Core Reinstatement Procedure

1) The core, or coupon, cut from the pavement using the keyhole coring equipment can be reinstated as a permanent repair using Utilibond after the hole has been properly backfilled and compacted. The first step of reinstating is to properly prepare/clean the cored hole. Wipe clean all cut surfaces of the core and walls of the hole with a clean, damp sponge to remove all loose cutting debris and particulate from the cut surface. Proper bonding depends on achieving a clean surface for the bonding agent to adhere to.

2) Line the bottom of the hole with a 1"- 2" deep bed of pea gravel. Because the pea gravel is added fill that was not present before, the backfill should be left approximately 2 inches lower than the base of the pavement. Undercut the bottom of the existing pavement in the hole by about 1" all around to allow the pea gravel to fill under the pavement. Utilibond will impregnate the pea gravel and create a solid base / plug for the core to bond to.

3) Using the core puller, lower the core back into the hole and check for level and flushness with the existing pavement. Adjust the pea gravel until the core is level with the surrounding pavement, and approximately 1/8" to 3/8" below the surface of the surrounding pavement. This process is referred to as "dry fitting" the core. This is an essential step to a successful core reinstatement. Once the Utilibond has been added to the hole and the core has been reinserted, you will not have a second chance to change its level to make the core level with the surrounding pavement. **Make sure it's done right the first time.**

4) Prepare the bonding compound by first removing the bag (s) of Utilibond from the pail. Add water to the level indicted on the outside of the pail. Do not exceed or reduce the amount of water. Exact proportions of water to Utilibond are crucial for effective performance. Use the 1-litre container supplied in all Twin Pack pails to achieve exact water proportions.

5) Carefully open the bag(s) of Utilibond, creating a clean opening though which to pour the Utilibond powder from.

With the mixing blade inserted into the bottom of the pail, slowly add the Utilibond powder to the water in the pail, while engaging the drill with the mixing blade.

6) Use the handheld drill and appropriate mixing blade, mix the bonding compound until it is smooth and flowing. (Mixing time is approximately 2- 3 minutes). Once mixed the Utilibond will appear smooth and creamy with a flow characteristic similar to that of pancake batter. **Do not add** additional water if the mixture looks dry at the beginning of the mixing process. Keep mixing and the Utilibond compound will "turn" after about one minute and begin smoothing out.

7) Carefully pour the entire pail of Utilibond permanent pavement bonding compound into the hole. Be careful not to disturb the layer of leveling pea gravel in the bottom of the hole while you pour the Utilibond in.

8) Slowly lower the core down into the hole, on top of the Utilibond compound. Move the core back and forth with the core puller, while tapping downward to allow the bonding compound to flow up through the cut spaces around the core (the kerf) and over flow slightly onto the surface of the pavement. Remove the core puller and allow the Utilibond to flow up through the centre hole. Apply gentle pressure to the top of the core, and ensure the core is level with the pavement by allowing the excess Utilibond to flow up to the surface from the kerf and the pilot hole. Use a flat trowel to clean up any excess Utilibond. Drag the flat edge of a trowel across the edge of the kerf to ensure that the core is flush with the rest of the roadway all around the circumference.

9) Carefully clean off the excess Utilibond from the surrounding pavement before it dries. The bonding compound will begin to set up within approximately 15 minutes (at 70° F). Keep the exposed areas of Utilibond "wet" while carefully cleaning off the Utilibond from the surrounding surfaces. Thoroughly clean all mixing tools and pails before the bonding compound has a chance to set. Dip the whitewash brush in water and carefully apply moisture to the surface of the Utilibond in the kerf and center pilot hole, keeping it damp until it has set-up and the surface is firm to the touch.

10) Once the core has set and gained strength (30 minutes at 70° F), use water (high pressure is recommended) to clean off any excess debris and thoroughly sweep the area before leaving.

Properly dispose of all excess Utilibond material, and reuse or recycle the Utilibond pail.

Hot Weather Core Reinstatement Procedure

Utilibond™ is specially formulated for permanently replacing excavated cores in asphalt, asphalt and concrete and concrete road systems and sidewalks and other paved surfaces. The rapid hydration and fast strength gain of this product allows the roadway to be reopened within 30 minutes at 70°F/21°C.

However, sometimes cores will need to be reinstated when the ambient temperatures are well above 70° F.

Utilicor deems hot weather to be temperatures when the day time highs exceed 80 °F and extreme hot weather to be above100 °F. When reinstating cores in these hot or extreme hot weather temperatures certain procedures will help the crews attain a proper core reinstatement. Failure to follow these instructions may result in improper or poor reinstatements.

Utilibond™ permanent pavement bonding compound is designed to be mixed with a precise amount of water to the proportion of Utilibond powder. **This ratio must be maintained even in extreme hot weather conditions.** The precise amount of water required is one litre of water for one 22 lbs. bag of Utilibond powder. For a 44 lbs. bag of Utilibond powder, mix with 2 litres of water. Do not alter this ratio the ultimate strength gain and performance of the Utilibond™ will be reduced.

In the case of hot weather and extreme hot weather conditions the following tips will allow for additional working time during the process of reinstating the core:

- **Start with cold water to mix the Utilibond™ and keep the Utilibond™ in a cool place.** As only two litres of water are required for an entire 44 lbs. pail of Utilibond, filling a potable water container with cold tap water before leaving the yard and storing it in the air conditioned cab of a work truck on site until mixing is needed will help to inhibit the set up time of the Utilibond. Make sure the Utilibond powder is as cool as possible before mixing.

- **Reduce overall mixing time**. Utilicor suggests a full three minute mix time of Utilibond™ at 70°F. At this temperature this with help to accelerate the setting times for the product. However, in hot weather conditions we recommend reducing this time to 1½ minutes. Once the Utilibond™ is mixed through and is lump free, with a flow consistency of pancake batter, it is fine to stop the mixing process and start the core reinstatement.

- **Keep everything wet.** This would include the cored portion of the roadway and the core itself before reinstatement occurs. Dampen all portions of the cored roadway and core with a sponge just prior to reinstatement.

- **Once the core has been reinstated keep the kerf and pilot hole portions wet**. By using a wet soft bristled brush you can "paint" the top of the reinstated core with cold water – this will help the Utilibond™ to set a little slower and reduce any premature or rapid hydration of the Utilibond. Mke sure you keep the kerf and the pilot hole damp.

- **Keep the cores cool.** In extreme hot and sunny days the asphalt cores can literally "melt" if left unprotected at the side of the road with the sun beating down on them. An asphalt core will also have the tendency to expand, or "mushroom" due to excessive heat when left in the sun. We recommend storage of cores for short durations in the shade and if possible covered with wet burlap. For longer durations they should be carefully moved to an inside warehouse location.

- **Do not leave the core puller in the core for extended periods of time.** Once the core has been removed from the roadway it is imperative that the Utilicor puller be extracted from the center of the cut core. If it is left in the core in tightened position it could possibly cause the core to split. During reinstatement on a hot day only tighten the puller to the point that one can securely move the core.

With ambient temperatures of 70°F Utilibond has an initial set in 15 minutes, a final set at 20 minutes and is load bearing at 30 minutes, at which time the roadway can be safely reopened to traffic.

At correspondingly higher temperatures set times will be slightly reduced.

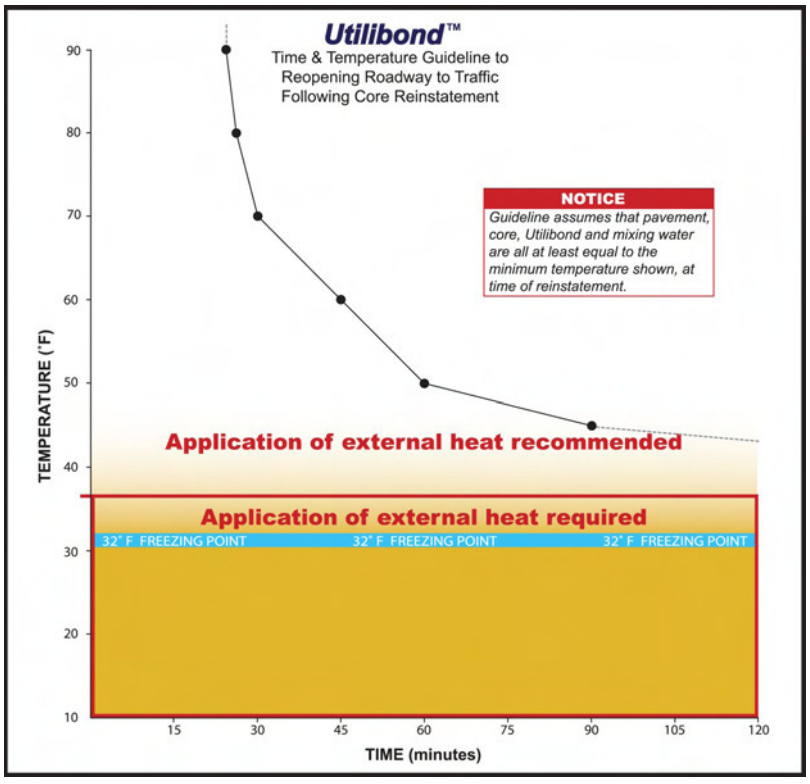
Time and Temperature Guide to Reopen Roadway to Traffic Using Utilibond Core Bonding Compound

Reinstatement at 70°F (21°F) - 30 Minutes to safely reopen the roadway to traffic
Cores may be safely reinstated with Utilibond and the roadway safely reopened to traffic in 30 minutes when the temperature of the pavement slab, core and bonding materials, including mixing water immediately before placement, are at a minimum of 70°F (21°C). At that temperature the bond strength of a typical 18-inch diameter core, 8-inches deep will be capable of supporting a wheel load of at least 30,000 lbs or 3 times the AASHTO H-25 Standard, in **30 minutes** after application, and the roadway can be safely reopened to traffic at that time.

Reinstatement at 50°F (10°F) - One hour to safely reopen the roadway to traffic
Cores may be safely reinstated with Utilibond and the roadway safely reopened to traffic in 60 minutes when the temperature of the pavement slab, core and bonding materials, including mixing water immediately before placement, are at a minimum of 50°F (10°C). At that temperature the bond strength of a typical 18-inch diameter core, 8-inches deep will be capable of supporting a wheel load of at least 30,000 lbs or 3 times the AASHTO H-25 Standard, in **one hour** after application, and the roadway can be safely reopened to traffic at that time.

Reinstatement at temperatures BELOW 50°F (10°C)
While reinstatement of cores can be performed with Utilibond at temperatures as low as 40°F (5°C) because of the proximity to freezing temperatures and the danger of frost crystals forming at the bonding interface, it is recommended that a source of external heat, such as a Utilicor Core Heater, be employed to raise the surface temperatures of both the core and the surrounding pavement to 70°F (21°C) at which temperature the bond strength of a typical 18-inch diameter core, 8-inches deep will be capable of supporting a wheel load of at least 30,000 lbs or 3 times the AASHTO H-25 Standard, in **30 minutes** after application, and the roadway can be safely reopened to traffic at that time.

Reinstatement at temperatures BELOW FREEZING - 32°F (0°C)
The Core Heating procedure can also be successfully employed to facilitate core reinstatement with Utilibond at temperatures **below freezing,** providing that the duration and application of external heat from an approved Core Heater is sufficient to raise the temperature of both the core and the surrounding pavement to approximately 70°F (21°C) and the bonding materials, including water, immediately before placement , are at the same minimum temperature of 70°F (21°C)



As might be anticipated, the duration of heating required to achieve these results at below freezing temperatures, using an approved core heater, will vary inversely with the ambient temperature of the pavement but should not exceed 15-20 minutes in normal circumstances at a temperature down to 10°F (-21°C).

Once the surface temperature of the core and the pavement reach a sustainable 70°F (21°C), normal core reinstatement procedures can be employed and the bond strength of a typical 18-inch diameter core, 8-inches deep will be capable of supporting a wheel load of at least 30,000 lbs or 3 times the AASHTO H-25 Standard, in **30 minutes** after application, and the roadway can be safely reopened to traffic at that time.

Cold Weather Core Heater Reinstatement Procedure

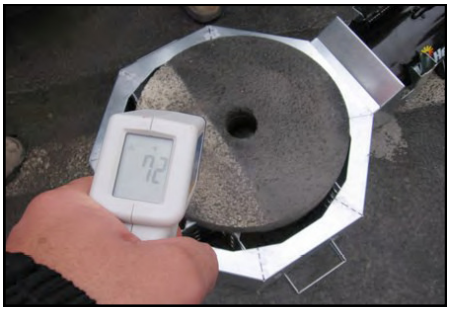
The Utilicor Core Heater **should be used** when ambient temperature drop below 50°F. as set up times will exceed the 30 minute target. The Core heater **must be used** when ambient temperatures are below 32° F.

Before you begin, make sure the core is dry fitted properly, as per warm weather reinstatement.

Place the core heater base in the hole and connect heater-blower to unit and place core on the base.

Place core cover on top of the Base, and open vents on top of core cover - ignite blower and position into baffle.

Check the temperature occasionally with a non-contact infrared temperature sensor.



When the surfaces of the core reaches at least 70° F, the core reinstatement process can begin. Note: Make sure the Utilibond powder is stored in a warm location, and use warm water to mix with.

Remove the core heater and place the core in the opening, which will keep the core warm while mixing the Utilibond. Once ready, remove core, pour in mixed Utilibond, and reinstate the core as per normal procedure.

The reinstated core will begin to set up within 15-20 minutes. Take intermittent temperature readings to better gauge set time.

At 70° F ambient temperatures Utilibond will reach final strength gain in 30 minutes.

Final core reinstated.

Valve Box / Test Station Installation

1) Core hole through pavement around existing valve box or location of test station.

2) Clean up area. Remove core with core puller or sunken valve box by hand.

3) After test wire is installed and hole is back filled clean the sides of the cored hole.

4) Add 1-2 inches of pea stone and install test box or new valve box

5) Using a straight edge, make sure the top of the valve box is flush with the surrounding pavement.

6) Test box or valve box is flush and ready for reinstatement.

7) Supplies required: Utilibond, water, pea stone, trowels, sponge, whitewash brush, power drill and Utilibond mixing blade.

8) Add one litre of water to the pail. (for larger areas mix both bags of Utilibond)

9) Add bag of Utilibond powder to pail while mixing blade is engaged.

10) Mix for 2 minutes or until Utilibond is smooth and flowing.

11) Add 3 litres (3 full cups) of ¼ to ½ inch pea stone to the Utilibond, mix until blended together. (2/3 Utilibond to 1/3 pea stone)

12) Spray outside of cored hole and test box with Utilicure. Carefully pour Utilibond mixture into the hole around the valve box.

13) Consolidate the mixture into the hole to make sure there are no voids.

14) Smooth and remove excess Utlibond. Trowel smooth.

15) Keep surface wet with whitewash brush to ensure proper hydration. Spray top liberally with Utilicure while setting.

16) Spray top portion liberally with Utilicure.
30 minutes @70°F the roadway may be safely reopened to traffic.

Delaminated Cores

Once a core has been cut, and depending on the road which it was cut from, it is not uncommon to find the core has come apart horizontally in sections… or delaminated.

This occurs most often when the top portion of the core is asphalt and the bottom section is concrete. However, often a road which has been milled and overlaid with a new layer of asphalt rolled over the older roadway, the binder used to glue the new with the old will not have adhered properly, and once the core is cut and extracted the two sections will delaminate.

By inserting the core puller all the way to the bottom of the core it is possible to remove both delaminated sections. It is also possible to use Utilibond to bond the delaminated sections together when reinstating the core.

Above: The core has been extracted from the roadway, but in two pieces.
This core has delaminated.

To reinstate horizontally delaminated cores:

1) Dry fit the core 1/2" lower than normal.
2) Make sure the orientation of the top portion matches the bottom portion.
3) Mark with paint if required.
4) Reinstate the bottom portion first, allowing the Utilibond to flow up and on to the top of the lower core - pour more Utilibond on top of bottom core.
5) Slowly lower the top portion onto the bottom portion and push down to level with surrounding roadway.
6) Clean up remaining Utilibond off top of roadway and core and trowel smooth.
7) Keep kerf and center pilot bit area wet with wash brush and clean water until initial set has occurred.

Core Farms

It is also not uncommon to see the core that has been cut and extracted from the road completely fall apart, and not be suitable for reinstatement.

In these cases it is possible to import a core from either another piece of roadway which is destined to be a trench or an area where a larger excavation is to be performed. In this case simply have the coring equipment cut, remove and store spare cores before actual trench or the excavation performed.

In some instances an actual "core farm" can be built where the coring crews can pre-cut cores that match the optimal core composition and thickness. Typically these "core farms" are constructed with the same asphalt specifications that the municipality requires in their new road construction specifications and is of a similar depth profile.

As seen above, a Core Farm where cores can be harvested year around as needed to replace defective cores from the field.

Overlapping Cores

The industry standard size for keyhole is 18" in diameter. However often larger or smaller cored opening are required due to differing applications. While spot locates for direction drilling facility verification can be as small as 12", it is important to remember that when the core will be reinstated there really is little to be gained by making the hole smaller than is practical for the work to be preformed.

Often there is a need to core a larger diameter hole than the standard 18" diameter. All Utilicor equipment can accommodate coring drum diameters up to 24", and a combination of these larger cored openings may even be capable of serving as a launch pits for HDD.

While not the norm, and usually due to a missed locate, it is possible to core and properly reinstate overlapping cores.

Two 18" diameter cores are cut to allow for greater access to buried facility

Two cores that have been simultaneously reinstated

As seen above, a triple core cut, extracted, and reinstated as one repair

Utilibond Colors to Match Existing Roadways

Utilibond comes in two colors - Aged Asphalt and Natural Concrete. Aged Asphalt Utilibond is identical in composition to Natural Concrete Utilibond with the exception of a carbon black additive, which once cured will dry to a darker color than Natural Concrete Utilibond. The Natural Concrete coloured Utilibond once dried will closely match that of a typical concrete sidewalk or concrete topped roadway.

Older roadways, which are asphalt topped, have the appearance of being lightened in shade when compared to that of a newly constructed asphalt roadway. In these cases Aged Asphalt Utilibond will closely match that of am asphalt roadway which has been in use for some years. However, on newly constructed asphalt topped roadways Utilibond can be mixed to appear even darker with the addition of carbon black - which is provided in the form of UtiliBlack.

The 2 oz. container of UtiliBlack can be added to either the Aged Asphalt formulation or the Natural Concrete. Follow the directions below.

1) Prepare the bonding compound by first removing the bag (s) of Utilibond from the pail. Add water to the level indicted on the outside of the pail. Do not exceed or reduce the amount of water. Proportions of water to Utilibond are crucial for effective performance. Use the 1-litre container supplied in all Twin Pack pails to achieve exact water proportions.

2) Carefully open the bag(s) of Utilibond, creating a clean opening to pour the Utilibond powder from. With the mixing blade inserted into the bottom of the pail, slowly add the Utilibond powder to the water in the pail, while engaging the drill with the mixing blade.

3) Using a handheld drill and appropriate mixing blade, mix the bonding compound until it is smooth and flowing. (Mixing time is approximately 2-3 minutes). Once mixed the Utilibond will appear smooth and creamy with a flow characteristic similar to that of pancake batter. Do not add additional water if the mixture looks dry at the beginning of the mixing process. Keep mixing and the Utilibond compound will "turn" after about one minute and begin smoothing out.

4) Add Utiliblack to Utilibond mixture. Continue mixing until carbon black is mixed through and proper shade has been achieved. It is important to note that unlike Aged Asphalt Utilibond, Utilibond with Utiliblack added will not lighten as it cures. The color seen in the pail while mixing will be the color of the Utilibond once set.

Adjusting Aged Asphalt to a Lighter Shade

If the roadway is Asphalt topped and quite old, it may be necessary to lighten the Aged Asphalt colored Utilibond.

There are two options available to achieve a lightened Aged Asphalt:
1) Mix one bag of Natural Concrete with one bag of Aged Asphalt.
2) Once the core has been reinstated continually keep the kerf and center pilot hole area wet with water. This will have the effect of washing out some of the carbon black in the Utilibond, and once set it will appear lighter in color.

Core Drum Rotation Speed
The rule of thumb here is the smaller the drum diameter the faster the rotation, and the larger the drum diameter the slower the rotation. If a drum rotates too fast for its diameter, the diamond segments will be a "glazed", or polished, and new diamonds will cease to be exposed. As a result the cut will take too long. Running at too slow a speed will result in premature erosion of the diamond segments and will reduce the cuting life of the segments, and result in a higher cost per cut.

Below are some general guidelines for setting the drums R.P.M. to get you the best penetration rate and the longest core drum life.

•12" drum: 200 rpm to 250 rpm •18" drum: 190 rpm to 230 rpm •24" drum: 160 rpm to 200 rpm

Coring Drum Segments
Coring drum segments are composed of synthetic diamonds impregnated in a specially formulated matrix. As the bit is driven into the substrate the diamonds grind away the material being cut. In the keyhole environment we are generally cutting through two very different materials: asphalt and concrete. The asphalt cutting creates slurry that is very abrasive, and contrary to conventional wisdom, even though asphalt is a softer material than concrete, it is more abrasive on the segments than when cutting through concrete.

Utilicor, through years of in-field testing, has developed a segment that provides its end users with the best of both worlds. Our ProCor coring drums are equipped to handle both asphalt and concrete and will provide quick and efficient core cutting action with extended drum life. This means more cuts per drum and reduced cost per core cut.

Feed and Speed
Feed and speed are the two variables the core cutter has to keep in mind when cutting a core. The correct down pressure feed rate will depend on what you are cutting through. With this in mind, all of Utilicor's equipment comes with a feed gauge and a rotational pressure gauge. We recommend a down pressure of 500-700 psi and a rotational back pressure of 800-1200 psi. This should result in a penetration rate of approximately one inch per minute, through asphalt, concrete or composite roadways and sidewalks. If you are taking longer than this, one or more parts of your cutting equation need to be adjusted.

Water for drum cooling slurry removal
While there are core drums designed to "cut dry", in the keyhole process we recommend always using water to cool and lubricate the drum and to carry away the slurry away that is created in coring. Water also keeps the dust down. How much water is proper amount? We recommend a ratio of approximately one gallon per one inch of core cutting. Too much water will clear away all the slurry too quickly, and it's that slurry that helps to expose the new diamonds in the segment during the coring process. Too little water will result in a thick slurry that might cause the core to get stuck inside the core barrel. You should adjust your water flow to keep the kerf area clear, but not so much that you flood the street. As a rule of thumb, for a 10" thick core, you should normally use about 10 gallons of water.

Coring Completion
When you are coring it is impossible to "see" when you are through the roadway or sidewalk. But there are a number of ways that will help you to determine when to stop cutting. If you core too far below the paved surface there is a danger that the loose dirt will work its way up into the drum and cause the core to become stuck. We have five senses, and when you use them they will tell you when it's time to stop coring and time to check to see if your core is ready to be extracted.

Sound
The Utilicor core cutting process incorporates a center pilot bit which simultaneously cuts a center pilot hole through the center of the core. This pilot bit extends an inch or two beyond the bottom of the core barrel so it will actually cut through the pavement before the rest of the drum. When that occurs, you can usually hear a change in the coring sound, and you will know that the bottom of the coring drum needs only to cut another inch or so.

Sight
Watch the color of the slurry. The slurry from the cutting of asphalt or concrete is a distinct and consistent color. As soon as the core drum cuts through the bottom of the roadway or sidewalk, the slurry coming up to the surface will look different. Watch for the change in color of the slurry, and it will help you tell when you are through. Also, watch the Hydraulic gauge that measures pressure on the coring drum. It will often spike just as the core drum cuts through the last portion of the core. When you see this spike in PSI you will know you are through and the core can be extracted.

Feel
All Utilicor coring equipment is equipped with a proportional orbital feed system connected to the steering wheel that gives the operator real time feedback from the coring operation. As you cut through different materials you will notice a different feel. Once the drum penetrates through the asphalt or concrete and into the soil beneath the pavement, the steering wheel will become easier to turn, and you will know that you are through. To check that the core is ready for extraction, stop coring, lift the drum, and stick a pry bar down the center pilot hole in the middle of the core and gently try to rock it back and forth. If it moves easily you will know that the cut is all the way through. This action will also help to break the suction between the bottom of the core and the base of the roadway.

Extracting the Core
Cores are heavy. And larger diameter and deeper cores are very heavy. Always use caution when extracting these from the roadway. Utilicor's specially designed core puller is the safest way in the industry to extract a core. The rubber stopper at the bottom will expand inside the pilot hole and the friction will create a solid hold on the core. A 5 foot pry bar can be inserted through the eye-bolt mounted on the top of the core puller and with a crew member on either side of the core the two of you can share the load and safely lift the core out of the hole. Make sure you lift with your legs - and never with your back. For cores too heavy for two crew members to lift, use the core hoist on the unit or hook the core puller to a small skid steer or backhoe and lift.

Storing and Moving the Core
Cores are circular, and when turned on their side they roll. This helps when you need to move one from the middle of the road to the side of the road. Gently tip it on its side, and roll it away. If you need to store the core for an extended period of time, and it is a hot day, store it upside down on a flat surface. Because of the way it is poured in the first place, the bottom of the core is usually uneven. On a hot day, if you rest the core on this uneven bottom, the asphalt is likely to soften allowing the core to sag or deform.

Delaminated Cores
Not every core cut will be perfect. Many older roadways have been overlaid (resurfaced) with new layers of asphalt. Sometimes entire new roadways are laid over old roadways. Every time you core it's a bit of a crap shoot as to what you will find. Sometimes a core will have separated between its different layers of asphalt or between the asphalt the concrete. Make sure that you insert the core puller all the way down to the bottom so that you can pull the core (and all of its layers) out in one piece. When you seek to reinstate this delaminated core, the bond strength of Utilibond will effectively bond the layers together.

Marking Cores for Reinstatement
Because you will be saving the core to be reinstated at a later time, it is important to mark its orientation in the roadway before you core cut and extract it. We recommend using white marking paint with two intersecting lines that will extend across the cutline of the kerf of the core. The letter V works best, as there is only one way to put it back to make the lines match up. This is preferable to an X, which due to being symmetrical can result in misinterpretation of its original orientation.

In areas when you will be cutting multiple cores, paint a number on the top of the core and mark the roadway with the same number. Reinstatement is simplified when you know which core goes in which location.