California Vocational Agriculture Curriculum Guidelines Instructional Unit

CONCRETE STRUCTURES - LANDSCAPING FOUNDATIONS

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CONCRETE STRUCTURES - LANDSCAPING FOUNDATIONS

Unit Goal:

The goal of this unit is to have students in Ornamental Horticulture become aware of the concrete structures used in landscaping, and how they are constructed and installed.

Unit Performance Objectives:

Upon completion of this unit the student will be able to:

1. Recognize and identify the concrete structures used in landscaping.
2. Develop and estimate a bill of materials for concrete structures from sketches and drawings provided in landscape plans or blueprints.
3. Identify materials used in the construction of concrete structures in the landscape.
4. Describe and use basic masonry techniques used in the construction of concrete structures in the landscape.
5. Identify and use basic masonry tools used in the construction of concrete structures in the landscape.
6. Build simple concrete items used in the landscape.

Teaching Outline

I. Introduction

Concrete, when used wisely, will add to the beautification of the landscape plan and will last indefinitely. It is the most versatile of all paving materials. It will give you more material for your money. Because it is a plastic material, it can be molded or cast in many shapes and forms, and will blend well with other materials. However, the disadvantages of concrete are considerable when it is handled thoughtlessly. You must plan carefully, use basic masonry skills and follow all local or county building codes for strength and durability.

II. How concrete is made (See TM 1 and TM 2)

A. What is concrete?

1. Concrete is a mixture of portland cement, water and inert materials called aggregates (Usually sand and gravel)

2. The ingredients combine to form a paste which binds the aggregates into a stone-like mass

B. Rules for assuring good concrete

1. Use proper ingredients: portland cement, clear water, and well-graded, clean aggregates
2. Proportion the ingredients correctly and mix them thoroughly
3. Place mixture into properly made and braced form
4. Finish the concrete correctly
5. Moist cure for correct length of time

III. How are concrete materials obtained?

A. Bulk dry materials

1. Cheapest way
2. Sand and gravel mix
3. Cement comes in 94 pound sacks (must be kept dry)
4. Storage can be a problem
5. Mix in mixer or use wheelbarrow as mixer
6. Use 5 parts sand and gravel to 1 part cement for most concrete jobs

B. Transit mix (Ready mix)

1. Delivered to your door, ready to set in place
2. No mixing equipment, no storage
3. Consistent, well-mixed concrete
4. Cost is more than for bulk dry materials
5. Prepared according to any specifications before delivery
6. Cost is more for smaller jobs
7. Trucks usually too big and heavy for driveways

Suggested Learning Activities	Suggested Resource Materials
1. Take a walk around the high school campus and identify all of the landscape concrete structures that you can and have the students write these down.	1a. Sunset Western Landscaping Book. b. Better Homes & Gardens Landscape Book.
2a. Visit a concrete plant with the class. b. Invite the manager of a concrete. plant to come to your classroom and discuss costs.	2. Consult the yellow pages of the telephone book for local concrete plant or concrete supply yard.
3. Have available samples of concrete materials for identification.	3. Shop Work on the Farm, Jones.
4. Make a miniature trial batch of concrete in the classroom and allow to harden.	4a. Shop Work on the Farm, Jones. b. "Concrete and Masonry" Unit of Instruction, Introduction to Agriculture Guidelines--1976.

C. Dry ready-mix

1. Usually comes in 80 pound sacks and contains the right amounts of sand, gravel and cement
2. Just add water and mix
3. Ideal for a small job or piecemeal work
4. Quite expensive, four times as much as the other two forms

D. Other materials used in concrete construction

1. Reinforcing steel (various sizes)
2. Reinforcing wire mesh (for walks and drives)
3. Foundation bolts (various sizes)
4. Materials for forms (wire, wood, sheet metal)
5. Concrete preservatives and cures
6. Color materials to add to concrete
7. Joint expansion materials
8. Spray liquid curing compounds

E. Determine the quality of concrete ingredients

1. Testing aggregates for impurities

   a. Use a small jar
   b. Fill 1/2 full with aggregates to be used
   c. Fill other 1/2 with water
   d. Shake well
   e. Allow to settle
   f. Silt reading should not exceed 1/8 inch in depth.

2. Water used should be clear and clean when mixed with concrete ingredients

IV. Tools used in concrete work (See TM 3, TM 4 and TM 5)

A. Hand tools
1. Steel trowels
2. Steel floats
3. Wood floats
4. Edgers
5. Groovers
6. Tamps (turkey foot)
7. Square pointed shovel
8. Hoe
9. Mortar box or wheelbarrow
10. Level
11. Yardstick or ruler
12. Mason's nylon line
13. Metal stakes 12" or 18" long
14. Jointer for tooling mortar joints

Suggested Learning Activities	Suggested Resource Materials
1. Perform a silt test in class.	1a. Shop Work on the Farm, Jones. b. "Concrete Masonry" unit from Introduction to Agriculture
2. Have all concrete tools available for identification.	2. Use tools from shop or borrow from local or school district mason.

B. Power tools

1. Cement mixers (electric or gas)
2. Electric powered floats
3. Electric powered tamps

V. Estimating concrete (Follow directions in TM 6)

VI. Types of concrete construction (See TM 7)

A. Walks and driveways (See TM 8)

1. Can run with the grade
2. Rules to follow

a. Don't pour too much at one time
b. Make sure forms are set right for proper grade and are strong
c. Make joints to provide for expansion (approximately 10-15 feet on driveways)
d. Place walks higher than ground level
e. Usual thickness is 4 inches
f. Use reinforcing mesh to prevent cracking and provide durability
g. Score concrete with marking tool at joints and on edges. This allows a better finish and prevents edges from chipping
h. Use a broom to give concrete a rough finish to prevent slipping

B. Steps or stairways

1. For safety, steps should never be steeper than 2 to 1 (6 inch rise for each 12 inch tread) or 3 to 1, 5 inch rise for each 15 inch tread)
2. Hillside steps should have check walls to prevent soil from eroding onto steps
3. Steps with more than four risers should have handrails
4. Place landings at every 8 to 10 risers
5. A landing should be large enough for one stride (4 feet)
6. All treads and landings should pitch to the front 1/4 inch

C. Walls and fences (See TM 9)

1. Free standing masonry and concrete walls can be 8 inches thick if they are not more than 2 to 3 feet high
2. Walls and fences over 3 feet high should be reinforced with steel, and should be at least 12 inches thick
3. Brick walls can be reinforced by 16 inch piers every 6 to 8 feet
4. All walls should have footings at least 16 inches wide and 6 inches thick.
5. Footings must be placed below the frost line on solid earth and must be level

Suggested Learning Activities	Suggested Resource Materials
1. Obtain the latest price list on concrete materials.	1. Consult a local concrete company.
2. Hand out information sheets provided in the "teaching aids section" on figuring concrete.	2. TM 6.
3. Have sample problems made up and worked out ahead of time and review with the class.	3. TM 6.
4. Show slides of different types of construction using concrete in the landscape.	4. Use personal slides.
5. Order films from concrete supply companies.	5a. Southern California only: Portland Cement Association Southern California Film Library 520 S. LaFayette Park Pl. #312 Los Angeles, CA 90057 5b. Portland Cement Association 5420 Old Orchard Road Skokie, Illinois 60076
6. Have students construct simple concrete structures as suggested in the unit.	6. TM 7--Stepping stones TM 10--Concrete Flower Box
7. Draw up plans for concrete structures and figure out the bill for materials.	7. TM 6.

6. If the walls run down hill, the footings should stay with the grade
7. Retaining walls should never be less than a foot thick
8. Retaining walls should be increased in width to equal one-third the height
9. Gravel should be packed on the base of a reinforced retaining wall on the back side
10. All retaining walls should have weep holes 6 to 10 feet apart

D. Footings and Foundations--Check local building codes for specifications (width, depth and reinforcing)

E. Other student projects in concrete construction (See TM 10)

1. Set up concrete edging for individual, permanent plant specimens, turf or ground cover plants
2. Make concrete stepping stones--TM 7
3. Make concrete lawn and flower bed edges
4. Build soil bins
5. Put in simple walks around buildings
6. Construct a soil fumigation slab.
7. Construct concrete flower boxes--TM 10
8. Cast concrete bench ends
9. Put in a patio floor (use designs)
10. Make up gutter down spout extensions
11. Construct Bar-B-Que pits
12. Construct a retaining wall using "broken concrete pieces.
13. Put in footings or foundations for any future construction projects

VII. Curing Concrete

A. To prevent rapid drying that will result in cracks

1. Cover concrete with burlap or sand and keep moist
2. Immediately after finishing, cover concrete with a vapor sealing material, such as building paper or plastic film
3. Spray liquid curing compounds on the surface to prevent moisture evaporation

B. Let Concrete cure for five or more days for best results

C. To keep concrete forms from sticking, use crankcase oil to "paint" the forms before pouring

Suggested Learning Activities	Suggested Resource Materials
1. Have students make simple concrete tools such as floats, edgers, etc.	1. TM 3 and TM 4
2. Landscape a part of the high school campus using concrete structures.	2. Follow discussion in TM 8.
3. Show students how to cure concrete using different methods.	3. Use student or class projects to demonstrate.

Student Evaluation

1. Define the following:

   A. Concrete--

   B. Mortar--

   C. Aggregate--

   D. Silt test--

   E. Curing concrete--

2. Identify the tools for concrete work on display.

   A. _____ E. _____

   B. _____ F. _____

   C. _____ G. _____

   D. _____ H. _____

3. List four rules for assuring good concrete.

   A. _____

   B. _____

   C. _____

   D. _____

4. What is the cheapest method of obtaining concrete?

5. You are pouring sections of a concrete walk that is 16 feet long, 12 feet wide and 4 inches thick. (Ready mix cement is $45.00 per yard.)

   A. How many cubic feet of concrete will you need? Ans._____

   B. How many cubic yards? Ans._____

   C. If you used ready mixed materials, delivered, how much will it cost you for the amount needed? Ans._____

D. If you were mixing the concrete yourself, how many sacks of cement would you need? Ans._____

SHOW ALL WORK!

CONCRETE MIXES

TABLE 1--SUGGESTED PROPORTIONS OF WATER TO CEMENT FOR VARIOUS KINDS OF CONCRETE WORK AND TRIAL MIXES

KINDS OF WORK	ADD U.S. GAL. OF WATER TO EACH SACK BATCH IF SAND IS:			TRIAL MIXTURE AGGREGATES			MATERIALS PER CU. FT. OF CONCRETE AGGREGATES		
	VERY WET	WET	DAMP	CEMENT SACKS	FINE, CU. FT.	COARSE, CU. FT.	CEMENT SACKS	FINE, CU. FT.	COARSE CU. FT.
5-GAL. PASTE FOR CONCRETE SUBJECTED TO SEVERE WEAR, WEATHER OR WEAK ACID AND ALKALI SOLUTIONS									
TOPPINGS FOR TWO-COURSE WORK,	3 3/4	4	4 1/2	1	1 3/4	3	7	12 1/2	21
				MAXIMUM SIZE 1 1/2 INCHES					
ONE-COURSE INDUSTRIAL, CREAMERY AND DAIRY PLANT FLOORS.	3 1/2	4	4 1/2	1	2	2 1/4	7 3/4	15 1/2	17 1/2
				MAXIMUM SIZE 3/4 INCH					
THIN SECTIONS OF DENSE, STRONG CONCRETE	3 1/2	4	4 1/2	1	2	1 3/4			
				MAXIMUM SIZE 3/8 INCH					
6-GAL. PASTE OF CONCRETE TO BE WATERTIGHT OR SUBJECTED TO MODERATE WEAR AND WEATHER									
WATERTIGHT FLOORS SUCH AS INDUSTRIAL PLANT, DAIRY BARN, BASEMENT, ETC.	4 1/4	5	5 1/2	1	2	3 1/2	6	15	21
				MAXIMUM SIZE 1 1/2 INCHES					
WATERTIGHT BASEMENT WALLS. ALL WATERTIGHT CONCRETE FOR STORAGE TANKS, SEPTIC TANKS, SWIMMING POOLS ETC.	4	4 3/4	5 1/2	1	2 3/4	2 3/4	5 1/2	18	18
				MAXIMUM SIZE 3/4 INCH					
CONCRETE SUBJECTED TO MODERATE WEAR OR FROST ACTION SUCH AS WALKS, DRIVEWAYS, TENNIS COURTS, ETC. REINFORCED INDUSTRIAL BEAMS, COLUMNS, SLABS, ETC.	4	4 3/4	5 1/2	1	2 1/2	2			
				MAXIMUM SIZE 3/8 INCH					
7 GAL. PASTE FOR CONCRETE NOT SUBJECTED TO WEAR, WEATHER OR WATER									
FOUNDATION WALLS, FOOTINGS, MASS CONCRETE, ETC.	4 3/4	5 1/2	6 1/4	1	3	4	5	15	20
				MAXIMUM SIZE 1 1/2 INCHES					
	4 1/2	5 1/2	6 1/4	1	3 1/4	3	5 1/2	18	16 1/2
				MAXIMUM SIZE 3/4 INCH					
				1	3 1/4	2 1/4			
				MAXIMUM SIZE 3/8 INCH					

TABLE 2--PINTS OF WATER TO ADD TO MIXER FOR BATCHES USING 1/2, 1/4, 1/5 and 1/10 SACKS OF CEMENT

SIZE OF BATCH	PINTS OF MIXING WATER TO ADD			
	VERY WET SAND	WET SAND	DAMP SAND	DRY SAND
5-GAL. WATER PER SACK OF CEMENT				
1/2 SACK	14	16	18	20
1/4 SACK	7	8	9	10
1/5 SACK (18.8 lbs)	5 3/4	6 2/5	7 1/5	8
1/10 Sack (9.4 lbs)	2 4/5	3 1/5	3 3/5	4
6-GAL. WATER PER SACK OF CEMENT				
1/2 SACK	17	20	22	24
1/4 SACK	8 1/2	10	11	12
1/5 SACK	6 4/5	8	8 4/5	9 3/5
1/10 SACK	3 1/5	4	4 2/5	4 4/5

TABLE 3--RECOMMENDED SLUMPS FOR CONCRETE

TYPE OF STRUCTURE	SLUMP IN INCHES	
	MINIMUM	MAXIMUM
MASSIVE SECTIONS: PAVEMENTS AND FLOORS LAID ON GROUND.	1	4
HEAVY SLABS, BEAMS OF WALLS; TANK WALLS; POSTS.	3	6
THIN WALLS AND COLUMNS; ORDINARY SLABS OR BEAMS: VASES AND GARDEN FURNITURE	4	8

DIMENSION TABLES FOR ROCKLITE MASONRY UNITS

For Use in Design and Material Take-Offs
Modular -- All Joints 3/8"

Wall Length	No.16" Long Blocks	Wall Length	No.16" Long Blocks
0'8"	1/2	20'8"	15 1/2
1'4"	1	21'4"	16
2'0"	1 1/2	22'0"	16 1/2
2'8"	2	22'8"	17
3'4"	2 1/2	23'4"	17 1/2
4'0"	3	24'0"	18
4'8"	3 1/2	24'8"	18 1/2
5'4"	4	25'4"	19
6'0"	4 1/2	26'0"	19 1/2
6'8"	5	26'8"	20
7'4"	5 1/2	27'4"	20 1/2
8'0"	6	28'0"	21
8'8"	6 1/2	28'8"	21 1/2
9'4"	7	29'4"	22
10'0"	7 1/2	30'0"	22 1/2
10'8"	8	30'8"	23
11'4"	8 1/2	31'4"	23 1/2
12'0"	9	32'0"	24
12'8"	9 1/2	32'8"	24 1/2
13'4"	10	40'0"	30
14'0"	10 1/2	50'0"	37 1/2
14'8"	11	60'0"	45
15'4"	11 1/2	70'0"	52 1/2
16'0"	12	80'0"	60
16'8"	12 1/2	90'0"	67 1/2
17'4"	13	100'0"	75
18'0"	13 1/2	200'0"	150
18'8"	14	300'0"	225
19'4"	14 1/2	400'0"	300
20'0"	15	500'0"	375

Wall Height	No.4" High Blocks	No.8" High Blocks
0'4"	1	
0'8"	2	1
1'0"	3	
1'4"	4	2
1'8"	5	
2'0"	6	3
2'4"	7	
2'8"	8	4
3'0"	9	
3'4"	10	5
3'8"	11	
4'0"	12	6
4'4"	13	
4'8"	14	7
5'0"	15	
5'4"	16	8
5'8"	17	
6'0"	18	9
6'4"	19	
6'8"	20	10
7'0"	21	
7'4"	22	11
7'8"	23	
8'0"	24	12
8'4"	25	
8'8"	26	13
9'0"	27	
9'4"	28	14
9'8"	29	
10'0"	30	15

Wall Height	No.4" High Blocks	No. 8" High Blocks
10'4"	31	
10'8"	32	16
11'0"	33	
11'8"	34	17
11'4"	35	
12'0"	36	18
12'8"	37	
12'4"	38	19
13'0"	39	
13'8"	40	20
13'4"	41	
14'0"	42	21
14'8"	43	
14'4"	44	22
15'0"	45	
15'8"	46	23
15'4"	47	
16'0"	48	24
16'8"	49	
16'4"	50	25
17'0"	51	
17'8"	52	26
17'4"	53	
18'0"	54	27
18'8"	55	
18'4"	56	28
19'0"	57	
19'8"	58	29
19'4"	59	
20'0"	60	30

MORTAR MIX

TYL A U.B.C.

1 Part Portland Cement
3 Parts Sand
1/2 fire clay

Using this mortar mix, one sack of cement will lay 60 blocks using 3/8" mortar.

GROUT

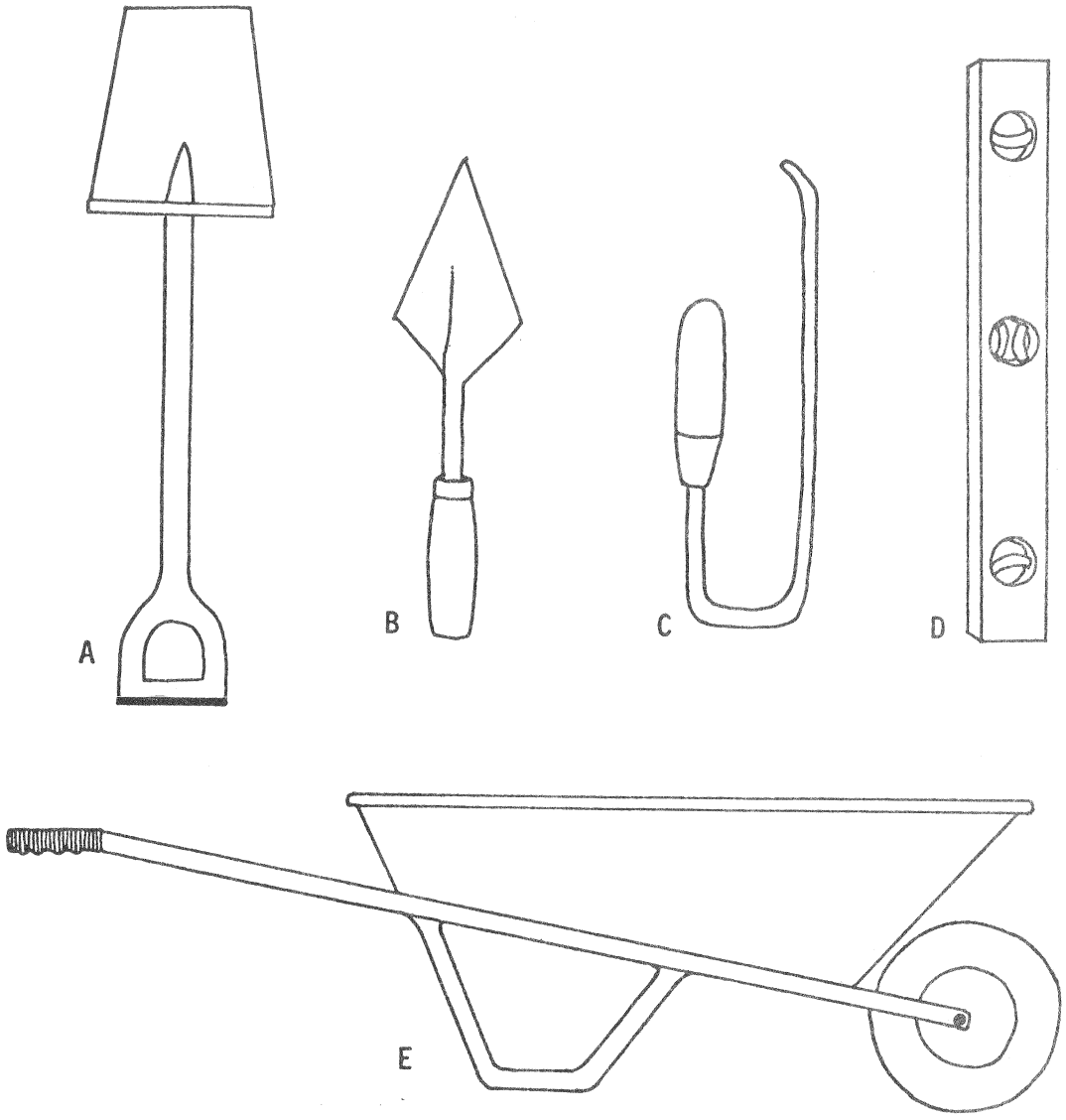
U.B.C.

1 Part Portland Cement
3 Parts Sand
2 Parts Pea Gravel

Using this grout mix, one cubic yard will fill the cavities of 100 square feet of surface area.

TM 3

EQUIPMENT NEEDED FOR INSTALLATION & CONSTRUCTION OF CONCRETE STRUCTURES



A. SHOVEL (SQUARE NOSED) AND HOE

B. TROWEL

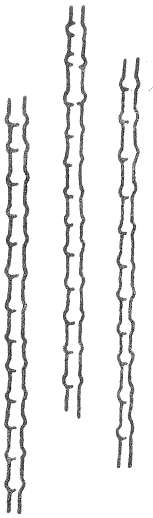
C. JOINTER FOR TOOLING MORTAR JOINTS

D. LEVEL

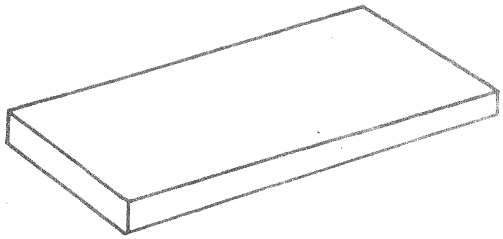
E. WHEELBARROW OR MORTAR BOX

TM 4

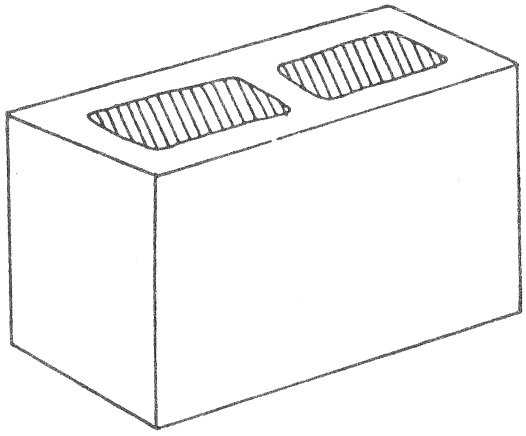
MATERIALS REQUIRED FOR BUILDING A WALL



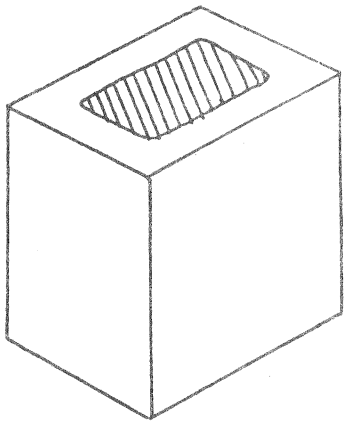
A.



B.



C.



D.

A. Required length of reinforcing steel

B. Masonry caps or special block as selected.

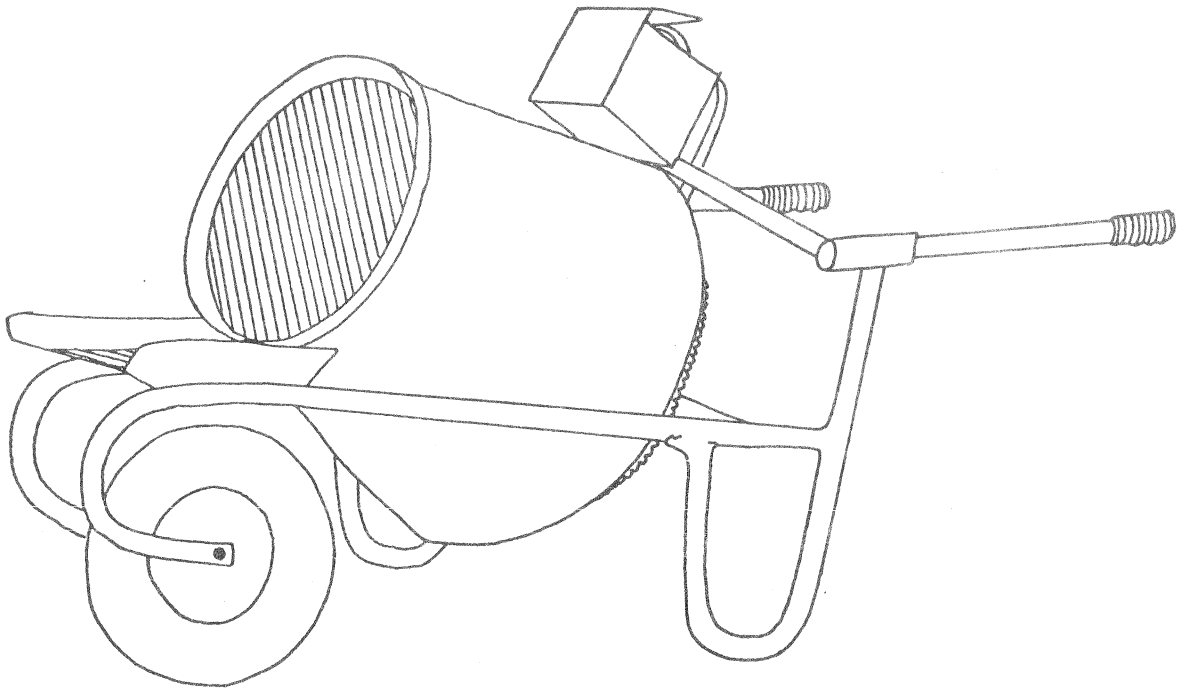
C. AND D.--Required number and types of concrete blocks for height and length of wall. (Consult local supplier.)

E. Regular and plastic Cement

F. Rock and sand.

TM 5

WHEELBARROW-TYPE MIXER



A VERY USEFUL TOOL IN LANDSCAPE CONSTRUCTION IS THE WHEELBARROW-TYPE MIXER. IT MIXES THE CONCRETE AND TAKES IT RIGHT TO THE JOB. NO WHEELBARROW IS NEEDED.

CALCULATING QUANTITIES OF INGREDIENTS FOR CONCRETE

TM 6

Introduction

There are many methods of calculating quantities of cement, sand, and gravel needed to build any given structure, but all require that the volume of concrete needed be determined. The methods suggested here have been selected for their simplicity coupled with reasonable accuracy.

Two methods are given. Method one allows for considerable wastage and surplus and is suitable for small jobs such as steps, small walks, etc. Method two is more accurate. It allows little if any for wastage or surplus and should be used where there is little waste or where jobs are large.

METHOD I

Order as much gravel as there will be of concrete.
Order cement and sand to go with the gravel in proportion to the mix ratio.

Example A

Assume 60 cu. ft of concrete needed.
Assume a 1:2.5:4 ratio (1 part by volume of cement, 2-1/2 parts of sand, and 4 parts of gravel.) See note below.

Order 60 cu. ft. of gravel.
Order 1/4 X 60 = 15 cu. ft. of cement.
Order 15 X 2.5 = 37.5 cu. ft of sand.

METHOD II

Order 3/4 as much gravel as of concrete needed.
Order cement and sand to go with gravel in proportion to the mix ratio.

Example A

Assume 60 cu. ft. of concrete needed.
Assume 1:2.5:4 mix ratio.

Order 3/4 X 60 = 45 cu. ft. gravel.
Order 1/4 X 45 = 11 1/4 sacks of cement.
Order 11 1/4 X 2 1/2 = 9 cu. ft. of sand (approx.)

Example B

Assume 36 cu. ft. concrete needed.
Assume 1:2:3 mix ratio.

Order 36 X 3/4 = 27 cu. ft. gravel.
Order 27 X 1/3 = 9 sacks of cement.
Order 9 X 2 = 18 cu. ft. of sand.

Note:

A. The same rule can be used using cubic yards instead of cubic feet of unit of volume.

B. A sack of cement is taken as 1 cu. ft. of cement. The common weight is 94 lb. per sack.

D. Sand and gravel are sometines sold by the ton and though the density of these materials, especially gravel, vary as much as 15%, a ton can be taken as 20 cu. ft. or 1 cu. ft. as 100 lb. or a cu. yd. as 2700 lb.

TM 7

GENERAL CONCRETE INSTRUCTIONS

Concrete structures using forms--stepping stones, border blocks

--AN INDIVIDUAL EXERCISE--

1. Construct and oil forms to be used.
2. Measure gravel needed for job.
3. Measure sand needed for job.
4. Measure cement needed for job.
5. Measure water needed for job.
6. Put in mixing box in the above order. Not adding water.
7. Mix materials dry--then add water.
8. Make slump test.
9. Pour 1/4 of needed mix in forms.
10. Add reinforcing steel.
11. Add the remaining mix.
12. Screed with straight edge.
13. Tamp rocks down.
14. Give surface a broom finish.
15. After being checked by instructor, give surface a smooth finish.
16. Have checked and make a pebble finish.

When pouring a concrete floor 4" to 6" thick the correct sequence of placing and finishing operations are:

1. Place mix in forms and level with square shovel.
2. Screed or level off.
3. Use the vire tamper or turkeys foot.
4. Tap the sides of the forms with a hammer.
5. Use the edger.
6. Use the full float at proper time.
7. Use the hand wood float.
8. Use the steel finishing trowel.

CONCRETE WORK

-A SEQUENCE OF EVENTS-

Concrete is an ideal material for walks, steps, water tanks, foundations, floors, pavements, walls, patios, and many other construction jobs about the home, ranch, or farm. It is economical, durable, sanitary, and attractive in appearance.

1. Selecting Good Materials:

   A. Fine aggregate--(usually sand), very fine to 1/4" mesh. Should be hard and clean, free of dust, loam, clay, and vegetable matter. Should be well graded from small to 1/4" mesh. See test below.

   B. Coarse aggregate--(pebbles or crushed stone) 1/4" to 2" diameter. Should be tough, fairly hard, and free from any impurities. Well graded as for sand. Embankment gravel usually not suited--too much sand.

   C. Portland cement--Many brands on market. Made to meet standards by U.S. government and American Society for Testing Materials. Always store in dry place, will absorb moisture. If lumps will not break up readily do not use. 94 lb. sacks--1 cu. ft./sack.

   D. Water--Should be clean, free from oil, alkali and acid. In general, water that is good to drink is good for cement mixtures, (concrete).

2. Testing Sand and Gravel for Silt: Sand and gravel may be easily tested to determine if they contain injurious amounts of fine clay or silt as follows:

   A. Place 2 inches of a representative sample of the sand or gravel in a pint fruit jar.

   B. Add water until the jar is almost full, fasten the cover, shake vigorously, and then set the jar aside until the water over the material becomes clear.

   C. Measure the layer of silt on top of the sand or gravel. If the layer is more that 1/8" thick, the material is not clean enough for concrete and must be washed.

3. Testing Sand and Gravel for Vegetable Matter: A test to see whether sand or gravel contains too much decomposing vegetable matter for use in concrete may be made as follows:

   A. Place 1/2 pint of water in colorless one-pint fruit jar, and dissolve a heaping teaspoonful of household lye in it.

   B. Pour 1/2 pint of a representative sample of sand or gravel into the jar containing the lye water.

C. Cover the jar and shake vigorously for one or two minutes.

D. Set the jar aside for 24 hours, and then inspect in a good light.

E. If the water is clear or colored not darker than cider vinegar, the material is suitable for use in concrete. If the water turns darker than this, the material is not suitable for concrete and should be washed to remove all vegetable matter.

4. Determining Proportions of Materials--Most jobs, 1 sack cement to 2 1/4 cu. ft. of sand and 3 cu. ft. of gravel and 5 gallons of water depending on the job. Trial batches--If the sand is wet reduce water amount used. Concrete should be smooth and plastic. It should not be so thin it runs, or so stiff that it crumbles. It should be mushy, not soupy.

5. Estimating Quantities of Materials Needed--Figure volume of concrete to be made. Thickness X width X length. See page 314, Shopwork on the Farm. 144 cu. in/cu. ft.--27 cu. ft./cu. yd., etc. Problem: Walk--4" thick X 16' long X 8' wide.

6. Building and Preparing Forms

A. Appearance--use smooth lumber, otherwise the form will be rough.
B. T & G or sliplap for tight joints--(leak proof).
C. Construct so easily removed without hurting concrete.
D. Well braced, avoid collapse.
E. Forms can be oiled with used engine oil, prevents sticking and warping.
F. Usually not needed below ground level.

7. Reinforcing Concrete

A. Steel bars and wire mesh usually used where there is stress.
B. Should be free from rust and other coatings.
C. Lap ends of steel bars 12" for every 1/4" of diameter: 1/4" = 12", 3/8" = 18", 1/2" - 24", etc.

8. Measuring and Mixing the Materials

A. Measure all materials especially water.
B. Should be mixed by machine whenever possible, saves time and labor and is more uniform.

For school mixer with 2 cu. ft. capacity:

1. Start mixer.
2. Add water--1 1/4 gallons.
3. Add cement--2 shovels.
4. Add aggregate--10 shovels.

9. Placing Concrete

   A. Be sure forms are braced.
   B. Decide how much area you can finish at one time.
   C. Level or slope for drainage--1/8" - 1/4"/ft. = good drainage.
   D. Place concrete in single course.
   E. Place concrete as near to its final position as possible.
   F. Place concrete on firm sub-grade--compact and uniform.
   G. Use expansion material--in walks, drive ways, and patios
   H. Spade along vertical surfaces.
   I. Strike off top with straight edge.

10. Finishing Concrete

   A. Float minor irregularities with wood or metal.
   B. Delay further finishing until concrete has stiffened. Premature working will reduce concrete's wearability.

11. Protecting Fresh Concrete While Curing

   A. Keep wet for at least five days after placing.
   B. Curing:

      1. Cover with burlap or sand, keep moist.
      2. Cover with polyethylene.
      3. Cover with vapor sending material--liquid curing.

12. Removing Forms

   A. Wait until concrete is self-supporting--1 day to 2 weeks.
   B. Remove carefully. Cut wire if present.

13. Making Water Tight Concrete

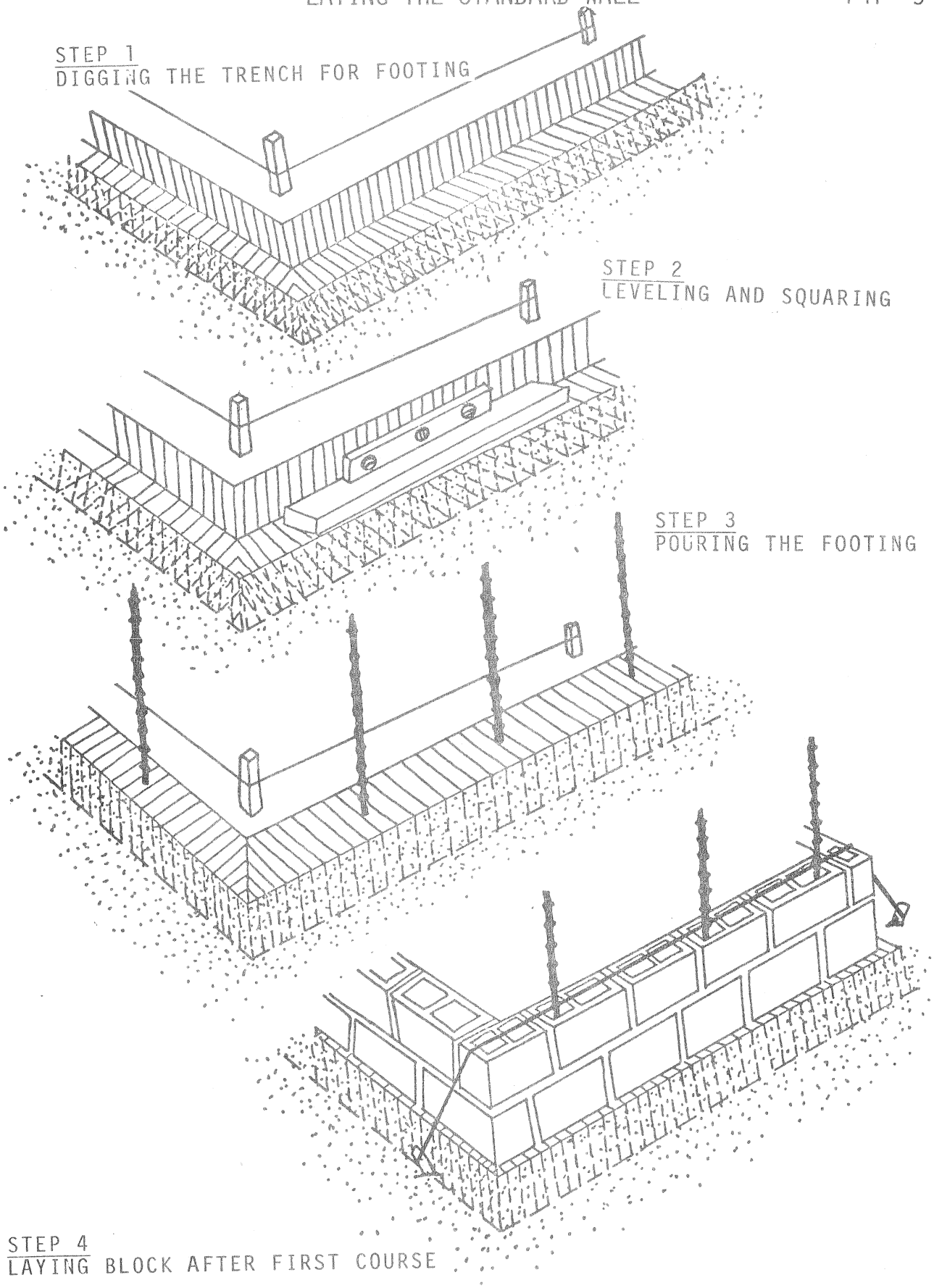
   A. Use fairly rich, properly proportioned mix.
   B. Do a good job of mixing, placing and curing.
   C. No special ingredients necessary.
   D. Use required amount of water. No more!
   E. Keep moist for at least 2 days.

14. Setting Bolts in concrete that has hardened

   A. Drill holes, use expansion shields and lag screws.
   B. Drill and fill with lead.
   C. Place bolt in drilled hole, pour lead.

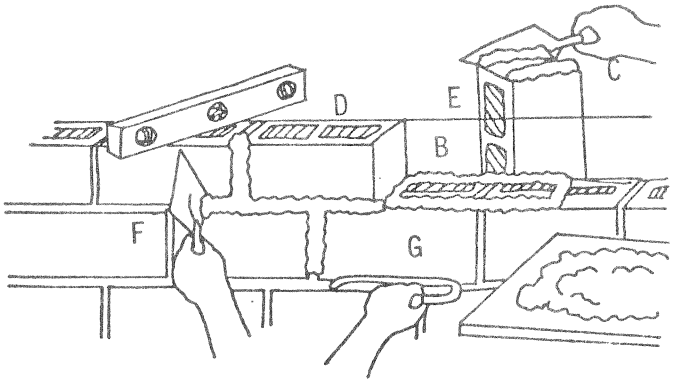
LAYING THE STANDARD WALL

TM 9

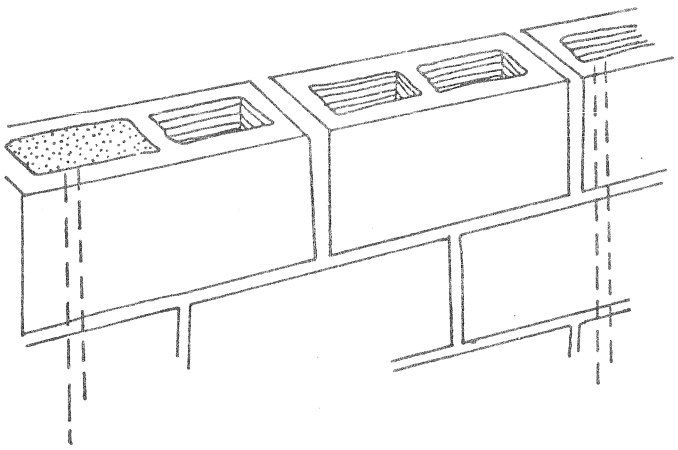


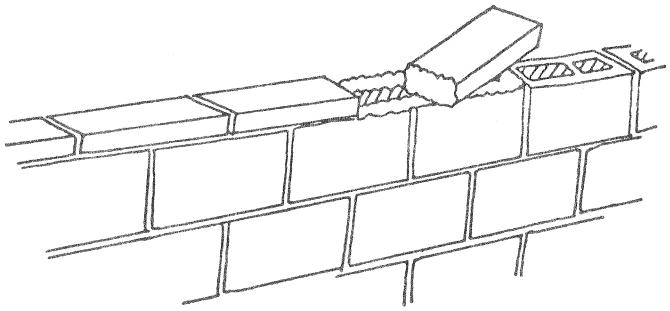
LAYING THE STANDARD WALL

STEP 5 --LAYING THE STANDARD WALL



STEP 6
POURING THE GROUT





STEP 7
COMPLETING YOUR WALL

LAYING THE STANDARD WALL

Step 1 Digging the Trench for Footing

Lay out the exact position of your wall with stakes and a nylon mason's line. Check with your local supplier for correct dimensions of trench for footing. Dig trench along laid-out line to recommended dimensions.

Step 2 Leveling and Squaring

Drive a stake at one end or corner of the trench to a depth which permits the top of the stake to be at the lowest point of the ground level. Measure from the bottom of the trench to the top of the stake, to make sure the desired depth has been reached. Next move down the trench about 8 or 10 feet and drive another stake. Place a straight 2" X 4" on top of both stakes, and place your level on top of the 2" X 4". Center the bubble on your level by adjusting the last stake used. A nylon line and line level may be used instead. Repeat this operation throughout the length of the trench.

Use your square-nosed shovel to square off the sides and bottom of the trench. If local building codes require horizontal reinforcing steel in the footing, place the reinforcing rods approximately 4" from bottom of trench by resting them on stones placed on the floor of the trench.

Step 3 Pouring the Footing

Use a regular 5:1 concrete mix for the footing. Pour and tamp to eliminate air spaces. Be careful not to jar loose the horizontal reinforcing steel. If the wall is to be higher than three feet, place vertical reinforcing steel as the footing is poured, bracing it with wood lath or wire. Vertical steel should be placed so that it will come up in the one hole of every two to three blocks, depending on the length of the wall.

Step 4 Laying Block After First Course

The following mortar mix is recommended: 3 1/2 parts of sand, 1 part of plastic cement and enough water to make the mixture "fat," and yet firm enough to support the weight of the block. Start from a corner with a corner-shaped block, making sure it is level and square. Lay the mortar in sufficient quantities to allow you to maintain 3/8 of an inch mortar joint between blocks, since blocks are sized 3/8" short of an even number of inches both vertically and horizontally. The nylon mason's line should be stretched along the top edge of two on each course to serve as a guide and leveling line. The distance between these key blocks should be the length of the wall.

Step 5 Laying the Standard Wall

A. Place a small supply of mortar on a board or in the wheelbarrow.

B. With a pointed mason's trowel, place mortar on the edges of previously laid block approximately 1" thick for a short distance (8-10 feet) along the wall. Don't work too far ahead with the mortar.

C. Place mortar on ends of block for vertical joint.

D. Force the block into the approximate position on the mortar bed. Check level and carefully align the block to the mason's line by tapping with the trowel handle if too high.

E. The top edge of each block as placed should just miss touching the guide line. Take care that the end of each block as laid covers exactly one half of the block under it.

F. Cross-level blocks frequently with your level. Cut excess mortar from the joint.

G. Joints should be compacted and finished by tooling when mortar has partly stiffened. This emphasizes the joint lines and gives the concrete masonry job a neat appearance. Cleaning off excess mortar as you work will result in a finer appearing wall upon completion.

Step 6 Pouring the Grout

All block cells holding vertical steel reinforcing rods must be filled solid with grout. The grout mix should be very wet, and contain 5 parts sand to one part cement. Rock may be used in this mix too, if desired. A stick or poker should be used to make sure the grout goes down to the foundation, forming a solid reinforced pier in your wall.

Step 7 Completing Your Wall

The final step in building your wall is finishing off the top. The top of the wall may be finished with any of the following methods:

A. A course of masonry caps as shown. Caps are laid in the same manner as blocks, and as much care should be exerted here as in laying the first course of blocks.

B. A course of design blocks.

C. A crown of regular mortar mix--Round and trowel smooth.

CASTING A CONCRETE FLOWER BOX

Reason for Job: Concrete makes a permanent flower box. Wood decays, and metal corrodes, but concrete gets stronger as it is allowed to stand. The moisture necessary for the growing plant does not cause the concrete to deteriorate. For this same reason watering troughs, silos, and the like are now made of concrete. The slogan is, "Use concrete for permanency."

Material: Sand, cement, water, coloring material, and oil.

Tools: Form, mixing box, trowel, tamper, and fine wire cloth.

Procedure:

1. Determine the amount of material.

   Fill the form with sand, and measure the amount. This determines the sand necessary. Add one-half this amount of cement, to make a 1 to 2 mixture. The cement that is added will not increase the space; it just fills the openings between the particles of sand to make a more solid mixture.

2. Oil the form.

   Before the cast is made, a fresh coat of oil is desirable. Apply a thin coat of crude oil, linseed oil, etc., with a swab or brush.

3. Mix the dry concrete.

   Screen the sand through a fine wire cloth. Thoroughly mix the sand and cement until it is uniform in color.

4. Add water.

   Determine the mix you wish to use--quakey, or dry. The dry mix is recommended, because the core can be pulled immediately. Add just enough water to moisten the mixture so that it will stick together when pressed in the hand.

5. Fill the form.

   With the core removed, add enough mixture to make the bottom, and tamp it into place. Fasten the core and tamp the mold full. Remember, the harder you tamp, the stronger the concrete will be.

6. Remove the core.

   Remove the top cleat, and carefully pull the metal sides. The remainder of the core can then be removed with ease. Patch any defects around the top at this time. Set away to dry for at least 24 hours.

7. Remove the sides.

   Carefully remove the sides after 24 to 48 hours.

8. Bore hole for drainage.

   A drainage hole can be cored into the bottom with a screw driver. Do this while the concrete is green and before it is removed from the bottom.

9. Cure the concrete.

   Wet the box as often as possible. This will cure it and increase its strength.

10. Decorate the flower box.

    If a smooth finish is desired, mix cement and water very thin and spread it on with a paint brush. Pleasing effects can be secured by filling the different designs with a colored mixture.

General References

Better Homes and Gardens Landscape Book.

"Concrete and Masonry," Introduction to Agriculture, Course Guidelines Vocational Education Productions, California Polytechnic State University San Luis Obispo, CA 93407.

Shop Work on the Farm, Jones.

Sunset Western Landscaping Book, Lane Publishing Co., Menlo Park, California.