

***GEOTECHNICAL
DRILLING:
GUIDE TO
CHOOSING THE
RIGHT CORE BIT***

INTRODUCTION

Choosing the right drill bit is the one decision that will have the greatest impact on your success and geotechnical drilling productivity. Unfortunately, due to the many variables you must consider, it is a complex question.

This guide will outline the steps you should take when choosing a drill bit, also known as a core bit.



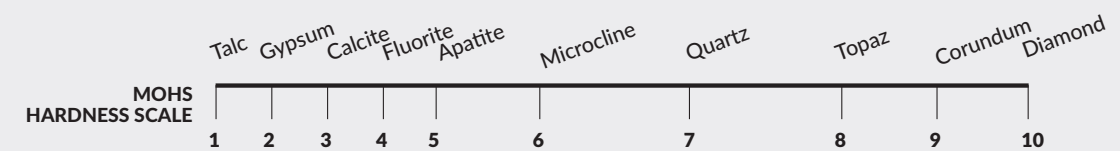
1. DEFINE HARDNESS OF ROCK

Let's look at one of the most important variables that will affect your choice - ground conditions. The type of ground is paramount in any decision regarding drill bit choice. There are several factors to look at.

HARDNESS

The hardness of the ground is measured according to Mohs Hardness scale, [a chart](#) of relative hardness of various minerals. The scale consists of numbers one through ten; 1 being the softest and 10 being the hardest. Drill matrices are developed to perform ideally within a certain range of the scale so you need to pick a bit suitable to the hardness of the ground to be drilled. There are tools that help you identify the hardness of the ground.

The simplest and most reliable way to determine rock hardness is to perform a scratch test using an [etcher kit](#) and compare the results with Mohs scale. If you do not have such tools, you can still determine the hardness using a pocket knife or a metal saw, although results may not be as precise.



If you are using a pocket knife, the average hardness of this tool is approximately 6.0 to 6.5 and if you are using a metal saw, it should be around 6.5 to 7.0 on Mohs scale.

For more details on how to perform a scratch test, or to order a Fordia etcher kit, [contact your sales representative](#).

EXAMPLE

Mike measured an average hardness of 5.5 after performing three scratch tests on samples of his latest project. As the ground is coarse grained and slightly abrasive, his representative suggests he should choose a [GeoHawk Red](#).

After a few hundred feet, Mike realizes that the penetration rate is too slow. His representative then suggests he should use a premium matrix and sends him a couple of [HERO 9](#) core bits.

A week later, the new bits have proven themselves. The penetration rate has improved and Mike has reached the productivity level he was hoping for.

2. ABRASIVE ROCK

This is another ground condition that can be challenging and can cause headaches among many drillers. It can be difficult to drill through when present in any hardness of ground. [Abrasive rock](#) can wear down drill bits prematurely.

Luckily, there are premium core bits, such as the [HERO Abrasive](#) line that have been developed specifically for abrasive ground conditions. These bits have a special matrix consisting of alloys and diamonds that when combined, are very resistant to abrasive conditions and are easy to sharpen in the hardest conditions. You should look always at waterway configurations that specifically address abrasive conditions, for exemple, those with wider waterways that flush out cuttings easily.



3. VARIABILITY OF ROCK

Some ground is more variable. It may be soft for the first 100 feet and then become harder, or fractured. When dealing with variable ground there are many products on

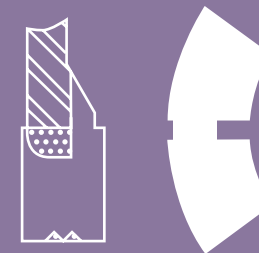


the market that provide the versatility needed to perform well in varying conditions, such as the [IXtreme](#) series.




4. IS ROCK COMPETENT OR FRACTURED?

Terrain can be either fractured or competent and each will need a different kind of drill bit. For example, a bit with a deep lateral discharge waterway configuration is ideal for fractured rock. It is designed to allow better water flow to the bit with reduced risk of eroding the core.

DEEP LATERAL DISCHARGE



- Ideal for soft broken, ground
- Deep design increases space for water and mud to flow to the bit
- Waterways allow minimum water and pressure on sample to prevent erosion of the bit
- Preferred choice when sampling in overburden

STANDARD	CYCLONE	TURBO PIE SHAPED (TPS)
 <ul style="list-style-type: none">• Can be used on most impregnated core bits• Great fluid circulation from the inside to the outside• Available with wider and/or larger waterway configurations	 <ul style="list-style-type: none">• Designed with specific angled waterways• Greater ejection of drilling fluids• Works best in broken ground	 <ul style="list-style-type: none">• Greater ejection of fluids and cuttings• Reduced contact area with the same flushing performance• Recommended for higher rotation speeds• Available with wider and/or larger waterway configurations

Other waterway configurations available

4. CONSIDER TYPE OF DRILL RIG

The type of drilling rig and at what capacity it is working are both things you should consider when choosing your drill bit.

As a rule, [geotechnical and environmental drill rigs](#) have a lower RPM capacity, meaning less power than the drill rigs used in mineral exploration. For rigs with a capacity less than approximately 1,000 RPM, an economical [GeoHawk](#) core bit is an ideal choice.



For rigs with more power, the GeoHawk line may still be an excellent choice, but if drilling becomes difficult, you can always switch to higher performance bits from the [HERO](#) line of products.

5. CONSIDER LEVEL OF DRILLING EXPERTISE

No one starts out as an expert in diamond drilling, so while you are gaining experience, you should pay attention to certain parameter. You should always refer to a drilling parameter chart to make sure the speed or rotation of your drill rod corresponds with the diameter you are using.


SIZE	RPM
AWL	950-1,050
BWL	850-950
NWL	750-900
HWL	650-750
PWL	600-700

Even using this chart as a benchmark, you may have to adjust a few times before you achieve your ideal penetration rate in relation to your rotation speed.

6. CONSIDER KNOWLEDGE OF AREA

Sometimes you will be lucky enough to know the hardness and type of ground in which you will be drilling, but even armed with this knowledge, you may find yourself drilling to a certain depth and then coming across a landfill. Landfills pose problems as they contain different materials with different levels of hardness. You should consider a core bit which adapts easily to varying ground conditions, such as the [GeoHawk Green](#).

Sometimes unexpected conditions call for premium core bits with greater performance. One such option would be a premium bit from the [HERO](#) line or drill bits that have been developed to handle a wider range of ground, such as the [IXtreme](#) series.

An aerial photograph showing a large, multi-level highway interchange with several overpasses and ramps. The interchange is situated in a dry, brownish landscape. In the background, a large, blue reservoir or lake is visible, surrounded by some greenery and hills. The sky is clear and blue.

An entire range of ground hardness, from 3-8 on Mohs scale, can be covered with 4 bits from the [T Xtreme](#) series. In this way, you will not have to replace a bit before it wears out of if the ground conditions change.

Whenever possible, refer to previous drilling campaigns in the area to learn more about the ground.

9. CHOOSE THE RIGHT WATERWAY CONFIGURATION

Fordia offers a wide range of waterway configurations to provide you with the best drilling performance, no matter what type of work needs to be done.

All of our configurations are available with different waterway widths and come in most matrix heights.

DEEP LATERAL DISCHARGE



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- Deep design increases space for water and mud to flow to the bit
- Waterways allow minimum water and pressure on sample to prevent erosion
- Preferred choice when sampling in overburden

STANDARD



- Can be used on most impregnated core bits
- Great fluid circulation from the inside to the outside
- Available with wider and/or larger waterway configurations

CYCLONE



- Designed with specific angled waterways
- Greater ejection of drilling fluids
- Works best in broken ground

TURBO PIE SHAPED (TPS)



- Greater ejection of fluids and cuttings
- Reduced contact area with the same flushing performance
- Recommended for higher rotation speeds
- Available with wider and/or larger waterway configurations

Other waterways configurations available

10. EVALUATE RESULTS AND MAKE ADJUSTMENTS

As every type of ground is unique, these rules of thumb may not always be enough to find the perfect bit on your first attempt. [Abrasive](#)ness, fractures or competence in rock formations are some other major considerations when it comes to choosing a bit.

Reviewing bit performance is important - it may provide critical information to help you find the right bit and to improve productivity.

If the penetration rate is too slow, using a higher matrix could help solve the problem. For example, let's say you are using a [GeoHawk Red](#) in hard ground and the penetration rate starts to diminish. Your next choice should be a [GeoHawk Orange](#), a bit with a higher number and a softer matrix that will allow diamonds to be exposed efficiently. The exposed diamonds will cut the rock better and improve penetration.

With so many variables to consider in the selection of a drill bit, you end up having to choose from an array of drill bits that are developed for very specific situations. Sometimes, you may have to change drill bits as conditions change or their performance decreases. Manufacturers are always looking to improve the performance of drill bits and are developing new products to help drillers achieve success.

Remember that [technical support](#) is always available to offer advice or even for an [onsite visit](#).