

INTRODUCTION

Cement masons expose aggregate to create decorative effects on a variety of concrete surfaces, including walls, driveways and walkways. The concept is simple: after pouring the concrete, cement masons remove some portion of the surface mortar to reveal the underlying aggregate. The amount of mortar removed and the amount of aggregate that is exposed will vary with the specifications and the technique that is used. This unit will focus on the techniques of creating an exposed aggregate finish on plastic cement. Because imagination and innovative methods influence the outcome of the design, a cement mason must master techniques that will produce a professional job.

FOCUS ASSIGNMENTS

FOCUS ASSIGNMENTS

1. Look for examples of exposed aggregate in your neighboring areas.
2. Choose one and describe the exposed aggregate surface. Is it compatible with the structure? Is it well finished? What kinds of aggregates were used? Do you see any flaws in the surface? What would you have done differently if anything? Explain.



Reading



Critical Thinking

UNIT OBJECTIVE

After completing this unit, you will show the following competencies by mastering the activities on the Job Sheets and by scoring at least 85% on the Written Test.

SPECIFIC OBJECTIVES

1. Match methods of creating an exposed aggregate finish to their correct description.
2. Describe the characteristics of chemical retarders.
3. State guidelines for pre-task planning of an exposed aggregate finish.
4. List steps for applying chemical retarders to expose aggregate.



5. Identify techniques for exposing aggregate.
6. State the principles of seeding a concrete surface to expose aggregate.
7. Describe the methods used to patch a concrete surface after exposing the aggregate.
8. Place and finish a slab with an exposed aggregate finish using sugar retarder. (Job Sheet 1)
9. Place and finish a slab with a seeded, exposed aggregate finish using sugar retarder. (Job Sheet 2)
10. Place and finish a slab with an exposed aggregate finish without retarder. (Job Sheet 3)



OBJECTIVE 1

Match methods of creating an exposed aggregate finish to their correct description.

Wash-off technique — A thin layer of the plastic concrete is removed by brushing and spraying the surface with water as soon as the concrete is hard enough to support the weight of finishers (Figure 1).

FIGURE 1



Surface retarders — Same principle as the wash-off technique except that a liquid material is sprayed on the surface of the finished concrete. This compound slows the set of the surface of the plastic concrete giving the finisher several hours to remove the top layer of paste with a broom and hose.

Abrasive blasting — This method is used on hardened or set concrete. The finish can range from a light, textured finish to exposure of the large aggregate. Abrasive blasting can also affect the finish of the aggregate. Unit 16 will cover exposing aggregate using abrasive blasting techniques.



Seeded surface — Additional aggregate can be added to the surface of the concrete after it is placed. This is often used when a denser surface or a decorative stone is required. Surface seeding is often used in conjunction with surface retarders (Figure 2).

FIGURE 2



OBJECTIVE 2

Describe the characteristics of chemical retarders.

- Retarders slow the setting time of concrete by releasing active chemicals. The retarder keeps the concrete from hardening as quickly at the surface. After the slab has hardened, washing or blasting the surface removes the unhardened layer.
- Commercial retarders are available from companies that produce admixtures, sealants, stains, and other concrete chemicals.

✓ **NOTE:** Commercial retarders can be purchased that will etch the surface to many different depths. By using a combination of etching depths, some very creative uses of texture can be produced. There are also similar retarders for wallforms.

- One of the most common retarders used by cement masons is sugar-based (one pound of sugar per 3 gallons of water).
- Sugar will only etch about $\frac{1}{4}$ inch when applied to a soft surface, less when it has hardened to a lay down.



- Some cement masons use molasses or soft drinks (Figure 3).

FIGURE 3



- Molasses is inexpensive and because of its color, the cement mason can see where it is sprayed.
 - Cement finishers vary in the amount they use when mixing, but the common amount is 3 or 4 parts water to 1 part molasses.
 - It is advisable to strain the molasses through cheesecloth into a clean spray can to eliminate clogs.
- ✓ **NOTE:** Molasses is a common additive to livestock feed and is available at feed stores.

OBJECTIVE 3

State guidelines for pre-task planning of an exposed aggregate finish.

Certain guidelines should be followed to create a good exposed finish. These guidelines include some of the basics of concrete construction.



WORDS YOU SHOULD KNOW

blow-outs	weakened areas on the surface where grout and aggregates may be expelled when washing; these may be caused by bleeders, cold joints, or improperly placed seeded rock
bleeders	areas where water seeps to the surface of newly placed concrete; caused by the settling of the solid materials in the mixture, especially on wet subgrade
laitance	a layer of weak and nondurable material containing cement and fines brought by bleedwater to the surface of the slab
slump	a measure of the consistency of freshly mixed concrete
air-entrainment	the process of intentionally introducing air into the concrete mix; this is done by using an air-entraining admixture during mixing
cold joints	visible lines caused by the hardening of concrete before the next placement

- **Subgrade** — As with all concrete, a well-graded and compacted subgrade is a prerequisite to long-lasting quality concrete construction.
 - ❑ Pouring over muddy subgrade will often lead to bleeders.
 - ❑ If care is not taken in exposing aggregate, blow-outs will occur if there are bleeders.
- **Setup** — Setup is critical to a good exposed finish.
 - ❑ Always have adequate fall in your forms.
 - ❑ If ponding occurs, these areas will attract laitance.
- **Concrete**
 - ❑ Order a high cement concrete such as a six-sack mix that produces a strong mortar and will hold the exposed rock. The mix should contain a high percentage of coarse aggregate.



- ❑ Fly ash adds to the strength of the concrete and bonds with the free lime in the mix to form a molecule almost identical to hydrated cement. Fly ash also reduces the laitance on the finished surface.
- ❑ Use air entrainment in exterior concrete to prolong the concrete's service life and surface. Air will also allow the concrete to be placed at a lower slump while maintaining workability. Lower slump suspends the aggregate on the surface and eliminates much of the bleeding.

- **Aggregate**

- ❑ Order the correct, specified size. When matching an existing slab, try to find the supplier of the slab in order to obtain the mix design (Figures 4 and 5).

FIGURE 4



FIGURE 5



- ❑ If seeding is not required, consider ordering an over-rock mix of 10 or 15% that includes more rock and less sand.
- ❑ When pumping do not use 15% or you may clog the pump. Consult pumping contractor.
- ❑ Over-rock will provide a fuller and more consistent finish.
- ❑ If seeding, aggregate should be cleaned and damp, not wet at the time of placement.

- **Ordering trucks**

- ❑ Order trucks according to the rate they will be needed, usually 30 to 40 minutes apart, depending on the available crew.
- ❑ Eliminate cold joints as much as possible. If a cold joint exists, plan to finish the concrete pour on a control joint location.
- ❑ Coordinate well in advance and confirm the day before with all parties involved.
- ❑ When the truck arrives, have the driver give the material a good mix to make sure the aggregate is equally distributed.

OBJECTIVE 4

List steps for applying retarders to expose aggregate.

1. Screed or strike off the surface to desired grades.
2. Seal the entire surface as soon as possible. Remove all float or trowel marks.

✓ **NOTE:** Avoid cold joints as much as possible. Pretask planning and timely truck delivery will help.

3. When the surface is shaped up, spray it with the retarder. Spray all the areas to be exposed, preferably using a colored retarder to ensure an even application.
4. Cover the area with a thin mil plastic to prevent crusting of the surface, especially during hot weather or when left for long periods.

✓ **NOTE:** Thin mil plastic should be in full contact with the surface.



5. After the concrete is hard enough to walk on without displacing the aggregate, hose off the top layer of paste, using the broom to remove the mortar. If aggregate starts to dislodge, stop and wait for the slab to harden more (Figure 6).

FIGURE 6



OBJECTIVE 5

Identify techniques for exposing aggregate.

WORDS YOU SHOULD KNOW

buckshot loose, fine aggregate.

● Size of Aggregate

- ❑ When dealing with 7/8 inch aggregate, drag a finish broom across the soft surface to imbed a sugar-based retarder.
- ❑ When imbedding 3/8 inch aggregate that has been laid down, use the same broom because the surface has hardened to the point that it needs to be imbedded to reach the necessary depth.
- ❑ With 1¼ inch rock, a street broom may be used to imbed the retarder if needed.
- ❑ Some cement masons increase the amount of sugar-based retardant, depending on the size of the aggregate.



EXAMPLE: Use $\frac{3}{4}$ gallon feed molasses to 5 gallons of water for a pea gravel mix, but 1 $\frac{1}{4}$ gallons molasses in 5 gallons of water when exposing $\frac{7}{8}$ inch aggregate.

- **Brooming**

- ❑ The cement mason should have a good eye for consistent depth and be aware of possible trouble spots like cold joints and shaded areas.
- ❑ The cement mason should break down the surface with consistent strokes.
- ❑ Continually pull back the berm of grout without being aggressive with the surface. This process will speed up the operation (Figure 7).

FIGURE 7



- ❑ Continually look back at the exposed area and rebroom inconsistent areas for the next wash.
- ❑ Always have a variety of brooms on hand from soft to wire.



NOTICE: during pre-task planning, decide what to do with the grout. Cover all drains because grout will ruin a drain system. Protect surrounding areas from cement waste. The EPA has determined that cement waste is harmful to water sources.



- **HOSING** — The hose-person should adhere to the following practices:
 - ❑ Be consistent (Figure 8).

FIGURE 8



- ❑ Adjust the spray to the hardness of the surface.
- ❑ Spray at an angle to avoid gouging the surface with direct blasting.
- ❑ Direct the broom-person to inconsistent areas.
- ❑ Always look toward the finished product.
- ❑ Be aware of possible trouble areas.
- ❑ Always test the water source for good pressure. If there is a chance of rain, be prepared to cover areas with drips (at a minimum) or the whole slab if possible.

✓ **NOTE:** It is always a good idea to wash a second and sometimes a third time. The broom person, with an assortment of brooms, will come back and wire brush inconsistent areas to obtain the best finish possible. This process also allows the hose-person to remove excess laitance and buckshot.



OBJECTIVE 6

State the principles of seeding a concrete surface to expose aggregate.

- When a denser rock finish is needed or a special rock required, the surface can be seeded. Selected aggregates are cast over the surface and then tamped to embed them beneath the surface. Seeding is generally done with a shovel. After seeding, the surface is floated and washed to expose aggregate (Figure 9).

FIGURE 9



- To create a denser finish of the same aggregate, apply one layer.
- When seeding decorative rock for a consistent cover, use slightly more than one layer.
- It is critical to cover all the redi-mixed aggregate but avoid piling. Grout may not accumulate around the rock causing a blowout.
- With special seed, it is recommended to jitterbug or tamp the area to bring more grout to the surface and to imbed the ready mix rock before seeding the decorative rock.
- With a hand float or darby, tap the rock in flush with the surface.
- Expose as required.



OBJECTIVE 7

Describe methods used to patch a concrete surface after exposing the aggregate.

- For a successful repair, use the correct proportions and the same rock, sand, and cement as the original concrete.
- Make samples beforehand to assure a match and modify if necessary.
- The same principles of preparation apply to exposed patching as other types of concrete repair—that is, clean, sound substrate and saw-cut edges. A good rule of thumb for exposed work is a depth 1½ times the size of the largest aggregate.

✓ **NOTE:** A horizontal patch, due to gravity and large aggregate, can accommodate slightly more water than dry pack without dry shrinkage.

- When doing exposed patching, knock off all saw cut aggregate on the edge, being careful to replace them with whole rock.
- Slurry coat the patch substrate (bonding agent may be added), press in the patching mix, strike off and float to grade making sure the large aggregate is embedded and the edges are rocked and full.
- Let it set until firm and then expose the aggregate. Brush towards the edges of the patch to avoid “outlining” the edge.
- A vertical patch must be dry enough to prevent sagging. A deep patch should be dry-packed first and cut back far enough to accept the exposed mix. Some cement masons patch with the larger aggregate in the mix, others apply the mortar and seed into it.

OBJECTIVE 8

Complete Job Sheet 1.

OBJECTIVE 9

Complete Job Sheet 2.

OBJECTIVE 10

Complete Job Sheet 3.





Name _____ Score _____

OBJECTIVE 8

Place and finish a slab with an exposed aggregate finish using sugar retarder.

BASIC SKILLS



Employability

EQUIPMENT AND SUPPLIES

- Spreading shovel
- Rod
- Bull float
- Hand float
- Leaner trowel
- Knee boards (if necessary)
- Edger – 1/2” radius
- Jointer – 1/2” radius (if necessary)
- Molasses or other form of sugar
- Cheesecloth
- Spray can
- Finish broom, if needed
- Variety of exposing brooms – soft & stiff bristles, wire
- Water source, hose and nozzle
- Personal protective equipment

✓ **NOTE:** Refer to CFR (Code of Federal Regulations) 1926 Construction Industry Safety and Health Regulations.

PROCEDURE

Yes No

1. Strike off the concrete to grade and seal with the rod.
2. Seal the entire surface immediately. Bull float and hand float.

✓ **NOTE:** Leaving the concrete unsealed in areas for a length of time may cause unevenness in the exposed work.



Yes No

3. Edge the slab and float back to grade.

4. Install joints, if necessary.

✓ **NOTE:** When the slab is shaped to your satisfaction, without float, edger or jointer marks (these may show because of displaced large aggregate), it is time to apply the retarder. Ask your instructor about the application method best suited for the set of the slab and the size of the rock.

5. Wait until the aggregate is well set in the slab.

6. Dampen, broom, and expose a corner to make sure it meets your expectations. If it does, broom and expose the remainder of the slab (Figure 1).

FIGURE 1



7. Re-broom any less-exposed areas in order to obtain an even finish. Judge which broom will do the best job.

8. Rinse. Repeat if necessary.

9. Clean up the area and dispose of sediment.

10. Have your instructor inspect your work.



Yes No

11. Clean the work area and return tools and equipment to proper storage.

**PRODUCT
EVALUATION**

SKILL TEST RECORD

Evaluator note: Rate the student on the following criteria by circling the appropriate numbers. Each criterion must receive a rating of “3” or higher to demonstrate student mastery. (See Key below.) A student who is unable to demonstrate mastery should review the material and submit another product for evaluation.

Criteria:

Safety	4	3	2	1
Use of tools	4	3	2	1
General appearance	4	3	2	1
Overall performance	4	3	2	1

**AVERAGE
RATING**

Evaluator note: To obtain an average rating for the Profile of Training Mastery, total the points in Product Evaluation and divide by the total number of criteria. Circle the rating on the Key.

KEY

- 4 Skilled** — Can perform job with no additional training
- 3 Moderately Skilled** — Has performed job during training program; limited additional training may be required
- 2 Limited Skill** — Has performed job during training program; additional training is required to develop skill
- 1 Unskilled** — Is familiar with process, but is unable to perform job

**EVALUATOR'S
COMMENTS**





Name _____ Score _____

OBJECTIVE 9

Place and finish a slab with a seeded, exposed aggregate finish using sugar retarder.

BASIC SKILLS



Employability

EQUIPMENT AND SUPPLIES

- Spreading shovel
- Rod
- Bull float
- Hand float
- Leaner trowel
- Knee boards (if necessary)
- Edger – 1/2 inch radius
- Jointer – 1/2 inch radius (if necessary)
- Molasses or other form of sugar
- Cheesecloth
- Spray can or paint brush and container (depending on project)
- Finish broom, if needed
- Variety of exposing brooms – soft & stiff bristles, wire
- Water source, hose and nozzle
- Seed rock
- Jitterbug (if appropriate for project)
- Personal protective equipment

PROCEDURE

✓ **NOTE:** Refer to CFR (Code of Federal Regulations) 1926 Construction Industry Safety and Health Regulations.

Yes No

1. Strike off concrete 1/4 inch to 1/2 inch below grade.

✓ **NOTE:** This depends on the amount and size of the rock.



Yes No

2. Jitterbug the surface (if appropriate for project).

✓ **NOTE:** This will push down the mix rock if you are seeding with decorative rock, and bring up grout for imbedding.

3. Seed the rock evenly across the surface (Figure 1).

FIGURE 1



4. Tap down the seed rock with a hand float until it is imbedded in grout.

5. Seal the entire surface immediately. Bull float and hand float.

✓ **NOTE:** Leaving concrete unsealed in areas for a length of time may cause unevenness in the exposed work.



Yes No

6. Edge and float the surface back to grade (Figure 2).

FIGURE 2



7. Install joints, if necessary (Figure 3).

FIGURE 3



✓ **NOTE:** When the slab is shaped to your satisfaction, without float, edger, or jointer marks (these may show because of displaced large aggregate), it is time to apply the retarder. Ask your instructor about the application method best suited for the set of the slab and the size of the rock.

8. Wait until the aggregate is well set in slab.



Yes No

- 9. Dampen the slab, broom, and expose a corner to be sure it meets your expectations. If it does, broom and expose the remainder of the slab.
- 10. Re-broom any less-exposed areas in order to obtain an even finish. Judge which broom will do the best job.
- 11. Rinse. Repeat if necessary.
- 12. Clean up the area and dispose of sediment according to local regulations.
- 13. Have instructor inspect your work
- 14. Clean the work area and return tools and equipment to proper storage.

PRODUCT EVALUATION

SKILL TEST RECORD

Evaluator note: Rate the student on the following criteria by circling the appropriate numbers. Each criterion must receive a rating of “3” or higher to demonstrate student mastery. (See Key below.) A student who is unable to demonstrate mastery should review the material and submit another product for evaluation.

Criteria:

Safety	4	3	2	1
Use of tools	4	3	2	1
General appearance	4	3	2	1
Overall performance	4	3	2	1

AVERAGE RATING

Evaluator note: To obtain an average rating for the Profile of Training Mastery, total the points in Product Evaluation and divide by the total number of criteria. Circle the rating on the Key.



KEY

- 4 Skilled** — Can perform job with no additional training
- 3 Moderately Skilled** — Has performed job during training program; limited additional training may be required
- 2 Limited Skill** — Has performed job during training program; additional training is required to develop skill
- 1 Unskilled** — Is familiar with process, but is unable to perform job

**EVALUATOR'S
COMMENTS**





Name _____ Score _____

OBJECTIVE 10

Place and finish a slab with an exposed aggregate finish without retarder.

BASIC SKILLS



Employability

EQUIPMENT AND SUPPLIES

- Spreading shovel
- Rod
- Bull float
- Hand float
- Leaner trowel
- Knee boards (if necessary)
- Edger – 1/2 inch radius
- Jointer – 1/2 inch radius (if necessary)
- Finish broom
- Variety of exposing brooms – soft & stiff bristles, wire
- Water source, hose and nozzle
- Personal protective equipment

✓ **NOTE:** Refer to CFR (Code of Federal Regulations) 1926 Construction Industry Safety and Health Regulations.

PROCEDURE

✓ **NOTE:** There can be occasions when, due to inclement weather or just not having access to retarder, it becomes necessary to do the job without it.

Yes No

1. Strike off concrete to grade, sealing with rod.
2. Seal entire surface immediately. Bull float and hand float.

✓ **NOTE:** Leaving the concrete unsealed in areas for a length of time may cause unevenness in the exposed work.



Yes No

- 3. Edge and float the slab back to grade.
- 4. Install joints, if necessary (Figure 1).

FIGURE 1



- 5. Shape up the slab until there are no float, edger or jointer lines (these may show because of displaced large aggregate).
- 6. Mist the slab with water.
- 7. Wait 15-30 minutes, depending on the temperature. Mist the slab again and broom with finish broom.



- 8. Wait. Check the firmness of the aggregate. If not solidly fixed, mist and broom again (Figure 2).

FIGURE 2



- 9. When the aggregate is firm, begin to expose, being careful not to be too aggressive with the broom or nozzle.

✓ **NOTE:** It is better to be a little “light” the first time over than to overexpose the rock.

- 10. Wet down, rebroom and rinse the project a second time, being consistent with both broom and nozzle.

✓ **NOTE:** For the best results be selective when choosing the stiffness of the bristle of the broom you will use.

- 11. Inspect the slab and spot broom any inconsistent areas. Rinse.

- 12. Clean up the area and dispose of sediment.

- 13. Have your instructor check your work.

- 14. Clean the work area and return tools and equipment to proper storage.



**PRODUCT
EVALUATION**

SKILL TEST RECORD

Evaluator note: Rate the student on the following criteria by circling the appropriate numbers. Each criterion must receive a rating of “3” or higher to demonstrate student mastery. (See Key below.) A student who is unable to demonstrate mastery should review the material and submit another product for evaluation.

Criteria:

Safety	4	3	2	1
Use of tools	4	3	2	1
General appearance	4	3	2	1
Overall performance	4	3	2	1

**AVERAGE
RATING**

Evaluator note: To obtain an average rating for the Profile of Training Mastery, total the points in Product Evaluation and divide by the total number of criteria. Circle the rating on the Key.

KEY

- 4 Skilled** — Can perform job with no additional training
- 3 Moderately Skilled** — Has performed job during training program; limited additional training may be required
- 2 Limited Skill** — Has performed job during training program; additional training is required to develop skill
- 1 Unskilled** — Is familiar with process, but is unable to perform job

**EVALUATOR'S
COMMENTS**

