

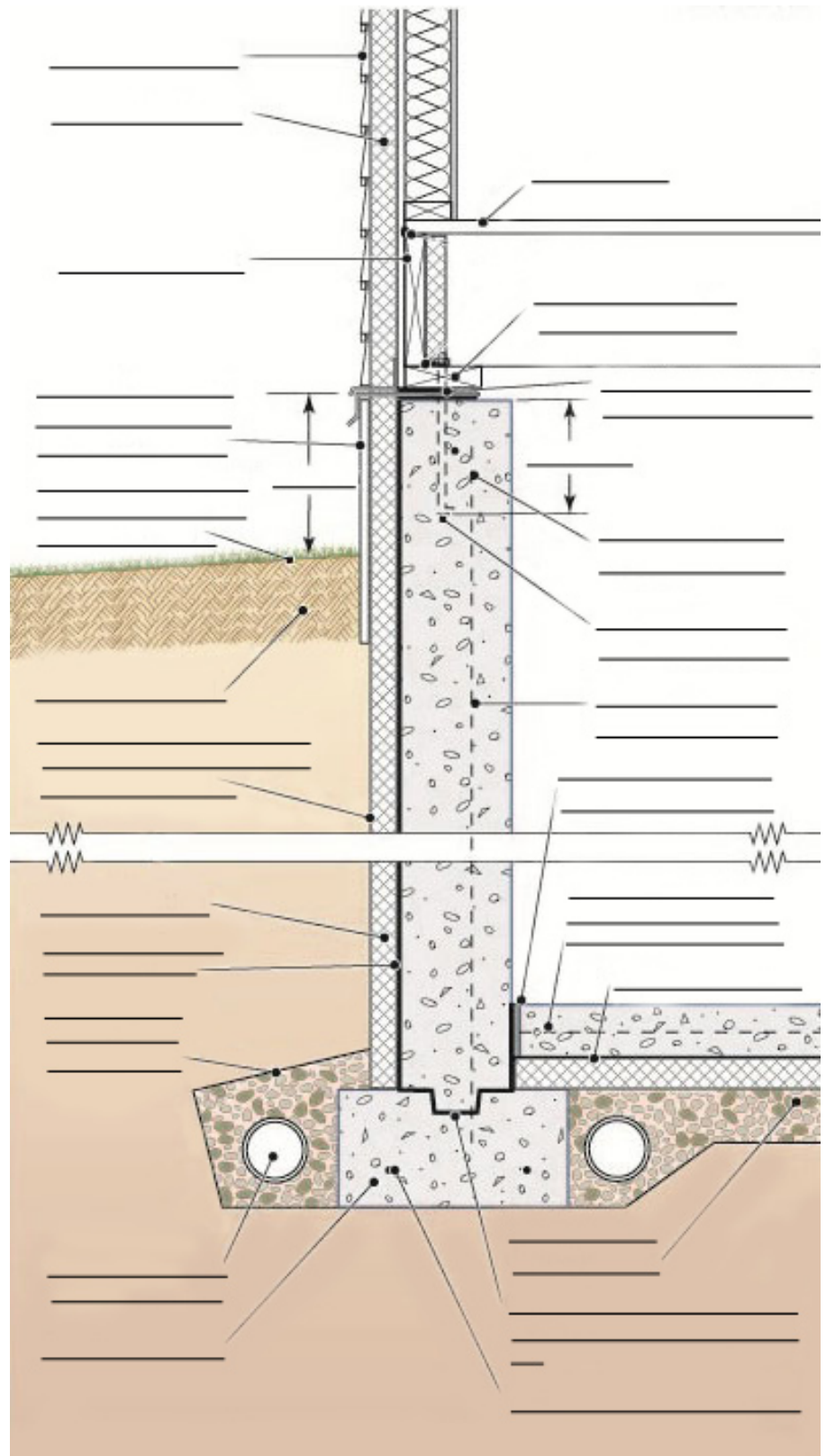


Building Concrete Foundations

Any building has to start with a professionally designed foundation to carry and distribute the building load and protect against environmental factors such as freezing and water drainage. The build process involves surveying, excavation, forms, concrete footings, walls, columns, slab basement, water-proofing, weeping tile drainage, and backfilling.

Ten Building Stages

1-Survey and steaks done by a surveyor using building plans will determine appropriate distances from property line, where the building corners are located using stakes. **2-Excavation** removes earth inside of those stakes a depth based on building plans done by design engineer. The top of the **3-footings** must be below the winter frost line to prevent concrete from cracking and shifting when the ground thaws. **Wood forms** are used to hold the poured concrete pathways to create the building **foundation** to support the foundation walls and also include **rebar** to strengthen tensile load demands. Foundations are always wider than the foundation walls to anchor and spread the load and it is common to have **additional footings** inside the building perimeter to support load bearing beams and walls. Prior to the slab (**4-sub-slab work**) being poured **plumbing** such as water and sewage lines are run under the footings and located appropriately. Underground **electrical** service will also have to be considered during the wall foundation process.





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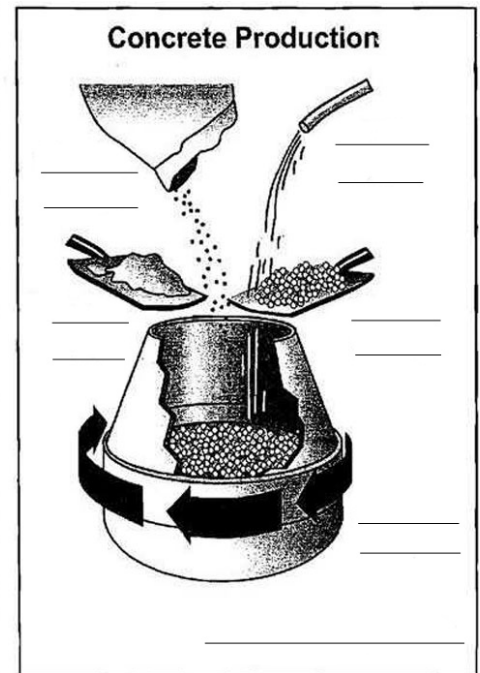
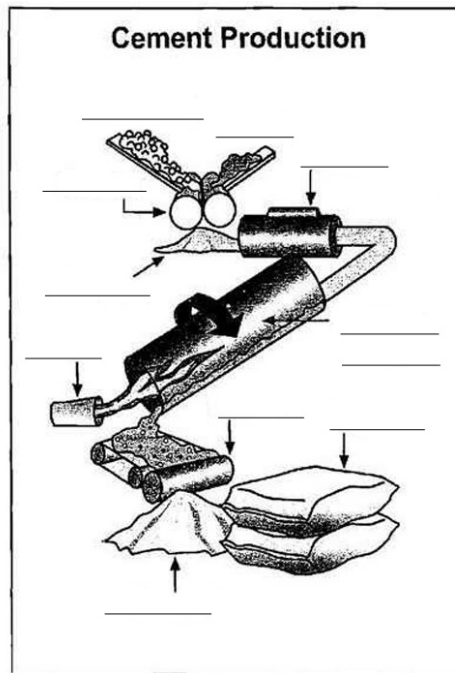
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Radiant heating which needs flex pipe inside concrete slab may also be needed in basement slab if the design plan calls for it. **5-Foundation drainage** is placed outside and above foundation using filter cloth, gravel, and weeping tile made up of 4" plastic hole-punched corrugated-plastic drainage pipe to prevent water pooling and possible basement flooding. **6-Foundation walls** generally are poured concrete, but may be built using cinder block, and then filled with concrete, both of which will also use rebar also. Predetermined locations of 1/2" **7-wall anchor bolts** embedded 7" into top of wall foundation to hold down sill plate (1st floor and exterior walls – i.e. house) to foundation wall usually no more than 6' apart while **7-beam pockets** also located top of foundation walls hold I beams running across length of home also supported internal foundation and column supports. Exterior walls are **8-waterproofed** with a special sealant and/or plastic wrap below grade to help stop water leaking into basement. **Exterior insulation** such as Styrofoam is also a consideration which design may require. The 4" basement **9-slab** is poured above and inside the foundation/foundation walls and will help stabilize the base of the walls. **10-Backfill** is put back against the waterproofed walls and on top of the filter cloth, gravel, and weeping tile drainage system.

Mixing Concrete for Forms

Concrete is made from cement, sand, gravel, and water. It can be purchased in dry pre-mixed form usually in 30 kg /66 lbs bags to use when needed usually for smaller jobs. You can also order by the truck load, pre-mixed wet ready to use immediately usually for larger projects. If you have an on-site mixer, you may also order the cement, gravel, and sand separate and mix aggregate together, and then with water to use. **Cement** is created through a crushing and heating process using limestone, and clay called



calcination, then adding additives and grinding to powder and used as a "binder" when mixed with concrete aggregates (sand and gravel) with water results in solid concrete once cured. Even though it may be hard after several hours, it will take several days to cure to full strength that it was designed for.

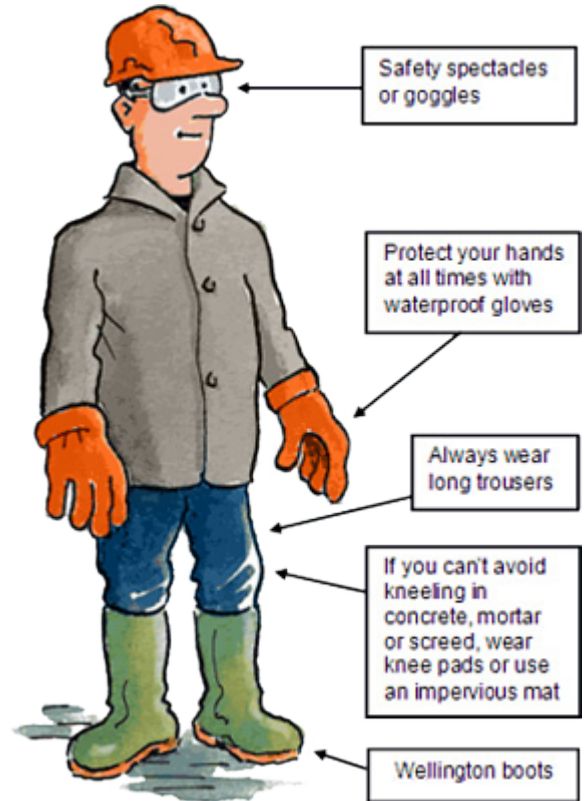
Forms that will support the concrete must be prepared ahead of time with rebar supports. It is important that the forms be properly supported and/or braced to hold the concrete and tops of form level to required height. **Rebar** is used to strengthen the tension ability (tensile strength) of the concrete to support tensile loads. Rebar in foundations is usually supported off the ground by chairs so that they are completely embedded into concrete. Lengths of rebar are overlapped about a foot and tie wire is used to lock them together. **Wire mesh** can be found in slabs rather than rebar to also strengthen the slab.



Safety – Working with Concrete

Working with cement has some safety concerns. It is important to wear rubber coated gloves and eye protection. The following precautions must be kept in mind when working with concrete and cement.

- Contact with wet concrete, mortar, cement or cement mixtures can cause skin irritation, severe chemical burns, and/or serious eye injuries
- Avoid contact with eyes and skin
- Wear waterproof/rubber gloves, long-sleeved shirt, full-length pants, and eye protection
- Wash any wet concrete, mortar, cement, or cement mixtures from your skin immediately
- Seek immediate medical attention if you have persistent or severe discomfort
- In case of eye contact, flush with plenty of water for at least 15 minutes and consult a physician immediately
- Wear a well-made respirator while handling dry cement dust. Do not breathe in air-born cement dust or other fine particles



Common Tools Used

Working with concrete requires different tools depending on the scope of the job that you are working on. Smaller jobs may only require a tool to mix the concrete by hand such as a small hoe or small shovel to fold the mix while adding water in a container of some sort such as a wheel barrel or similar. Larger jobs may use

an electric mixer with either pre-mixed ready to use concrete dry mix and just add water or obtain the concrete aggregates separately and mix together, then add water and finish mix to right consistency, and then usually pour into a wheel barrel to transport to site location. Larger jobs can use cement trucks to bring cement close to the site and pour directly into forms and/or use wheel barrels, and/or concrete crane/pump truck. Concrete can be spread with shovels in the forms to ensure even spread.

Finishing tools include trowels to move and work in tight corners, floaters to spread and finish top surface, edgers to curve edges and minimize sharp corners, and grovers to create groves in the concrete which later may be also cut to control cracks that may form in the future from shrinkage.





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Review Questions

All questions must be answered before practical work. Answer questions neatly in the space provided.

1. Name the ten building stages of a concrete foundation and wall build?

2. What is the difference between a foundations and foundation wall?

3. What is the purpose of wall anchors and where are they located?

4. List the materials used and explain how water is drained away from the exterior wall/foundation.

5. How is cement made and how is it used to make concrete?

6. Why is rebar used in concrete forms and how is it installed?

7. When working with concrete, what safety equipment must be used in class and why?

8. List some precautions you must keep in mind when working with concrete?

9. Name and describe common hand tools used when working with concrete?

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