UNITED STATES DEPARTMENT OF THE INTERIOR

NATIONAL PARK SERVICE

A REPORT ON THE MANUFACTURE AND USE

OF

CONCRETE SHINGLES

IN

SHENANDOAH NATIONAL PARK

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FOREWARD

During the days of CCC in Shenandoah National Park there was established at Big Meadows a sub-headquarters for the maintenance and storage of Park equipment. The area contains six substantially-built structures; a repair garage, a blacksmith shop, equipment storage building, warehouse and office, cement, lumber and miscellaneous storage building and a carpenter's shop. The roof covering of these buildings is rough-sawed chestnut shingles. The time is fast approaching when these shingles will have to be replaced, and this should be done with a more permanent material. CCC made some concrete shingles for comfort stations and the permanent buildings at the Headquarters Utility Area. However, there was considerable lack of uniformity in color, thickness, aggregate and texture of finish. With CPS* labor available, and since the men were not required to work outside in bad weather, the logical thing to do was to provide inside work. The shingle project was the ideal solution in order to take advantage of this otherwise wasted labor. After getting prices on roof covering of a type that would be permanent for Park buildings, we experimented with concrete shingles. The idea is not original with us. Concrete shingles have been made for years by firms whose desire it was to supply a roof covering which gave the appearance of age, yet was fire resistant and rustic.

*Civilian Public Service (Conscientious Objectors)

THE SHINGLE MILL

There was no building available at the Headquarters Utility Area which we could adapt for this use, so we built a shed for the purpose. The building was designed for mass production and was built entirely of scrap material salvaged from old buildings in the Park which had been razed under another CPS project. The building houses a sand bin, power-operated sand screen, power-operated cement mixer and conveyor for the mortar box. Shingles are made on a production-line basis, each man having certain tasks to perform. The mortar box moves along the production line on a frame suspended from an overhead track (salvaged from old CCC garage doors). The forms for the shingles are placed on trays. The trays are 28" wide and 6" long. The table on which the trays are placed is a convenient working height and holds six trays placed end to end. When one set of trays is filled, another set of trays is placed on top and the process continues. The sides or frame of the tray hold it up sufficiently to clear the lower course of newly-made shingles. The capacity of each tray is from 6 to 10 shingles, depending on the width of shingles being made.

While the power-operated sand screen and mixer speed up production and make for uniformity, the project could be operated entirely by hand labor.

PRODUCTION

In production the process is as follows: In twenty minutes of operation the power sand screen will screen enough material for a day's run.

The Number One man feeds the mixer, places the reinforcing wires and fills the forms with mortar.

Number Two man screeds off the mortar to the thickness of the forms and removes the forms.

Number Three man shapes up the shingle with a steel trowel and punches the nail holes.

Number Four man puts on the color (black, yellow and green paint pigment in powder), rubs it in with a wooden float or trowel and marks the shingle with the desired texture.

The tool for marking the shingle is a block of wood 1" x 4" x 8". One end is cut down for a handle. Through the other end are driven 10 or 12 8D nails on an angle. Drawing this across the shingle in a straight or wavy line produces the desired texture or rough finish.

The formula is one part Portland cement to two and one-half parts of clean, sharp sand. Water is added from an automatic measuring tank providing a consistency that will stand alone when the forms are removed. The day's run is sprinkled the next morning before they are moved from the trays to the storage yard. If the weather is nice, allowing work on other projects, the shingles are left on the trays as they cure better in the shade. Four men can operate the mill efficiently and can make 2 SQUARES (approximately 448 shingles) in 8 hours under normal conditions when each man knows his job and does his part. From one to four additional men can work on the same project which makes the work lighter but has little material effect on the output.

All shingles are made in 6, 8 and 10 inch widths. The standard shingle is 21 inches long, starters are 12 inches long. The shingle for the next-to-the-last course at the ridge requires a special form to allow nailing space for the last course (see picture on page 15). The last course is a short shingle, and its length is governed by the exposure. In other words, if the courses are laid 8 inches to the weather, the shingle for the final course at the ridge will be 8 inches in length.

The forms are made from material 1 inch wide and 1/2 inch thick for the butt side of the form and 3/8 of an inch thick for the top edge of the form. This gives the shingle a slight taper and they match better. As no ridge cap is used, it is necessary to use a sealing compound or mastic to get a water-tight joint.

While we have not made shingles for a roof with a valley, the process is similar to that of making the various shapes for a hip roof. For a hip roof four special shapes must be made. The angle, of course, is governed by the pitch of the roof. Rights and lefts are required for the starters, regulars, next to the last and last courses. If care is taken in building the forms for hip shingles, one can get such a close fit that the mastic in the joint is hardly noticeable.

LAYING THE CONCRETE SHINGLE ROOF

For a concrete shingle roof, the framing should be built the same as for a slate roof as the concrete shingles weigh approximately the same per SQUARE. The roof should be sheathed solid, and any good grade of felt or tarpaper used under the shingles.

To get the proper pitch for the starter course, a strip 3/4" x 1-1/2" wide, slightly beveled, is nailed along the edge of the last course of sheathing (see drawing on page 9). Starters are laid with a 1" overhang. The next course, standard length, breaks joints over the starters and the butts laid to the same line as the starters. Courses can be laid in a straight line at the butts or staggered from one-half to three-quarters of an inch. The staggering gives a pleasing and artistic effect (see page 16). After the first three or four courses are laid, by working from the staging, care must be taken to avoid breakage in getting on the finished portion of the roof. The accompanying drawing (page 9) illustrates a suggested method which has worked satisfactorily for us. Both sides of the roof can be shingled up to within two or three courses of the ridge. The job then can be completed by straddling the ridge. The caulking should be done along the ridge as the work progresses to avoid having to go back over the laid shingles. If the ridge is long, two men can start at the center and work toward the gable ends.

A gray mastic is used and put in the joints with a mastic gun. Concrete shingles are nailed on with two No. 6 cement-coated or galvanized nails. Care should be taken not to drive the nails up tight as there is danger of breakage from driving the nails and from expansion.

TECHNICAL DATA

Note:-All data, such as costs, weight and quantities, are based on a SQUARE when laid with an exposure of 8 inches to the weather.

A SQUARE of concrete shingles contains 224 shingles in the following proportions: Starters, 14; Regulars, 182; Ridge, 14; Finish, 14.

A SQUARE of concrete shingles made according to the methods outlined weighs 1150 lbs., or 11½ lbs. per sq. ft.[a]

Materials Required and Cost per SQUARE

Sand - 16½ cu. ft.	$ 1.10
Cement - 3½ cu. ft.	3.15
Reinforcing wire - 448 pieces 12 gauge 18"	.40
Color - 2 ozs.	.10
Labor - 2 man days @ $4.00 per diem (4 men)	8.00
Cost per SQUARE	$11.75

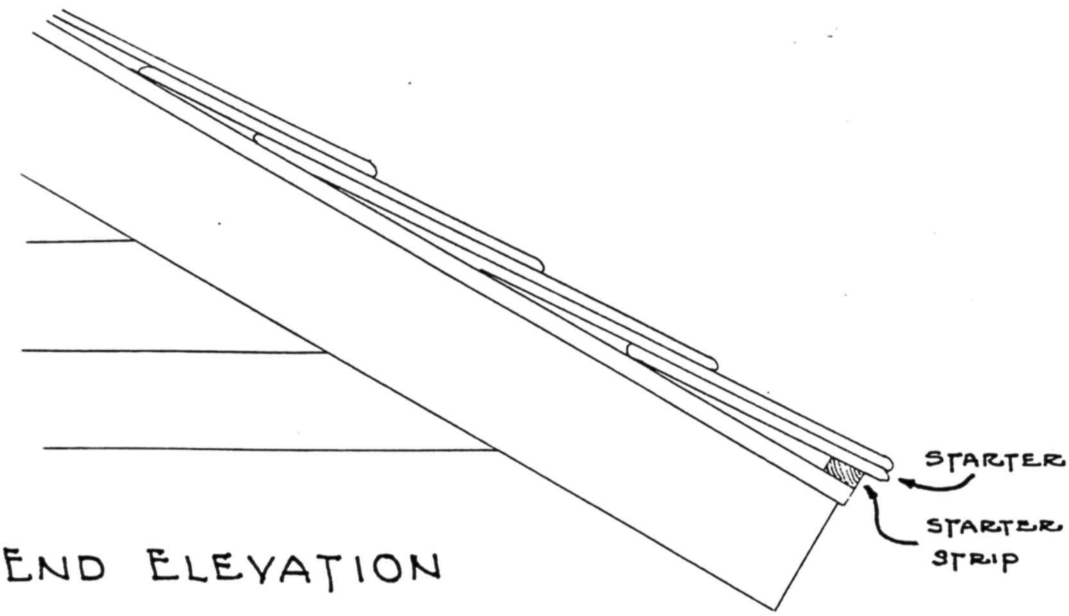
Our Cost per SQUARE with CPS Labor $3.75.[b]

Our cost per shingle .016; with per diem labor .052.

a.--Slate shingles ½" thick by 12" x 16" weight 18 lbs. per sq. ft.

b.--Slate shingles ½" x 12" x 16" cost $18.00 per SQUARE in 1940.

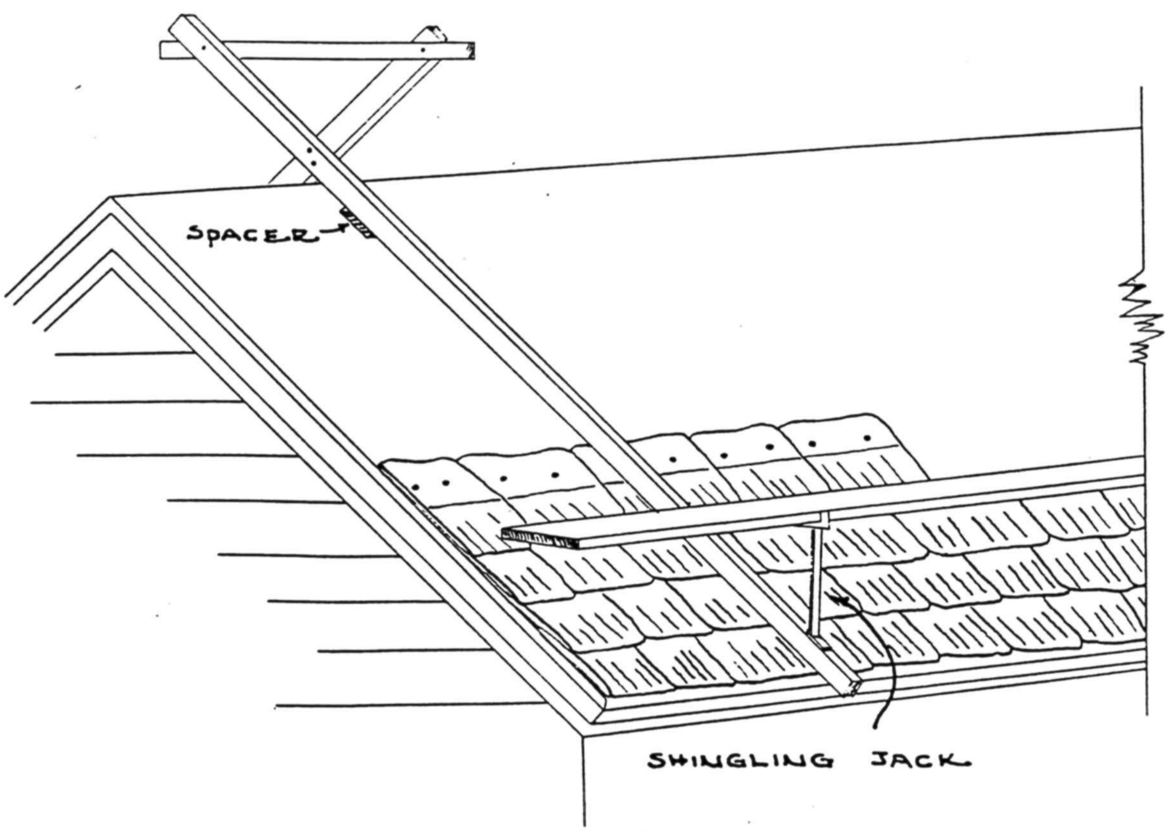
No prices available now on this or other sizes.



END ELEVATION

SHOWING STARTER STRIP
STARTER AND REGULARS.

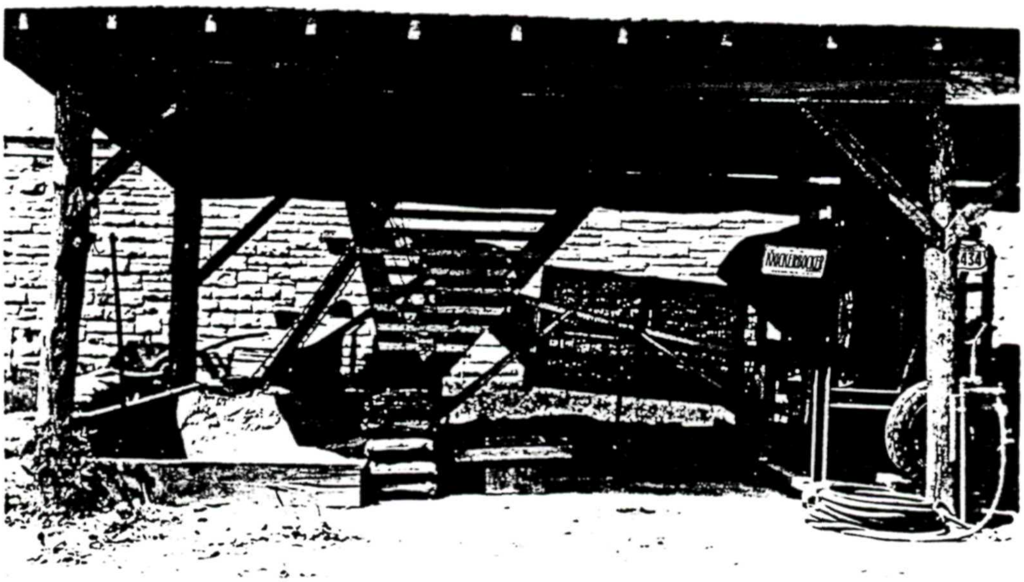
SCALE 1½" = 1'-0"



PERSPECTIVE SHOWING STAGING
NO SCALE

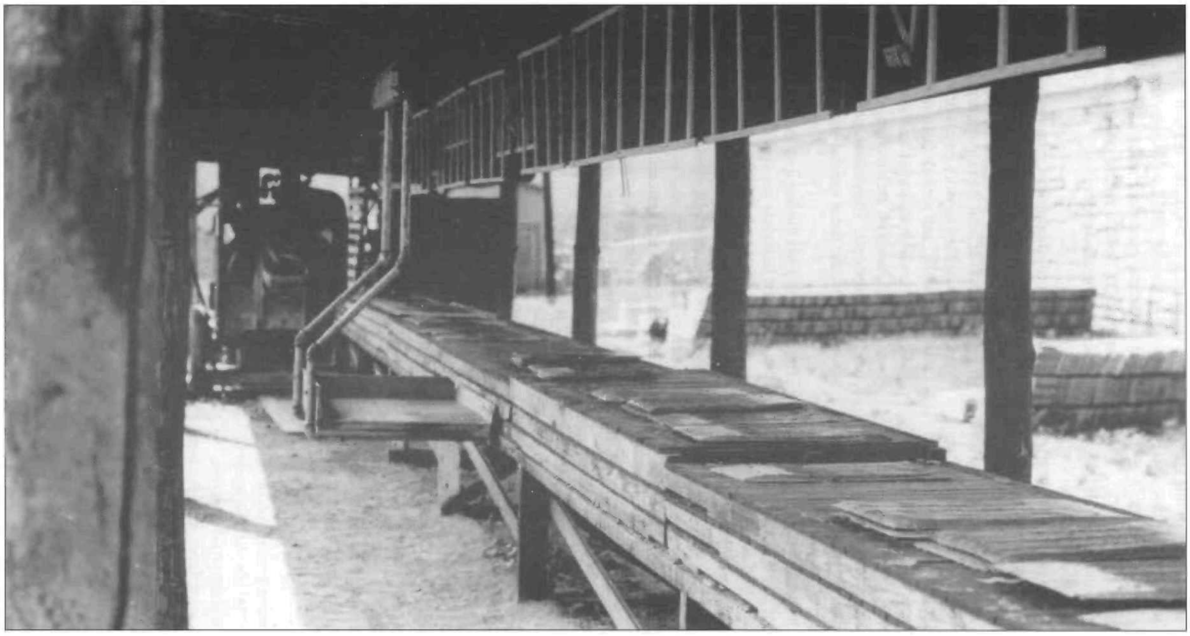
SHINGLE MILL

Showing equipment and production line. Three courses of trays are on the work bench.



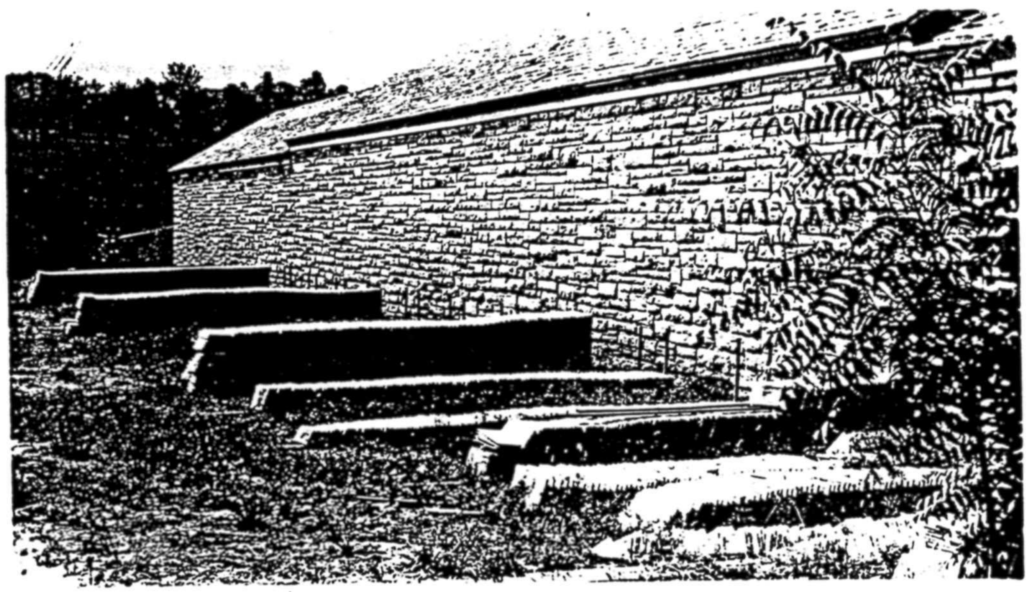
SHINGLE MILL

Showing sand bin, sand screen and mixer. Gears and chain of sand screen are protected by V-shaped lattice work. Sand screen is operated by a $1\frac{1}{2}$ h.p. gasoline engine. Mixer operated by a 1 h.p. gasoline engine.

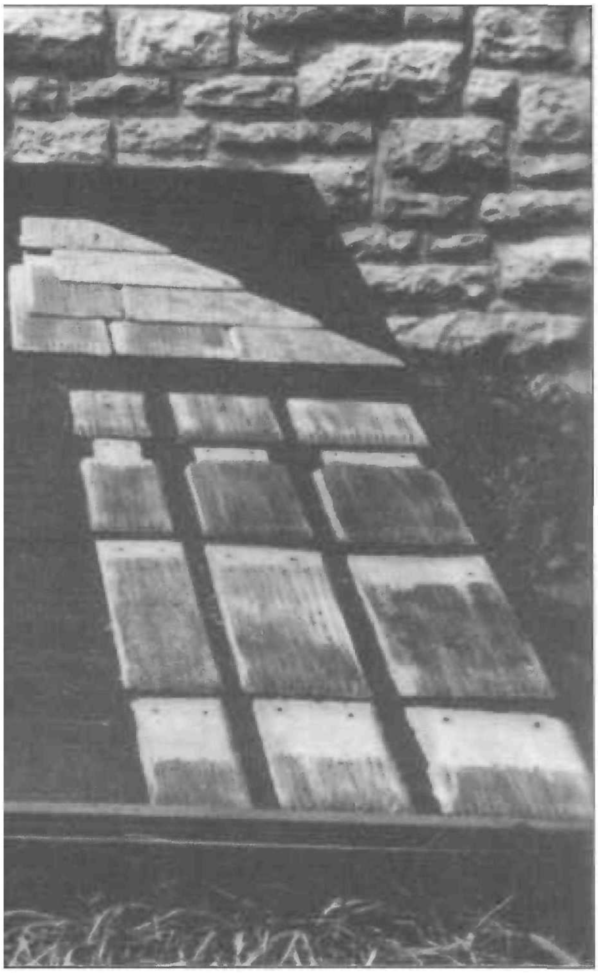


SHINGLE MILL

Note conveyor. Hopper of mixer empties directly into mortar box on conveyor. Frames hanging on rack above work table are shingle forms. Each form makes three or four shingles, depending on width. Shingles on trays are being moved to storage yard seen at right and in next picture.



SHINGLE STORAGE YARD

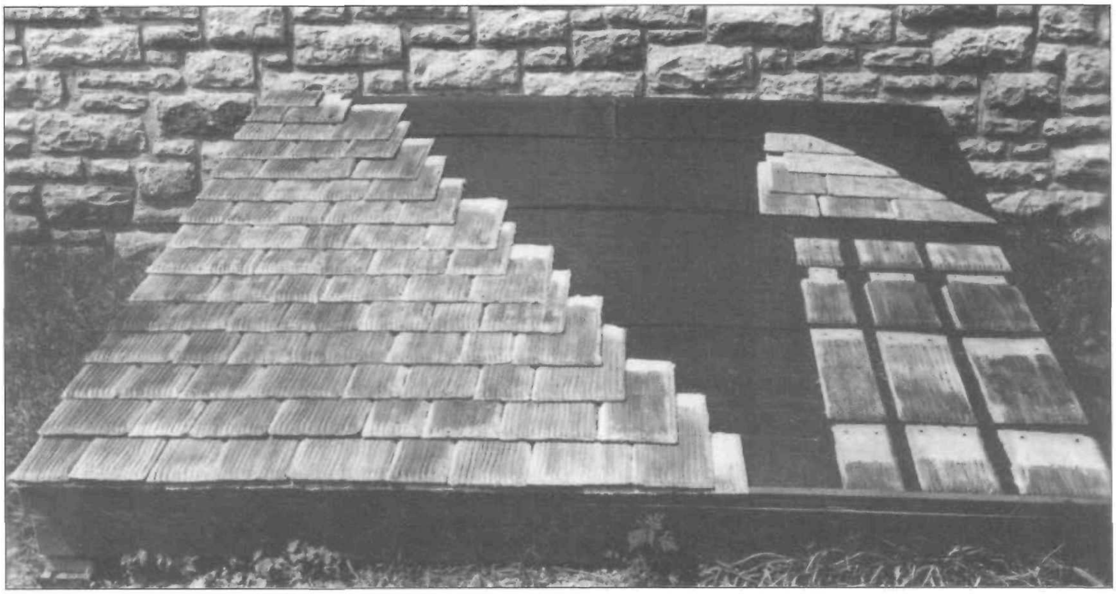


Finish--8" long.
6", 8" and 10" wide.

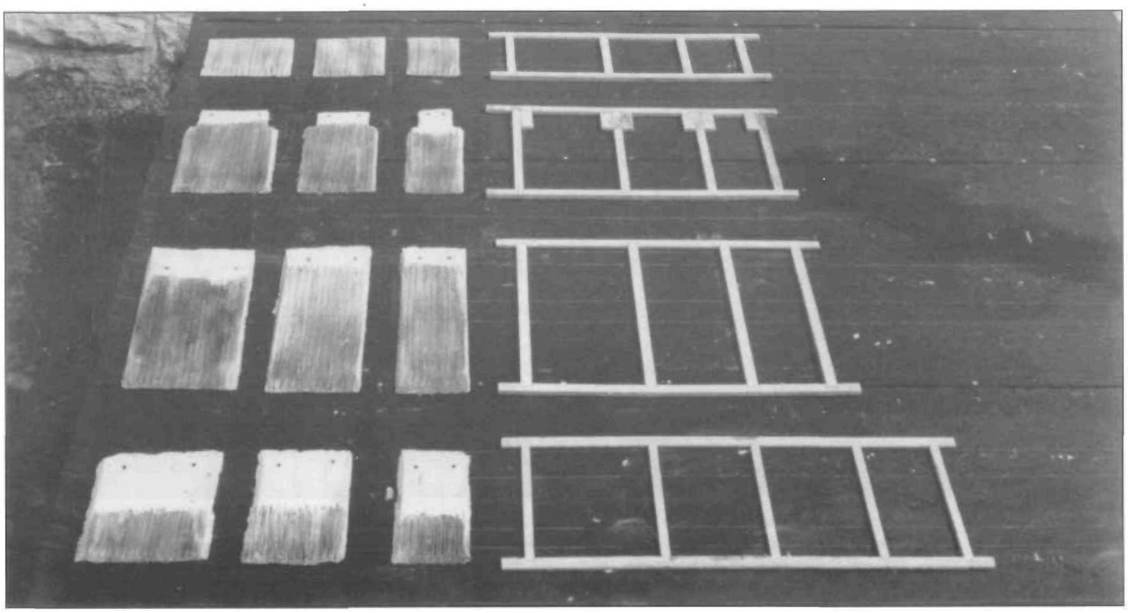
Ridge-- 16" long.
6", 8" and 10" wide.

Regulars--21" long.
6", 8" and 10" wide.

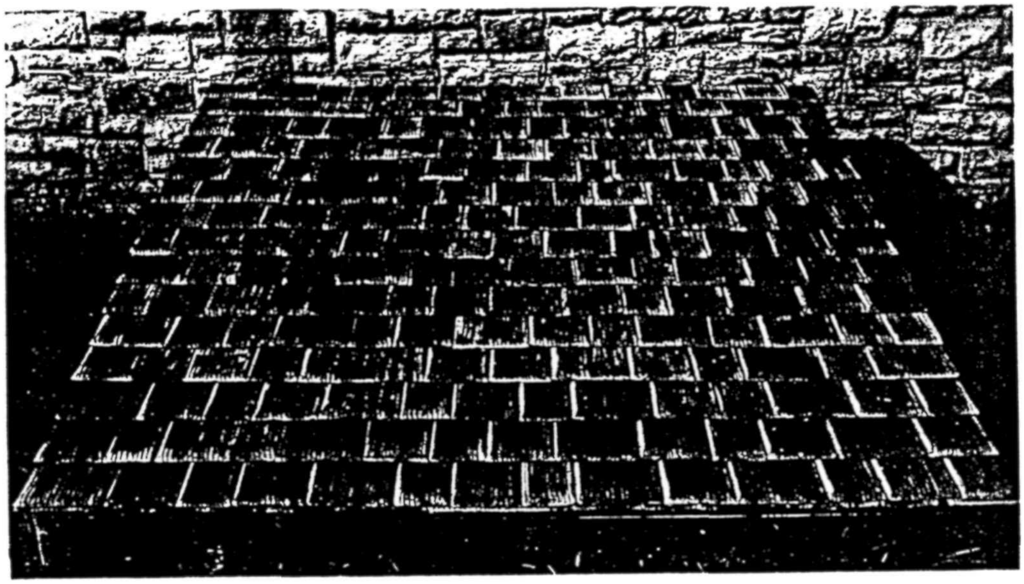
Starters--12" long.
6", 8" and 10" wide.



SQUARE (10' x 10') section of roof built to demonstrate use of concrete shingles. It is used also to teach new hands method of laying, types made and how used.

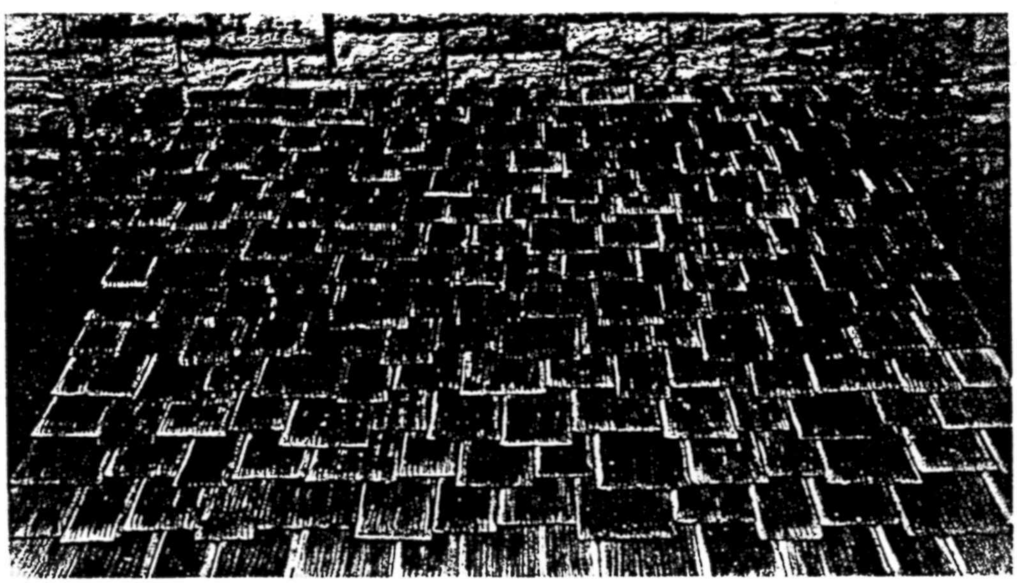


Shingle forms and four shapes (3 widths each) of shingles made.



"A"

SQUARE section of roof showing shingles
laid to line.



"B"

Same as above, but shingle butts staggered
for artistic or more rustic effect.

A set of three shingles can be furnished anyone who is interested in the manufacture and use of concrete shingles. Address your request to

The Superintendent
Shenandoah National Park
Luray, Virginia