed influence area is defined as the subsurface area located under the road and shoulder surface, between each shoulder point or back of curb; and continues transversely outward and downward from each shoulder point or back of curb on a 1 on 1 slope. Pipe shall be specifically designed and certified for HAB by the pipe manufacturer.

1.2 Allowable forces

The allowable jacking strength capacity of the casing pipe shall be capable of withstanding the maximum jacking forces imposed by the operation. Steel casing pipe shall have minimum yield strength of 35,000 psi.

1.3 Casing Pipe Characteristics

(a) Casing pipe materials shall be steel. Alternate materials will require prior approval.
(b) Only new casing pipe shall be used, unless otherwise approved by the MDOT Engineer/Inspector.
(c) Casing pipe shall have a minimum wall thickness of $^1/_4$ inch or as specified in the current MDOT Standard Specifications for Construction, Table 909-18, whichever is larger.
(d) Casing pipe shall be round. Casing pipe shall have a roundness tolerance, so that the difference between the major and minor outside diameters shall not exceed 1% of the specified nominal outside diameter, or 0.25 inch, whichever is less.
(e) Casing pipe shall have square and machine beveled ends. The pipe end maximum out-of-square tolerance shall be 0.04 inch, (measured across the diameter).
(f) Casing pipe shall be straight. The maximum allowable straightness deviation over any 10 foot length of steel casing pipe is 1/8 inch.
(g) Pipe shall be without any significant dimensional or surface deformities. All pipes shall be free of visible cracks, holes, foreign material, foreign inclusions, blisters, or other deleterious or injurious faults or defects. Any section of the pipe with a gash, blister, abrasion, nick, scar, or other deleterious fault greater in depth than ten percent (10%) of the wall thickness, shall not be used.
(h) Casing pipe shall normally be constructed without any longitudinal seams. However, longitudinally welded casing pipe is allowed for 48 inch or larger diameter pipes when a certified welder performs all the welding.
(i) Casing pipe shall have smooth interior and exterior walls to reduce jacking force and prevent casing rotation
(j) The inside diameter (ID) of the casing pipe shall be at least 6 inches larger than the largest outside diameter (OD) of the carrier pipe to allow the carrier pipe to be inserted or removed subsequently without disturbing the casing or the roadbed.

1.4 Casing Spacers - Casing spacers are required for all carrier pipes. Casing spacers shall be plastic, fiberglass, stainless steel, or carbon steel. Normally, one spacer is adequate to support a carrier pipe length that does not exceed ten feet; otherwise, two spacers are required for longer carrier pipe lengths.

2 Construction

2.1 Minimum Allowable Depths

The minimum allowable depth of a HAB installed casing pipe under the road and shoulder surface is listed in table 1. Any deviation from table 1 shall require prior approval from the MDOT Engineer/Inspector.

Table 1 – HAB minimum installation depth under different soil conditions

Soil Condition	Minimum Depth (feet)
Clayey	4
Silty	4
Sandy	6
Gravely	6

In locations where the road surface is super elevated, the minimum depth of the bore shall be measured from the lowest side of the pavement surface. In addition, a minimum 3 foot depth shall be maintained in all other features including ditch bottoms.

2.2 Access Pits

(a) Location - A minimum distance, from the edge of the paved shoulder or curb, to the face of any access pit, equipment, and supplies, shall be 35 feet along freeways and limited access roadways and 25 feet along free access roadways. Any deviation from these distances shall require prior approval from the MDOT Engineer/Inspector.

(b) Sheeting and Bracing -Sheeting and bracing shall be required whenever any part of the access pit excavation is located within the roadbed influence area. Steel sheet piling shall be furnished and installed as indicated in the current MDOT Standard Specifications for Construction, section 704. An additional earth retention structure shall be required above and below the bore hole on the drilling face of all access pits to prevent loss of material during construction.

(c) Protection - Fencing barriers shall be installed adjacent to access pits, open excavations, equipment and supplies with suitable fencing and plastic drums to prohibit pedestrian access to the work site. Equipment shall not be used as fencing to protect access pits.

2.3 Lead Auger / Overcut Allowance

A full-size auger section shall be used as the lead section of the casing. The auger shall not protrude from the leading edge of the casing. However, if soil conditions halt the movement of the casing, the auger shall be allowed to protrude not more than 3 inches in front of the casing during the boring operation.

Overcut is the annular space between the excavated hole and the outside diameter of the casing pipe. The allowable overcut diameter is one inch greater than the casing pipe radius.

2.4 Watertight Joints

Water tight pipe joints are required to ensure the integrity of the roadbed. Casing pipe shall be constructed to prevent water leakage or earth infiltration throughout its entire length.

2.5 Lubrication Fluids

(a) Lubrication fluids are specifically required for this method regardless of the soil conditions. Any deviation from the use of lubrication shall require prior approval from the MDOT Engineer/Inspector.
(b) Lubrication fluids, consisting of a mixture of water and bentonite or bentonite/polymer, shall be used in the annular space between the casing being installed and the native soil. Lubrication may also be used inside the casing pipe to facilitate spoil removal.
(c) Grease is not allowed for use as lubrication for this purpose.

2.6 Pipe locating and tracking - One of the following tracking, locating, and guidance systems shall be used, unless an alternate is approved by the MDOT Engineer/Inspector.

(a) Waterline system.
(b) Mechanical control head.
(c) Electronic (inertial) control head.
(d) Walkover system.
(e) Laser guided tunnel attachment.
(f) Laser guided pilot rod.

2.7 Settlement/Heaving Monitoring

(a) This method shall be performed in a manner that will minimize the movement of the ground in front of, above, and surrounding the HAB operation; and will minimize subsidence of the surface above and in the vicinity of the boring. The ground shall be supported in a manner to prevent loss of ground and keep the perimeter and face of the boring stable at all times, including during shutdown periods.
(b) Potential heave or settlement shall be monitored at each shoulder point, edge of pavement, the edge of each lane (or centerline for two lane roads), and otherwise at 50 foot intervals along the pipe centerline.
(c) A survey shall be performed one day prior to initiating this operation at each required monitoring location. A similar survey shall then be performed at each location, on a daily basis, until the permitted activity has been completed. All survey readings shall be recorded to the nearest one-hundredth (0.01) of a foot. Digital photographs of the pavement conditions shall also be taken prior and after the pipe installation.
(d) All operations shall stop immediately whenever monitored points indicate a vertical change in elevation of 1/2 inch or more, or any surface disruption is observed. The Contractor shall then immediately report the amount of settlement to the MDOT Engineer/ Inspector.

2.8 Ground Water Control

(a) Dewatering shall be conducted whenever there is a high ground water table level to prevent flooding and facilitate the operation. The water table elevation shall be maintained at least 2 feet below the bottom of the casing at all times. When needed, dewatering *may* be initiated prior to any excavation.

(b) Minor water seepage or pockets of saturated soil may be effectively controlled through bailing or pumping. This control shall be accomplished without removing any adjacent soil that could weaken or undermine any access pit, its supports, or other nearby structure.

(c) Larger volumes of ground water shall be controlled with one or more well points or with staged deep wells. Well points and staged deep well pumping systems shall be installed and operated without damage to property or structures, and without interference with the rights of the public, owners of private property, pedestrians, vehicular traffic, or the work of other contractors. Any pumping methods used for de-watering and control of ground water and seepage shall have properly designated filters to ensure that the adjacent soil is not pumped along with the water. Well diameter, well spacing and the pump's pumping rate, shall provide adequate draw down of the water level. Wells shall be located to intercept ground water that otherwise would enter the access pit excavation and interfere with the work. Upon removal of a well, the hole shall be filled and grouted according to the specifications identified in MDOT's flowable fill special provision, and MDOT's Plugging Drill Holes special provision.

(d) Existing storm sewers shall only be used to discharge water from the dewatering operation in accordance with a permit obtained from the appropriate storm sewer owner. Filters or sediment control devices shall be required to ensure that the existing system is not adversely affected by construction debris or sediment.

(e) If grouting is used to prevent ground water from entering the area of the access pit, the grouting shall be installed without damage to property or structures and without interference with the rights of the public, owners of private property, pedestrians, vehicular traffic, or the work of other contractors. The material properties of the grout shall conform to the specifications identified in MDOT's flowable fill special provision.

2.9 Failure

(a) Should anything prevent completion of this operation, the remainder of the pipe shall be constructed and/or abandoned by methods approved by the MDOT Engineer/Inspector.

(b) Abandonment of any component of the installation shall only be allowed as approved by the MDOT Engineer/Inspector.

2.10 Contamination

When an area of contaminated ground is encountered, all operations shall stop immediately, and shall not proceed until approved by the MDOT Engineer/Inspector. Any slurry shall be tested for contamination and disposed of in a manner, which meets Local, State and/or Federal requirements.

2.11 Bulkhead

Casing ends shall be enclosed or bulkheaded with a commercial grade concrete, or approved alternate to seal the ends to prevent water leakage or earth infiltration. The concrete shall extend longitudinally into the pipe end opening to create a minimum one foot thick bulkhead barrier, or as required by permit. MDOT Engineer/Inspector may allow rubber bulkheads in special situations.

2.12 Work Site Restoration

(a) Access pits and excavations shall be backfilled with suitable material, and in a method approved by the MDOT Engineer/Inspector. Any embedded supports shall be removed

to 10 feet below the original ground surface. The disturbed work site area shall be restored to existing grades and original material condition.

(b) The disturbed grass-surface area shall be topsoiled, seeded, fertilized, mulched, and anchored according the current MDOT Standard Specifications for construction, sections 816 and 917.

(c) Upon completion of the work, the contractor shall remove and properly dispose of all excess materials and equipment from the work site.