

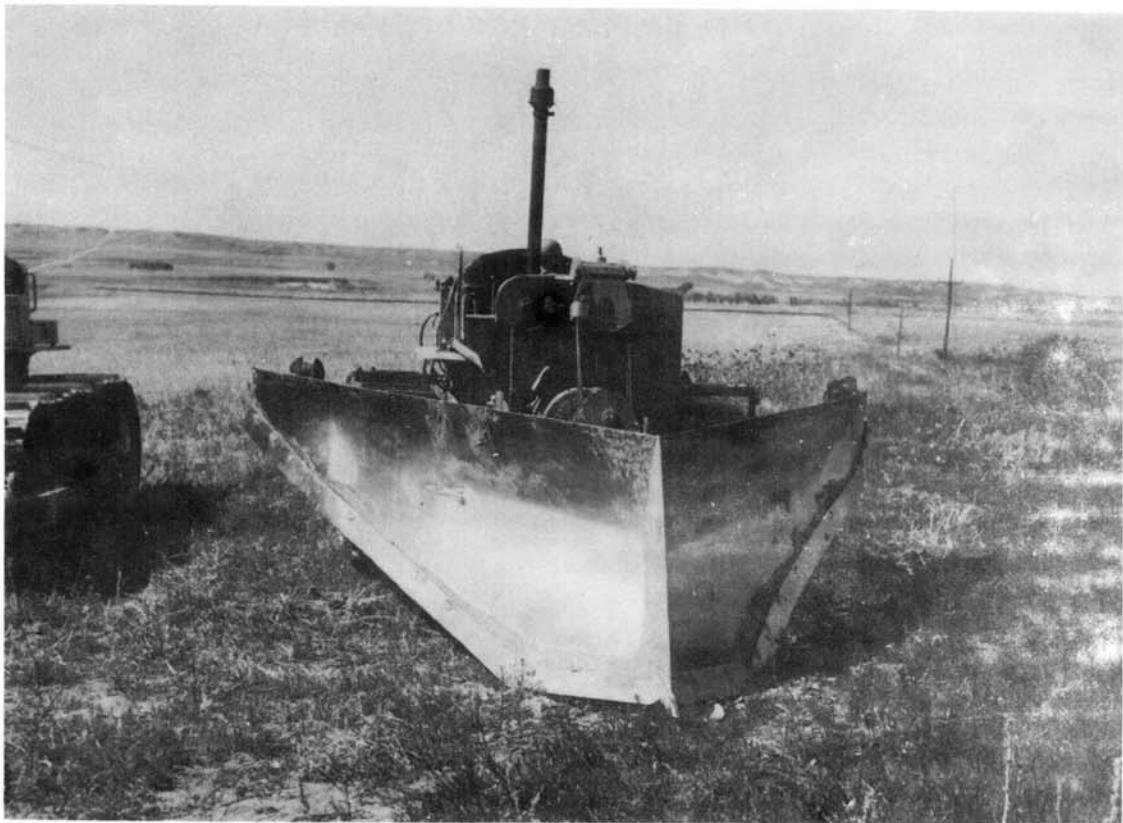
Department of the Interior  
Bureau of Reclamation

# OPERATION AND MAINTENANCE EQUIPMENT AND PROCEDURES

RELEASE NO. 1

November-December 1952

PROPERTY OF BUREAU OF RECLAMATION  
OF THE DEPARTMENT OF THE INTERIOR  
THIS EQUIPMENT IS TO BE USED AS AN  
OFFICIAL TOOL OF RECLAMATION  
INDEPENDENT OF AGENCIES



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## INTRODUCTION

This is the first of a series of information bulletins on Operation and Maintenance equipment and procedures which is being issued as a joint endeavor of the Divisions of Operation and Maintenance and Design and Construction. The bulk of the information material is being furnished by the Operation and Maintenance people, who are also distributing the bulletin. The organization of the material and the issuance of the publication is being done by the Chief Engineer's O&M Liaison Representative. Information available in the Chief Engineer's office which is considered to be of value to the operators is also being included.

The purpose of this bulletin is to provide a means of exchanging ideas and operating kinks between regions and projects and to serve as an outlet for general information items which are of value to operating people.

In addition to the issuance of this bulletin, the Chief Engineer's O&M Liaison Representative has been given the job of coordinating the Bureau-wide effort to have specialized and improved O&M equipment developed and made available by the equipment manufacturers. The details of this assignment are given in the Assistant Commissioner's letter, dated June 9, 1952, to all of the regions on the subject, "Organization to assure exchange of information and to facilitate research and development of operation and maintenance equipment and labor saving devices"

Most of the ideas for the improvement of O&M equipment will have to come from the project people who are actually using the machines and who recognize the need for certain modifications or changes in the commercial models to better adapt them for O&M use. So please do not be backward about funneling your ideas in to your Regional Chief of Irrigation Operations who will pass them on to the Chief Engineer's office, Code 206. If people on several projects want a certain improvement made on a piece of equipment, they stand a much better chance of getting the manufacturer to make that improvement if they join their voices through this means.

The various information items contained in this release will, no doubt, remind you operators of a number of kinks you have developed to simplify your own work and which some other operator could use to very good advantage. Ideas for small items are often as valuable as more impressive ones but, whatever the size of the gadget, let us have a full description of its construction and use together with a photo or drawing - at least enough information so we can pass the idea on to the next fellow - and we will carry on from there.

\* \* \* \*

# PNEUMATICALLY APPLIED CEMENT MORTAR

## Relining of South Canal - Orland Project

### Installation Procedure and Summary of Costs

The reach of canal treated extends below the outlet of Newville Road crossing siphon for 3,983 lineal feet (Station 348+45 to 308+62). The original concrete lining was placed better than 30 years ago, averaging about 2" thick and varying in perimeter from 22.6' to 30.1'. The old lining was cleaned with steel bristle brushes and washed down with water. All cavities in the lining were cleaned, and those exceeding an area of one square foot were filled with a soil cement mix (7 to 1) several days prior to the guniting. The smaller cavities were filled with cement mortar and incorporated in the relining during the guniting proper.

The relining of the canal slopes was extended six inches beyond the top of original lining, butting against 1" x 4" forms. Weeds and grass growing at the edges of the lining and on the earth embankments were oil sprayed. The cement mortar was pneumatically applied at about 60 or 70 pounds, utilizing a "Jetcrete" machine, Model "240-C", through 150' of 1 1/2" high pressure hose and controlled with a Hamm type nozzle. Mix proportion of the mortar was generally one part by weight of cement to four parts by weight of sand. Sand meeting Government specifications with particle size 3/16", or under was obtained locally out of Stony Creek channel. Cement from Permanente was delivered to the project headquarters in sack. It was found to be most economical to dry batch the aggregates at the project headquarters in a 7 sack concrete mixer and deliver to the "Jetcrete" machine on the job. The dry batch was shoveled continuously and directly into the hopper of the machine. A 500 gallon tank carried on a flat bed truck supplied water. The dump trucks providing the aggregate picked up the sand at the gravel plant on their return trips to the concrete mixer at the project headquarters. This procedure was highly successful as it eliminated any stock piling of either sand or cement along side the canal adjacent to the county road and necessitated no clean up as the work progressed. No cement or sand was lost over weekends or periods of close-down.

No unusual trouble occurred during the installation, although the personnel engaged in the work were unfamiliar with it. As might be expected, there was an excess of "rebound" which materially lessened as the job continued. An average of nine men were engaged daily in the operations which covered a total of 37 working days. The guniting required 23 days with an average daily production of 150 lineal feet of canal relined or approximately 21.5 cubic yards of cement mortar placed 1 1/2" thick. Occasionally, daily runs reached 200 lineal feet or better.

False joints at 8' centers were struck transversely across the green surface of the mortar on about half the total length; in the remaining reach, they were omitted. No membrane curing was applied to any of the new surface.



Orland Project South Canal after relining

A summary of the various costs follows:

<u>Items of work</u>	<u>Units of cost in dollars</u>		
	<u>Lin. ft.</u>	<u>Sq. yds.</u>	<u>Cu. yds.</u>
Oil Spray - lining edge and canal embankment	0.00628	0.0022	0.0506
Cleaning - patching - setting head boards for lining, etc.	0.434	0.153	3.502
Guniting	1.911	0.671	15.404
Equipment - repairs	0.058	0.0204	0.467
Supervision	0.123	0.0433	0.994
Subtotal	<u>2.532</u>	<u>0.889</u>	<u>20.417</u>
Replacement equipment	0.251	0.088	2.024
Grand total	<u>2.78</u>	<u>0.977</u>	<u>22.44</u>

The completed installation cost amounted to \$10,086.78, requiring 2,730 man-hours to place 494 cubic yards of cement mortar. The aggregate consisted of 3,215 sacks of cement and 760 tons of sand. Total cost of \$10,086.78 does not include depreciation of the "Jetcrete" equipment, placed at \$1,000 per annum for ten years.

This relining job accomplished by Bureau O&M personnel and costing an average of \$22.44 per cubic yard of mortar placed, compares with a similar relining job performed by contract during the winter of 1950-51. The contract job cost \$44 per cubic yard of mortar placed or nearly twice as much as the force account job. It is believed that costs could be reduced below \$22.44 per cubic yard as maintenance personnel become more familiar with the various operations entailed. While this

relining job was not a real big one it does demonstrate the possibilities of carrying out minor canal relining programs by maintenance personnel during the non-irrigation season, at substantial savings over contract costs for similar work.

A recent inspection of this work revealed no apparent defects.

\* \* \* \*



A Convenient Storage Rack for Small Parts

The storage rack depicted above is located in the warehouse of the Twin Falls Canal Company at Twin Falls, Idaho. The accessibility of all compartments and bins, and their arrangement to permit good lighting so that one can readily see what is in each bin, makes this a rather noteworthy piece of equipment.

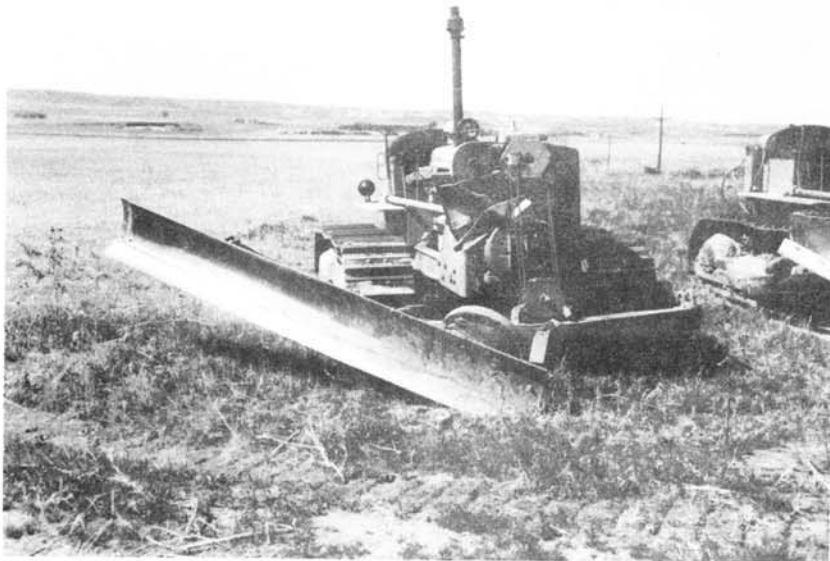
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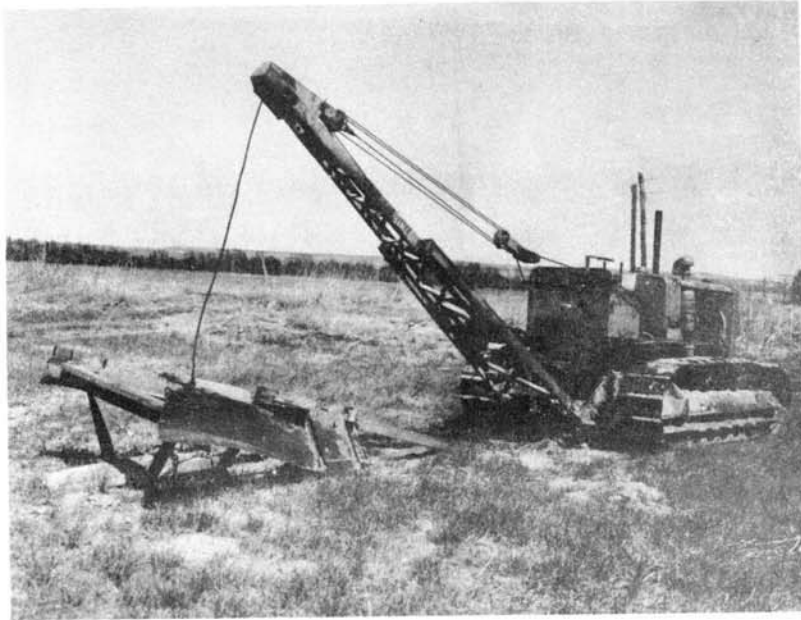
## Tractor Attachments



This ditch cleaning plow, built and used by the Northport Irrigation District on the North Platte Project, was made by modifying an ordinary snow plow. Laterals in sandy soils, such as prevail on the Northport system, are particularly well adapted to the use of this implement.



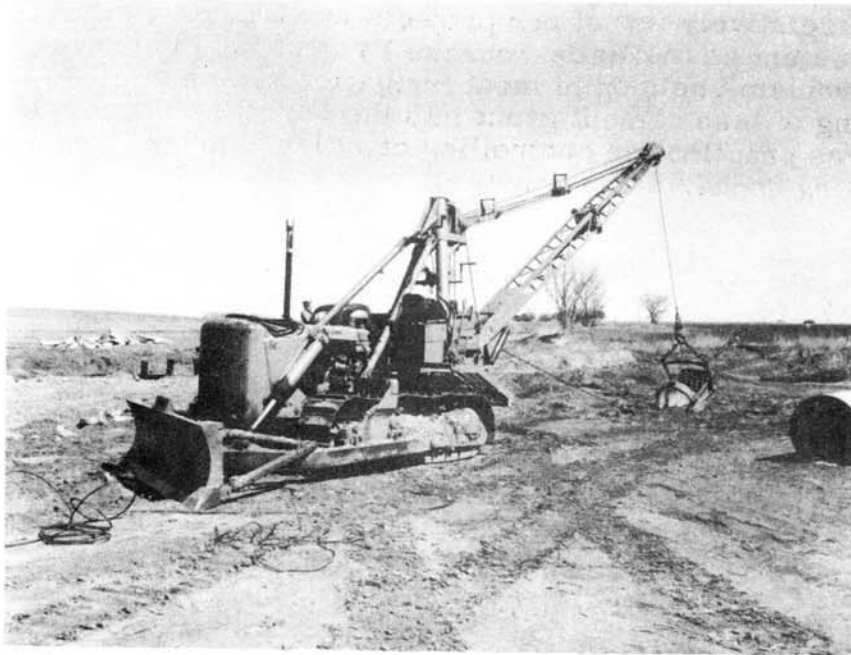
Here is another invention of the Northport Irrigation District. They find this cat mounted blade very useful in removing overhanging berms and in dressing up their canal banks.



The Northport Irrigation District has rebuilt the Hyster boom on this tractor and uses it to handle the remodeled Chatten ditcher. They have found that the boom is very handy to give greater maneuverability to the ditcher and to lift it out of the lateral in by-passing structures. The draft of the ditcher is taken by the tractor drawbar.



The Farmer's Irrigation District on the North Platte Project also recognizes the usefulness of a boom and hoist arrangement on a tractor. While the equipment is being used as a crane for placing pipe in this photo, the machine is also used in the manner shown in the foregoing picture.



This Hyster dragline attachment, mounted on a D-6 tractor-dozer, is owned by the Farmers Irrigation District on the North Platte Project. The District uses this piece of equipment for a number of jobs such as; cleaning canals and drains that are not readily accessible for other cleaning equipment, loading trucks and excavating structure foundations.

\* \* \* \*

#### Portable Power for Electric Hand Tools

The Carlsbad Irrigation District at Carlsbad, New Mexico, reports that they have found that a portable generator furnishing power for electric hand tools has been a big help to them in getting their maintenance and structure work done. The generator is powered by a 3 h. p. air cooled gasoline engine and the set is mounted on a two wheeled truck for easy maneuverability. It is readily hauled to field, with the other tools, where it furnishes power for two skill saws, an electric drill, an electric chipping hammer, electric buffing brushes, paint spray guns, concrete vibrators or other electrical equipment. The generator puts out 120 volts AC so that the same tools used in the headquarters shops may be used in the field.

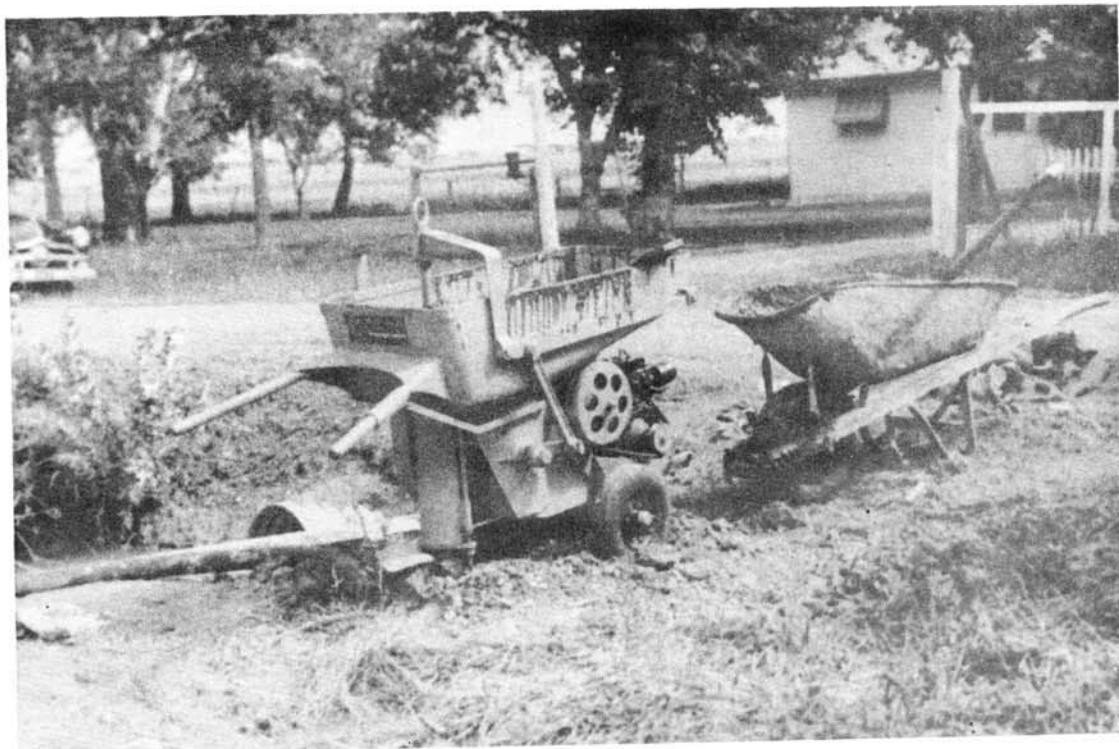
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#### Filling Animal Burrows in Canal and Lateral Banks

The April 1951 issue of the Reclamation Era carried an article entitled, "Belle Fourche vs Crayfish", which told of the damage done to the project canal and lateral banks and structures by these pests. The control methods utilized were also discussed.



While relatively few of our projects are troubled with crayfish to as great an extent as the Belle Fourche Project is, the burrowing of gophers is a problem common to most irrigation systems. It is believed that the pumping of lean cement grout into the burrows with a mud jack machine, as was practiced in controlling crayfish damage, might be applied to repairing gopher damage as well.



The machine shown here is a Koehring Mud Jack owned and used by the Belle Fourche Irrigation District. A slurry of 4 parts of top soil to one part of portland cement is pumped into the burrow under 20 to 40 pounds per square inch pressure. Solvent naphtha is added to the slurry to kill any crayfish which might be trapped in the burrow. If this treatment was being used on gopher holes it might be advisable to use Rosin-Amine-D Acetate as the chemical additive since that substance repels gophers.

\* \* \* \*

#### Crop Report Card Summarizing Simplified

Summarizing crop report data is recognized as one of the most unwanted and time consuming jobs falling upon the operating project. Nevertheless, it must be done and any means of simplifying the process are usually welcomed. Following is a description of a procedure originated by F. C. Winkler, Project Manager of the Belle Fourche Project, which has saved that project thousands of dollars in labor over a few years. Some other projects in Region 6 have adopted this system also and it is understood that similar systems are in use in some areas.

This system eliminates the use of the "Abstract of Form 7-332" form and the laborious copying of the data from the Form 7-332 card to the summary sheet.

In collecting the data from the farmers, each ditchrider is supplied with the cards for all of the units on his beat and is instructed to obtain, in addition to the data on page 1 and the acreage data on page 4 of the card, only the acres in each crop and the yields of those crops. He is not to compute total values. Every other day he sends the project office the cards completed at that time.

As the cards reach the project office, the acreage figures are balanced to agree with the irrigable acreage figure for each unit and the cards are sorted according to the way they are to be summarized, that is, by counties, by land classes, etc. A group of cards, from a dozen to fifty or more, is then summarized by taking individual items from the cards directly to the adding machine, the totals being entered on a new 7-332 card marked "Summary." For instance, the item "Acres of Barley" is taken from each card, totaled, and entered on the summary card. Then another item such as "Yield of Barley" is handled likewise and so on until all of the data on the group of cards have been summarized on the summary card. If two adding machines are used, two items may be summarized each time through the cards. The summary cards are then summarized and the totals of acreages and yields are entered on Form 7-316 where values are computed and totaled to complete the report.

\* \* \* \*

UNITED STATES  
DEPARTMENT OF THE INTERIOR  
BUREAU OF RECLAMATION  
Office of the Chief Engineer  
Denver Federal Center  
Denver, Colorado

PREFABRICATED ASPHALTIC CANAL LINING MATERIALS

There are numerous types of prefabricated asphaltic materials which may be used for lining irrigation canals and laterals for seepage control. Many of these are in the laboratory investigational phase. Some are proposed but have not yet reached the testing stage. Others have passed through the preliminary laboratory testing phase and are in service in a number of experimental and demonstrational installations.

Test installations of prefabricated asphaltic linings date from early 1950. Recent inspections of these test sections reveal that the materials are giving good service and many more years of useful life are expected from them.

Any or all of the materials briefly discussed herein are considered satisfactory for use as prefabricated canal linings. They have been subjected to intensive examination and testing in the laboratory and most of them have been installed in canals as experimental or demonstrational linings.

Light-weight prefabricated asphaltic membranes weigh 40 to 50 pounds per roll of 12 square yards. These have been designed to be competitive pricewise to other lower-cost types of canal linings. The width of prefabricated materials has been more or less standardized at 36 inches due to the influence of ready-roofing manufacturers. However, some manufacturers have expressed a willingness to produce canal linings at widths up to 60 inches if desired.

Prefabricated linings are particularly well adapted to conditions where the job proposed is rather small; where funds and time are limited; and where, for various reasons, it is not desired or possible to use contractual facilities. Linings of these types can be quickly and easily placed with unskilled labor and with a minimum of equipment. Smoothness of the subgrade upon which the lining is placed and care in placement of a good quality protective cover of earth and/or gravel are of prime importance in lining a canal with a prefabricated asphaltic membrane. The Bureau of Reclamation's tentative standards for membrane covers are given on Drawing No. 103-D-188, accompanying this report. These standards may serve to guide those individuals who may be unfamiliar with membrane lining installation practices.

The types of prefabricated asphaltic membrane canal lining materials now available and which have been thoroughly tested in the laboratory are:

- a. Bureau-type, paper-backed (heavyweight)  
(An unreinforced film of asphalt on kraft paper)
- b. Glass-fiber reinforced (heavyweight)  
(A glass fiber mat, coated on both sides with asphalt)
- c. Glass-fiber reinforced (lightweight)  
(Similar to b.)
- d. Asbestos reinforced (lightweight)  
(Saturated asbestos felt, coated on both sides with asphalt)
- e. Organic-felt reinforced (lightweight)  
(Saturated rag-felt (organic), coated on both sides with asphalt)

All of the above types of linings were designed for use with a protective cover. (See attached drawing.)

#### Bureau-type Paper-backed Prefabricated Asphaltic Lining

The Bureau-type paper-backed prefabricated asphaltic lining consists of catalytically-blown asphalt equivalent to 1 gallon per square yard spread on Kraft paper. This amount of asphalt provides a membrane approximately 3/16-inch in thickness. It is, like all available prefabricated materials, packaged in rolls 36 inches in width and 36 feet in length. The weight per roll is about 130 pounds. The Kraft paper is intended only to facilitate in manufacture and handling.

This product has been found quite difficult to handle because of its weight, and the fact that it tends to stick together in the rolls upon storing. It also has a tendency to crack as it is unrolled, especially when temperatures of 50° F and below prevail. However, existing installations of this type, carefully placed, are giving excellent results.

The disadvantages cited could be easily corrected by the manufacturers. Should a demand develop for the Bureau-type lining material, the following steps would be taken. Finished weight of the lining would be reduced to 70 or 80 pounds per roll, which would provide greater flexibility. A substantial layer of mica or other dusting material would be used which would eliminate the tendency to stick in the rolls during shipping and storage. Rolls would be prepared with the asphalt coating face out, which would minimize cracking when unrolled during low temperatures.

Several field installations have been made using paper-backed prefabricated liners of P<sub>2</sub>O<sub>5</sub> catalytically-blown asphalt. While the use of "cat-blown" asphalts in which FeCl<sub>3</sub> was employed as the catalyst has been discouraged and is not acceptable under existing specifications, one field installation was made of FeCl<sub>3</sub> "cat-blown" asphalt on Kraft paper.

The best information available indicates that costs will be 50 to 60 cents per square yard fob factory for this type of lining.

The Lloyd A. Fry Roofing Company, Fifty-ninth and Archer Road, Chicago, Illinois, manufactures the heavy, paper-backed, catalytically-blown asphaltic material.

A lightweight paper-backed material is being produced by the Certainteed Corporation, 1014 Chesley Avenue, Richmond, California. This product, based on laboratory examination, seems to be a very satisfactory lining material. Most of the objections to the earlier heavy paper-backed type of lining materials have been successfully overcome. This material consists of a low-penetration, high-softening point, filled, air-blown asphalt. It is pliable and tough. Its resistance to cracking is high at low temperatures. Its weight is about 70 to 80 pounds per roll, and it does not stick together in the roll during storage. There is no available information relative to price.

#### Glass-fiber Reinforced Prefabricated Asphaltic Lining (Heavy-type)

The heavy-type glass-fiber reinforced lining material has been produced by the Kerr-McGee Oil Industries, Oklahoma City, on manufacturing specifications of the Owens-Corning Fiberglas Corporation of Toledo, Ohio. The glass-fiber mat is saturated and coated with a filled air-blown, low-penetration, high-softening-point asphalt.

This material weighs about 80 pounds per roll and costs 50 to 55 cents per square yard fob factory. It handles very easily, is easy to install, does not stick together in the rolls during storage, and is not as liable to crack as the paper-backed type when unrolled during low temperatures. It is a little stiffer than some of the subsequently developed lighter materials. This stiffness is likely to cause "fish mouths" occasionally at the laps during placement, but does not seem to prevent it from conforming well to the subbase.

Several very successful and satisfactory test installations have been made using this material. Recent inspections of materials installed early in 1950 indicate that where the lining was covered with a protective earth cover it is in very good condition, having retained much of its original characteristics, and appearing watertight.

#### Glass-fiber Reinforced Prefabricated Asphaltic Lining (Lightweight)

The industrial firms which have become interested in the manufacture of the lightweight prefabricated linings have suggested that prices can be expected to be 30 to 35 cents per square yard delivered. These prices are, however, based on quantity shipments.



These lightweight linings are very easily installed and are sufficiently pliable to conform well to minor irregularities in the subgrade on which they are laid. Glass fibers impart slightly greater strength to the linings than do most other types of reinforcing mats.

Lightweight glass-fiber reinforced asphaltic prefabricated materials are being manufactured by the following firms:

Owens-Corning Fiberglas Corporation, Toledo, Ohio

Kerr-McGee Oil Industries, Incorporated, Oklahoma City, Oklahoma. (Owens-Corning Fiberglas Corporation specifications.)

Glass Fibers, Incorporated, Toledo, Ohio

American Asphalt Roof Corporation, Kansas City, Missouri

#### Asbestos-reinforced Prefabricated Asphaltic Linings

The asbestos-reinforced prefabricated asphaltic lining material is very similar to the glass fiber reinforced material except that in the former an asbestos mat weighing about 9 pounds per square is used for reinforcing.

Two test installations using asbestos-reinforced prefabrications were made in the early part of 1952.

Both the glass- and asbestos-reinforced materials are quite resistant to rotting or decay in the soil. Bureau tests of canal lining materials, in the A. S. T. M. standard compost material, show that the type of asphalt recommended for canal lining is very resistant to attack by soil micro-organisms. Both glass and asbestos reinforcing mats are practically immune to such attack.

Asbestos-reinforced prefabricated linings are available from Johns-Manville Products Corporation, Pittsburg, California and Waukegan, Illinois, and the Rubberoid Company, 500 Fifth Avenue, New York City, New York.

#### Organic-felt Reinforced Prefabricated Asphaltic Linings

Reinforcing felts of organic materials (rag fibers, wood fibers, etc.), also are saturated and coated with asphalt for use as canal linings. The weight of these materials is within 40 to 50 pounds per roll and the price is expected to be under 35 cents per square yard. One test installation of this type of lining has been made.

These lining materials are available from the Rubberoid Company, 500 Fifth Avenue, New York and from Pabco Incorporated, Fourth and Brannan Streets, San Francisco, California.

Laboratory tests have shown that organic types of reinforcing felts require very thorough saturation with asphalt to obtain necessary resistance to attack by soil micro-organisms.

### Lap Cements

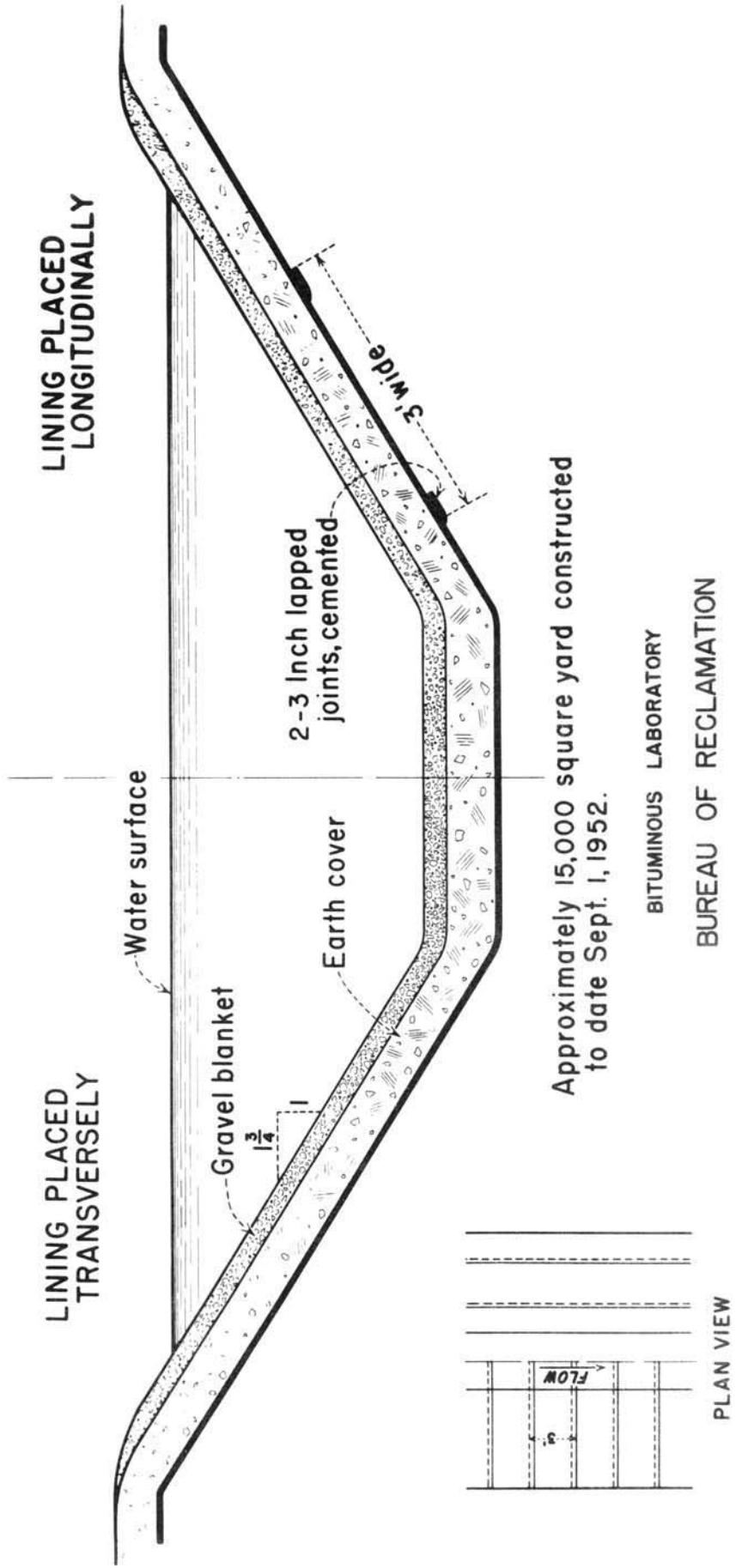
Asphalt cut-backs, either RC-O or RC-1 have been used as lap cements in cementing the edges of the lining material together where it is lapped. Several manufacturers of lining materials have developed lap cements which have been found superior to the lighter cut-backs used heretofore. These lap cements are obtainable with the lining material. A good quality lap cement should dry rapidly to a tacky consistency and should be sufficiently viscous to make a firm water-tight joint. They, therefore, should be the "quick-setting" type.

### Costs

The prices for the various types of materials that have been mentioned are based on information from the manufacturers and are for car-load lots. The minimum car-load is 40,000 pounds, shipping weight. Purchase of less than car-load lots would of necessity increase the cost of the materials.

If any further information is desired, it may be obtained by writing the Chief Engineer, United States Bureau of Reclamation, Denver Federal Center, Denver, Colorado, attention 295. Manufacturers also may be contacted directly.

# PREFABRICATED BURIED MEMBRANE



**NOTES**

The cover materials shall have hard dense durable rock fragments in the percentages by weight shown in the following tabulation:

MATERIAL	MINIMUM % RETAINED (By Weight)	SCREEN SIZE
1. Gravel, Flat, Belt	25	No. 4
2. Earth Material	25	3/4 inch
3. Gravelly Material	45	3/4 inch
4. Gravel	10	3 inch
5. Screened Gravel	10	10

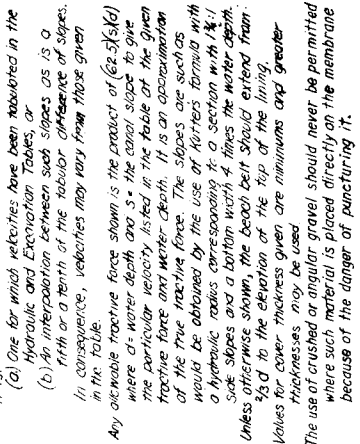
See slopes of canals with water depths greater than 2.5 ft to be 1 1/2 ft if gravel of cover materials are angular or subangular and 2 ft if they are well rounded. The velocities of the table are shown to hundreds of a foot per second to make a smoothly graded table. In the determination of slopes, it is desirable for the convenience of survey work to select each slope so that it is:

(a) One for which velocities have been tabulated in the Hydraulic and Elevation Tables, or

(b) An interpolation between such slopes as is a fifth or a tenth of the tabular difference of slopes. In consequence, velocities may vary from those given in the Table.

Any obtainable tractive force shown is the product of (62.3)(s)(d) where d = water depth and s = the canal slope to give the particular velocity listed in the Table of the given tractive force and water depth. It is an approximation of the true tractive force. The slopes are such as would be obtained by the use of A.H. Turner's formula with a hydraulic radius corresponding to a section with 1/4:1 side slopes and a bottom width 4 times the water depth. Unless otherwise shown, the bench belt should extend from 1/2 d to the elevation of the top of the lining. Values for cover thickness given are minimum and greater thicknesses may be used.

\*\*The use of crushed or angular gravel should never be permitted where such material is placed directly on the membrane because of the danger of puncturing it.



UNITED STATES  
DEPARTMENT OF THE INTERIOR  
BUREAU OF RECLAMATION  
**BURIED ASPHALT MEMBRANE LINED CANALS**  
TENTATIVE STANDARDS FOR COVERERS  
USING NON-COESIVE MATERIALS

APPROVED  
FEBRUARY 6, 1951  
103-D-168

DR. W. L. B. ... SUBMITTED ...  
S. ... RECOMMENDED ...  
S. ... APPROVED ...

This drawing approved  
July 19, 1951 by Chief  
Engineer as part of  
Field Trip Report  
dated May 9, 1951 by  
Engineers J. R. Benson  
and I. B. Hosig.

Water Depth - d (feet)	Membrane Freeboard - FB (feet)	Bench Belt (1)	Earth Cover (2)		Gravelly Material (3)		Earth or Gravelly Material with Gravel Topping (2 x 1/4 in. - 4)		Earth or Gravelly Material with Screener Gravel Topping (2 x 1/4 in. - 4)		Gravel (4)		Screened Gravel (5)	
			Slope	Max Velocity (ft/sec)	Slope	Max Velocity (ft/sec)	Slope	Max Velocity (ft/sec)	Slope	Max Velocity (ft/sec)	Slope	Max Velocity (ft/sec)	Slope	Max Velocity (ft/sec)
1.0	0.5	0	12	122	10	159	9	4	190	8	3	7	2.45	
1.5	0.6	0	12	133	10	168	9	4	190	8	3	7	2.54	
2.0	0.6	0	12	142	10	180	9	4	201	8	3	7	2.64	
2.5	0.7	0	13	144	11	181	9	4	203	8	3	7	2.66	
3.0	0.7	0	13	147	11	185	9	4	207	8	3	7	2.70	
3.5	0.8	0	13	150	11	188	9	4	211	8	3	7	2.75	
4.0	0.8	0	14	151	11	190	9	4	212	8	3	7	2.77	
4.5	0.8	0	14	154	12	192	9	4	216	8	3	7	2.81	
5.0	0.9	1 1/2	14	156	12	195	9	4	219	8	3	7	2.86	
5.5	0.9	2	15	157	13	197	11	5	220	10	4	8	2.88	
6.0	0.9	2	15	158	13	199	11	5	222	10	4	8	2.91	
6.5	0.9	2	15	161	13	201	11	5	223	10	4	8	2.95	
7.0	1.0	2	16	163	13	203	11	5	224	10	4	8	2.97	
7.5	1.0	2	16	164	13	205	11	5	229	10	4	8	3.09	
8.0	1.0	2	16	167	13	207	11	5	231	10	4	8	3.11	
8.5	1.1	2 1/2	17	168	14	209	12	5	233	11	4	10	3.04	
9.0	1.1	2 1/2	17	170	14	210	12	5	235	11	4	10	3.07	
9.5	1.1	2 1/2	17	171	14	211	12	5	237	11	4	10	3.10	
10.0	1.1	2 1/2	18	172	15	212	13	6	239	12	4	11	3.13	
10.5	1.2	3	18	174	15	214	13	6	241	12	4	11	3.15	
11.0	1.2	3	18	175	15	216	13	6	242	13	5	12	3.16	
11.5	1.2	3	19	176	15	217	13	6	244	13	5	12	3.19	
12.0	1.3	3	19	177	15	218	14	6	244	13	5	12	3.21	
12.5	1.3	3	19	178	15	219	14	6	245	13	5	12	3.22	
13.0	1.3	3	19	180	15	220	14	6	246	13	5	12	3.25	
13.5	1.4	3	20	181	16	221	15	7	247	13	5	12	3.27	
14.0	1.4	3	20	182	16	223	15	7	248	13	5	12	3.27	
14.5	1.4	3	20	183	16	224	15	7	249	13	5	12	3.28	
15.0	1.4	3	21	184	17	225	15	7	251	13	5	12	3.30	
15.5	1.5	3 1/2	21	185	17	226	15	7	252	13	5	12	3.32	
16.0	1.5	3 1/2	21	186	17	227	15	7	253	13	5	12	3.32	
16.5	1.5	3 1/2	22	187	17	228	16	7	254	14	5	12	3.33	
17.0	1.5	3 1/2	22	188	17	229	16	7	255	14	5	12	3.35	
17.5	1.5	3 1/2	22	189	17	231	16	7	256	14	5	12	3.37	
18.0	1.5	4	23	189	18	231	16	7	257	14	5	12	3.38	
18.5	1.5	4	23	190	18	232	16	7	259	14	5	12	3.39	
19.0	1.5	4	23	191	18	234	16	7	259	14	5	12	3.41	
19.5	1.5	4	24	192	18	234	17	7	260	14	5	12	3.42	
20.0	1.5	4	24	193	19	235	17	7	261	16	6	13	3.43	
20.5	1.5	4	24	194	19	237	17	7	262	16	6	13	3.45	
21.0	1.5	4	24	194	19	237	18	8	263	16	6	13	3.45	
21.5	1.5	4	24	195	19	242	18	8	263	16	6	13	3.53	