



Bar Bending & Concreting Level II

Learning Guide # 44

**Unit of Competence: Carry -out Concrete Bursting
cut, core and Crushing
Operations**

**Module Title: Carrying-out Concrete Bursting
cut, core and Crushing Operations**

LG Code: EIS BBC2 M12 LO4 LG-44

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LO4: Cut and core concrete

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| Instruction Sheet | Learning Guide 44 |
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This learning guide is developed to provide you the necessary information regarding the following content coverage and topics –

- 4.1 Identifying and assessing cutting/coring requirements
- 4.2 Selecting equipment for sawing/drilling according to the task
- 4.3 Cutting sawn joint to specifications and job requirement
- 4.4 Cutting sawn joint in to penetrate to specified depth
- 4.5 Drilling cored hole to specifications and job requirements
- 4.6 Drilling cored hole clear through the concrete to the specified diameter

This guide will also assist you to attain the learning outcome stated in the cover page. Specifically, upon completion of this Learning Guide, you will be able to –

4.1. Identify and assess cutting/coring requirements in accordance with the structural engineer

4.2. Select equipment for sawing/drilling according to the task

4.3. Cut sawn joint to specifications and job requirements

4.4. Cut sawn joint in to penetrate to specified dept

4.5. Drill cored hole is to specifications and job requirements

4.6. Drill cored hole clear through the concrete to the specified Diameter

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described in number 3 to 7.
3. Read the information written for each “Information Sheets given below
4. Accomplish the “Self-check after reading & understanding of each information sheet
5. If you earned a satisfactory evaluation from the “Self-check” proceed to “Operation Sheet
6. Lastly do the “LAP test



7. If you have any question ask your teacher

| | |
|----------------------------|---|
| Information Sheet 1 | Identifying and assessing cutting/coring requirements |
|----------------------------|---|

4.1 Identifying and assessing cutting/coring requirements



Fig. Core cutting



Concrete cutting is a process of controlled sawing, drilling and removal of concrete performed by skilled operators using special saws that use diamond impregnated blades. ... This is accomplished by using a saw that attaches to a track on the wall to be cut in addition Concrete coring utilizes a diamond cutting drill to cut a perfect round hole in any concrete structure – in a floor, wall, or ceiling. The process is low-noise, dust free and non-percussive, meaning it is the most popular choice when it comes to cutting.

Concrete coring uses a drilling tool made with a diamond cutting end attached to a steel tube to pierce concrete. Holes can be drilled at any angle – whether vertical or horizontal, and a choice of electric or hydraulic rigs can be used for drilling in sensitive locations or confined spaces. As the rig drills the cutter is cooled by water in order to reduce friction. The cutting process is completed by the removal of the slug, leaving a perfect hole with no cosmetic damage or requirement for after care.

Types of Safety Requirement

1.1 Working Safely on Site Preparing a Safe Site Those people responsible for workplace safety and health must ensure that the work site is safe, based on the results of the workplace health and safety risk



Fig 2 Wearing PPE in the work site

Site preparation for concrete cutting and drilling operations should include consideration of:

- Weather/environmental conditions that can create hazards (e.g. heat, rain).
- Access to and from the work site.
- Barricades and warning signs.
- Provisions for appropriate personal protective equipment.
- Specific health and safety instructions for the site.
- Provision for GFCI residual current devices for electrical equipment.



Fig 3 Barricades and warning signs

Concrete cutting or concrete coring requirements

- **Core Drilling** This process is used for the drilling of circular holes in reinforced concrete, precast concrete, asphalt, brick, cinderblock, and other structural materials. Usually, the holes are made for electrical, plumbing, heating, sewer, and sprinkler installations. Other applications include holes to anchor bolts or lifting rods, to place explosive charges, to install load-carrying devices, or for analysis of the structure or rock.
- **Concrete Slab Cutting** This process is used when reasonably level and flat surfaces have to be cut and includes cutting through reinforced concrete, precast concrete, and other structural materials. These surfaces include floors, roofs, bridge decks, and suspended slabs. The surfaces are usually cut to provide expansion joints, to make openings for ducts, elevators, stairwells, machine pads, trenching, and for demolition purposes.



- **Concrete Wall Cutting** This process is used for the cutting of openings in vertical surfaces and surfaces with slopes so great that flat saws cannot be used. These surfaces are usually cut to provide for doors, windows, vaults, silos, chests, foundations, ducts or large diameter pipes, or to remove part or all of existing walls.
- **Asphalt Cutting** This process is usually done for trenching, to provide expansion joints, to remove damaged pavement sections prior to patching or to clean and prepare random cracks for repair. **Safety Grooving and Texturing** This process is used to make concrete, asphalt, and other surfaces more comfortable and safer to walk on. These surfaces include foot paths, stairs, public platforms and ramps. **Managing Workplace Safety and Health** Under the OSH Act, exposure to health and safety risks that arise from work Safe removal of cut pieces and cores.



| Self check1 | True or False |
|-------------|---------------|
|-------------|---------------|

Instruction: Say True or False (2 Point Each)

1. Concrete cutting is a process of controlled sawing, drilling and removal of concrete
2. Concrete coring uses a drilling tool made with a diamond cutting end attached
3. Asphalt cutting this process is usually done for trenching, to provide expansion joints
4. Working safely is the one requirement to Concrete cutting

Note: Satisfactory rating - 2 points Unsatisfactory - below 2 points
You can ask you teacher for the copy of the correct answers.

Answer Sheet

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|---------------|
| Score = _____ |
| Rating: _____ |



Information Sheet 2

Selecting equipment for sawing/drilling according to the task

4.2 Selecting equipment for sawing/drilling according to the task

Core drilling is a fast, safe method of producing consistent diameter holes in concrete, stone, asphalt, & masonry without causing impact or vibration damage to the surrounding structure. Common applications include creating openings for plumbing, electrical, & HVAC installations & slab & roadway holes for doweling drilling, rebar tie-ins, & drainage systems.

Core drilling uses a wet cutting method utilizing a mounted drill. Our core drilling equipment can effectively create holes as small as ½" to as large as 60" in diameter, at any angle, & depths that can exceed 50' or more. Our selection of diesel, electric, & hydraulic core drilling equipment provides the flexibility to work in any environment.

Flat (Slab) Sawing

Flat sawing, also known as slab sawing, refers to sawing horizontal concrete surfaces such as roofs, floors, highways, & bridge decks. Typical applications include trenching for electrical & plumbing installation; creating openings for staircases, elevators, & duct work; cutting expansion & control joints; & removing sections of pavement. Flat sawing is the most commonly used diamond-cutting method. Also called slab saws, flat saws use a blade that is mounted vertically on a saw that the operator usually walks behind. Slab sawing can eliminate the vibration & dust that comes with breaking up concrete & allow for clean pieces to be cut, instead of the irregular-shaped pieces created by a breaker.



Fig.1concret sawing



Fig. concrete sawing

Wall (Track) Sawing

Wall sawing, also known as track sawing, refers to sawing vertical surfaces, such as concrete walls, pits, or areas that cannot be accessed easily by other conventional flat-cutting equipment. It is often used for precision cuts for dimensional door, vent, & window openings.

Wall sawing utilizes a diamond blade on a portable, track-mounted system that can be used for both horizontal & vertical cuts. The wall saw technique is fast & convenient, allowing our customers to save money & valuable time. Our saws can cut into a depth of 30” in concrete using this method, or if both sides are accessible, can cut up to 60”. Our fleet includes hydraulic & electric saws, & we are equipped to work in any environment



Fig. Wall (Track) Sawing



Fig. Wall (Track) Sawing



Wire Sawing

Wire sawing is a versatile method used to accomplish vertical, horizontal, or angled cuts of complex structures that are too large or awkward for other cutting methods or in areas with limited access. The wire saw is perfect for cutting any shape or thickness and is often applied to complex situations such as bridge pier modifications, industrial plant upgrades, generator replacements, and lock and dam retrofits.

Wire sawing is commonly used for underwater cutting, cuts in restricted or remote areas, cuts that require minimal vibration, anchor door openings, & cutting through depths which are beyond the reach of conventional tools. Wire saws are diamond-laced cables that are pushed or pulled via pulleys through the target material whilst being cooled down with water. Using this method, almost no structure is too large for us to cut, & we are only limited by the lifting & removal capacity of equipment on the job. Our fully portable equipment can be operated in any environment



Fig.5



Fig.6

Basics of Core Drilling

Core drilling is a type of service in which a drill is used to remove a cylinder of material, called a core. Penhall utilizes diamond core drills in order to best cut through the concrete and additional material and ensure that the customer's utmost satisfaction is met. This type of technique of concrete cutting is used in many cases such as but not limited to:

- Walls, floor slabs, and ceilings for electrical and communication services, cabling, plumbing, or HVAC
- Slab and roadway holes for doweling drilling, rebar tie-ins, or drainage
- Recessed lighting and fixtures
- Sample and analysis of material



Fig.7



Fig.8



| | |
|---------------------|--------------------------|
| Self-check 1 | say true or false |
|---------------------|--------------------------|

Instruction: say true or false

1. Core drilling is a type of a drill is used to remove a cylinder of material, called a core.
2. Wire sawing is a versatile method used to accomplish vertical, horizontal,
3. Sawing horizontal concrete surfaces such as roofs, floors, highways, & bridge deck

Note: Satisfactory rating - 2 points Unsatisfactory - below 2 points
You can ask you teacher for the copy of the correct answers.

Answer Sheet

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|---------------|
| Score = _____ |
| Rating: _____ |



4.3 Cutting sawn joint to specifications and job requirement



Fig. concrete Cutting

Saw cuts are used to create control joints in concrete, which help control where cracking occurs due to shrinkage. The cuts should be made at a predetermined spacing and only *after* the concrete has obtained sufficient strength but *before* internal cracking begins. Therefore, the timing of saw cuts is critical. Determining when to make cuts depends on many factors, including the type of admixtures and aggregate used in the concrete, the air temperature, and the concrete's mix design.

When to Saw-Cut Concrete

In addition to the concrete mix and the weather conditions, determining when to saw concrete is based on the concrete's hardness as well as the type of cutting equipment used to make the saw cuts. Cutting too early causes raveling, an effect created by the saw blade pulling the aggregate



out of position, leaving a messy, weakened edge along the cut. This also causes undo wear on diamond concrete saw blades. Sawing too late can result in uncontrolled cracking as the concrete contracts during curing.

In hot weather conditions, saw cutting may start as soon as four hours after the concrete is poured. In cooler weather, sawing may not start for 12 hours after pouring. The best way to determine whether the slab is ready is to make trial cuts to check for raveling. Saw cutting should start as soon as the raveling stops during these trial cuts.

Some contractors delay sawing to protect their equipment and saw blade to reduce blade abrasion. There are several types of saw blades that can be used, depending on the concrete type and how soon the cuts can be started. Other factors that can lead to excessive blade wear and joint raveling include:

- Pushing the blade too hard
- Saw cutting at high speed
- Using a saw with a Ben spindle
- Using an inappropriate saw blade

Where to Saw-Cut Concrete

Before you start saw cutting concrete, is important to select where these cuts will be done. It is recommended to start saw cuts on or at the center of column lines. Joints shall be spaced at 24 to 36 times the slab thickness but this need to be confirmed by a structural engineer. Joint spacing normally ranges between 10 to 18 feet depending on the amount of reinforcement the slab has. If you are using high shrinkage concrete, you might want to decrease the cut spacing. Here are other factors to will help you determine where to saw cut:

- Try to form square patterns
- Make saw cuts continuous
- It is important to select an area that doesn't have continuous steel reinforcement from one slab or square to another
- It is better to have smaller cracks than to increase cost by having and maintaining several joints.



- Under hot weather conditions, you might want to try forming a larger square and then cutting interior joints. By doing this you will be controlling fast setting concrete cracks in larger areas.

How to Saw-Cut Concrete

Factors such as curing techniques, slab thickness, slab length, and base type must be analyzed before selecting where joints should be cut. Once you've laid out the joints to be cut, mark them using a chalk line. If you're using water cutting equipment, make sure that the water is running all the way down to the blade. Allow the blade to reach the required depth, then start walking or moving the equipment following the chalk like mark. Here are some recommendations when sawing concrete:

- Do not twist the saw blade.
- Do not let the blade spin in the cut, as this will increase wear on the bond.
- When cutting concrete with heavy rebar, use blades with soft metal segment bonds.
- Always use the required PPE (personal protection equipment).

How Deep to Make Saw Cuts

A good rule of thumb is to cut the joints one-quarter to one-third the slab thickness. For a 6-inch-thick slab, that means cutting 1.5 to 2 inches deep. Ensure that the saw cut depth meets the structural engineering specifications. If the joint is too deep, aggregate interlocking will not be sufficient to transfer loads. If the saw cut is too shallow, random cracking might occur.



| | |
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| Self check1 | True or False |
|--------------------|----------------------|

Instruction: Say True or False (2point each)

1. Saw cuts are a used to create control joints in concrete
2. In hot weather conditions saw cutting may start four hours after the concrete is poured
3. A good rule of thumb is to cut the joints one-quarter to one-third the slab thickness
4. Before you start saw cutting concrete, is important to select where these cuts will be done.

Note: Satisfactory rating - 2 points Unsatisfactory - below 2 points
You can ask you teacher for the copy of the correct answers.

Answer Sheet

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| Score = _____ |
| Rating: _____ |



| Operation Sheet- 1 | Cutting sawn joint |
|--|--------------------|
| <p>PROCEDURE For Cutting sawn joint</p> <p>Step 1. Secure workshop manuals, Specifications, tools and equipment;</p> <p>Step 2. Prepare the working area</p> <p>Step 3. Select appropriate methods based on standard specification and drawing</p> <p>Step 4. Identify and prepare resources and technical requirements for Carry-out Concrete cutting</p> <p>Step 5. Observe the proper application of Occupational Health and Safety requirements.</p> | |



Information Sheet-4

.Cutting sawn joint in to penetrate to specified depth

4.4 Cutting sawn joint in to penetrate to specified depth



Fig. 1 concrete Drilling cored ho



Fig. 1 concrete Drilling cored ho

Core drilling is the process of cutting circular holes through concrete surfaces. Core drilling techniques are used when precise, circular cuts are needed in concrete. Holes of almost any



diameter are easily drilled to make openings in the concrete for plumbing, electrical and HVAC installations.

Core drilling is also commonly used to create holes for routing cables or placing anchoring bolts, installing load carrying devices like dowel bars, or for analysis of structures, rock or strata. The core drill can either be hand-held or mounted to the surface that will be drilled.

In addition one of the most common uses for concrete coring is to create holes in pile foundations most often placed under buildings to transfer the weight of the structure to deeper below the surface of the ground. By transferring the structure's weight deeper, there's less chance of the building shifting. This is especially useful in climates with severe cold weather, significant weather fluctuations, or frequent flooding. Piles can be made out of steel, wood or concrete. All are jacked or driven into the ground and connected to pile caps. When the piles are concrete, the process of concrete coring is used to create a hole to connect the pile caps to the piles

Core drilling process

- For operator safety, most manufacturers recommend drilling over 67mm be done with the drill mounted in a stand.
- Ensure there are no gas, power or water lines or any other issues where you are going to drill
- Never stand on a rig to hold it down, as this causes a 'ribbing' effect on the core, and the bit will eventually bind up in the hole
- Always turn on the water (always use clean water) before turning on the motor. Otherwise the water jacket seals on the drill can overheat, which will cause them to leak.
- For best results, apply water until the slurry looks like coffee made with a lot of milk. Too much water flow washes away the abrasive slurry which is needed to keep wearing away the segment and keep fresh diamonds exposed. Too little water can cause the diamond segments to overheat
- Do not use the overload protection as on/off switch - when the overload fails, it will not be warranty



- Use only heavy duty (2.5mm or thicker) extension cords and keep them as short as possible
- When cutting steel, the slurry usually changes colour (usually to gray), or the drill motor speed drops. Drop the motor speed down and relax pressure by about 1/3. If you don't, the segments may overheat and bend inwards (occasionally outwards), and stop cutting. The barrel may also crack. Some operators reduce water after exiting the steel to redress the blade again, but don't forget to turn the water up again afterwards.
- Similarly, if you are drilling concrete with a high strength (or MPA), or with very hard aggregate in it, the bit may glaze up and need redressing. Do this by reducing the water by half for a few minutes, or by drilling into an abrasive material like limestone, a cinder block or similar. A bit of Ajax down the hole can also have the same effect.
- When removing the bit, turn the water down and back the bit out while the drill motor is still running.
- You can avoid stuck core barrels by:
 1. cleaning the core hole often
 2. don't try removing too large of a slug
 3. good water pressure will help flood the sediments up from deeper holes. Relieve the pressure on the core bit for a few minutes now and then..
- Always read your drill's operation manual before use
- Wear correct PPE (personal protective equipment)
- Use the drill and bits only in a safe manner as described in the operation manual
- If the drilling is slow, the barrel may have glazed up. Redress the bit by reducing the water by half for a few minutes, or by drilling into an abrasive material like limestone, a cinder block or similar. A bit of Ajax or builders sand down the hole can also have the same effect - run the drill at a slower speed, with reduced downwards pressure, so that an abrasive paste forms that will sharpen the segments .



| Self-check | True or False |
|------------|---------------|
|------------|---------------|

Instruction: Say True or False (2point Each)

1. Core drilling is the process of cutting circular holes through concrete surfaces
2. Core drilling is also commonly used to create holes for routing cables
3. concrete coring is to create holes in pile foundations
4. Ensure there are no gas ,power or water lines or any other issues where you are going to drill



Note: Satisfactory rating - 2 points Unsatisfactory - below 2 points
You can ask you teacher for the copy of the correct answers.

Answer Sheet

Score = _____

Rating: _____

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|----------------------------|---|
| Information Sheet-5 | Drilling cored hole to specifications and job requirements |
|----------------------------|---|

4.5 Drilling cored hole to specifications and job requirements

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|----------------------------|---|
| Information Sheet-6 | Drilling cored hole clear through the concrete to the specified diameter |
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4.6 Drilling cored hole clear through the concrete to the specified diameter



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| Operation Sheet- 1 | Bursting and crushing reinforced concrete |
| <p>PROCEDURE For Bursting and crushing reinforced concrete</p> <p>Step 1. Secure workshop manuals, Specifications, tools and equipment;</p> <p>Step 2. Prepare the working area</p> <p>Step 3. Select appropriate methods based on standard specification and drawing</p> <p>Step 4. Identify and prepare resources and technical requirements for Carry-out Concrete Bursting</p> | |



| | |
|------------|-------------------------|
| LAP Test 1 | Practical Demonstration |
|------------|-------------------------|

Name: _____ Date: _____

Time started: _____ Time finished: _____

Instructions: Given necessary templates /guide tools and materials you are required to perform the following tasks within 1:00 hours.

Task 1. Cutting sawn joint

