

## Lesson Plan 33: Concrete Slab Construction

**3 hours total**

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### Lesson Description



This is an optional practical lesson. Participants learn how to construct three concrete latrine slabs, including a reinforced slab dome slab and SanPlat. They will also discuss construction safety, in particular the hazards of working with cement, and know what to do in an emergency.

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### Learning Outcomes



At the end of this session participants will be able to:

1. Demonstrate how to mix and pour concrete for a reinforced slab, a dome slab and SanPlat.
2. Demonstrate how to prepare the mold for a reinforced slab, dome slab and SanPlat.

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### Scheduling this Lesson in the Agenda



The Lesson Plan: Slab Design should be delivered before participants construct the slabs. This will ensure that they understand the different slab types and their key design features.

Concrete slab construction requires two practical sessions scheduled over two consecutive days in the agenda. It is recommended to do these sessions early in the workshop since it will give the slabs as much time as possible to cure before testing.

All participants can have a chance to construct each type of slab. In the first session, half of the participants can construct a reinforced concrete slab while the other half constructs a dome slab and SanPlat. In the second session, each group will de-mold their slab from the previous day, then construct the other slab types. The first practical session will take longer to facilitate since construction safety and determining ratios need to be discussed.

Remember to leave time in your agenda to go back an hour later to take out the drop hole, foot rest and vent pipe molds and finish the concrete. As well, you will need to go back to the slabs and at the end of the day to wet and cover them.

The slabs should be tested on the last day of the workshop (see Lesson Plan: Slab Testing).

If the sand and gravel are mixed together, groups will have to sieve the sand and gravel before starting construction. This will take more time than is planned in this lesson. You can save time by having the sand and gravel sieved before the workshop starts.

Optional depending on time: Participants can construct only one type of slab and observe the slabs constructed by the other groups.

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## Tools and Materials



- Pieces of broken concrete for demonstration
- Buckets
- Samples of cement, sand and gravel
- Construction tools and materials (see Latrine Construction Manual)
- First aid kit



### Notes on Materials:

The exact volume of materials needed for each slab will vary depending on the slab size, climate, sand and gravel grain size, amount of water used, and other factors.

As a guide, the tables below list the volumes of cement, sand and gravel used in the CAWST workshop in Canada. You should purchase more than these volumes to ensure that you will have enough materials to make each slab.

For a 1.1 metre x 1.1 metre reinforced concrete slab, you will need approximately:

Quantity	Materials	Comments
17 metres	6 mm diameter steel reinforcement (rebar)	Or use 11 metres of 8 mm rebar, per slab
6 metres	Reinforcement tying wire	For tying rebar, per slab
12 L	Cement	Minimum, per slab
24 L	Sand	Minimum, per slab
48 L	Gravel (6 mm–13 mm)	Minimum, per slab
1	Pour flush pan insert	Where appropriate

For a 1.1 metre diameter dome slab, you will need approximately:

Quantity	Materials	Comments
15 L	Cement	Minimum, per slab
30 L	Sand for slab	Minimum, per slab
45 L	Gravel (6 mm–13 mm)	Minimum, per slab
90 L	Sand for mold	For making the dome shape, volume depends on slab dimensions
1	Plastic sheeting, sheets of paper or newspaper	To cover sand before pouring concrete
1	Pour flush pan insert	Where appropriate

For a SanPlat, you will need approximately:

Quantity	Materials	Comments
1	SanPlat mold	Mold needs to be purchased
4 L	Cement	Minimum, per SanPlat
8 L	Sand	Minimum, per SanPlat
12 L	Gravel (6 mm–13 mm)	Minimum, per SanPlat

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**Preparation**


- Review topic in the Latrine Construction Manual
- Gather construction tools and materials (see Latrine Construction Manual)
- Organize tools and materials into work stations for construction groups
- Put together a first aid kit
- Write local emergency phone numbers on flipchart paper
- Write a flipchart of slab names with ratios next to them with an empty row below each one to be filled in during the lesson
- Optional: Write the learning outcomes on flipchart paper

	Cement:	Sand:	Gravel
Reinforced Concrete Slab	1	2	4
Dome Slab	1	2	3
SanPlat	1	2	3

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**Introduction**
**5 minutes**

1. Pass around a piece of broken concrete. Ask the participants “What is this and what is it made of?”
  - *Sand, gravel, cement and water*
2. Ask the participants “What is the difference between concrete and cement?”
  - *Cement is a fine, soft powder. It is made from a mixture of elements that are found in natural materials such as limestone, clay and sand.*
  - *When cement is mixed with water, it binds sand and gravel into a hard, solid mass called concrete.*
  - *Concrete should not be confused with cement.*
3. Ask the participants “Why is the quality of concrete important for a slab?”
  - *Lasts longer, no cracking or breaking, safety issues*
4. Present the lesson description or learning outcomes.

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**Construction Health and Safety**
**10 minutes**

Note: This activity only needs to be delivered in the first practical session. Participants can be reminded in subsequent practical sessions about protections measures for that particular activity.


-  1. Explain that it is important to work safely and avoid the potential for injury during latrine construction. Participants will be using sharp tools, lifting heavy objects, and handling potentially dangerous materials. When properly managed, the risks involved in these tasks can be reduced to avoid injuries.
2. Explain that everyone on the construction site should wear closed shoes to reduce foot injuries, and reduce tripping or catching of sandals. In loud environments, workers should wear earplugs to protect their hearing.
-  3. Explain the dangers of working with cement. Ask the participants “What can you do to protect yourself?”

*What to wear:*

- *Eye protection for mixing, pouring, and other work with dry cement*
- *A face mask to prevent inhaling cement dust*
- *Work gloves or rubber gloves*
- *Long sleeve shirt and full-length pants, pull sleeves down over gloves*

*What to do:*

- *Use a bucket, shovel or trowel to measure and mix cement.*
- *Work upwind from cement dust*
- *Remove rings and watches because cement dust can collect underneath and burn your skin*
- *Remove any clothing contaminated by cement*
- *When your skin comes into contact with cement, wash with cold running water as soon as possible. Flush out any open sores or cuts. Get medical attention if your skin still feels like it is burning.*
- *After working with cement, always wash your hands before eating, smoking, or using the toilet*
- *If your eyes are exposed to cement, rinse with cold clean water for at least 15 minutes. Get medical attention if necessary.*

-  4. Make sure everyone knows where the first aid kit is located. Make sure everyone knows who to call in an emergency. Write important phone numbers on flipchart paper and post it in a visible area.

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### Determine the Concrete Ratios

**20 minutes**



Note: This activity only needs to be delivered in the first practical session. It only needs to be repeated in the second practical session if the participants are still struggling with the concept.



1. Place four buckets on the floor in front of the participants that will be used to measure out quantities of sand, gravel, cement and water. Place the example material in front of each bucket.

2. Explain that we need the correct ratio of cement : sand : gravel in order to get the right mixture of materials to make strong concrete. Each slab has its own ratio. As an example, explain the ratio for a reinforced concrete slab of 1 part cement : 2 parts sand : 4 parts ½ inch gravel (1 : 2 : 4).
3. In pairs, ask the participants to discuss “What do you need to mix together to get this ratio?” Share as a large group and see if everyone agrees. If they are correct, then move on. If not, explain the ratios again.
4. Ask a volunteer to follow instructions from the group and make a mixture of 1:2:4 using the buckets.
5. On the slab ratios flipchart, write the amount of cement required beneath the ratio. 12 litres cement for a reinforced concrete slab, 15 litres for a dome slab and 4 litres for a SanPlat.

Reinforced Concrete Slab	1 : 2 : 4
Litres	12:
Dome Slab	1 : 2 : 3
Litres	15:
SanPlat	1 : 2 : 3
Litres	4:




5. Ask the participants “How much sand and gravel are needed for each slab based on the ratio and the litres of cement required?” Record answers on the flipchart.

Reinforced Concrete Slab	1 : 2 : 4
Litres	12:24:48
Dome Slab	1 : 2 : 3
Litres	15:30:45
SanPlat	1 : 2 : 3
Litres	4 : 8 : 12



6. Ask the participants “How many buckets are needed to make the mixture for one slab?”
  - *Need to measure using a container of known quantity to determine how much each bucket can contain (in other words the volume)*
7. Determine how many buckets will be needed to get the correct amount of sand, gravel and cement.

8. Ask a volunteer to follow the instructions from the group to get the right amount of sand, gravel and cement for a dome slab.
-  9. Ask the participants “Why are the amounts of each material so important?”
  - *For concrete to be the strongest*



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### Construct the Slabs


90 minutes



Notes:

- This activity can be repeated twice so that all participants have a chance to construct each type of slab. There are two practical sessions available in the agenda for slab construction. In the first session, half of the participants can construct a reinforced concrete slab while the other half constructs a dome slab and SanPlat. In the second session, each group will de-mold their slab from the previous day, then construct the other slab types.
  - If the sand and gravel are mixed together, groups will have to sieve the sand and gravel before starting construction. This will take more time than is planned in this lesson.
-  1. Refer participants to their Latrine Construction Manual. Explain that they will follow the directions in the Manual to construct their slab.
  -  2. On the slab ratios flipchart, write the dimensions of the slabs.

Reinforced Concrete Slab	1 : 2 : 4
1.1 m x 1.1 m      Litres	12:24:48
Dome Slab	1 : 2 : 3
1.1 m diameter      Litres	15:30:45
SanPlat	1 : 2 : 3
0.6 m x 0.6 m      Litres	4 : 8 : 12

-  3. Ask the participants to write the information in their Latrine Construction Manual. Explain that the Manual does not have these numbers because the steps in the Manual can be used to make any sized slab. Sizing slabs will be discussed further when we talk about excavating pits.
4. Divide participants into groups of 4 to 6 people per slab. Assign half of the groups to construct a reinforced slab and the remaining half a dome slab and SanPlat. Explain that the groups will switch the next day and everyone will have a chance to build each slab type.
5. Encourage participants to work together and figure out a system for greatest efficiency.



6. While participants are constructing their slabs be sure to check in with each group to answer questions and provide helpful hints.

- *While groups are placing rebar in the reinforced slab, explain that the rebar and wire must be well covered with concrete. Ask the participants why they think this is important. (To prevent the steel from getting wet and corroding.) Explain they must also bend the tying wire down so that it will not stick out of the concrete.*
- *While groups are pouring concrete into the reinforced slab, explain that the gravel used in the concrete must be smaller than the distance between the rebar and the top (or bottom) of the slab. This is so that there is no pathway along the edge of a piece of gravel where water could travel to the rebar, and so no weak spots are created through the slab along the edge of the piece of gravel.*
- *If you are building a latrine with a vent pipe, a hole for the pipe should be made in the slab. Before pouring the concrete, place a short length of 4" pvc pipe in the location of the vent pipe (usually in the corner of the slab behind the drop hole). Remove the pipe when the concrete has set, at the same time as the drop hole mold is removed.*
- *You can slightly angle the floor towards the drop hole, so any liquids spilled or used to clean the latrine will flow towards the drop hole. On a dome slab, you can create a flat area at the top of the dome, and/or angle it slightly towards the hole.*
- *Using footrest molds is optional. You can also create a rough surface in the location of the footrests, so users have better grip under their feet. Making the surface too rough, however, will make the slab difficult to clean.*
- *If using a pour flush pan, it can be cast directly into the concrete slab.*

7. Explain that the groups will come back in an hour to remove the drop hole, footrest and vent pipe molds. They will finish the surface of the slab. At the end of the day, they will return again to do a final finish on the concrete, and wet and cover the slabs. The next day, the groups will de-mold their slabs and build the other type of slabs. At the end of the workshop, they will test their slabs to see how strong they are.



8. After 1 to 3 hours, remove the drop hole and vent pipe molds when the concrete begins to harden. Smooth the edges of the drop hole and the surface of the slab. Do not make the surface too smooth, or it will become slippery for users.



9. After 24 hours, remove the mold, but do not move the slabs or they might crack.



10. Let the slabs cure for at least 7 days (preferably longer) before moving and installing it. It may not be possible for the slabs to cure for 7 days and you may need to test and move them by the end of the workshop. While curing, cover the slabs with plastic or moist cloths. Check the slabs regularly and add water as needed to keep it damp.

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## Review

**10 minutes**



1. Ask the small groups to discuss "What advice would you give to the others who will be making their slab the next day?"

2. Share responses as a large group.

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**Reflections on Lesson**

