

PORTLAND CEMENT ASSOCIATION
ATTN: LIBRARY
33 WEST GRAND AVE.
CHICAGO 10, ILLINOIS 12

ERN

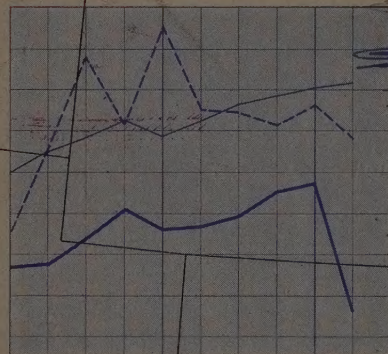
CONSTRUCTION

INDEX COPY

Do Not Mark or Mutilate

1953

LMA
JAF
PF
GKR
~~HAT~~
WH
JAL
EGR
WEB
JSS



MANPOWER—
Getting the
most "mileage"
from Western
highway staffs

KEEPING THE RIGS ROLLING—
Ten tips for steady production



HIGHWAY COSTS DROPPING? —
Oregon adds to Western record

HOT STUFF FOR MAINTENANCE MEN—
You can pull a patcher right to the pothole



ANNUAL HIGHWAY ISSUE
JUNE 1953

2 facts to remember about your **AIR COMPRESSOR LUBRICATION**



THE TEXACO SIMPLIFIED LUBRICATION PLAN will handle ALL your major lubrication with *not more than six* Texaco Lubricants — will save you time, money and mistakes. Let a Texaco Lubrication Engineer present the Simplified Lubrication Plan that will best serve you.

Courtesy Joy Mfg. Co.

Fact No. 1: You have to lubricate according to the particular operating conditions. An oil suitable for normal service, for instance, will not be right where rusting conditions are bad. There is no *one* oil that can give top results under *all* conditions.

Fact No. 2: You can get an oil from Texaco that will assure clean, low-cost compressor performance *under your particular operating conditions*. There is a complete line of Texaco air compressor oils — covering every operating condition and every type and size of compressor.

For longer drill life, use *Texaco Rock Drill Lubricant EP*. It guards against wear, and protects against rust whether drills are running or idle.

A Texaco Lubrication Engineer can help you step up efficiency and cut maintenance costs for all your equipment. Just call the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States, or write:

☆ ☆ ☆

The Texas Company, 135 East 42nd Street, New York 17, N. Y.



TEXACO Lubricants and Fuels

FOR ALL CONTRACTORS' EQUIPMENT

NORTHWEST

**makes the
Dragline jobs**

EASIER!

**NINE
NORTHWESTS**
for Claude C. Wood Co.,
Lodi, California

Here's another California Contractor that has steadily added to his Northwest fleet. He found out what Northwest advantages mean on dragline work with his first Northwest, and he's been a Northwest user ever since.

Northwest Draglines bring you a combination of advantages that lets you get the most out of a job. Northwest Crawler mechanism with self-cleaning action stands up under the abuse of long travel. Travel gears are fully enclosed and run in oil. Smooth swing, assured by Uniform Pressure Swing Clutches, makes spot-

ting easier and reduces spillage at the truck. The "Feather-Touch" Clutch Control takes fatigue out of operation without resorting to complicated valves, pumps and tubing. Simplicity of design assures easy upkeep. The Northwest Cushion Clutch eliminates shock overloads before the overload reaches the machinery. These and other Northwest advantages combine to make one out of every three Northwests sold a *repeat order* in the hands of successful contractors. You can plan to have these advantages. Talk to a Northwest Man.

NORTHWEST ENGINEERING COMPANY
135 South LaSalle Street, Chicago 3, Illinois

Local NORTHWEST sales agents

BUTTE, MONT., Hall-Perry Machinery Co.

RENO, NEVADA, Sierra Machinery Co., Inc.

CHEYENNE, WYO., Wilson Equip. & Supply Co.

SALT LAKE CITY, UTAH, Arnold Machinery Co.

MEDFORD, ORE., Cal-Ore Machinery Co., Inc.,

PORTLAND, ORE., Balzer Machinery Co.

DENVER, COLO., Constructors Equipment Co.

NORTHWEST SALES OFFICES:

LOS ANGELES, CALIF.
3707 Santa Fe Ave.

SAN FRANCISCO, CALIF.
255 Tenth Street

SEATTLE, WASHINGTON
1234 Sixth Ave., South

*Successful
Contractors
Stay Successful
with
Proved Equipment*

WESTERN

CONSTRUCTION

Volume 28

JUNE 1953

Number 6

ARTICLES

- West begins new era of highway construction 59
- A practical look at highway construction costs 60
- Pulling the patcher to the pothole—pro and con 63
- New Mexico four-lanes U. S. Highway 66 66
- 1953 season opens on the WASHO Test Road 68
- Bringing roads up to date in Douglas County, Ore. . . . 69
By WALLY M. HECTOR
- Chemical weed control use—a comparative study 71
By W. A. HARVEY
- MANPOWER—How to get and keep it 74
- Give your equipment a break so it won't break you 83
- Prestressed concrete for Northwest logging bridges 87
- Bituminous stabilized base course built in Colorado 91
By J. R. BANNING
- Proper lubrication keeps road equipment on the job 95
- Concrete paving program by municipal bond issue 100
- Biggest highway embankment for Idaho 103
- The Sand Equivalent Test—For use in the field 107
By F. N. HVEEM
- Emulsified asphalt improves poor-quality aggregates 115
- Colorado studies truck sizes and weights 119
By HAROLD N. KINDRED
- The portable rock plant—A story of 25 years' growth 122
By MELVIN OVESTRUD

DEPARTMENTS

- | | | | |
|---------------------------------|-----|-------------------------------------|-----|
| Editorial Comment | 57 | Bids and Contracts | 162 |
| How It Was Done | 128 | Unit Bid Prices | 170 |
| News Review | 137 | New Literature | 190 |
| Alaska Newsletter | 146 | New Equipment | 194 |
| New Books | 148 | News of Distributors | 206 |
| Safety | 150 | Classified Advertising | 210 |
| Engineers On the Move | 152 | Advertisers In This Issue | 213 |
| Supervising the Jobs | 156 | Backfill, uncompacted | 214 |

Editorial Director
JAMES J. BALLARD

Executive Editor
Ralph Whitaker, Jr.

Managing Editor
John J. Timmer

Assistant Editor
Howard M. Smith

News Editor
June A. Siringer

Editorial Assistant
M. A. Carroll

★

Published Monthly by

KING PUBLICATIONS

609 Mission Street
San Francisco 5, Calif.
Telephone YUkon 2-4343

James I. Ballard President
Franklin B. Lyons Vice President
L. P. Vretos V. P. & Treasurer
E. F. Hubbard Circulation Mgr.
R. L. von Thurn Asst. Circ. Mgr.
Gerald Ray Production Mgr.

Please address all communications to
the San Francisco Office

★

District Offices

NEW YORK OFFICE

Richard J. Murphy, Eastern Manager
107-51 131st Street
Richmond Hill 19, New York
Telephone Jamaica 9-2651

CLEVELAND OFFICE

Clifford E. Beavan, District Manager
3307 E. 149th St., Cleveland 20, Ohio
Telephone SKyline 1-6552

CHICAGO OFFICE

A. C. Petersen, District Manager
3423 Prairie Ave., Brookfield, Ill.
Telephone Brookfield 532

SAN FRANCISCO OFFICE

V. C. Dowdle, District Manager
609 Mission St., San Francisco 5, Calif.
Telephone YUkon 2-4343

LOS ANGELES OFFICE

Jerome E. Badgley, District Manager
128 So. Mansfield Ave., Los Angeles 36
Telephone WEbster 8-8512

PACIFIC NORTHWEST

Arthur J. Urbain, District Manager
609 Mission St., San Francisco 5, Calif.
Telephone YUkon 2-4343



Subscription Rates

The annual subscription rate is \$4
in the United States and countries
in the Pan American Postal Union.
All other countries, \$5 per year.
Single Copies, 35¢

Send your new address along with
old address, enclosing if possible
your address label, to Circulation
Department, Western Construction,
609 Mission St., San Francisco 5,
Calif. Allow one month for the
change to become effective.

★

Entered as Second Class Matter at the
Post Office in San Francisco, California
under the Act of March 3, 1879.
Copyright, 1953 by King Publications.

JAMES I. BALLARD	Editorial Director
RALPH WHITAKER, Jr.	Executive Editor
JOHN J. TIMMER	Managing Editor

Bay bridge badminton

Like the sparrow caught in the badminton game, the proposals for an additional crossing between San Francisco and the East Bay communities have been batted back and forth in legislative committees. No engineering project is improved with this type of treatment. Logic and technical considerations are soon submerged in the political struggling of local interests. Representatives only remotely concerned with the basic question quickly assert a disproportionate influence. This situation, of course, is the same at city, state or the national level, and is an element of democracy in action.

However, the professional engineer becomes righteously indignant when problems that are primarily technical develop into political squabbles, and he cannot help but compare the procedure to legislating the decision of a doctor. Engineering projects of any magnitude have a large element of public interest, and therefore get lost in the realm ruled by the "representatives of the people." This will continue until a new generation of engineers arises to assume leadership in public affairs.

Getting back to the situation now confusing the Bay bridge proposals, the unsolved problem is the jealous rivalry between two large metropolitan communities. Until their differences are reconciled and a mutual urge for regional progress is established there will be no answer or advance. Possibly engineers who are concerned about the current political wrangling should take more interest in finding a solution to the problem of regional development. Engineering thinking and ability are badly needed at the level of civic leadership.

Contractors' debt to the colleges

Support of education by business has been a subject of increasing discussion in recent years. The tax advantage angle has been an important consideration for such support, and it is perhaps the sole basis for contributions by many firms. But there are sound arguments that are far-reaching in their applications. There are arguments that apply to Western contractors which can be measured in terms of dollars almost as soon as tomorrow.

Take the case of one young civil engineering graduate who went to work for a large contractor working on the Central Valley project. This contractor had been using a standard design for his batch plant footings—an item duplicated a dozen times a year on various projects at a cost of about \$5,000 per installation. The young civil

engineer redesigned the footing in a day's time, coming up with a new standard that could be applied equally well under all conditions with slight modifications. The cost was halved. That engineer pretty well paid his freight.

The days of the Carnegies and Rockefellers are past. But the support which those men lent to American educational institutions should be continued. The need of contractors for college and university-trained engineers has increased tremendously. And so has the need of each institution to improve the educational job it is doing in the engineering field. Individual firms and the entire industry profit from the services of college-trained men. They would do well to find some method of investing in this operation that trains their engineers and executives of tomorrow. This is a dollars-and-cents proposition that should be readily apparent to all those contractors who have just completed their annual "recruiting" at Western engineering schools.

Construction follows demand

Water development in the West is not tied to any particular agency carrying out this vital work. Demand will always be the real initiating force, with agency influence coming second. Today there is a feeling of concern in some segments of the construction industry that the reshuffling and emphasis on economy in Federal agencies may result in serious curtailment of regional water development, an important part of Western construction activity. The answer to this anxiety lies in the steady growth of population and industry in the West, with the resulting demands for water, power and flood control. Some of the proposed projects in the "super" class will lend themselves to dividing into smaller units for stage construction, with financing more closely paralleling direct benefits. Others, put back on the shelf in the blueprint stage, will insure a backlog of projects for the future.

One characteristic of the new trend is the welcome return to development by private and local interests of all projects that can be handled at this level. On interstate streams there may be cases where Federal legal authority and financing are still necessary, but even in these situations the possibility of interstate pacts or authorities has never been fully explored in the West.

In general, the present trend, rather than being a threat to prospects for construction activity, is the opposite. Paced by the ever mounting pressure of Western growth the smaller projects, meaning more contracts and more equipment, will move out in front under local sponsorship, leaving as a solid reserve those super-projects that will be demanded tomorrow.

MIXING BLACKTOP



FINISHING SLOPES AND SHOULDERS



MOVING WINDROWS



GRADING SLOPES



CLEANING DITCHES



you've got to Swing that Rear-End for TOP performance

Austin-Western Power Graders do a superlative job on blacktop. ALL-WHEEL DRIVE provides the power and traction for high-speed operation. PRECISION SIDE SHIFT moves the blade in or out, as desired, while the grader is in motion. Ample throat room between top of blade and bottom of circle makes it possible to move a tremendous windrow without interference.

CONTROLLED TRACTION — product of exclusive ALL-WHEEL DRIVE and ALL-WHEEL STEER — places all wheels where they miss the windrow; moves a maximum amount of material the maximum distance. Yes, on oil mix, as on many other types of work, you've got to SWING THAT REAR-END for *top* performance.

...handling many other jobs

AUSTIN-WESTERN COMPANY · Subsidiary of Baldwin-Lima-Hamilton Corporation · AURORA, ILLINOIS, U.S.A.

ARIZONA—SHRIVER MACHINERY COMPANY.....Phoenix
CALIFORNIA—EDWARD R. BACON COMPANY.....San Francisco 10
CALIFORNIA—SMITH BOOTH USHER COMPANY.....Los Angeles 54
COLORADO—LIBERTY TRUCKS & PARTS COMPANY.....Denver 1
IDAHO—COLUMBIA EQUIPMENT COMPANY.....Boise
MONTANA—WESTERN CONSTRUCTION EQUIPMENT CO.....Billings
WYOMING—WILSON EQUIPMENT & SUPPLY COMPANY.....Cheyenne

MONTANA—WESTERN CONSTRUCTION EQUIPMENT CO.....Missoula
NEVADA—C. D. ROEDER EQUIPMENT COMPANY.....Reno
NEW MEXICO—N. C. RIBBLE COMPANY.....Albuquerque
OREGON—COLUMBIA EQUIPMENT COMPANY.....Portland 14
UTAH—WESTERN MACHINERY COMPANY.....Salt Lake City 15
WASHINGTON—COLUMBIA EQUIPMENT COMPANY.....Seattle

JUNE 1953

A NEW ERA in Western highway building

THE WEST is entering a new era of highway building. The first era began in the early twenties, with the extensive "out-of-the-mud" programs, and ended with the depression slow-down. Necessary curtailment of activities during World War II resulted in the build-up by war's end of a tremendous backlog of deficiencies in Western highway systems.

We have been entering the new era gradually since 1947. Continual year-to-year increases in state highway budgets, along with bond issues and toll financing, have attempted to cope with the deficiencies.

But now, with overall deficiencies still actually increasing and with a mounting population asserting further demands, Western states are going "all out" to meet the problem. Current legislative action indicates that there will be a truly major increase in Western highway building funds this year, and no slackening for the next several seasons.

This expanding activity is good news for the Western construction industry as a whole, but presents some serious problems as well. It creates a situation that demands the sharpening up of old ideas and the development of new ones in all phases of highway engineering and construction. The best procedure for securing this expansion in the fund of usable information is the exchange of ideas that could have mutual advantage.

This issue of *Western Construction* has been developed to provide this fund of "idea" material through interchange among the engineers and contractors of the West. The ideas exchanged are of value to all, and may provide assistance in the execution of construction pro-

grams such as are indicated by these legislative "straws in the wind."

The suggestion of tax revenues for highway improvements makes for political hassles over the allocation of new construction funds. Such discussion now delays the inevitable increase in the gas tax in California.

In Colorado, the question of method for taxing trucks and the possibility of using tax anticipation warrants are the legislative hurdles. By way of contrast, New Mexico legislators are concerned with a proposal that would direct part of the highway fund to pay state government overhead.

Wyoming wants a comprehensive two-year study of its entire highway system authorized. Washington discusses plans for several important bridge projects and a possible toll route connecting Puget Sound cities.

And so each Western state is legislating on, or has just concluded the enactment of, laws that will be the foundation for accelerating highway programs.

Estimate of the amount and form of this revenue increase cannot be definite at this date. Indications point to several increases in state gas levies, some bond financing, and some substantial increases in user fees for various classes of vehicles, with emphasis on weight differential. There will also be enabling acts to provide for the study of possible toll roads.

Add to all of these the normal increase in gas tax funds based on population growth, and the aggregate represents the approach to a new high plateau for the curve of highway engineering and construction activity in the West.

PLANNING • DESIGN • CONSTRUCTION • MAINTENANCE

Oregon's index and two unit cost breakdowns provide a good practical look at —

HIGHWAY CONSTRUCTION COSTS

AN OVERALL FORESIGHT of the trend of highway construction costs is a practical impossibility. The picture changes too rapidly. But "backsights" are possible.

Two backsights on highway construction costs in the West are the cost indexes maintained by the Oregon and California highway departments. These indexes represent a convenient method of determining the annual fluctuation of highway prices by relating them to a common base. Such comparisons are highly valuable for providing a factual means of studying the effect of known influencing factors on these costs. This in turn provides the means for interpretation of current factors.

Oregon's use of the index this year exemplifies the value of the method for estimating current bid prices. The index roughly portends the overall trend in the state. Two other cost tabulations, based on actual contract prices during 1952, provide the reference points. Used judiciously, the tabulations plus index provide a helpful guide for the preparation of preliminary estimates for 1953.

One breakdown gives the average contract bid prices of successful bidders on the various components of highway construction in Oregon during 1952. (For its usefulness as a reference, this entire tabulation is presented this month in the "Unit Bid Prices" section). The other shows the average cost per mile for each of the same components during 1952. For its reference value, and because it indicates so well the comparative cost "weight" of these components, this entire tabulation is presented here in slightly abstracted form.

(Note: All cost figures include 12½% for engineering and contingencies.)

AVERAGE CONTRACT COST PER MILE FOR COMPONENTS OF OREGON HIGHWAY CONSTRUCTION DURING 1952

GRADING—Common Excavation

Avg. Cut & Fill	Width of Grade in Feet			
	30	34	38	46
2-Foot	\$ 2,910	\$ 3,275	\$ 3,660	\$ 4,385
5-Foot	7,990	8,880	9,825	11,430
10-Foot	18,260	20,120	21,950	25,640
15-Foot	30,860	33,630	36,350	41,875
20-Foot	45,730	49,395	53,030	60,385
25-Foot	62,825	67,490	72,040	81,250
30-Foot	82,305	85,470	93,460	104,340

(Note: Average cost of excavation \$0.30 per cubic yard. Cost per mile includes overhaul, truck haul, finishing roadbed and slopes, and rounding cutbanks.)

GRADING—1/3 Solid; 2/3 Common

Avg. Cut & Fill	Width of Grade in Feet			
	30	34	38	46
2-Foot	\$ 4,350	\$ 4,900	\$ 5,430	\$ 6,535
5-Foot	11,890	13,235	14,605	16,975
10-Foot	27,150	29,870	32,585	38,065
15-Foot	45,845	49,905	54,015	62,215
20-Foot	67,935	73,340	78,770	89,630
25-Foot	93,325	100,175	106,980	120,635
30-Foot	122,215	130,370	138,455	154,905

(Note: Average cost of excavation \$0.54 per cubic yard. Cost per mile includes truck haul, overhaul, finishing roadbed and slopes, and rounding cutbanks.)

GRADING—2/3 Solid; 1/3 Common

Avg. Cut & Fill	Width of Grade in Feet			
	30	34	38	46
2-Foot	\$ 5,595	\$ 6,320	\$ 7,015	\$ 8,415
5-Foot	15,310	17,080	18,830	21,900
10-Foot	35,015	38,510	41,960	49,050
15-Foot	59,090	64,335	69,630	80,120
20-Foot	87,510	94,505	101,495	115,580
25-Foot	120,380	129,070	139,565	155,345
30-Foot	157,540	168,030	178,520	199,600

(Note: Average cost of excavation \$0.77 per cubic yard. Cost per mile includes truck haul, overhaul, finishing roadbed and slopes, and rounding cutbanks.)

GRADING—Solid

Avg. Cut & Fill	Width of Grade in Feet			
	30	34	38	46
2-Foot	\$ 7,450	\$ 8,410	\$ 9,290	\$11,190
5-Foot	20,400	22,725	25,025	29,090
10-Foot	46,565	51,210	55,885	65,150
15-Foot	78,585	85,605	92,500	106,515
20-Foot	116,460	125,755	135,050	153,535
25-Foot	160,000	171,715	183,335	206,665
30-Foot	209,595	223,230	237,375	265,450

(Note: Average cost of excavation \$1.00 per cubic yard. Cost per mile includes truck haul, overhaul, and finishing roadbed and slopes.)

CLEARING AND GRUBBING

Light	Width Cleared		
	60 Ft.	80 Ft.	100 Ft.
Sagebrush and juniper, Eastern Oregon, \$35.00 per acre.....	\$ 325	\$ 425	\$ 550
Scattered trees, brush, orchard, etc., \$125.00 per acre	1,200	1,600	2,000
Medium			
Southern Oregon, pine, fir, laurel, etc., \$400.00 per acre.....	3,650	4,800	6,000
Second growth fir, oak, maple, alder, etc., \$600.00 per acre.....	5,450	7,300	9,100
Heavy			
Cascade Range, \$850.00 per acre.....	8,100	10,800	13,500
Coast Range, \$1,500 per acre.....	15,200	20,400	25,300

(Note: Tractors, clearing dozers, donkeys, power saws, flame throwers and explosives are used when practical.)

DRAINAGE AND IRRIGATION

Including Box Culverts and Siphons

Location	Average Cost per Mile
Eastern Oregon	\$2,575
Central Oregon	2,100
Willamette Valley	3,325
Coast (Mountains)	6,875

Average cost of drain and culvert pipe per lineal foot in place including structural excavation and backfilling

4-in. concrete drain pipe	\$0.90
6-in. ditto	1.00
8-in. ditto	1.35
8-in. concrete sewer pipe	1.50
12-in. concrete culvert pipe	2.70
18-in. ditto	4.75
24-in. ditto	6.00
36-in. ditto	13.25
12-in. corrugated metal culvert pipe	3.50
18-in. ditto	5.70
24-in. ditto	8.00
30-in. ditto	9.50

36-in. ditto	14.00
48-in. ditto	21.00
Catch basins, each.....	85.00
Manholes, each	275.00
3 x 3 concrete box culverts, per ft., incl. wingwalls.....	26.00
4 x 4 ditto	36.50
5 x 5 ditto	46.50
6 x 6 ditto	57.00
8 x 8 ditto	74.00
9 x 9 ditto	84.50

(Note: Cost includes 12½ per cent for engineering and contingencies.)

TOPPING—Pit Run Gravel or Talus					
Compact Thickness	Width in Feet				
	26	30	34	38	42
3 Inches	\$1,655	\$1,905	\$2,145	\$2,405	\$2,660
6 Inches	3,355	3,850	4,360	4,860	5,360
9 Inches	5,100	5,850	6,600	7,355	8,105

(Note: Average cost \$0.95 per cubic yard. Cost per mile includes 20% for shrinkage and compaction.)

TOPPING—Pit Run Cinders

Compact Thickness	Top Width in Feet				
	26	30	34	38	42
3 Inches	\$1,225	\$1,410	\$1,600	\$1,785	\$1,970
6 Inches	2,490	2,855	3,230	3,600	3,975
9 Inches	3,780	4,335	4,895	5,450	6,010

(Note: Average cost \$0.65 per cubic yard. Cost per mile includes 30% for shrinkage and compaction.)

CRUSHED ROCK OR GRAVEL SURFACING

Compact Thickness	Width in Feet				
	26	30	34	38	42
2 Inches	\$ 3,185	\$ 3,670	\$ 4,150	\$ 4,640	\$ 5,130
4 Inches	6,410	7,380	8,360	9,310	10,280
6 Inches	9,715	10,030	12,630	14,090	15,530
8 inches	13,075	15,020	16,960	18,910	20,835
10 Inches	16,490	18,900	21,320	23,750	26,170

(Note: Average cost \$2.45 per cubic yard. Two sizes of crushed rock used when depth exceeds 2 inches. The average cost per mile includes 25% allowance for key shrinkage and compaction, and 30 gal. of water per cu. yd. of crushed rock.)

HIGHWAY COSTS LEVELING OFF . . . OR ARE THEY?

ARE COSTS for highway construction leveling off? Cost indexes maintained by the California and Oregon highway departments indicate that a slight drop or at least a leveling off in prices is occurring during the first half of 1953.

Here's the picture as of April 1953 according to E. H. Clymer, Chief Cost Analyst for the Oregon State Highway Department:

"Oregon highway construction bid prices increased steadily from the start of the Korean conflict in the second quarter of 1950 until the fourth quarter of 1952. During this period the Oregon composite cost index increased from 157.6 to 207.2, an increase of 31.5%.

"In the first quarter of 1953 there was a sharp drop in contract bid prices, which reduced the composite cost index to 176.3, a reduction of 14.9%.

"This sharp drop in contract bid prices can be attributed chiefly to the large number of contractors who were anxious to secure work. Excellent construction weather until late fall enabled many contractors to finish their work last year, and they now have a considerable amount of idle equipment and not sufficient work.

Construction costs on California highway projects during the 1953 first quarter were 3.5% lower than fourth quarter 1952, as reflected by the California cost index (the methods of preparation and usefulness of this index were reviewed in *Western Construction*, June 1952 pp. 61-63).

According to Richard H. Wilson, California Assistant State Highway Engineer, this 3.5% drop in the California index was almost entirely due to a 32% decline in the average price of roadway excavation

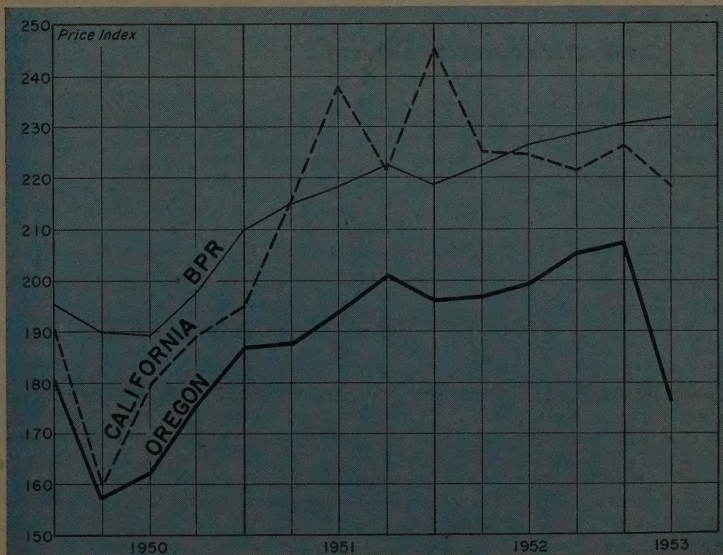
(from \$0.66 to \$0.45). While crushed rock and Portland cement concrete pavement were also down slightly, the average prices for other items used in compilation of the index registered increases (notably plant-mixed surfacing, structural concrete, bar reinforcing and structural steel).

These facts indicate that in spite of the 3.5% overall decline in California's index, costs of major items are still on the rise. It is thought that, in California as well as Oregon, the drop in roadway excavation merely reflects the seasonal effort of bidders who have completed work in the fall and early winter to insure their obtaining jobs during the coming construction season.

The Bureau of Public Roads Composite Mile Index, exhibiting less sensitivity than the two state indexes, climbed 0.7% for the first quarter of 1953. This index is based upon actual contract prices in the United States as a whole for construction of a mile of composite highway. Differences between it and the state indexes are accounted for by differences between local state costs and the average of costs over the entire nation.

Chief inflationary factor in the BPR index was a 3.9% increase in common excavation average cost, while structural steel and structural concrete each increased by less than 1.0%. Depressant on the index was a 4.0% decrease in the average cost of reinforcing steel.

Fluctuation of highway costs, 1950 into 1953



CRUSHED CINDER SURFACING

Compact Thickness	Top Width in Feet				
	26	30	34	38	42
1 Inch	\$1,135	\$1,305	\$1,480	\$1,655	\$1,825
2 Inches	2,270	2,615	2,960	3,305	3,650
3 Inches	3,430	3,955	4,475	4,995	5,515
4 Inches	4,600	5,290	5,980	6,675	7,365

(Note: Average cost \$1.70 per cubic yard. The average cost per mile includes 30% allowance for shrinkage and compaction, and 40 gallons of water per cubic yard of crushed cinders.)

SHOULDER ROCK SURFACING

Compact Thickness	Top Width in Feet (Each Side)				
	2	4	6	8	10
1 Inch	\$ 230	\$ 470	\$ 705	\$ 940	\$1,180
2 Inches	480	940	1,420	1,895	2,390
3 Inches	720	1,420	2,125	2,850	3,565
4 Inches	960	1,925	2,850	3,810	4,760
5 Inches	1,220	2,380	3,580	4,760	5,945

(Note: Average cost \$2.60 per cubic yard. Two sizes of crushed rock used when depth exceeds three inches. Average cost per mile includes 25% allowance for key, shrinkage and compaction, and thirty gallons of water per cubic yard of crushed rock.)

OIL MAT SURFACE TREATMENT

Average Thickness	Width in Feet		
	18	20	22
Spec. 0-9 3/4-in.	\$3,015	\$3,350	\$3,680
Spec. 0-11 1/4-in.	4,970	5,510	6,060
Spec. 0-30 3/4-in.	1,420	1,575	1,730
Spec. 0-31 3/16-in.	930	1,025	1,135

(Note: If a binder course is required add \$1,000 per mile.)

ROAD MIX SURFACE TREATMENT

	Width in Feet	
	18	20
2 inches thick	\$5,000	\$5,500
2½ inches thick	6,000	6,600

(Note: Cost per mile includes preparation of base, tack coat, aggregate, RC-3 cutback, mixing, finishing, and seal coat.)

BITUMINOUS MACADAM WEARING SURFACE

Type	Thickness	Width in Feet		
		18	20	24
B-2	2 Inches	\$6,725	\$ 7,475	\$ 8,225
B-3	2½ Inches	8,555	9,505	10,455
B-11	3 Inches	9,180	10,205	11,230

(Note: If a tack coat is required an additional 15 tons of asphalt and 150 cubic yards of aggregate would add \$1,000 to the cost per mile.)

ASPHALTIC CONCRETE PAVEMENT

Compact Thickness	Width in Feet			
	18	20	22	24
2-Inch	\$ 8,850	\$ 9,825	\$10,800	\$11,800
3-Inch	13,275	14,750	16,200	17,700
4-Inch	17,700	19,675	21,600	23,600
5-Inch	22,050	24,525	27,000	29,450

(Note: Based on Class A, B, C, D and E asphaltic concrete in place at \$6.50 per ton. One cubic yard equals 4,000 pounds. The cost per mile includes 5% for shrinkage and compaction.)

CUTBACK ASPHALTIC CONCRETE NON-SKID WEARING SURFACE

Compact Thickness	Width in Feet			
	18	20	22	24
1-Inch	\$3,750	\$4,200	\$4,600	\$5,000

(Note: Based on asphaltic concrete in place at \$6.50 per ton. One cubic yard equals 3,400 pounds. Five per cent allowed for shrinkage and compaction.)

PORTLAND CEMENT CONCRETE PAVEMENT

Thickness	Width of Pavement in Feet			
	18	20	22	24
Standard 8-inch	\$43,700	\$48,600	\$53,400	\$58,200
Standard 7-inch	39,700	44,100	48,600	52,900

(Note: Average bid price \$3.50 per square yard 8-inch standard concrete pavement. The average cost per mile includes 8% for sand cushion, dowels, tie bars, expansion and contraction joints as per standard specifications.)

GUARD FENCE, SIGHT POSTS, MAIL BOX POSTS AND POSTS AT BRIDGE APPROACHES

Flat—No Sharp Curves	\$ 300.00
Hilly—With Sharp Curves	1,500.00
Mountainous—With Extreme Sharp Curves	3,000.00

(Note: Based on guard fence at \$2.50 per lineal foot and sight posts and mail box posts at \$9.00 each.)

MISCELLANEOUS CONSTRUCTION

Cement Rubble Masonry	\$50.00	per Cubic Yard
Dry Rubble Masonry	16.00	per Cubic Yard
Rock Parapet Walls	16.00	per Lineal Foot
Riprap	6.00	per Cubic Yard
Concrete Curbs	1.60	per Lineal Foot
Concrete Sidewalks	3.50	per Square Yard

BRIDGES AND STRUCTURES

	Under 20 Ft. in Height	20 to 25 Ft. in Height	Over 25 Ft. in Height	Varied Heights
Composite Treated Timber Trestle	\$225.00	\$240.00	\$250.00	.....
Composite I-Beam Span	290.00	325.00	350.00	.....
Steel Trusses—120-ft. Span .....	.....	.....	.....	\$325.00
Steel Girders—60- to 90-ft. Span .....	.....	.....	.....	375.00
Concrete Arches—200-ft. Span .....	.....	.....	.....	600.00
Concrete Viaducts	300.00	340.00	375.00	.....

TRAFFIC LIGHT SIGNALS**At Intersections, Street Lighting and Electrical Signals at Railroad Crossings**

Traffic Lights:	
Flashing Signal Suspended at Middle of Intersection, Complete Installation	\$ 450.00
Traffic Signals—5 Lights, One in Center and Four Pedestrian Lights on Corners of Intersection, Complete Installation	3,750.00

Street Lighting, Metal Standards with Concrete Base:

Single Light	\$ 400.00
Twin Light	500.00
(Fully installed including transformers, wiring and accessories.)	

OREGON SENATE OKAYS SECOND COLUMBIA BRIDGE

A SECOND highway bridge across the Columbia River from Portland, Oregon, to Vancouver, Washington, came closer to reality in April when the Oregon Senate passed a bill, 18 to 11, permitting tolls to be collected on the present bridge to help pay for the new one.

The bill, which had already passed the House of Representatives, needed only agreement on minor changes by both houses and the signature of Governor Paul L. Patterson to become law. A similar bill had already passed the Washington legislature.

Senator Richard L. Neuberger, a Portland Democrat,

spearhead of the opposition, said that the tolls would be a "tariff barrier" which would cut Portland off from its markets in southwest Washington. The tolls would probably be 15 cents for cars and 50 cents for trucks.

Other opponents of the bill argued that it would work a hardship on college students and workers who have to cross the river twice daily.

Under provisions of the bill, Oregon would design and construct the new bridge, which would cost an estimated \$10,000,000, and the Washington Toll Bridge Authority would finance it, maintain it, and collect the tolls.

PULLING the PATCHER ...to the POTHOLE

Hot mix right on the job is the newest technique for filling in the ruts and holes on roads and highways—Here are the facts

HOTTEST subject of conversation among highway maintenance men and paving contractors recently has been the small trailer-type portable asphalt mixer. These towed mixers, introduced and developed only during the past year, are of especial interest to Western engineers and contractors because of the many miles of roads linking the cities, towns, and rural centers of the West in an asphalt web.

These roads are deteriorating at an ever-increasing rate because of the growing volume of traffic, both in numbers and weight, which uses them. And road maintenance, naturally enough, is causing increasing concern among highway engineers. A realistic view of maintenance practice, taking into consideration available funds as compared with traffic needs, will recognize that pavement patching should be considered as a permanent repair rather than a temporary substitute until extensive rebuilding can be done.

Asphalt control needed

An asphalt-aggregate mixture is usually used for pavement patching and for paving small areas such as these towed mixers were designed to work on. A satisfactory mixture, regardless of the type or intended use, depends on the proper amount of asphalt being added. If too little is used the mixture will be dry, difficult to work, and will disintegrate under the erosive action of traffic and weather. If too much is added, the mixture will be unstable and the asphalt will be pushed to the surface by traffic, making the roadway slippery and wet. So material control is a very important part of the choice of any road-mix machinery.

One big bone of contention in pavement patching has been whether to use hot- or cold-mix patch material. Hot is apparently winning out for the reasons that hot mix permits the patching of all types of surfaces in cold weather and when cold-mix types may not prove to be permanent. Also, moisture, which cannot be removed in the production of cold mixes, attracts further moisture, which in turn invites stripping and deterioration of the patch. Most methods of producing cold mix material in the past have not

been capable of turning out truly durable and long-lasting patches.

Four manufacturers who have specifically entered the field of producing towed asphalt mixers were invited to describe them in these columns. The manufacturers, and their portable models, are: Barber-Greene Company of Aurora, Illinois, Model 804 Mixall; Hetherington and Berner, Inc. of Indianapolis, Indiana, Moto-Patcher and portable dryer; K. E. McConaughay of Lafayette, Indiana, Multi-Pug Model Jr., and HTD asphalt mixers; and Wylie Manufacturing Company, Inc. of Oklahoma City, Oklahoma, Model PM-210 Patchmobile.

The Barber-Greene Model 804 Mixall is a combination rotary drum dryer and twin-shaft pugmill mixer mounted on a single rubber-tired chassis. It is equipped with a towing hitch and can be drawn by a truck, which also can be used to carry the aggregate and bitumen supply. The machine can be operated while still attached to the truck or it can be supported by the wheel mount and a built-in jack, permitting the truck to be used elsewhere if desired. Any type of hot or cold bituminous mix, stabilized base materials, or low-slump portland cement concrete can be produced.

The machine is charged with a skip, of approximately 300-lb. capacity, which is raised and lowered mechanically. It can be filled by hand shoveling from a truck or stockpile, or, since the skip's edge is only 14 in. above the ground in its lowered position, by dumping from a wheelbarrow.

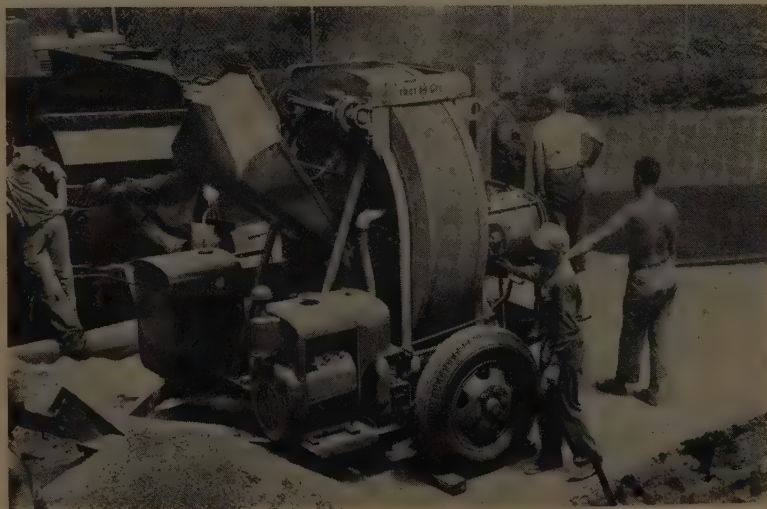
As the skip is raised by the operator, the aggregate slides into the rotating dryer drum. Here flights, which are bolted around the interior of the drum, lift the aggregate and drop it repeatedly in a series of thin veils through a blast of gas and hot flame provided by a fuel-oil burner.

Counts drum revolutions

Duration of the drying cycle is controlled by the number of drum revolutions, indicated on a revolution counter. After the desired drying cycle is completed, the operator pulls a lever which drops the dried aggregate into the twin-shaft mixing pugmill. The bitumen is added and both the aggregate and bitumen are combined through the special kneading action of the pugmill paddle shafts.

At the completion of the mixing cycle, the entire bottom of the pugmill is withdrawn by means of a crank-operated rack arrangement.

THIS is the Barber-Greene Model 804 Mixall which has a combination rotary drum dryer and twin-shaft pugmill.





THE CASE FOR A PORTABLE CENTRAL MIX PLANT FOR MAINTENANCE

THE IOWA Manufacturing Company of Cedar Rapids, Iowa, manufacturers of Cedarapids crushers and asphalt plants, spent a considerable amount of time and money in research into the problem of producing a small, trailer-type portable asphalt mixer for hot and cold patching.

It was found that demand exists for plants with an increased total capacity because of rapidly deteriorating roads, and that a capacity of at least 20 to 30 tons per hr. would fit in best with present day requirements and future demands.

Labor is scarce

Manpower is an important consideration because of labor's cost and scarcity at present. It was found that the trailer-type plant would require about six men, as a conservative estimate, to take care of the varied operations, including a driver, plant operator, man to load aggregate in mixing plant, two men with wheelbarrows to dump the material in holes, and additional men for raking, tamping, and operating other equipment.

Stockpiling requires a plant with

ample production. The small, on-the-job portable plant which produces 5 tons per hr. of hot mix or 10 tons per hr. of cold mix would be unable to stock at the same time because of its low capacity and being away from the stockpile base.

This research program revealed that the twin-shaft mixer was found to be best suited for all types of patching jobs, since it meets more specifications than any other types. And a plant like this, provided it has a production of at least 20 to 30 tons per hr., can be used for road patching, making driveways or parking lots, making roads and walks in parks, small street jobs, and jobs which require permanent surfacing work.

From the results of this study, the Iowa Manufacturing Company came to the conclusion that the trailer-type plant is not the answer, mainly because of high labor costs and short labor supply.

One result of this survey, however, is that the company has completely redesigned its portable asphalt plant so that it answers the need for present-day patching work. Known as the Model CM

Commercial Bituminous Mixing Plant, it was to have been released for production in May. It will take two men to operate, and will permit road departments to make full use of good weather by putting out as many trucks and men as are available.

Up to 40 tons per hr.

Specifications on the Cedarapids Model CM Commercial Bituminous Mixing Plant include a rated capacity of up to 40 tons per hr., depending on type of mix, specified mixing time, and capacity of drying and feeding equipment; weight of 7,900 lb. with power; overall dimensions (traveling and shipping), height 8 ft., length 14 ft., 6 in., and width 8 ft.; twin-shaft, continuous type mixer of 7.1 cu. ft. capacity; and 36 paddle faces, adjustable on arms to control mixing time and action and adjustable end for end to compensate for wear.

All controls are located on the operator's platform. An 18-in. wide steel apron with covered surge hopper receives aggregate from the bucket and chain type elevator at a rate of 56 tons per hr.

The mix material falls directly onto the area being patched or into a waiting wheelbarrow. The discharge height allows the employment of gasoline-powered wheelbarrows if desired.

The principal users of the Mixall to date have been the street and highway departments of cities, counties, and states. However, many contractors have found it most useful for the preparation of bituminous material for the construction of sidewalks, driveways, trenches, tennis courts, railroad station platforms, factory floors, barn floors, cellar floors, stor-

age areas, loading docks, parking lots, service stations and for other small uses.

Specifications on the Mixall include a capacity of 3 cu. ft. per batch, up to 5 tons per hr. of hot mix, 10 tons per hr. of cold mix; weight 6,650 lb.; overall dimensions, height 7 ft., 7½ in., length 10 ft., 3 in., and width, 7 ft., 11 in.; 22-hp. engine; and a skip of 14-in. shoveling height, 50-deg. dumping angle, 3-cu. ft. capacity, and automatic top limit throw-out. The burner system consists of a Hauck low pressure oil burner.

The Hetherington and Berner

Moto-Patcher is a self-contained unit built up around a 400-gal. storage tank. This tank is provided with heating flues which can use either kerosene or bottled gas. The aggregate is fed either by shovel or by a small feed elevator (optional equipment) into an aggregate feed hopper, under which is located a roll feeder. This feeder pulls the aggregate directly into a single-shaft pugmill mixer. The mixer itself runs through the asphalt tank, from front to rear, so that it is surrounded at all times by heated asphalt in the tank, thus creating a more satisfactory condition for mixing.



FEATURE of the Hetherington and Berner Moto-Patcher is a 400-gal. storage tank which keeps the asphalt hot at all times.

The mixed material falls onto a pan at the rear of the Moto-Patcher and may be shoveled from this pan onto the street or dropped directly through a door in the bottom of the pan onto the road or street being patched.

A small asphalt pump is provided to furnish bitumen to the mixer immediately after the aggregate is introduced into the mixer by the aggregate feed roll. The mixer, aggregate feed roll, and pump are all driven from a small air-cooled engine. A circulating system is provided in conjunction with the bitumen pump so that bitumen may be taken from the tank, circulated through the pump, and go back into the tank. A micro-adjustment valve controls the amount of bitumen going into the mixer, giving a positive control of the proportions of asphalt to aggregate.

Four pieces of auxiliary equipment are offered with the Moto-Patcher. A small, self-contained feed elevator, powered by its own gasoline engine, for feeding the aggregate directly from a dump truck into the storage hopper is available.

A hand spray can be attached to the discharge side of the pump and be used to tack coat or prime the hole before placing the patch material in it. In case the hole needs drying before the patching material is added, a hand torch is available, either with the bottled gas or kerosene-heated tank.

A small spreading mechanism can be towed by the Moto-Patcher for use when small areas, such as driveways, are being paved. The material drops down in front of the spreader where a strikeoff will set the material at any given depth, thus eliminating the necessity of spreading the mixed material by hand.

The fourth piece of auxiliary equipment is the portable dryer, specific-

ally designed to furnish dried aggregate to the Moto-Patcher. This wheel-mounted unit consists of a rotary drum, 30 in. in diameter and 8 ft. long, with a circular feed elevator and circular discharge elevator as an integral part of the drum. A low-pressure air blower furnishes air to the oil burner. The unit, which is driven by a small gasoline engine, normally works immediately ahead of the Moto-Patcher.

Normally local materials are used for patching. Where crushed stone is available, a $\frac{3}{4}$ -in. down to $\frac{1}{8}$ -in. size is recommended. Where stone is not

available, crushed gravel may be used. In some places crushed gravel combined with sand or sand alone has furnished creditable patching material. Most of the cutbacks, tars, and emulsions have been used successfully as bitumen base.

Moto-Patchers are being used by small contractors to pave small parking areas and driveways, as well as all types of political subdivisions—cities, counties, townships, states, and public utilities which have found a use for this type of machinery.

Specifications on the Moto-Patcher include a capacity of 10 tons per hr.; weight of 2,700 lb.; overall dimensions, height 5 ft., 11 in., width 5 ft., 10 in., and length, including tongue, 11 ft., 10 in.; Briggs & Stratton Model 23R6 engine; and a Viking Model H-117 pump at 10 gpm. capacity.

Both models of the McConaughay Multi-Pug Mixer, the HTD and the Jr. Model, are similar in appearance and operation, so they will be described as one.

The Multi-Pug Mixer was developed for the purpose of mixing bituminous materials and aggregates to obtain a high capacity combined with low power consumption. The aggregates and bituminous materials are proportioned into the mixer where they are received by a shaft and blades mounted laterally to the direction of flow of the aggregate. This initial mixer combines and throws the material forward to the second shaft and blades, where it again combines and is tossed forward to the third mixer which, in turn, passes it on to the fourth and final mixer, from which it

Concluded on page 183

THE McCONAUGHAY Multi-Pug Mixer tosses the material back and forth through four series of blades, providing a thorough mix.



New Mexico pushes work on —

FOUR-LANING



Increasing traffic causes need for expanded highway facilities — Four-year construction program planned to spend \$6,770,000 on improving intolerable sections of the road

NEW MEXICO'S State Highway Department is pushing a construction program aimed at making U. S. Highway 66, which provides the most direct route from Los Angeles to Chicago, a four-lane divided highway all the way through the state.

All this construction will re-create a highway on which the Department first began blacktopping work in 1931, and which could be considered a paved road through the state perhaps seven years later.

U. S. 66 along with Highway 85, running generally north and south through the state, and Highway 70-80, running west from Las Cruces in the southern part of the state, make up the New Mexico National Interstate System. This entire system ultimately will be four-lane divided highway, but the work under way and planned for U. S. 66 highlights this program and poses problems and solutions common to the entire interstate system.

Area served

Running east and west for 375 mi. in Central New Mexico, U. S. 66 carries an increasing volume of traffic between the Texas Panhandle and the Arizona border each year. It brings vehicles from Amarillo in the Texas Panhandle to Tucumcari, Santa Rosa, Albuquerque (New Mexico's biggest city), Grants in the heart of New

Mexico's uranium ore mining area, Gallup, and on into Arizona.

Increases 10% yearly

Percentagewise, traffic volume increases on the highway were 9.2 for 1950, 9.6 for 1951, and 10.2 for last year, so the route now handles an average daily volume of 2,500 vehicles. In certain places and in certain seasons the load peak reaches 6,000.

To handle the increased traffic load, several sections of the thoroughfare have been four-laned in the last few years, and some new two-lane stretches have been put down. But for the most part the route remains a two-lane macadam highway still to be improved.

The picture of need is highlighted by two factors:

First, if traffic increases on the route continue as they have the past few years, by 1960 the overall volume will have grown from the present 2,500 vehicles daily to about 5,000 a day—a load which the department feels requires a four-lane arterial.

Second, the state's National Interstate System contains a total of 1,014 mi. of road specially designated as a portion of the nationwide network of highways necessary to the national defense and to major national transportation needs. But only 375 mi. or

37% of this system is considered satisfactory by the Highway Department at this time. The other 639 mi. should be improved at once, and 196 of the 378 bridges in the system are in need of improvement.

In facing its needs, the state placed a dollar value on the requirements of state highways by setting up estimates for four alternate program periods of 5, 10, 15, and 20 years. Each of the programs contemplates the replacement of all road sections which are inadequate according to modern standards of safety and convenience. The state now is operating under the five-year program.

Would cost \$35,000,000

At present-day costs, it would take something like \$35,000,000 to four-lane that portion of Highway 66 not yet so improved. But such a sum of money is not easily found. Construction scheduling is dependent on availability of funds, and in New Mexico that essentially means substantial federal aid allocations plus gasoline tax revenues to meet current costs.

Besides, what money is available must be distributed across the overall highway system, including U. S. 66, according to need. The entire state highway system during the last two years ate up \$27,000,000 for new construction work and some \$9,000,000 more for maintenance. Yet at the end of that time, the Highway Department could report that of its 10,983 mi. of roads, 6,513 mi. were intolerable, that is in need of immediate improvement, at a total estimated cost of \$254,987,647. At the same time, it was found that of 1,987 bridges in the

highway system, 496 were intolerable and 31 new bridges were needed where none now exist, all at an estimated cost of \$26,855,209 more.

Four-year program

Thus the needs of U. S. 66 are just part of this whole. But at that, for the next four fiscal years starting July 1, the Highway Department has proposed and expects to carry out on U. S. 66 alone construction projects totaling \$6,770,000.

In connection with wear and tear on roads, which contributes to the intolerable ratings, two points can be mentioned. First, 18% of the state's roads, its main arterials, handle 79% of the state's traffic. Second, as in most states, heavy truck traffic is on the upswing. The Highway Department says of this: "From 1936 to 1951 the number of trucks and combinations with gross weight of 30,000 lb. or more on New Mexico highways increased from 5 to 118 per 1,000 commercial vehicles. During the same period, the number of trucks registered increased from 22,823 to 65,889. This indicates that there are more than 70 times as many trucks weighing 30,000 lb. or more on New Mexico highways today as there were in 1936." U. S. 66 is one of the two most heavily traveled tourist and truck routes in the state.

High fatality rate

On safety, New Mexico's unsatisfactory accident fatality rate involves a high proportion of out-of-state drivers. The portion of four-lane divided highway built east of Albuquerque, for example, helped meet this problem by replacing a hazardous two-lane roadway that twisted and turned up hill and down through a steep canyon. Similar improvements, it is hoped, will contribute to a better traffic safety record.

The large proportion of intolerable roads are those the Highway Department has checked in field studies as to structural adequacy, service, and safety, then rated against a theoretically perfect road in these respects. Those falling below a certain level are considered in need of immediate attention.

The U. S. 66 program from the start of 1949 to the time of this writing saw expenditures of \$7,482,004.88 in 13 contracts for about 90 mi. of new construction including the four-laning, \$1,049,473.75 for two new bridges and an overpass, and \$34,971.86 for a raised concrete divider of varying width in Albuquerque. Another \$365,833.35 was for needed surface reprocessing and sealing.

Much two-lane work

This work resulted in, among other things, 16 mi. of divided four-lane highway just east of Albuquerque; a divided four-lane highway for 2.5 mi. in the Tucumcari area, and 3 mi. of four-laning west of Albuquerque.



The figures cited above on highway construction on U. S. 66 since 1949 indicate that considerable two-lane work is being done on what is to be a four-lane divided highway. Whenever the arterial is being rebuilt as a two-lane highway, a 200-ft. right-of-way is being obtained and the two-lane strip is being placed to one side of this to allow later construction on the right-of-way of an additional two lanes divided from the strip already in place.

Co-ordinated with others

The work under way in New Mexico, incidentally, is being coordinated with that of other states through which the route runs as to design and other factors according to Bureau of Public Roads requirements.

To boil down construction scheduling to a phrase, the work is being spotted along the highway where it is most needed first. The basic factors balanced together for each decision are urban needs, safety, and highway condition, which includes the intolerable sections in immediate need.

Counties get right-of-way

The Highway Department does not acquire rights-of-way. Under New

Mexico law, the counties obtain the right-of-way as required by the State Highway Commission and it is the policy of the commission to request municipalities to furnish necessary clearance for urban projects.

Specifications in general call for a 2-in. hot mix on a minimum 6- to 8-in. base, depending on the soil profile. Four-lane highways ordinarily are made up of two 24-ft. roadways, separated by some sort of division, with 10-ft. shoulders.

The Highway Department says that one reason road building costs are so much higher in New Mexico than in some other states is the considerable number of drainage structures required to cope with the effects of flash floods and mountainous terrain. Concrete box culverts are used in many arroyos in which fast water seasonally flows.

One-way bridges

Where culverts will not be adequate, bridges are constructed. To increase capacity where such a bridge already exists but is inadequate, as over the Rio Grande in Albuquerque, a twin steel and concrete structure is built a few feet to one side of the existing bridge, and each bridge then handles traffic moving in one direction. The bridge approaches in Albuquerque are divided and soon are to be lighted.

Dividers are planned mainly for urban areas, on hills, and in other places where the safety factor is especially important, though the whole route ultimately will be divided. Raised dividers of 4-ft. minimum width go in urban areas, and they are made wide enough where necessary and feasible to allow shielded left turns. Depressed dividers, generally 30 ft. in width, are used outside urban areas.

The Highway Department also is considering construction of truck incline lanes on U. S. 66, but no decision has been made yet on this feature.

OVER THE TOP of this railroad goes U. S. Highway 66 west of Gallup, N. Mex. This is the new Manuelito overpass, built at a cost of some \$229,000 by J. H. Ryan, Albuquerque.





The WASHO Test Road

*... Symbol of Western determination
to solve the region's highway design
and construction problems*



MATCHING unprecedented highway engineering programs of the West this year is a full 1953 schedule of testing on the new test track near Malad, Idaho. Special studies of pavement deflections began in April.

Conduct of the WASHO tests is being administered by the Highway Research Board. The test tracks, which will eventually be incorporated

into a 4-lane alignment of U. S. Highway 191, were built by Carl E. Nelson Co. of Logan, Utah. Cooperating in the project are the Bureau of Public Roads and various truck, trailer, and petroleum manufacturers.

Pictured above are two tandem-axle test rigs, (top) an International truck and Pike semi carrying 40,000 lb., and (bottom) a Mack truck and Fruehauf semi loaded with 32,000 lb.

Maintaining Oregon's county roads

Heavy log truck traffic, varying topography, and different climatic conditions complicates the problem of bringing horse and buggy era roads of Douglas County, Oregon, up to date

BRINGING a thousand miles of horse and buggy era county roads up to date has been keeping the engineering department and road maintenance crews of Douglas County, Oregon, hopping these days.

Since the major part of the county road system was established between 50 and 100 years ago, most of the roads are narrow and crooked, and have insufficient rights-of-way and steep grade lines. This type of road most certainly cannot take care of today's heavy traffic. An additional problem is caused in Douglas County by the fact that the chief industry is timber, and practically every road has log truck traffic using it. This large and heavy volume of log truck traffic means that a road has to be designed to satisfactory width and grade, sufficient base, and for as smooth a surface as can be obtained practicably.

Adding 20 mi. a year

Our county has been progressing on a road building and surfacing program during the last few years, resulting in a good system of all-weather roads. We have been adding about 20 mi. or more of asphalt-surfaced roads to the system each year, mostly by reconstruction before paving. This reconstruction varies from minor improvements to extensive rebuilding, depending of course on the condition of each individual road, and takes place a year or two before the asphalt surfacing is placed.

Located in the southwestern part of Oregon, Douglas County has a population of about 60,000 and an area of 5,062 sq. mi. Roseburg is the county seat and central location for the County Road Department, which is divided into nine maintenance districts, each headed by a district patrolman. A small crew of men and some equipment are based at each district for maintenance of the road system.

Area geography

Geographically, Douglas County contains widely varying topographical features and radically differing climatic conditions. The eastern boundary is the summit of the Cascade Mountains, at a high elevation with the usual snow and cold in the wintertime. The western boundary is the Pacific Ocean. Most of the county is heavily timbered, primarily Doug-

By
**WALLY M.
HECTOR**
Road Engineer
Douglas County
Oregon



las fir, and is mountainous with many streams. Since the annual rainfall is approximately 35 in. in the Roseburg area, with a much higher precipitation in the coastal region, strong bases and adequate drainage is necessary for satisfactory roads. Soil available for road building is mostly clay.

Design features

The base rock, usually being of bar-run river gravel, is generally laid about a foot in depth. This material is thoroughly compacted by rolling and sprinkling, and a leveling course approximately 2 in. thick of $\frac{3}{4}$ -in.-0 crushed rock is applied and set up by routine methods.

During the following summer, while we are getting ready for our oiling

program, we reshape these roads, correcting the few minor defects which appear after going through the first winter after reconstruction. When a well-compacted, tightly-bonded, smooth surface is attained, an application of MC-1 or similar asphalt is applied at a rate of from 0.35 to 0.50 gal. per sq. yd., with a light coat of cover stone. This is the usual prime shot which holds the road for a few weeks until we are ready for the road-mix surfacing. Also this makes a most satisfactory floor to mix upon, which is very necessary. At times we have used successfully a heavy grade of fuel oil for the prime coat work without the use of any cover stone. Although this is less costly, there are serious traffic problems to contend with, for unless you can keep traffic off the road for a few hours you will have many complaints from the motoring public.

Haul in aggregate

A day or two before we are ready to begin mixing operations on a section of road, we haul in the aggregate to be used in the mixing process. This rock is of suitably-graded crushed river gravel of $\frac{3}{4}$ -in.-0 in size. Sometimes it is necessary to haul in some fines, to blend with the $\frac{3}{4}$ -in.-0 to bring the aggregate to the desired gradation. The total amount of material hauled in varies with the thickness and width of the oil mat. For a 20-ft. wide oil mat, approximately 2 in. thick, 12 to 14 cu. yd. per station is about right.

At this time it should be mentioned that to secure satisfactory results from a road-mix job, control over the

MANY MILES of county road like this confront the author in his modernization and maintenance tasks. This is the type of road-mix machine which helps solve his problems.





THIS ADJUSTABLE spreader box was used by Hector to measure the amount of cinders added to his road mix in Klamath County, Ore., where he worked before he went to Douglas County.

amount of material in the windrow is of prime importance. Some method should be used to control the predetermined cross section area, or cubic yards per station, of aggregate that you intend to mix. This is especially true when using a road-mix machine, which applies a definite amount of asphalt. We have been using such a machine that gives a good mix in only one pass. Remember the old adage, "A controlled job is a good job."

A mile a day

This type of machine picks up the material from the windrow and passes it through the mixing drum, at which time the predetermined amount of asphalt is applied by regular pressure nozzles, then deposits the mixed materials behind the machine in a similar windrow. You can easily mix a mile of road per day with this type of equipment.

In most of our work throughout Douglas County, we use MC-3 asphalt for this type of road-mix work. Usually the asphalt is delivered right on the job by transport truck and trailer which run out of Portland, a distance of approximately 200 mi. This asphalt is delivered in units of about 5,800 gal. Our trailer tank on the road-mix machine holds 1,500 gal., so it takes about three hours on the average to empty the truck and trailer unit. We use two or three of these units per day, depending on working conditions, amount of work laid out, and other varying factors.

Grader's position

It is possible to start the grader not too far behind the mixing machine, so that while the road mixer is proceeding ahead the grader can process a section of the mixed material. Although the mixer does a very good job of mixing the aggregate with asphalt, it is necessary to turn the windrow several times before starting to

lay down the mat, using the grader for insurance in mixing the material.

However, it is best to let the windrow of mixed material stand in the "stack" for a day or two in order to aerate before beginning to lay down the mat. Sometimes, due to traffic conditions, it is hazardous to leave such a windrow in the roadway for this length of time and you must lay down the mixed material the same day.

Marker aids graderman

It is also a good idea to have a line of stakes, small rocks, or some such marker at the edge of the oil mat to assist the graderman in laying it down. This not only gets a better line for the edge of the finished pavement but also controls the width of the finished job.

To get a good finished job you must have a skilled and experienced bladesman, since he is working to a finished

STRETCHING OUT behind the road-mix machine is a windrow of prepared material. This type of machine paved a mile of road per day.



thickness of approximately 2 in., and it is necessary to keep this thickness held as close as possible. When the bladesman unavoidably gets thin spots in the mat, these places tend to "scale off," necessitating placing a patch. This not only makes an unsightly appearance but also impairs the smooth-riding qualities you wish to attain. From the foregoing discussion, you can see the importance of first having a good, well-prepared smooth floor to place your road mix upon.

Wobble-wheel roll

Rolling of the finished oil mat, the next operation, may vary according to the density of the traffic. Road mix has been laid without any rollers, relying on the traffic to roll out the finished mix. This procedure sometimes results in an appearance of slight ridges and valleys in the road. Usually we first roll with a wobble-wheel pneumatic tire roller and then finish with a steel-wheel roller for final smoothing out. Sometimes a light rolling the following day is a good idea.

Since it takes a few days for a road mix to cure out and set up hard on the surface, some care should be taken not to damage the surface. This is especially true along the edges, which do not seem to set up as fast as the center portion of the roadway. The center is constantly being rolled by the traffic. I have seen the edges of newly-laid road mix badly damaged by such livestock as horses walking along the shoulder of the surfaced road.

Wait for the sun

Although weather conditions are sometimes very trying in any type of road oiling work, you do not have too much trouble in ordinary oiling weather. If you should get a heavy rain on a windrow before it is mixed, or if it is very wet material when it is hauled to the road, spread it out across the roadbed and turn it a few times with the grader when the sun comes out and it will soon dry. If after the windrow is mixed with asphalt the weather turns bad, or if there is a delay for some other reason, it is possible to leave the mixed material for several days in the windrow before laying it out with no harm being done.

With suitable material available it is possible to construct good, high-type roads by using road-mix methods. Ordinarily it is the most economical method to use for a given thickness of asphalt surfacing.

Before the author moved to Roseburg, Douglas County, he was engaged in road building in the southern part of Oregon, at Klamath Falls. He used a Model 36 Wood Roadmixer in his operation in both places. Thus he was able to maintain control of the amount of material laid in the windrows.

Right-of-way maintenance problems are fewer with—

Weed control by chemical methods



Weed growth today is more than matched by knowledge of chemical control methods — Characteristics and applications are cited

WEEDS show up wherever there is soil and moisture and that includes almost every area in which an engineer works. Particularly do weed problems exist along roadways, highways and streets. Weeds also are a problem along water courses. Municipal engineers face weed problems not only along the streets but in parkways, parks, storage yards and vacant lots. Time, effort and expense are required to keep down these pests.

Improved chemicals

Within the last ten years, however, tremendous strides have been made in chemical methods of weed control. Not only have many new herbicides (plant killers) been developed but with the increased interest there has been expansion throughout the country in research and testing so that today we have a much greater background of information on which to base recommendations for use of these materials. There are chemical methods available for almost every weed problem. Indeed, the major decision may often be which of several chemicals would be the best choice for a particular problem.

Success with chemical weed control will depend on: (1) proper choice of chemical, (2) proper application of the chemical, and (3) proper timing of the application. The last of these cannot be too strongly emphasized. Most of the poor results with herbicides can be laid at the door of poor timing. Thus, since this article will deal in the main with the available chemicals and their use it must be assumed that application will be made at the proper time.

By **W. A. HARVEY**
Extension Weed Control Specialist
Agricultural Extension Service
University of California
Davis, California

For convenience the more commonly used herbicides may be grouped into three classes, although such a classification is arbitrary and there is some overlapping. Some of the chemicals used primarily on farm crops are omitted. The three groups of chemicals are: (1) Contact herbicides, such as the oils that kill only the plants or parts of plants that are contacted by the spray, (2) Translocated herbicides, such as 2,4-D that have the property of moving within the plant and thus may be effective in killing out root systems of perennial weeds, even though sprayed on the tops, and (3) Soil Sterilants, which are applied to the soil and being carried into the soil by rainfall or irrigation, kill the present growth and prevent future growth for a period of time.

Contact herbicides

Crude oil, fuel oil and diesel oil have been used for many years to destroy plant growth. These materials wet the vegetation well and if of sufficient toxicity, do a good job of killing all the plants sprayed. In the past, oils of high toxicity were readily available. More recently, the fuel oils are being more highly refined and it is increasingly difficult to find a diesel oil high in plant toxicity. There are, however, special fractions being marketed by most of the major oil companies as

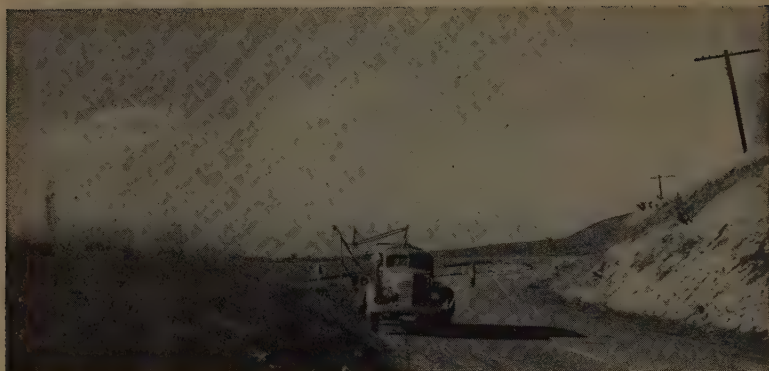
general contact herbicides that do contain a high percentage of plant killing ingredients.

Use of special fractions

These oils are much superior as herbicides to the ordinarily obtainable diesel oil and although more expensive in small lots may be obtained in bulk at about the same price as diesel. On heavy weed growth, particularly where grasses predominate, they may be used straight. In most cases, they can be used in emulsion with water at a great saving in cost per gallon of spray. The usual mixture varies from $\frac{1}{3}$ to $\frac{1}{2}$ oil with the rest water. The addition of an emulsifier, such as one of the packaged detergents or a paste or liquid emulsifier, will aid in holding the oil-water emulsion. An adequate agitator in the spray tank is essential to satisfactory performance.

Fortifiers

Where cheap low-toxicity oils are available or where oil resistant plants cause trouble, the addition of a fortifier will increase the general toxicity and produce a satisfactory kill. The two materials commonly used as fortifiers are dinitro phenols and pentachlorophenol. The former are marketed as oil soluble liquids called dinitro general contact herbicides and usually contain added emulsifier to permit the ready formation of fortified oil-water emulsions. The latter material can be purchased as a powder to dissolve in the oil or in solution in a solvent. Products of this last type are used as wood preservatives and such solutions may require the addition of emulsifiers to make them satis-



BEFORE the spray truck arrives, the slope is a tangle of weeds and grasses—unsightly and a fire hazard even for maintenance men with controlled blazes.

factory for use in water emulsions.

A common emulsion of this sort might contain 35 to 50 gal. of diesel or other cheap oil plus 1 qt. of a di-nitro general or about 4 lb. of pentachlorophenol plus water to make 100 gal. of spray. The oil and the fortifier can be varied to meet changing conditions of plant growth. If most of the weeds are broad-leaved species rather than grasses it is often possible to reduce the amount of oil in the emulsion to 20 or 25 gal. If grasses predominate the oil volume must be kept high. In either case the fortifier can be varied slightly to compensate for the oil toxicity (reduced slightly with higher volumes of oil and increased where less oil is used). In some cases where young yellow star thistle is the only problem, the oil can be omitted entirely or reduced to 5 or 10 gal., and 2 qt. of dinitro general used.

Rate of application

Total volume of solution required per acre will depend on the size of the weed vegetation. Weeds 2 to 4 in. high can be thoroughly covered with 100 gal. per acre and this is the ideal stage at which to spray. Weeds 18 to 20 in. high can be killed with the same spray mixture but may require 300 or 400 gal. per acre. Thus, proper timing is an important factor in cost in this instance. In any case, it is highly desirable to spray before the weeds have gone to seed. Spraying old mature weeds that are beginning to dry out is a waste of time and materials. At that stage it may be cheaper to burn directly or to mow and burn.

These materials are most useful for controlling annual weed growth. Perennial weeds will be killed to the ground but soon send up new sprouts and brushy vegetation may only be defoliated. Such plants, if they must be eliminated, will require additional or different treatment with another type of herbicide. A common practice is to use a general contact spray during the winter or early spring and follow with a translocated spray during the summer wherever required.

Because these contact sprays pre-

sent no toxicity hazards to livestock, they may be used along fence lines and roadsides for weed control or to make fire guards which are burned out early while other vegetation is still green. Disadvantages of sprays containing oil include the general messiness of the oil itself and the fact that the surface of black-top paving becomes tacky, if sprayed with the oil, due to the solvent action of the spray. Some workers may be sensitive to continued exposure to certain of the oils and the oils and fortifiers should be kept off the skin as much as possible.

Equipment

Equipment used for applying the oils or oil-water emulsions should have an adequate tank size so that refilling is not required too often and the tank should preferably be equipped with a mechanical agitator. High pressures are neither necessary nor desirable and a pump capable of producing 75-125 psi. while delivering the required volume is adequate. Centrifugal or gear pumps are often used. A separate power source for the pump and agitator is usually more satisfactory than a power take-off. The boom size and arrangement should be adapted to the job. For roadside spraying a side-mounted boom of sufficient length to cover the width of shoulder to be treated plus one or two hand booms with separate hose lines would take care of most situations. The main boom would be used on the major areas of road and the hand booms used around structures—signs, guard rails, bridges, etc. Hoses and gaskets should be oil resistant.

Translocated herbicides

The commonest material of this type that would be used is 2,4-D or one of the closely related compounds, such as 2,4,5-T. These materials are somewhat selective in action and usually kill broad-leaved weeds without harming established grass. They are also useful in controlling perennial weeds and brush or tree growth. Where a grass cover is desirable but

broad-leaved weeds and brush invade the cover a spray of this type is ideal. Many miles of power and telephone line rights-of-way are being sprayed each year. Banks or cuts subject to erosion may be treated to remove unsightly vegetation without destroying the grass cover.

Timing use of chemicals

These materials may be applied as foliage sprays or in the case of brush and trees as basal sprays or to cut surfaces. Foliage sprays should be made during the time the plants are in full growth. For many weeds this is just prior to blossoming. On brush it may be about the time the new leaves have attained full size. Action of 2,4-D is much greater on vigorously growing plants than on old mature plants or dry stunted plants.

Various formulations of 2,4-D are available for use. The water soluble amine is the easiest and cheapest, and is used on most easy-to-kill vegetation. On brush or tougher weeds the low volatile esters or the emulsifiable acid may be more effective. Experience in the area will usually have already established the preferred type for a particular job. Foliage sprays on the tougher vegetation may be improved by adding 1 or 2 gal. of diesel oil per 100 gal. of finished spray but the oil volume should be kept to a minimum to avoid burning or killing the vegetation by contact action.

The companion product, 2,4,5-T, is used in the same way as 2,4-D but is more effective on many brushy species of plants. Where brush is the major problem a mixture of the two is often used. There are many of these mixtures being marketed as "Brush-Killers." The advantage to the combination is that it will handle most species of brush and it is cheaper than straight 2,4,5-T. If you know the plants you are spraying are susceptible to 2,4-D there is no advantage to using the mixture.

Aerial application

As foliage sprays these materials are used with water as a diluent and may be applied by ground sprayer or on large areas by airplane or helicopter. Total volume per acre is not as important as with the contact sprays although the chemical must get on each plant that is to be killed. Rates of application vary from 1 lb. to as high as 8 or 10 lb. of the chemical per acre, depending on the problem. The lower rates are more common.

When foliage sprays are not practical, as near susceptible agricultural crops, brush is often treated by the basal spray technique. In this method the 2,4-D, 2,4,5-T, or mixture is dissolved in diesel oil and the oil solution sprayed on the stems from ground level up to a height of about 18 in. It is important to apply enough solution to get run-off and to spray all around each stem. The application can be

made during any season, although best results are obtained when the soil and the stems are somewhat dry. The low volatile ester form of the chemicals is used at a concentration of about 2% in the oil. Knapsack sprayers are convenient for the application. The method is frequently used as a follow-up after foliage spray to kill off re-growth and may be used on small, smooth-barked trees as well as brush.

Large trees are best killed by making a frill of ax cuts near the base of the tree and pouring or squirting from an oil can the undiluted amine of 2,4-D into these cuts. This treatment will kill most trees and requires only a little time and material per tree. The cuts which are slanted in and down, should make an almost continuous circle around the tree as near the base as practical. Each cut should extend through the bark and into the wood to form a small pocket into which the chemical is placed. Fill the cut with all it will hold of the 2,4-D amine but there is no advantage to letting it run down the trunk.

Precautions in using 2,4-D

Broad-leaved crop and ornamental plants are sensitive to 2,4-D—even to small amounts of drift. Grapes, tomatoes and cotton are extremely sensitive. In California the use of chemicals of this type is regulated by law and a permit is required from the agricultural commissioner of the county in which the spraying is to be done. In other states, it would be highly desirable to consult with local agricultural authorities to insure safe application. The possibility of damage to near-by plants can be minimized by careful spraying, using low pressures and avoiding windy days. In spite of the hazards, however, millions of pounds of these chemicals are being used each year to handle weed problems and they can be used safely if common sense precautions are taken.

Soil sterilants

It is often desirable to prevent all plant growth rather than eliminate it after it has developed. For such purpose several chemicals are available. Currently the most used materials of this type are mixtures of chlorate and borates, of which several are available on the market in both dry and liquid form. Certain other organic soil sterilants are now coming into use but our knowledge of how best to use them is still somewhat limited.

Soil sterilants are used around signs, guard rails, bridge heads, other structures, equipment storage yards, as well as along the shoulder of highways, fence lines and canal banks. The cleared areas thus produced permit easy access and inspection and increase safety as well as reduce maintenance costs.

The original cost of soil sterilants is greater than for the contact herbicides or the translocated herbicides,



AFTER treatment, a similar slope looks like this. Selective chemicals are often used for this work, killing broad-leaved weeds but letting grass survive.

previously discussed, but over a period of years the annual cost may be less. Where budgets do not permit extensive use of these materials in any one year, it is possible to start with the most troublesome areas and gradually extend the use year by year.

Applications of the chlorate-borate mixtures to the soil should be made during the season when rainfall will carry them into the soil. In regions of low rainfall a fall application would be preferred, in areas of high rainfall an early spring date would be more desirable. The goal is to get the chemicals dissolved in the moisture in the soil so that developing seedlings as well as deep rooted perennial weeds will be able to absorb toxic quantities of the chemicals.

Application of sterilants

Rates of application will depend on length of sterility desired as well as soil type and probable rainfall and vary from 2 to 8 lb. per 100 sq. ft. Application may be made of the dry material using a fertilizer spreader or similar machine or the material in water may be sprayed over the soil surface. Timing is important with respect to rainfall and weed growth. A spray of such mixtures has some contact action and will kill down the growth present. Most efficient treatments, however, are probably those on bare soil before any growth develops.

A recent development in soil sterilization has been the discovery of a material CMU which has been highly effective as a sterilant at rates of 40 to 80 lb. per acre. Tests to date indicate it may have an extremely long life in the soil even at these comparatively low rates. Because of higher cost per pound, however, it is at present in the same price range per area treated as the chlorate-borate mixture but represents a much smaller volume of material to handle. It may be less susceptible to leaching which would make it more attractive in high rainfall areas but possibly less effective on deep rooted weeds under low rainfall.

No soil sterilant is perfect, however, and even high rates of application usually require some touch-up work where application was faulty or excessive leaching removed the chemical too rapidly. Nevertheless, the nearest we can come to having no weeds is probably a good soil sterilant application with follow-up treatments as required.

Other chemicals

There are many other herbicides available and in use for specific purposes. To discuss them all would be a major undertaking. The ones discussed above are the ones most likely to be of value for general weed control problems. It might be of interest, however, to mention one new chemical of slightly different use on highway systems. This material, maleic hydrazide, has the property of stopping plant growth for a period of time and is being recommended in the East as a substitute for the frequent mowing of the grass along the highway shoulders. It may have some use for this purpose in the more humid areas in the West. It represents another substitution of a chemical for a mechanical process.

Sources of information

It is often stated that every weed problem is different. This is at least partially true and as a result each problem needs a somewhat different solution. In this article I have tried to point out general rather than specific solutions, with some information on how to adapt them to your problem. You can get additional help from many agricultural sources. The Agricultural Experiment Station and the Agricultural Extension Service in each state have bulletins and circulars giving recommendations for that area. The Farm Advisors, County Agents and Agricultural Commissioners in the counties know local conditions and locally successful weed control methods. All of these sources stand ready to help you with the valuable collections of information at their disposal.

GETTING THE MOST “MILEAGE” from highway engineering staffs

Highway construction in the West is proceeding at a far greater tempo than at any time in the region's history. This pace will continue, and accelerate, for years to come.

What about the “men behind the miles”—the harried highway engineers? Nobody has to be told that here's a breed in short supply. The problem of how to get more work done with limited engineering staffs is here today, and it's acute.

But the real problem lies ahead. Graduate engineering students will not fill the demand (conservative estimates indicate that in two or three years colleges will be supplying only one-third of the number of highway engineers actually needed in the West).

A confrontation of the problem requires the best of thought on two vital aspects:

(1) Where are the men going to come from for expansion of Western highway engineering staffs to plan and direct increased construction?

(2) If enough additional men are not obtained, how can this increased engineering load be handled by present staffs?

It's important that we have the best possible answers to these questions.

Some Western states, notably Oregon, Colorado, Washington and California, have taken vigorous action on many fronts to alleviate effects of the engineer shortage. Other states are doing what they can within their capabilities. All have something to contribute to the fund of knowledge and experience that will be required to meet the manpower emergency.

In an effort to “pool” information on methods now in use or planned, Western Construction editors questionnaired or interviewed representatives from each of the Western state highway departments. The result of these efforts is presented on these pages. We believe it represents a significant gathering and compilation of ideas and methods to help meet the challenge.—Editor.

How Oregon upped staff 35% in last two years

By Gene Huntley

Personnel Director, Oregon State Highway Department

THE ATTRACTING of college graduates in civil engineering constitutes one of the major efforts of Oregon's recruitment program. Students at the school of engineering at Oregon State College are contacted personally by representatives of the Personnel Division and members of the Bridge, Highway Construction, and Traffic Engineering Divisions.

Also, all of the accredited engineering schools in the United States are contacted and asked to post a bulletin announcing opportunities in Oregon's highway department. This brings many inquiries from all over the United

States, which are answered promptly and the complete qualifications of those interested obtained. This “mail order” recruitment has been very successful. Also—though there is no definite way to measure the effectiveness—many of the graduates who come to work pass the word along to acquaintances, faculty and previous classmates, and more contacts are obtained in this manner.

In categories other than graduate civil engineers (i.e., experienced transitmen, draftsmen, etc.) Oregon receives many inquiries based on the reputation of the department; and many also, no doubt, which are received just as routine by engineers making systematic inquiry of a number of agencies.

Generally, Oregon is recruiting from three sources:

- (1) Graduate civil engineers to start in junior category and train for positions of higher responsibility.
- (2) Experienced men in the categories of head chainman, levelman, computer, transitman, draftsman and inspector, irrespective of formal education, are definitely able to perform the duties in their given assignments.

- (3) High school graduates with a high aptitude for mathematics (but no experience) to be employed as stakemen, chainmen, etc., who through study and work experience will make candidates for promotion to higher grades.

From promotional policy, a strong base

Partly as a result of being covered by a Civil Service system, Oregon has a strict promotional policy and all positions in the grade of Civil Engineer II (Junior Resident Engineer) and above are filled on a promotional basis by employees already working for the department. Though some good candidates from the outside may be missed—unless they are willing to sacrifice and start in a lower grade—it is believed that this policy is in the long run the best. It creates better relations and morale for those employees in the lower grades who are working hard and studying, because they realize that they are going to have opportunity for promotion.

However, to be successful this closed system of promotions presupposes the building of a strong base in the lower grades, of men qualified for promotion to the higher positions. Oregon's dual policy of stressing the employment of graduate civil engineers and the employment in sub-professional grades of men with high mathematical aptitude has so far enabled Oregon to keep up with needs. Oregon's engineering forces have been built up from 630 two years ago to over 850 on a most recent count.

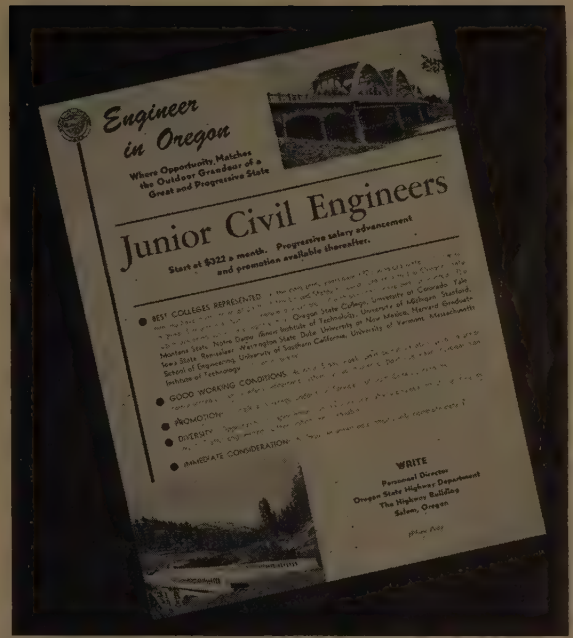
There has been no relaxing of age requirements on recruitment or entrance to a position; but there has been a definite relaxing in retaining engineers already at work who have reached retirement age. Normally the retirement age is 65 but because of the extreme shortage of engineers, those able to perform with competence are retained until the age of 70, thus giving the department an additional five years of skilled engineering service.

Physical requirements have not been altered significantly.

Requirements relaxed, new sources tapped

Out of necessity the experience requirements have been relaxed considerably. Oregon is even operating below the minimum requirements established by the Civil Service Department for the reason that in most instances they are unable to supply candidates. Chainmen are promoted to head chainmen after working a year in many instances; head chainmen are promoted to transmitters after only two or three years of experience; graduate civil engineers, in some cases, have become resident or locating engineers in a matter of three or four years after graduation. This relaxation of experience requirements puts an additional burden on all supervisory personnel and particularly on the resident engineer who must give guidance and training if he has an inexperienced crew.

Educational requirements have been relaxed. Primary



INQUIRIES from prospective employees all over U. S. result from posting this bulletin at accredited engineering schools. Vigorous follow-up of these inquiries has contributed to the success of Oregon's "mail order" recruitment.

interest is in graduate civil engineers; however, full recognition is given to formal education of whatever extent. A student who has completed two years of engineering college, for example, is ideal for a computer trainee and is frequently hired as such.

One standard established shortly after World War II has not been relaxed. This is the requirement that anyone promoted to the grade of Civil Engineer IV or above be a registered professional engineer.

Oregon has not to any extent utilized women engineers in either the office or the field. Since World War II perhaps only three or four technically trained women have been employed as computers in field engineering offices; one skilled cartographic draftsman; and one woman tracer.

Oregon relies heavily on the employment of Engineering Aides I (chainman, stakeman, etc.) who are high school graduates and have—as demonstrated by examination—a high aptitude for mathematics. Frequent use is made of candidates who have degrees in chemistry, physics, mathematics, or some related science field who are willing to switch their field of interest and work and study in the line of engineering.

"Study-work" program, a beginner bonanza

Though it is not formalized in a strict sense, the "study-work" program for engineering students is probably Oregon's largest and most successful training program. Leave without pay for employees on engineer crews is reserved for engineering students and preference is given to hiring engineering students for summer employment. Between 35 and 55 engineering students are employed each summer and the work experience supplements the academic training these men are receiving and when they graduate they have a good start in the highway engineering profession. If they cannot continue their education, then they have a position with the organization and can profit from the education which they have already had.

Training of graduate civil engineers is not on a formal basis, but all supervisory engineers are instructed to conduct on-the-job training for these men. This, coupled with a free system of transfer between divisions does



GENIAL
Gene Huntley,
Oregon's Highway
Department Personnel
Director, directs
recruitment program
of proven
effectiveness.

offer the graduate a good opportunity for training in the various divisions of highway engineering.

There is a high degree of cooperation with the School of Engineering at Oregon State College. Tours of the Highway Department are made by civil engineering students; and visits are made by the technical staff either directly or through engineering association meetings. Under the Marshall Plan of the Mutual Security Administration, Oregon has given thorough training to a number of engineering students and professional engineers from foreign countries such as Turkey and India.

Wherever possible Oregon has so established its organization and assigned personnel so that non-engineers or sub-professional engineers can perform their duties under the supervisory guidance of trained engineers. For example, at the present time an Engineering Economic Unit is being organized. This will be headed by a professional engineer with an advanced degree in engineering planning and economics. But the bulk of the work group will be made up of statisticians, accountants, and sub-professional engineering employees. In this manner it will be possible to consolidate this activity, accomplish more work in a coordinated manner, and free several higher supervisory engineers who previously had to devote a portion of their time to certain aspects of these studies.

All available modern equipment is used to facilitate the work of Oregon's engineering forces. At the present time developmental work is being performed on the feasibility of figuring cross sections centrally on IBM equipment.

Continual review is made of standard specifications toward the end of simplification and broader established consideration of factors to eliminate detail. There is also considerable standardization of design—with many recurring factors photographed or otherwise duplicated on a standard basis. Specifications are being reviewed now and the new standard specifications being developed will eliminate a large percentage of previously varying detail.

Engineering and inspection methods are continually being altered and improved to meet the accelerated program and heavy work load. Standardization has been established in inspection by appointing a supervisory paving inspector on a state-wide basis and also a state-wide oiling inspector. These two men can advise and set standards for all inspectors throughout the state. Also, central testing—such as roughness indicator tests and skid resistance tests—are made to highlight deviations from our standards. Also, because the highway department is centrally organized with the most skilled and experienced engineers holding top staff positions in Salem, it is more easily possible to screen new ideas and to distribute to all field engineers those methods which appear to be best.

R. H. Baldock is Oregon State Highway Engineer.

Wyoming to get a boost from county engineers

By Thurman D. Sherard

Administrative Assistant, Wyoming Highway Department

WYOMING has no definite program to attract qualified men, although each year an attempt is made to interest civil engineering graduates in employment with the highway department. For the past several years, this has been a difficult situation since these graduates have received many offers much more lucrative than Wyoming can present, usually long before their graduation. Therefore, Wyoming has hired non-college graduates and non-professional men with the intention of training them for their jobs. This procedure has worked out quite well, and in many instances these sub-professional men have made better employees on the average job.

The hiring of county engineers and their staffs to assist in the construction of state-county road projects has now been approved by the Wyoming State Highway Commission. This work will be under the supervision of a highway department engineer, but will release many of the department's regular men for primary highway work.

The Wyoming bridge department is presently studying the possibility of greater standardization of bridge design to alleviate somewhat the critical shortage of engineers for this work.

J. R. Bromley is Superintendent of the Wyoming Highway Department.

Fast promoting solves some of Utah's needs

By E. G. Johnson

Chief Engineer, Utah State Road Commission

UTAH IS HOPING for an increased salary schedule for all engineering personnel to help attract qualified men into the highway department ranks. Meanwhile, Utah is satisfying as best as possible its need for engineers in the following ways:

New men are sought from engineering schools, and among engineers who have become unemployed due to completion of other types of engineering work.

Due to a shortage of resident engineers in Utah, transitmen and chiefs of party are being promoted as rapidly as possible to become resident engineers. Also, resident engineers are being required to supervise more than one project at a time to compensate for the inexperience of relatively untrained men.

Increased salaries in Utah would definitely help to attract college graduates and others. Engineering graduates generally remain with Utah's highway department for only one or two years in order to gain experience, then they leave the state for more remunerative positions.

Engineering students are employed during their summer vacations, and also a few engineering students are employed as designers and draftsmen part-time during the winter months.

Engineering students who have not completed their work for degrees are welcomed as employees on a permanent basis. These men are employed in the various engineering classifications up to and including the position of transitman, according to the number of years of schooling and experience that they have acquired.

Women are employed where this appears feasible, particularly in designing and drafting capacities.

Foreign-born, unnaturalized engineers have been em-

HELP FROM IBM— It's in the works

MANY of the accompanying discussions mention IBM methods to help relieve engineers of tedious detail work. Machines designed and manufactured by the International Business Machines Corporation already are doing some compiling and computing operations in Western highway departments, but this use has been limited to the accounting and business end of operations.

IBM maintains an "Applied Science Department" which is actively searching for new applications of the machines in the highway engineering field. There are two places where the machines could "take over," based on this department's findings.

One is on the computation of earth moving requirements. A "Card Programmed Calculator" can compute and print the results for about 7 mi. of roadway per hour, working directly from field survey data.

The other is in the making of survey traverse closures. Working again directly from survey data, a calculating and accounting machine can team up to handle all of the computing automatically.

played in Utah. The department has soured on this practice, since non-citizen engineers complete two or three years of "training" with the organization and then return to their own countries, which actually wastes the time of the department in training such men.

A large portion of the engineering personnel in Utah is made up of men who, with little engineering background, have been employed in the lower grades and advanced to higher grades through years of experience.

Drafting, designing and materials standards manuals have been prepared to speed the training of new men.

Duties are being simplified wherever possible so that routine work can be turned over to non-engineers or sub-professional. Calculating machines and other mechanical aids are being employed where possible to expedite work.

A limited amount of standardization of engineering practices has been accomplished to date. Materials tests have been simplified and standardized so that many are more of a mechanical operation.

Engineer time-savers may cost more, but...

By Raymond Archibald

Chief, Western Headquarters, Bureau of Public Roads

IT IS SUGGESTED that efforts should be made toward accomplishing "more engineering with fewer engineers." It may be necessary to accept methods in many cases which add to the overall cost of engineering operations because they are "superimposed" on the normal budget for manpower and operations.

Examples of these methods are many. Aerial photography is a good example. Rather than measuring aerial surveys in terms of costs of ground surveys, it may be well to begin thinking of this type of survey as a necessity if location work is to be given the engineering it deserves, because the engineers to do ground surveys will not be available.

Radio communication on location and construction is another good example. This has not been given enough serious consideration on ordinary highway work because of its costs. Here again—the question should be whether it takes less engineers rather than will it cost more.

Specifications should be reviewed carefully to determine if it is necessary to require so many inspections. For example sonic measurements could determine the quality of concrete as placed and not make each step in its manufacture follow certain set procedures.

It seems that a machine could be developed that would automatically record the area of a cross section of cut or fill section, either by mathematical or photographic methods.

The samples required should be reduced to a bare minimum. This applies to traffic counts, road use studies, as well as materials. The IBM is an almost "must" in many of these surveys now.

Several state highway departments are now taking lump sum bids for the structural steel in the superstructure of a bridge. This eliminates long tedious hours of calculating the wet weight of structural steel. The same idea might be applied to other items which require so much time to calculate the final quantities.

Another means of utilizing the engineer's time to best advantage would be the use of small planes operated by the highway department.

If we could look forward to a normal supply of engineers in the future, the problem would be easy to solve and we could continue to operate as we do now—efficiently and economically. But we are faced with a serious shortage of engineers, and we must meet the situation without allowing the required engineering to be diminished. Probably at a greater cost, yes—but with fewer engineers.

How Washington met a double challenge

By William A. Bugge

Director of Highways, State of Washington

IN WASHINGTON, less than half of 1953 will have passed before total highway contract awards will have exceeded those for all of 1952. It takes capable engineering manpower to plan and direct highway construction, and Washington's program has more than doubled since 1950. It is obvious that the manpower shortage was a major obstacle to overcome in handling this greatly increased volume of office and field engineering. Washington's campaign methods for recruiting more engineers are the result of considerable attention.

First, a merit system featuring an objective program of hiring, giving tenure on the job, and providing for promotion was set up. The merit system has done much to attract and keep qualified men.

Cooperation with the colleges was sought and new men were obtained through regularly scheduled interviews.

Men for lower level engineering jobs were encouraged to apply at any time in any one of the six districts where offices are maintained.

News releases were helpful in attracting the attention of potential applicants, and from time to time, jobs were listed with the state employment agencies. Commercial advertising in newspapers was also used.

ADMINISTRATOR

**William Bugge,
Washington's
Director of High-
ways, manages a
program that has
more than doubled
since 1950.**



Age standards have always been exceptionally liberal in Washington's highway department, and men be employed any time up to their 70th birthday. Now, men past the age of 70, where they possess a particular skill needed for work on a temporary basis, are being granted extensions of time.

Physically handicapped applicants are being hired where the proper placement guarantees that they will not endanger themselves or their fellow workmen.

Experience requirements have generally been maintained, although formerly much more than maximum requirements were necessary and minimum experience requirements are now accepted. Minimum requirements are held for new employees, but they have been relaxed in a few cases to permit promotion of competent personnel within the ranks of present employees.

Work experience and correspondence courses equivalent to college training have been made acceptable as qualifications for some positions. Men who have not completed college are hired at sub-professional levels and are found to be excellent material for on-the-job training.

Women are employed in engineering offices to do drafting, but no women are assigned to field jobs.

Undergraduates in civil engineering have been encouraged to apply for employment. Summertime crews are built up largely through utilization of their services.

What has proved to be the best method of speeding up the indoctrination of college graduates is the program for summer employment during undergraduate years. Indoctrination in highway department policies and objectives is actually done through on-the-job training after the man has graduated.

Advisers in civil engineering at both of Washington's state colleges have arranged courses to provide the most practical background for highway engineering. Washington State College, for example, has special courses in highway work.

This program has worked. Enough help has been obtained to man the field parties and to carry on the expanded program. The principal lack, in capable draftsmen and engineers qualified to assemble the data and evolve them into finished plans, was alleviated by shortening the process itself. The overload of work fell particularly on the regular office forces, which per man undoubtedly turned out more work than ever before. The real answer, however, came in authorization for overtime for field and office employees as they were needed to keep surveys and plans apace with contracting schedules.

It was possible to attack this manpower problem from another position—that of eliminating as much of the manpower needs as possible. Aerial surveys have been found to be very useful in eliminating need for crews to work at the tedious job of preliminary locations. Use of accounting machines has eliminated many man-hours of computations.

“Schools” in the field build Nevada forces

By A. Berning, Jr.

Engineer of Personnel, Nevada Department of Highways

BECAUSE of the attractive salaries paid graduate engineers by industries and other agencies, Nevada has had little success in employing engineering graduates. Therefore, although engineering graduates are encouraged to join the department, Nevada has turned to other sources for manpower.

Continually, training is being given to applicants who do not have an engineering background, and this program has been successful, particularly for men on survey crews, and for computers in the headquarters design department and in field offices. Employment of engineering students who have left college before graduation is encouraged. If interested in highway work, they prove to be good material and promotion is fairly rapid.

Many positions have been filled with physically handicapped applicants, particularly in the design department, field offices and on inspection operations.

The employment of women is encouraged in headquarters design and planning department, particularly for those who have experience in drafting and computing.

Nevada's experience in employing non-citizen engineers has not been satisfactory, so applicants of this type are not solicited.

H. D. Mills is Nevada State Highway Engineer.

THE PROBLEM—and how it mushroomed in one Western state

HIGHWAYS are being built in Washington at a faster rate than ever before in the state's short history.

Washington, like most Western states, has experienced a considerable increase in population during the past few years. Registration of motor vehicles has increased at an even faster rate than population. In 1940, population of the state totaled 1,736,191; by 1950 it had reached 2,378,963. In 1940, total registrations of vehicles equaled 603,037; by 1950 they had reached 979,176; by 1952 the total was 1,053,511.

No let-up in sight . . .

And the future seems to promise no let-up in the rate of development. Estimates indicate that the State of Washington will continue to develop; its population will continue to grow; registrations of its motor vehicles will continue to increase.

Forecasts by experts of the U. S. Bureau of Census are that by 1960 3,000,000 people will be living in the state. If the same ratio of people to vehicles continues to exist, Washington will have about 1,300,000 motor vehicles registered in 1960.

This rapid development during the last decade, and the prospects for continued increases in population and motor vehicle registrations, together with the fact that highways in many sections of the state were crowded and not serving traffic effectively, brought home to the people the need for extensive highway improvements. To meet the need, the 1949 legislature raised the gasoline tax from 5 to 6½ cents per gallon, increased the basic registration fee from \$3 to \$5, and revised various capacity and weight fees upward.

The revision in the highway user tax schedule increased considerably the amount of revenue available for additional highway improvements. In 1948, the year before the increase in fees, revenue from gasoline taxes and license fees for state highways equaled \$19,047,373. In 1950, the first full year after the increase, such revenues totaled \$30,221,732.

This amount of revenue wasn't enough to pay for the improvements considered to be needed immediately, so the 1951 legislature provided for a \$66,703,625 bond issue to be repaid from revenue accruing yearly to the motor vehicle fund. The enabling act required the money from the bonds to be spent on specific portions of the highway system. Construction made possible by the bond issue was spread over a balanced period of four years, thereby adding about \$15,000,000 annually to a normal construction program of \$35,000,000 to \$40,000,000 per year.

It was uppermost in mind that the added load of engineering imposed by the new bond project must not operate to retard or interfere with the normal program financed from the motor vehicle fund. In a general way this aim has been met, although because of the urgency of certain grading and bridge projects, some priority was necessarily given to engineering for the bond program. Field help, particularly, was scarce all during 1951 when the greatest volume of field engineering ever undertaken by the highway department was under way, and this scarcity acted to slow up operations somewhat.

. . . but the campaign has hit its stride

It was obvious that manpower and material shortages were the two big obstacles to overcome. While not much could be done about the material shortage, quite a lot could be done about the manpower problem. Consequently, a campaign to make state highway service more attractive was initiated. [The methods and success of this campaign are described on the preceding page.]

That this program has paid off is witnessed by the fact that in 1951 about \$26,000,000 in contracts was awarded; in 1952, about \$33,000,000; from January through May of this year it is expected the total will be \$34,000,000. Less than half of 1953 will have passed before total awards will have exceeded those for all of 1952. The expanded highway program in Washington has hit its stride and will gain added momentum in the days ahead.

California streamlining design and inspection

By George T. McCoy
State Highway Engineer, California

TO OBTAIN additional engineering personnel for the considerably expanded program in California, a recruiting program was developed soon after World War II in cooperation with the state personnel board. This program is nation-wide.

Since it has not been possible to hire as many engineers as required, it has been necessary to augment and intensify the work of the engineering forces as much as possible.

It has not been considered desirable to relax any of the requirements for employment in the engineering classes, but increasing emphasis has been placed upon such items as the expanded use of women in engineering offices, the increased use of non-engineering personnel, and the provision of supporting aids wherever they can be used to advantage. Students always have been used during summer vacations to augment permanent forces.

While indoctrination of new employees, which is handled by district engineers and department heads, has been generally satisfactory, some refinements are under study which will be adopted where they seem to be justified. One recent development which has been of considerable help has been the publication of the first section of a new planning manual.

Current considerations before the California Legislature could result in a great increase in the highway construction program. While intensive recruiting efforts will be continued, it is probable that the resulting increase in staff will be limited. To accomplish the increased work with the personnel available, it therefore will be necessary to use every possible means to increase the productivity of our staff. Already expanded use is being made of photogrammetric surveying, and several methods of streamlining design and construction inspection procedures are in various stages of development.

Handling an increased program with a restricted engineering staff would present many problems, but it is not expected that any of them will be insoluble.

Machines, less detail are output boosters

By F. W. Panhorst
Assistant State Highway Engineer—Bridges, California

THE BRIDGE Department of the California Division of Highways has given serious consideration to ways and means of overcoming the shortage of engineers. Some suggestions have been put into operation; others are being tried out, and others are still being considered.

A study of all plans is under way, and consideration is being given during the new designs to eliminate all unnecessary details. Many items such as unnecessary shading, duplicated sections and similar unnecessary details can be eliminated without detracting from the value of the plans.

A large amount of engineering hours is spent in calculating quantities on which to base unit items. It is proposed to let certain units as a lump sum, such as structural steel, railing, and certain portions of structures where there is very little possibility of a change during construction from the contract plans. Footing blocks, structural excavation and other items which might vary during construction, of course, are unsuitable for lump sum bid items.

DRAFTING DESIDERATUMS



"AN EXTRA LINE is a waste of time" is a timely motto for highway staff draftsmen. Now especially, drafting must be stripped of its frills without surrendering either clarity of presentation or accuracy of dimension. The end result of designing and drafting is fabrication, erection and operation. And, in the final analysis, it is the man at the drawing board who must choose between the necessary and unnecessary for attaining this result with the greatest economy of time. He must be able to increase his own over-all efficiency and output. The best book we've seen yet to aid him in reducing the time and effort required to make effective drawings is "Simplified Drafting Practice" by Healy and Rau (for a complete review of this book, see page 110 of the May 1953 *Western Construction*).

It is discouraging to note that in almost any office a large amount of pencil pushing is done by high-salaried and competent engineers. Much of this work can be eliminated by using voice recording machines. These machines can save many man-hours in making reports in the field, writing memorandums, correspondence, and general instructions.

An electric lettering machine has been secured for lettering plans. The machine is operated by a typist, thereby saving many man-hours of an engineer's or draftsman's time.

Each engineering position is being studied by the head of the department and analyzed to see if the particular position can be filled by a non-engineer.

With pay OK, new plans now in New Mexico

By L. D. Wilson
Administrative Engineer, New Mexico State Highway Dept.

NEW MEXICO has already taken action on providing higher salaries and fringe benefits and is now preparing a more extensive recruiting and training program.

New Mexico is hiring men from 16 to 65 years old, and training is given to compensate for inexperience in engineering. Extensive use is made of engineering students during their summer vacations.

Newly-hired college graduates and others are trained rapidly by assignment to field and office crews. A cooperative program with schools and colleges is being formulated to be started in the fall of 1953.

Inspection, office and surveying manuals are being prepared, and formal training courses are being conducted.

Sub-professional work is being turned over to non-engineers, all possible work is being performed using mechanical aids, and engineering practices are being standardized where possible.

C. O. Erwin is Chief Highway Engineer of the New Mexico State Highway Department.

Colorado recruits with vigor, trains rapidly

By J. F. DeVivier

Personnel Director, Colorado Department of Highways

COLORADO has carried out and is continuing a vigorous program in both recruitment and training.

First step in the program was the setting up of a better pay plan, which now not only offers a better starting salary but also provides a substantially better range within grade providing for merit increases of sufficient amount to be attractive.

The services of both state and commercial employment offices are used in recruiting. Engineering societies in the schools are contacted in the search for qualified men.

Age standards have been relaxed somewhat to allow the hiring of young men into the sub-professional grades. The use of handicapped people for such jobs as drafting is not overlooked.



BUSY
Jack DeVivier,
Colorado Department of Highways Personnel Director, has achieved notable success in meeting his state's manpower problem.

Colorado has long advocated the relaxation of educational requirements as one of the solutions to manpower shortages. Competent high school graduates are hired and given in-service training, and encouraged to engage in off-the-job training at their own expense. This procedure has developed a fine supply of men qualified to do all types of engineering work.

Colorado finds that engineering students who have had to leave college before completion of work toward degrees develop into good engineers, and many times after going on the job they do complete their engineering courses.

The use of women is encouraged for drafting room work, but not for field operations.

Engineering students are used during their summer vacations for two reasons. One, Colorado's climate limits the construction season, and therefore it is necessary to build up forces during the summer months. Thus, this group offers a supply of men who are not yet interested in permanent employment, and also these employees can be released easily in the fall. Second, by using students during their summer vacations and giving them occupational experience, Colorado can show them the advantages of permanent employment in highway work.

Colorado is now taking a look at faster and more effective indoctrination of new personnel. The plan of action is to train supervisors in the most modern method of job instruction training. A department "Training Officer" works with individual supervisors in developing their own training program. He also helps them to make job breakdowns and to set up training tables. Also, check-ups are made

of the individual progress of each employee. The training progress of each graduate engineer employee is watched, and these men are moved around in order to round out their experience in all phases of highway engineering.

Colorado is willing to cooperate with schools and colleges for training student engineers for highway work, but the complaint is made that the schools are not in turn willing to cooperate. Perhaps it's the moth-eaten tradition of general educational training, which the colleges believe prepares the graduate for any specific job for which he might be hired—building a bridge, a road, a dam or a hydroelectric plant. Colorado's personnel department believes this "shot-gun" method of education is doing little to help alleviate the shortage of highway engineers.

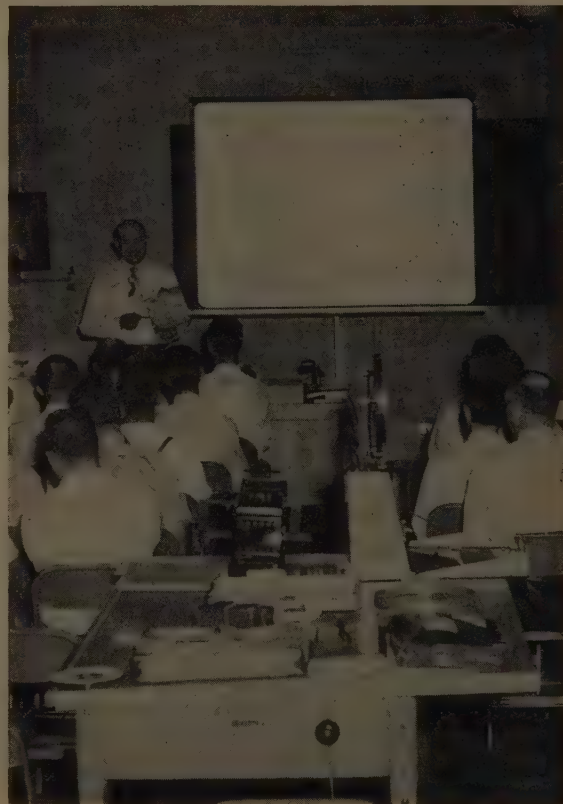
Efforts are being made to have more engineering detail work done by non-engineers or sub-professionals. Mechanical aids are approved, but have not been used extensively as yet. Attempts have been made to standardize engineering practices to save time and eliminate details.

Savings could be accomplished through greater use of photogrammetry for making surveys and preliminary locations. Substantial savings could also be accomplished through greater use of IBM equipment for calculating cross sections and other survey data.

Better scheduling of highway projects, where possible, would result in better utilization of trained men throughout the year and efficient use of available manpower.

Mark U. Watrous is Chief Engineer of the Colorado Department of Highways.

VISUAL AID training to make new employees efficient more rapidly is an important feature of Colorado's manpower activities. The use of film strips, slides, charts and cutaway models enables the department's experienced engineers to give organized instruction in a minimum of their valuable time. Visual aid equipment set up for training course in photogrammetry is shown below. Visible are a 16-mm. motion picture projector and a 35-mm. slide projector. Not visible are a wire recorder and a visual cast projector. A complete review of Colorado's training methods will appear soon in *Western Construction*.



Idaho concentrates on on-the-job training

By Keith E. Englund

Personnel Officer, Idaho Department of Highways

EARLY IN 1952, the Idaho Highway Department initiated an "engineer-in-training" program to attract civil engineering graduates (see box). Also, the entire department was reorganized and qualifications and salary schedules were revised to make the department's salaries competitive with private industry and other Western state highway departments.

Part of the reorganization resulted in initiation of a rigid qualification and classification plan. Adhering to this strict qualification schedule made higher salaries possible, so that they now compare favorably with other engineering agencies.

Idaho taps five main sources for securing new engineering talent:

- (1) Colleges and universities.
- (2) Other state highway departments.
- (3) Private engineering and consulting firms.
- (4) Professional agencies participating in engineering activities.
- (5) In-service training programs to train sub-professional activities.

Engineering students who leave the colleges before they graduate provide a definite source of securing sub-engineering employees. Raises are granted on a 6-month increment schedule, and promotions are dictated by the individual's qualifications. Therefore, Idaho offers security and advancement for college students who do not possess a degree.

IN-SERVICE TRAINING— 8 rules outline the right way

SPEAKING before the 32nd Annual Meeting of the Highway Research Board last January, Robert Winfrey of the Bureau of Public Roads outlined the basic requirements of an in-service training program. He recommends that the following eight points each be considered in order that such a program can reach its goals successfully.

- (1) A planned program to continue over several years. No now-and-then efforts. The program planned on a logical sequence basis.
- (2) In addition to initial instruction to employees in a given area of training, a systematic follow-up program. New ideas, practices and knowledge presented in "refresher" courses.
- (3) All employees should be reached.
- (4) The engineering college graduate should be marked for special attention. He needs a controlled course of two to three years duration. From among them should come the future department heads and administrative key men.
- (5) Bosses in shops and on maintenance and construction are supposed to know more than their men, so a training program must see to it that such is the fact.
- (6) Because the objective of employee training is to improve quality and quantity of work done, such accomplishment on the part of employees needs recognition. Placement and promotion policies should be coordinated with the training program.
- (7) A training program must have high quality instruction. Good teachers may come from within the department or, for certain areas of training, they may come from outside, colleges or industry.
- (8) No training program would be complete without continuous evaluation. How is it doing? Are the employees learning? Are the employees putting into practice what they are taught?

IDAHO'S ATTRACTION— 4 years of "work while you learn"

TO OBTAIN and retain qualified college graduates, the Idaho Highway Department has initiated an Engineer-in-Training Program. This plan consists of two stages, or 4 years, the length of time after graduation before the new employee takes the engineer licensing examination.

The two stages, and qualifications, are as follows:

Stage One

- Graduation from an approved engineering school. BS or BA Degree in Civil Engineering.
- Aptitudes and ability to advance to a higher position. Free from disabling effects.
- Salary range \$320 to \$380 per month.
- Employment in an engineering capacity during the summer months is taken into consideration in obtaining a position under this training program.
- A Master of Science Degree in Civil Engineering will substitute for one year of experience.

During this stage the engineer in training is given a general background of engineering in the following phases: construction, maintenance, highway and/or bridge designing, planning, materials and/or right-of-way.

After this stage is completed the Engineer in Training is consulted to find out what phase of highway engineering he is interested in for specialization and for the next two years he specializes in his choice.

Stage Two

- Graduation from an approved engineering school. BS or BA Degree in Civil Engineering.
- At least 2 years of progressive experience in the Idaho Highway Department, supplemented by extensive reading and home study in the field of engineering.
- Specializing in one of the following fields: construction, maintenance, location, highway and/or bridge designing, planning, materials or right-of-way.
- Aptitudes and ability to advance to higher positions.
- Salary range \$360 to \$450 per month.

The primary purpose of the program is to attract and retain qualified engineers. This plan provides for recruiting civil engineer graduates each year and to give them a 4-year training program in all phases of engineering in the Idaho Highway Department according to a definite job rotation schedule.

This program is supplemented by adequate and just personnel policies in the following phases:

- A probationary period preceding final appointment.
- Promotion based solely on merit and fitness.
- In service training programs.
- A classification program which places employees in proper groups based on working performance and with appropriate position titles.
- Salary schedules with minimum and maximum salaries for each group.
- Service records to serve the basis for advancement and promotions.
- Reasonable security against unjust dismissals or demotions.
- Good working conditions, uniform hours of work, vacation and sick leave privileges.

Idaho's policies do not discriminate against hiring female engineers, either in field or office. However, no women are now engaged for the state's field engineering forces.

No formal training program is provided for employees who do not have an engineering background. However, they are trained in their positions by qualified engineering personnel.

Personal interviews are arranged with newly-hired college graduates so that benefits and advantages of working with the highway department can be explained. A brochure has also been prepared to explain Idaho's training program and fringe benefits.

Idaho is cooperating with the University of Idaho by

HELP FROM THE FOUNT— Ask the engineers themselves!

HERE'S A LIST of questions that every highway engineer could answer for the administrators of his department's operations. It would elicit the most practical and useful information from the engineering staff.

(1) What specific jobs and tasks are you now performing which could be turned over to non-engineer technicians?

(2) Are there any of your duties that could be simplified so that part or most of them could be turned over to subordinates?

(3) Is there any of your administrative detail work that could be done by non-engineers or competent secretaries?

(4) Can you suggest how a training program for recent college graduates could make them better equipped to be of assistance to you?

(5) What changes or improvements in organization and planning would you recommend to lessen the engineering staff's workload?

(6) Do your working conditions enable you to work with peak efficiency? If not, what could be changed?

(7) Do you know of any persons within the department who would make good technical assistants or who would be interested in training for such work?

(8) Is there any of your routine work that could be performed by mechanical aids or made easier through their use?

(9) Do you know of any engineering operations that could be changed in order to reduce or eliminate waste time and motion?

This checklist is based on Executive Research Survey No. 2, prepared by the National Society of Professional Engineers.

maintaining a materials testing laboratory at the university, and training is provided for students there both during the school term and summer vacations.

To train men more rapidly, a standard book of specifications has been prepared. Also, a new inspectors manual depicts the types of methods used in inspecting the different types of materials.

Wherever feasible, more engineers and sub-professional engineers are functioning in duties formerly assigned to engineering personnel. Idaho is now in the process of reorganizing and streamlining its maintenance and engineering divisions so as to utilize to the fullest extent available engineering personnel.

E. V. Miller is Idaho State Highway Engineer.

Arizona's climate is a boon to recruiting

By R. C. Perkins
State Highway Engineer, Arizona

ONE FACTOR in the manpower shortage which has been found to be in Arizona's favor is the general Westward population trend, which brings into the state a certain amount of skilled personnel. Some are looking for a more temperate climate, some are health seekers, while others seem to feel that new frontiers are opening up in Arizona in the thinly populated but rapidly developing areas.

To recruit graduate engineers, personal visits are made to the campus of the University of Arizona (the only institution in the state offering engineering degrees). A relatively small percentage of qualified men are attracted into highway work despite this activity. Competition from private industry is strong; others offer more lucrative starting salaries than the highway department. Arizona,

however, attracts and interests some students by offering them summer employment.

The tendency is, of necessity, to pass on some responsibility to younger, less experienced men, although Arizona has been able to maintain a nucleus, or cadre, of experienced personnel. Women are used only in offices.

The department is resorting to as many mechanical aids and standardized practices as possible to eliminate details. The use of standard structure design has long been a time-saving feature of the bridge and plans division in Arizona.

In the face of all that is being done to lessen the shortage of engineering personnel, it is still difficult to escape the conclusion that the most effective answer would be—more money.

"Permanency" offered as Montana's inducement

By Scott P. Hart
State Highway Engineer, Montana

MONTANA concentrates on providing permanent employment for qualified men as the best inducement for keeping its engineers. New personnel is recruited primarily from Montana schools.

Age standards have been relaxed somewhat, but physical standards have not. Experience and educational standards have both been loosened, and men who have no engineering background are hired to be trained. Women engineers are not used in field or office. Engineering students are encouraged to work during the summer.

Instruction and supervision activities have been arranged to help indoctrinate new employees more rapidly. Wherever feasible, planned training courses, procedure manuals, and inspection manuals for various types of work have been prepared.

For accomplishing more work with a limited staff, some mechanical aids are used, but generally, efforts have been devoted to attaining tight supervision.

TIPS FROM TEXAS— A two-step training plan

EFFECTS of the critical shortage of trained inspectors, instrumentmen and draftsmen in the Texas Highway Department have been alleviated by a two-step program.

First, a plan was set up to train engineering personnel in these categories. This program involves a series of schools at Austin to train instructors who, after receiving their training, organize and teach classes within each of the districts where on-the-job training could also be accomplished.

Secondly, manuals were prepared for use in the "Inspector's Schools" as conducted by the instructors in each district. The manuals are intended to supplement the specifications, construction bulletins, laboratory demonstrations and practices, class work and on-the-job training in carrying on a continuous program for inspectors.

The manuals cover these subjects:

- (1) Hot Mix Asphaltic Concrete
- (2) Surface Treatments and Cold Bituminous Mixtures
- (3) Concrete Pavement
- (4) Earthwork and Flexible Bases

Reports from all Texas districts indicate that the training program has been successful—the men are co-operating, and the manuals are being used effectively.

Preparation of the manuals and the schooling program have been in charge of Jed N. Robinson, Construction Engineer. D. C. Greer is State Highway Engineer of Texas.

GIVE YOUR EQUIPMENT A BREAK

... And it will repay you richly by keeping your job going instead of breaking down at crucial moments — Ten tried and true suggestions for getting more out of construction equipment

IN SPITE OF its status as a post-election year, 1953 will likely see highway construction raised to a new level of dollar volume. That level promises to be permanent. In keeping with the many problems this situation is likely to create, 1953 may also well be known as the year in which engineers, as well as contractors, became interested in the equipment business.

Many signs point in that direction. In the state of Washington, for example, State Highway Engineer W. A. Bugge urges that more attention be given to contract completions on time. Some 3,000 mi. away, in Washington, D. C., one of the last things Commissioner of Public Roads Thomas H. MacDonald does before his retirement is to urge again, as he has done before, that America start winning its highway battle.

In the state of Idaho, State Highway Engineer E. V. Miller dares to set up production-performance standards for a snowplow not now conceivable. More and more emphasis by master mechanics on spreads of equipment is being directed toward the maintenance of machines in top-notch operating condition. The contractors who are making money are the firms whose men are selecting equipment well, assigning it to work

that equipment is best suited to perform, and demanding that down-time for any cause be kept to an absolute minimum. The contractors in financial difficulty, on the other hand, are the ones who have ignored these simple fundamentals.

Can't afford failures

In this new era of stepped-up state highway construction, no state highway department can afford to have a single one of its contractors going broke. Neither can the contracting business afford it. Highway contractors no longer are fly-by-night organizations. They are—or at least should be—permanent business fixtures, dedicated to serve a country whose commerce moves on wheels. By all the rules of common sense, that point should be above argument.

The most ironic thing in the construction business is that exceptions to this rule still exist in practice.

Visit many a highway job, and what do you find? On a northern expressway job, shut down for the winter, a big equipment spread worth approximately \$600,000 stood exposed to rain and snow for months without even tin cans over the exhaust pipes for protection against rust. On many a spread, almost as much equipment is



as idle in the yard as is working on the job. Too many people who call themselves master mechanics, but who wouldn't make patches on the seat of a good master mechanic's pants, still permit parts inventories to dry up completely, with the result that a piece of equipment can be down for days, sometimes, while ordinary replacement parts are flown to the job, sometimes at great expense.

Most resident engineers feel that idle equipment is none of their business, which is the worst thing of all.

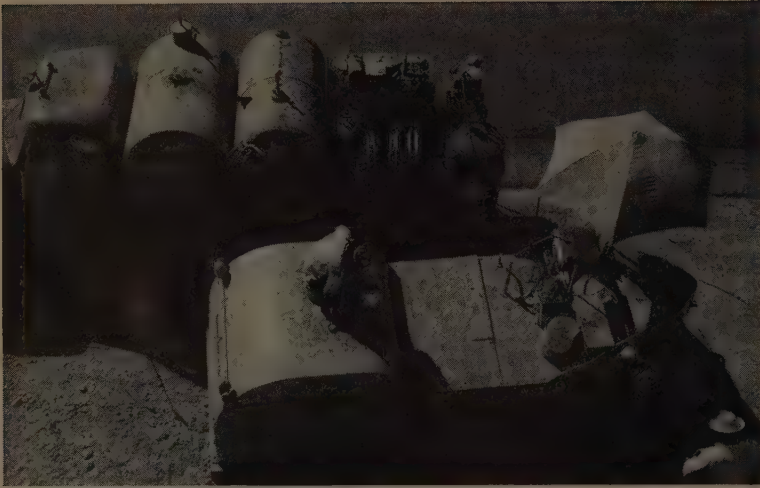
Situation changing

That situation, however, is so much on the wane that 1953 definitely should be the year in which inefficiency in equipment operation and maintenance largely disappears from the highway building and upkeep scene. Too many skilled contractors have now pointed the way to bigger profits by their equipment selection, operation, and maintenance. The competitive advantages these firms are now enjoying are more and more forcing less skillful organizations to adopt better practices.

One of the weakest parts of this entire relationship still is the feeling on the part of many a resident engineer that down-time of contractors' equipment is none of his business. Nothing could be farther from the truth. The whole business of a project's completion hinges on the application, in as short a time as possible, of a certain number of hours of equipment and labor. Anything the engi-

TAILGATE and push block repairs to this unit, unless they are made quickly, may throw this Utah highway job off schedule for days. Parsons & Fife Construction Co. is doing the work.





THE RESIDENT ENGINEER who thinks this maintenance scene is none of his business is wrong. Completion of the job on time may hinge on how well these oilers grease and service the roller.

neer can do to help his contractor arrive at that optimum number of hours will lower that contractor's costs, do a better construction job, and finish the facility in the minimum time.

What can be done?

Many things can be done to get more out of construction equipment. In fact, most of these suggestions have been carried out at some time or other by contractors hard-pressed to lower their costs. Some of the things good outfits are doing are these:

1. Top-level policies are being created in the executive echelon of the contracting organizations which direct that constant studies be made of the selection, operation, use, and maintenance of every piece of equipment that firm owns.

2. Except where previous experience clearly shows that certain main-

tenance practices are superior, manufacturer's recommendations are being followed to the letter. In this respect, several sets of instruction books are being furnished at key points throughout the jobs, and all aspects of operation and maintenance are being placed under competent mechanical supervision.

3. Unless night lubrication and other service is under dependable supervision, it is being discontinued on many jobs. Contractors are finding that it is cheaper to keep one spare unit in the line and service everything in the daytime under competent supervision. No equipment can run long on bearings night oilers failed to lubricate while they were sleeping.

4. Many equipment distributor organizations now offer a free parts inventory service.

5. The type of superintendent who

will overrule his master mechanic by demanding that equipment be held on the line and abused for the sake of minor and temporary increases in production is on his way out. Good contractors want superintendents who have the ability to get reasonable production out of their equipment over sustained periods of time without expensive breakdowns.

6. Weekly washing and steam cleaning is rapidly becoming standard practice, especially on excavating spreaders. This practice builds a healthy psychological respect on the part of operators for their equipment, and even more important, it allows mechanical inspections to uncover incipient breaks or other signs of failure which can then be repaired over a week-end before they become major breakdowns.

7. Equipment abuse of any kind is no longer being tolerated. Operating speeds on many a haul road are now being posted in engine rpm's by the better contractors. On some jobs, spinning the tires of a bogged down rubber-tired machine is cause for dismissal of the operator. By using spotters and dump men to kick aside loose rock around loading points, some outfits have more than doubled their normal tire life.

Safer, too

8. Some companies now consider equipment operation as a part of their safety programs. In fact, equipment operation as well as safety is taken up between foremen and operators at each periodic meeting. Undoubtedly this practice has averted many an accident involving a machine.

9. Misassignment of equipment always heightens production costs, as well as involving other economic and psychological values. Sometimes, fleeting temporary conditions justify such misassignment, but 1953-model highway building cannot sustain itself if contractors or engineers tolerate the misuse of equipment over long periods of time.

10. All good contractors and some good engineers are now giving new emphasis to the breakdown time of machines. One county road department recently permitted a D7 to stay idle for 60 days with a broken final drive. By way of contrast, a broken final drive on the same machine can be repaired—and is—on contract jobs, often in a single 8-hour shift. By stocking spare made-up transmissions, differentials, engines, and so on, the ineffective working time accompanying breakdowns is constantly decreasing as contractors become more and more aware of the relationship between effective working time and over-all profit.

The future of America's sustained highway building program depends largely on how well all concerned use their heads to get optimum production out of the finest equipment in the world.

IS THE SPEEDY movement of this wagon drill important? You bet it is. Header pipe carried air to the machines. Job location is on Oregon's Hood River.



Logging road bridges in Washington —

Prestressed for structural economy



High jobs costs at remote bridge sites met by prefabrication — Fast erection time recorded for husky concrete spans

TWO PRESTRESSED concrete logging bridges designed by Powell and Eldridge, Seattle structural engineers, now have been completed and are in use in timber areas of the Olympic peninsula in Washington.

Other spans are in the planning stage and they will follow the pattern established in construction of the Humptulips Bridge, first prestressed concrete truck span completed on the West coast, located north of Aberdeen, Washington, and Burma Bridge, situated west of Port Angeles.

Based on a preliminary survey of logging operators who have inspected the spans, the advantages that most appealed to them in prestressed concrete construction were the lower costs and the speedier, easier building methods employed.

One of the bugaboos of construction work in connection with logging operations in the Pacific Northwest is the increasing inaccessibility of the jobs, due to the retreat of the forests into higher, more rugged country. Construction of poured-in-place spans needed in connection with access roads has required the maintenance of construction crews in the field for long periods and the establishment of long-distance supply routes. The new designs, which combine prestressing with precasting, have cut the time spent at the construction site to a minimum and have eliminated the

need for a continuous supply operation.

Scope of work

For Powell and Eldridge, work in the field of prestressed concrete construction was preceded by activity in the field of precast bridges. One such span, a 30-footer which crosses Rattlesnake Creek near Yakima, Washington, was assembled last fall in less than 3 hr. by a 5-man crew using a truck-mounted hoist.

The Humptulips Bridge, constructed in an isolated area 45 mi. north of Grays Harbor, was purchased by the Anderson & Middleton Lumber Co., Aberdeen, for \$24,000—about three-quarters of the cost of a conventional bridge of the same length.

The Humptulips Bridge is 124 ft. long and 16½ ft. wide. Six prestressed concrete beams 76 ft., 4 in. long were laid side-by-side to form the center span, and six 25-ft. beams of the same type form each approach.

All 18 beams were precast and prestressed in Tacoma by the contractor, Neukirch Bros. of Seattle, and then

hauled 125 mi. by truck and steering trailer to the construction site. The long beams, weighing 20 tons each, were delivered without incident, the route having been carefully reconnoitered in advance.

Each of the beams was cast in the shape of an I-beam, with the top flange, which forms the road surface, being 2 ft., 9 in. wide. The beams are 3½ ft. deep and the web is 5 in. thick.

Plastic-coated plywood was used in making the forms. The concrete used was an 8½-sack mix with 3¾ gallons of water per sack.

Six lengths of 1-in. Roebling steel strand were hung in place inside the form before the concrete was poured. As is usual in cases where the strand is stressed after the concrete has set, each strand was greased and then wrapped in a plastic sheath to prevent it from bonding with the concrete.

No special methods were used to reduce the water-cement ratio or to hasten the setting of the concrete. When tests showed that the concrete had set sufficiently to withstand pressure of 5,000 psi. (within 5 days after being poured), the stressing of the six strands in each girder was begun.

Butt-plates were in place as the concrete was poured and the threaded tip of each strand extended through the plate with a lock-nut in place, ready to be tightened. Three of the strands were arranged in the lower

PICTURED ABOVE:

MANUFACTURED in Tacoma, the prestressed beams were loaded on trucks and steering trailers for transport to the job sites, over 100 mi. away.



TRAFFIC LIKE THIS required permanent bridge construction on backwoods haul roads. Burma Bridge over Calawha River west of Port Angeles is one of the new prestressed structures.

flange of the beam and three in the center web. A hydraulic jack was used to stress each strand individually.

Erection

The initial stress of 82,000 lb. on each strand reduced to 61,000 lb. by the time the beam was in place in the bridge, due to creep in the strand and plastic flow in the concrete. However, the overall initial "squeeze" of 492,000 lb. put a camber of 0.8 in. in each

beam, and this camber remained after the stress dropped to 366,000 lb.

The beams, which borrow their strength from the high-tensile qualities of the strand, are keyed together by means of grout-filled key areas and steel lock-bars. Both bridges meet the maximum requirements of the Washington State Highway Department and, since both are in use within the boundaries of Olympic National Forest, designs were checked and ap-

proved by Kelly B. Heffner, bridge engineer for the U. S. Forest Service, Portland, Oregon.

Due to unfavorable weather, completion of the Humptulips Bridge was delayed several weeks, but actual working time put in by the 6-man assembly crew totaled less than 8 days. A Lorain mobile crane was used to move the beams into place.

The second span to be completed, the Burma Bridge, was purchased by the Albion Creek Logging Co., Aberdeen. The bridge is 125 ft. long overall, with a center span of 65 ft. It crosses the Calawha River, 45 mi. west of Port Angeles.

The 18 beams required to complete this span were hauled more than 200 mi. from Tacoma to the construction site, following a route which led around the Pacific Ocean side of the Olympic Peninsula.

Speed of work

The manufacturing methods employed in precasting and prestressing the beams were identical with those used in making the beams for the Humptulips span. However, actual working time at the construction site was sharply reduced. It required an average of only 1½ hr. working time to place each beam, so that the entire bridge was completed in less than 4 days working time.

The sharp speedup was made possible by construction of a temporary wooden span next to the site of the new bridge. Once the piers of the permanent bridge were in place, the crew using only a truck hoist, skidded the 65-ft. beams into place on 12 x 12-in. timbers.

Alaska has its peculiar problems

THE ISOLATED location of most highway construction in Alaska makes it mandatory to plan jobs thoroughly well in advance and to carry adequate inventory for maintenance of equipment, according to a spokesman of McLaughlin, Inc., Great Falls, Montana. Other comments on the problems of Alaska's road-builders are as follows:

Transportation and supply

The big problem of getting equipment onto the job is to get it shipped and handled by the various agents promptly enough so that too much time does not elapse from shipping date until arrival date on-the-job. A typical delivery sequence is this—equipment transfers from railroad to dock to ship, then from ship back onto the dock, then back onto other transportation facilities, to a railroad, then from railroad back off onto ordinary trucks and so to the job site.

The excessive amount of rush and hurry during Alaska's short construction season makes all shipments to the

Territory jam up, and service on and off the wharves is sometimes difficult. Some items can be held up from 20 to 30 days at one location because of the pile-up of freight and the unavailability of the subsequent hauling service to carry it further.

Permafrost, and Alaska's rock

Permafrost materials in almost all cases are unsuitable for fill material, and wherever possible should be wasted. The cut areas in permafrost are difficult to make, but these can be drilled and shot similar to rock excavation. However, if it is not handled immediately, it freezes back together again.

Working in river channels and other Alaska locations subject to high water and floods is precarious. Waters rise rapidly under various conditions, and great care must be exercised to move all equipment to high ground at the end of each shift to prevent its being trapped by the water.

Solid rock operations in Alaska are similar to rock handling elsewhere.

Type of rock is generally similar to that of the Rocky Mountain area.

Rock can be worked after the so-called "freeze-up" in the fall and before the "break-up" in the spring, whereas other types of materials cannot be handled because of the severe nature of the freeze-up when it comes. All materials are constantly wet and freeze very solidly when low temperatures hit.

Equipment maintenance

Alaska does not offer any particular hazards in equipment maintenance other than the exceedingly great difficulty of getting men responsible and qualified to take care of equipment adequately.

Labor

Labor supply for highway construction in Alaska is adequate and by trading transportation charges and travel time, sufficient men are available to take care of the jobs. A lot of men go to Alaska just to make a stake but sometimes the quality of the labor is not quite as good as it should be, especially considering the high rate of pay.

Colorado experiments with —

Bituminous stabilized base

Rapid depletion of natural resources of aggregate forces state to investigate use of local available materials for highway construction — Test project area set up east of Hudson

COLORADO, like so many Western states, realizes that its natural sources of aggregate are fast becoming depleted, and has begun to study ways and means of utilizing local, available, materials for construction. Colorado is one of the few states which has not used bituminous stabilized bases, and the materials engineers of the highway department, anticipating an increased demand for this type of construction, studied the test procedures and construction methods used in other states. In order to familiarize themselves with these methods, several of the engineers made a trip to Kansas and Nebraska to analyze methods of design, and to inspect projects which have given satisfactory performance. After these technical observers reported favorably on their findings, early in 1952, the Colorado Highway Department decided to construct a bituminous base stabilization project as an experimental stab at the problem.

Sand meets criteria

In eastern Colorado there is an abundance of dune sands which do not, within themselves, make good base courses. However, after extensive studies by the Materials Laboratory, it was found that these sands, when properly blended and stabilized with bituminous materials would meet all criteria for base courses. The project selected to be built by contract was a 4.279-mi. section on Route 52, east from the town of Hudson. California Bearing Ratio tests on the natural subgrade soils on the project indicated that 17 in. of cover would be required to meet load requirements.

About the center of this project there was available a supply of wind-deposited sand which had the following gradation: 100% passing the No. 10 sieve, 74% passing the No. 40, and 5% passing the No. 200. Also available within a short distance, was a deposit of loess (wind-deposited silt) which could be used as a filler. The filler material had 99% passing the No. 40 sieve and 71% passing the No. 200. The liquid limit was 28 and the plasticity index 11. Hveem Stabilometer tests showed that the natural dune sand in place with a loess filler would require only 6 in. of cover, providing that the fraction passing the No. 200



By
JOHN R. BANNING
Division
Engineer
The Asphalt
Institute
Denver, Colo.

sieve was kept within the limits of 5% to 12%.

With this information the Materials and Design Sections set the project up for grading, sub-base and a 6-in. compacted bituminous stabilized base, with a single application seal coat. The finished width of the base was to be 22 ft. Colorado Constructors of Denver was the low bidder on this project, and the work was carried out last season.

The construction of the bituminous stabilized base involved seven essential steps:

- 1—Pulverization.
- 2—Addition of water with aggregate.
- 3—Addition and mixing of cut-back asphalt with aggregate.

4—Aeration to proper moisture and volatile content for compaction.

5—Compacting.

6—Finishing.

7—Application of surface cover.

On this project some pulverization difficulty of the filler was experienced as the material was cloddy when dry. The contractor did not have any type of mechanical pulverizer on the job, so the filler material was hauled onto the road, thinly spread, and pulverized with an 8-ton tandem roller. Clods had to be thoroughly pulverized in order for this material to be distributed throughout the voids in the aggregate and actually function as a filler.

For the addition of moisture, it was soon learned that a gravity-flow distributor developed puddling which made it difficult to secure a uniform moisture content. A pressure type distributor provided a more uniform application. The mixing-in of the moisture was accomplished by disking and blade mixing.

The contractor used a Barber-Greene travel plant, which accurately proportioned the aggregate and MC-3 cut-back asphalt binder. The sub-base material on this project was so friable and unstable that it would not sup-

ACCURATE PROPORTIONS of aggregate and MC-3 cut-back asphalt binder are furnished by this Barber-Greene travel plant. One inch is mixed out first to provide support for the plant.



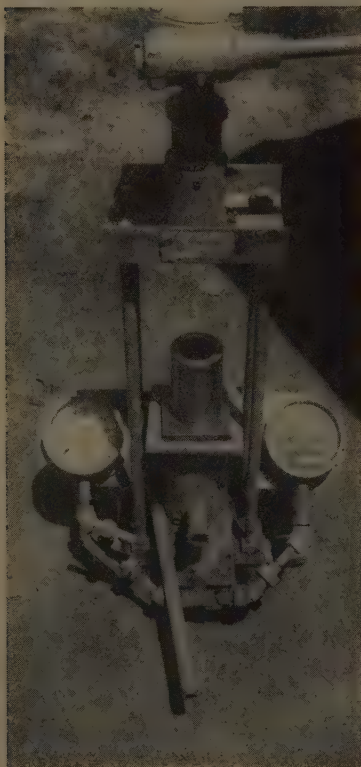
port the travel plant load without cutting and rutting the sub-base. To overcome this difficulty, a 1-in. course was first mixed out and laid to provide an adequate base to support the machine, and also act as a mixing table for the further manipulation of the mix during the aeration and lay-down periods.

Aeration

Perhaps the most troublesome item in bituminous base construction is aeration or curing. The success or failure of a bituminous base of this type depends in no small measure upon proper aeration of the mix. If adequate aeration is not secured, rutting and shoving may occur, either during finish rolling, or when traffic is permitted on the road. Several states have devised laboratory and field methods for determining what percentages of volatiles and moisture must be evaporated off by aeration to produce a dense, water-resistant, high stability mix.

The testing laboratory of the Colorado Highway Department has developed a portable field stability machine, which essentially consists of a steel frame having a 10-ton hydraulic jack equipped with two dial gauges for molding and testing the specimen. A standard Hubbard-Field 2-in. mold is used. Vertical adjustments of the testing plungers are controlled by an

THIS PORTABLE Hubbard-Field stability apparatus was developed by the State Highway Materials Laboratory.



THIS UNUSUAL team was formed because the base was placed before the shoulder material was laid, making it impossible to keep the roller straight when it hit the soft edge of the shoulder.

ingenious device made up from a reconstructed steering wheel worm gear from an old Chevrolet car. A handle is attached to the worm gear for the rapid raising or lowering of the head (see picture). With this piece of equipment the field testing engineer was able to take four samples per mile of the mix, and determine within an hour whether or not the proper aeration had been accomplished, and whether the mix was ready to be laid down. Aeration on this project was accomplished with motor patrols.

Compaction

Colorado's present specifications provide for alternate methods of compaction. Initial compaction may be done with sheepfoot rollers to within 1 in. of the finished surface—then pneumatic rollers are used to compact the top inch of loose mulch. Or the compaction may be done in 3-in. layers using flat steel wheel rollers. On this project all three types of rollers were used. The rolling of the edge of the base presented a problem, due to the fact that the base was laid before the shoulder material was placed. As a result the lack of lateral support provided by the shoulders made it impossible to get the tandem roller over on the edge of the base without losing control of the roller. This was overcome by tying the roller and a large motor patrol together with wire cables, permitting the motor patrol to stabilize the roller operations.

Finishing

The finishing on this project was accomplished by rolling with pneumatic tired and smooth faced tandem rollers until a smooth surface was obtained. Specifications provided for a single application seal consisting of an RC-2 or 3 cut-back asphalt.

The laboratory procedure for testing soil-asphalt and sand-asphalt mixtures adopted by the Colorado State Highway Materials Laboratory is essentially that submitted by L. Holmes

of the Standard Oil Development Co., and E. W. Klinger, Asphalt Engineer, Standard Oil Company of New Jersey, and published in "Procedures for Testing Soils," American Society for Testing Materials, July 1950. This procedure makes use of the equipment developed more than twenty years ago by Prevost Hubbard and F. C. Field of The Asphalt Institute for use in design and testing of sheet asphalt.

The Hubbard-Field stability test is an extrusion test. Briquettes of the mixture, 2 in. in diameter by 1 in. in height, are forced through an orifice 1.75 in. in diameter. The maximum load in pounds attained while forcing the specimen through the test orifice is termed the "stability" of the specimen.

By the Colorado procedure, the soil, sand or blended mixture to be tested is first wetted to the upper "fluff" point to aid in the distribution and mixing of the cut-back asphalt. The "fluff" point is akin to the phenomenon well known to civil engineers as "bulking" of sand.

Stands for an hour

After the proper amount of moisture has been thoroughly mixed into the aggregate, the damp aggregate is allowed to stand in a covered container for at least 1 hr. to obtain a more even distribution of the moisture. Then the percentage by weight of cut-back asphalt desired in the specimen is added to the damp aggregate, and thoroughly mixed. The test mixture is then placed in a loose layer about ½ in. in depth and allowed to cure at room temperature (not exceeding 100 deg. F.) for a period of 16 to 20 hr. Usually, about 4% of moisture and volatiles (based on dry weight of total mix) is lost during this curing period.

Duplicate specimens are molded for each percentage of asphalt used. For

Concluded on page 148

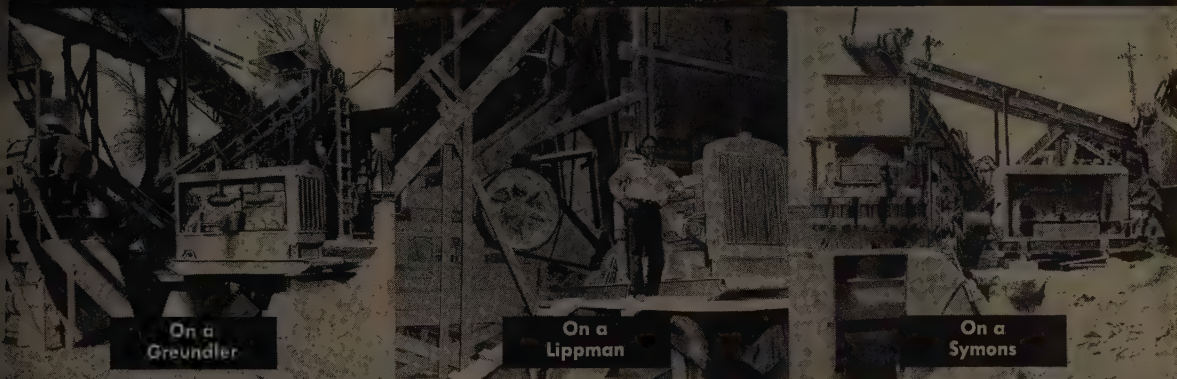


On an
Austin-Western

On a
Cedarapids

On a
Diamond

Your crusher will perform better with MURPHY DIESEL POWER



On a
Greundler

On a
Lippman

On a
Symons



On a
Pioneer

On a
Smith

On a
Universal

MURPHY DIESEL COMPANY

5325 W. Burnham St.

Milwaukee 14, Wisconsin

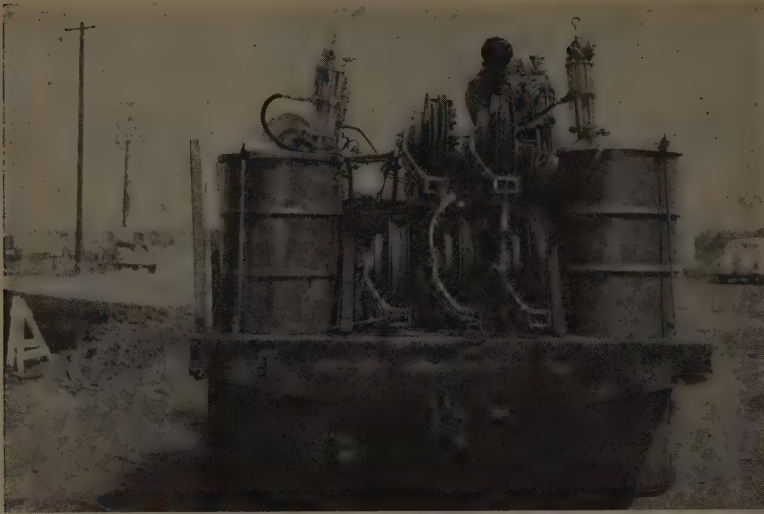
Engines and power units 90 to 240 H.P.; generator sets 60 to 140 K.W.

SEE YOUR MURPHY DIESEL DEALER, TODAY—

ARNOLD MACHINERY COMPANY, INC.....433 West Second South Street, Salt Lake City 1, Utah
ENGINEERING SALES SERVICE, INC.....P. O. Box 851, Boise, Idaho
LIVELY EQUIPMENT COMPANY.....1757 First Avenue, South, Seattle 4, Washington
A. H. COX & COMPANY.....2936 Hyde Street, San Francisco 9, California
OSWALD MACHINE WORKS.....205 W. Market Street, San Diego 1, California
DIESEL TECHNICAL SERVICE, INC.....5315 Valley Boulevard, Los Angeles, California
INDUSTRIAL ENGINE SERVICE.....502 South Real Road, Bakersfield, California
GLENN ROSE ENGINE SERVICE.....2136 S.E. Eighth Avenue, Portland 14, Oregon
BALZER MACHINERY COMPANY.....S. 118 Division Street, Spokane, Washington
BLACKWELL-COLEMAN EQUIPMENT CO.....720 W. 19th Avenue, Phoenix, Arizona
EQUIPMENT SALES CO.....

**MURPHY
DIESEL**

Lube practice on a highway job



ALL SIX barrels on this lube truck have pressure connections—no gravity supply for oils. Another efficient trick is spring-loaded reels for the hoses.

IN ANY construction job a dual task constantly faces the master mechanic—to keep equipment in production and working and still remain within his maintenance cost bid. Take, for instance, the extension of the Pittsburg-Antioch Freeway near Antioch, California, where Peter Kiewit Sons' Co. is nearing the end of this project, the fourth link of the Arnold Industrial Highway in Contra Costa County.

Jack Snead, master mechanic on the job, says, "It takes a good crew of mechanics, ingenuity and a strong preventive maintenance plan to keep production equipment on the move and at the same time keep costs within the maintenance bid structure. And, to use a common expression, 'eternal vigilance' is the heart of any PM plan that really works and spots trouble before it gets magnified."

This freeway, to throw a little light on the working conditions, is being constructed over flat terrain of the once large Rancho Los Medanos (meaning sand hills). The frequent high winds that sweep the job add to the equipment hazards which normally are encountered in heavy earth moving operations. Started in February 1952, the work will be finished well within the stipulated date, a tribute both to Kiewit production methods and to maintenance practices.

"To properly apply a PM plan," says Snead, "we figure a strict schedule covering each piece of equipment and calling for visual checks, plus actual checks, on a certain day and at a certain time. Our men use check charts to keep a record of this, but a lot of time and money have been saved

by an operator spotting some trouble and promptly reporting it to the mechanics.

"All our equipment and truck operators have a list of visual checks to make as part of the trouble shooting routine and this greatly facilitates our work. Also, our shift foremen have a good mechanical knowledge on a horizontal basis, and they know welding, mechanical repair and lubrication. It all helps keep the preventive maintenance business under control.

"Welding is one of our biggest helps in keeping equipment in work-

ALMOST READY for traffic, the \$2,700,000 job stretches for 5 mi. between Antioch and Pittsburg, California.



Maintenance program on this Kiewit job pays off — Careful checks by master mechanic justify switch to a different lube oil series for diesel equipment

ing order," says Snead, "and it certainly reduces down-time and part replacement. We also use hardfacing to reduce repair requirements and find that the Stoddy self-hardening rods we are now using adequately meet our working conditions here. We are equipped to do both gas and arc welding on the job. Naturally, our welding and other mechanical maintenance is scheduled wherever possible for the off-shift; emergency repair demands and gets immediate attention.

"Another place where we have gotten cost savings and better maintenance practice has been in the lubrication of our diesel engines. Walt Baldrige, our lube foreman, and his crew work on a strict schedule. They follow our standard PM practice and have reported improved diesel engine performance since the start of this job."

Equipment on the job

Earth-moving equipment being used on the job includes seven Caterpillar DW20's equipped with D337 engines, two Allis-Chalmers HD-20's utilizing General Motors Model 110 diesel engines, and 16 D8's with D-13000 engines.

While this equipment is relatively new, most of it had been in service for a short period in the Los Angeles Basin area and had operated on a Mil-O-2104 oil. Upon moving to Antioch it was decided to standardize on a Series 2 oil in all diesel equipment in view of the Caterpillar recommendation that this type of oil be used in all supercharged engines. (On gasoline-operated engines the Mil-O-2104 oil is standard practice.)

The switch to a Series 2, in this case Shell Rimula oil, was observed with interest because of the performance of this type of oil in extensive field tests conducted by the Caterpillar Tractor Co. Caterpillar recom-

don't let **HEAT**

RUIN YOUR FLYWHEELS AND PRESSURE PLATES

Install Velvetouch Matched Facing Sets

Whether you're having trouble with the master facings on your tractors or the clutches in your trucks, you'll find Velvetouch Matched Facing Sets keep equipment out of the repair shop and on the job. Because Velvetouch gives you **FOUR** controlled friction surfaces instead of two...gives you positive protection against heat-checked flywheels and pressure plates!

In addition, Velvetouch Matched Facing Sets insure increased clutch capacity, for they **DOUBLE** the controlled friction area you get with conventional plates. And with Velvetouch, you can reclaim old flywheels and pressure plates that have already been heat-damaged, and put them back into service... better than ever!

Detailed literature available now. For further facts about Velvetouch Matched Facing Sets... see your supplier, call our nearest branch, or write us direct.

THE S. K. WELLMAN CO. • 200 EGBERT RD. • BEDFORD, OHIO

THE S. K. WELLMAN CO. SALES OFFICES AND WAREHOUSES

* ATLANTA—119 14th St., N. E.,
Atlanta 5, Georgia

** DETROIT—16822 James
Couzens Highway,
Detroit 21, Mich.

* SAN FRANCISCO—424 Bryant
Street, San Francisco 7, Calif.

* CHICAGO—1500 South West-
ern Ave., Chicago 8, Illinois

* LOS ANGELES—1110 South
Hope St., Los Angeles 15, Cal.

* TORONTO, ONTARIO—The
S. K. Wellman Co. of Canada,
Ltd., 2839 Dufferin St.

* CLEVELAND—200 Egbert Rd.,
Bedford, Ohio

* PHILADELPHIA—1545 West
Belfield Ave., Philadelphia
41, Pa.

** WASHINGTON—1101 Vermont
Ave., N. W.,
Washington 5, D. C.

* DALLAS—2407 Main Street,
Dallas 1, Texas

* PORTLAND—638 N. W. 16th
Ave., Portland 9, Oregon

** EXPORT DEPARTMENT—8 South Michigan Ave., Chicago 3, Illinois

* SALES OFFICE AND WAREHOUSE

** SALES OFFICE



mends this type of oil for use in all supercharged diesels and suggests that it can be used to advantage whenever sulphur content in the fuel exceeds 0.5%. And, even with lower sulphur content the use of the oil was said to keep engines cleaner and enable the drain periods to be doubled.

Series 2 properties

This new type of oil is a step higher than the so-called "heavy duty" oils. It contains a high percentage of compatible additives for neutralizing the acids which cause corrosive wear. These acids are a special problem on high-speed, high-load operations such as heavy-duty road construction, and also where low-temperature, high idling operation is involved. Use of the Series 2 was also indicated by field tests conducted at Phoenix, Arizona, under conditions similar to the Kiewit job at Antioch (see box).

It was interesting to observe that these field test results were more or less verified on the Pittsburg-Antioch job where some 16 D13000 supercharged "Cats" were being used, along with seven D337 Caterpillars and various other diesel engines.

On the D13000's, for example, previous practice with a Mil-O-2104 oil was to drain the crankcase at periods of from 60 to 120 hr. Now, with the Series 2 oil, safe drain periods of 400 hr. are current practice and, with over 2,000 hr. experience the engines are operating at peak efficiency—no starting trouble or "weak" running. Standard practice is still to change the filter with each oil change, using a Caterpillar-specified filter.

Inspection of several engines operating on the Series 2 oil revealed that

varnish and valve carbon was practically eliminated and that valve sticking was no longer being experienced. Valves, valve mechanisms, bearings, crankcase and filters showed marked freedom from deposits as well.

In addition to improvement in engine performance it was noted that less oil and, consequently, less labor were involved. Such oil changes take two men about 30 min., including cleanup, a labor cost in the vicinity of \$4.50 per hr. The previous oil change period on the D13000's was 80 hr.; the current drain period is 400 hr. The savings on labor alone amount to about \$18.00 per 400-hr. drain period. Since each engine holds 9 gal., savings in oil cost come to a net of about \$19.00 on a comparable drain cycle. The total saving, labor and oil, is about \$37.

More important than these reduced costs, however, has been the trouble-free diesel engine operation on a job moving at high speed and under fairly rugged conditions. This, added to the excellent PM plan as administered by Kiewit standards, has been instrumental in maintaining required production levels and holding the maintenance budget well within line.

Even the special rigs required did not run the cost up. Standard practice on Kiewit jobs is to design special rigs when needed and then put them out for fabrication on a competitive basis. However, it proved more expedient on the Pittsburg-Antioch project not only to design some of these rigs but also to fabricate them on the job, a practice which speaks well for the mechanical crew charged with equipment performance and maintenance. Job-built equipment

Proof for the Series 2

FIELD TESTS under conditions similar to the Pittsburg-Antioch project recently resulted in data that helped justify the switch in lubrication practice. These tests took place at Phoenix, Arizona, where two 6-cyl. diesel tractor engines operated side by side under very dusty conditions.

First the engines were run with heavy-duty 2-104B in the crankcases (the number is merely a military classification) for, respectively, 20 and 8 drain periods of 120 hr. Pistons were then removed for inspection. Tractor engine A, with 2,400 hr. of running, showed wear and deposits typical of normal operation. Tractor B's piston had run for only 960 hr. and showed wear and deposits slightly below normal. This was as expected, but it left the operator with the expensive choice of shorter drain periods to minimize wear.

Next the engines were run with Shell Rimula oil. Engine A went through six 120-hr. and eight 240-hr. drain periods. Engine B went through seven 12-hr. and four 500-hr. drain periods. A piston from Tractor A this time showed that both cylinder and ring wear were substantially reduced and deposits were at a minimum, even after a total of 2,640 hr. The piston from Tractor B, which had run this time for 2,840 hr. over longer drain periods, showed reduced wear and deposits and a negligible 1% top ring groove carbon.

NOT JUST CAST-OFFS from other work, Kiewit's welding set-ups are specially fitted. This one has full supply bins and drawers, a 2-ton A-frame, lights for night work, and plenty of space to carry spare metal and timber blocks.



here included windrowing and grading rigs for the cement-treated base, and a hydraulic header pin puller.

This freeway will handle not only commercial traffic in the rapidly-expanding Pittsburg-Antioch area but also "through" traffic from the delta lands of the Sacramento and San Joaquin rivers to the San Francisco Bay area. The project consists of a four-lane portland cement concrete pavement with shoulders, ramp and service roads of plant mix.

The work is under the general supervision of B. W. Booker, assistant state highway engineer in California. D. M. Young is resident engineer, and R. B. Neff is bridge department representative.

For Peter Kiewit Sons' Co. general superintendent is George Premo, Jr., with Gene Neville as project superintendent on the job. Bob Fuller is office engineer, and Jack Snead is master mechanic. Data on lubrication practices on the job were furnished by the Shell Oil Co.

CARBIDE INSERT? or MULTI-USE?

LOCATION: Granite Quarry near Milbank, South Dakota.

OPERATING CONDITIONS: Drilling pilot holes, lift holes and core cutting in granite.

Melrose Granite Co. cuts drilling time 25% with TIMKEN® carbide insert bits!

PILOT hole drilling, core cutting, lift hole drilling—the Melrose Granite Company uses Timken® carbide insert bits for all these drilling jobs—and has cut drilling time 25%!

Timken carbide insert bits are always best for highest speed through hard and abrasive ground. They're most economical for constant-gage holes, small diameter blast holes and very deep holes.

But they may *not* always be best for *all* your drilling jobs!

When you're drilling ordinary ground, Timken multi-use bits are most economical! With correct and controlled reconditioning, they give you lowest cost per foot of hole when full increments of steel can be drilled.

Best of all, you can change from Timken carbide insert bits to Timken multi-use bits, easily, quickly—right on the job! As many as 93 different Timken bits in the same thread series fit the same drill steel.

All Timken bits are made of electric furnace Timken fine alloy steel and have the shoulder union developed

by Timken that protects threads from drilling impact.

For help in selecting the best bit type for your job, call on the Timken Rock Bit Engineering Service. Write The Timken Roller Bearing Company, Rock Bit Division, Canton 6, Ohio. Cable address: "TIMROSCO".



Timken threaded
multi-use rock bit



Timken threaded
carbide insert rock bit

*your best bet
for the best bit
...for every job*

TIMKEN
TRADE-MARK REG. U. S. PAT. OFF.

Education program by planning commission sparks —

Bond issue for municipal paving



CEDAR STREET HILL is part of about 5.4 mi. of Port Angeles streets being brought up to standard by bond issue program.

Photo by Fred Strange, Port Angeles

CONVINCING PROOF of what a determined group of public-spirited citizens can accomplish toward civic improvement is the recently awarded city-wide arterial street paving project in Port Angeles, Washington.

Port Angeles is a city of about 11,000 population, located on the Straits of Juan de Fuca in Clallam County, at the north extremity of the Olympic Peninsula. The city, rising from sea level to the residential hills 300 ft. above, has the unique distinction of being one of the two National cities of the United States, Washington, D. C., being the other. This was brought about by the efforts of the early Port Angeles citizens and led to the signing in 1862 by President Abraham Lincoln of an executive order setting aside for governmental purposes 3,520 acres of public lands, specifically making reference to Port Angeles and Ediz Hook, the sandy spit which forms the harbor.

Situated at the edge of a tremendous forest area, it is only natural that the chief industries of the city should derive from this resource, and the lumbering, pulp and paper, and plywood industries form the major portion of Port Angeles' manufacturing life. Most of the raw material to supply these industries enters Port Angeles in the form of logs, trucked in from the logging areas, and much of it leaves the city via the truck route.

Although the major state highway routes through the city are maintained by the Washington Department of Highways, many of the other city arterials—especially those used

as truck by-passes—fell in recent years to a very deteriorated condition.

As with many other cities, no improvements had been made to the street system of Port Angeles for many years previous to 1949. And then, a very hard winter caused nearly complete deterioration of the existing roadways.

The Port Angeles planning commission began in 1949 to lay the ground work for a bond issue to assist in financing the cost of the project. The bond issue was brought to a vote in July 1950. Before the election, the planning commission held many meetings and spoke to various groups throughout the city. However, when the balloting was completed, only 58% of the voters voted in favor of the

project. Since a 60% majority is required by state law in Washington, the measure was defeated.

The planning commission became only more determined after so narrowly missing its goal, and immediately set about to get the additional 2% of the necessary votes. The city council was somewhat reluctant to put the bond issue on the ballot for a second time but was finally persuaded to do so.

The local newspaper and radio station became staunch supporters of the project, local business men once again collected a fund to help pay for necessary advertising, and the planning commission embarked upon another campaign of talks to service clubs. The Washington Highway Department made an origin and destination survey in the city and confirmed the selection of streets to be improved.

Finally, in March of 1952, the same bond issue, with the exception that the amount had been raised to \$400,000 from the original \$360,000, was once again presented to the people of Port Angeles. This time 2,496 voted for and only 1,021 against the issue.

The bond issue provided only part of the necessary money, the remaining amount being raised through a local improvement district with costs being assessed in the manner provided under the local improvement laws of the State of Washington. The cost to the local improvement district was about \$247,000, yet less than 2% of the affected property owners filed objections to their assessments.

The improvements consist of paving with portland cement concrete, surfacing shoulders with type I-1 asphaltic concrete and gravel, and constructing storm sewers and appurtenances. Most of the concrete paving is to be laid 24 ft. wide and 8 in. thick, using a mix of 5 sacks per cu. yd. No reinforcing is specified in the slabs, and an air-entraining agent is specified for all concrete in paving and curbs and gutters. The class "C" type I-1 shoulders will be 2 in. thick on a 5-in. mat of pit-run material with only sufficient 5/8-in. minus crushed stone to properly fill the surface voids.

A bid advertisement was made for opening on February 26, 1953, and bids were received from six firms. The contract award was made to the lowest bidder, Pieler Construction Co. of Seattle on a bid of \$642,374.

The true driving force behind this improvement program has been the planning commission. Herman Ahlvers is city engineer, charged with design and administration of the paving project. J. W. Pierott is superintendent for the contractor.

PORT ANGELES PAVING PROJECT PRINCIPAL QUANTITIES

49,500 cu. yd. unclassified excavation
1,180 cu. yd. structure excavation
268 cu. yd. channel change excavation
10,036 cu. yd. bankrun gravel
2,425 cu. yd. 5/8-in. minus crushed stone top course
79,523 sq. yd. 8-in. cement concrete pavement
2,485 sq. yd. 8-in. cement concrete pavement 1/2 width
4,058 tons type I-1 class C wearing course asphalt pavement
34,642 lin. ft. storm sewers and appurtenances
534 lin. ft. 72-in. extra strength concrete culvert pipe.

lots of dirt dumped in...

Idaho's largest highway fill

When is a dam not a dam?
— **When it's a highway embankment straddling a Snake River tributary within the Palisades reservoir area**
— **84-in. culvert pierces fill to pass flow of Big Elk Creek and equalize reservoir level**



THE LARGEST highway fill in Idaho, and probably one of the largest in the nation, is now under construction across Big Elk Creek in the Palisades Dam reservoir area.

This fill was made necessary because Idaho State Highway 29 (U. S. Highway 26) followed the course of the Snake River and had to be relocated either around or across the reservoir area. During preliminary location and design of the relocated highway, a number of alternate plans for crossing Big Elk Creek were considered, including constructing the road around the high-water line of the creek basin and building bridges at various locations. The fill was found to be the most economical and practical method of crossing, from the standpoint of both initial construction and maintenance costs.

Similar to dam

Some 1,600,000 cu. yd. of material will be placed in the embankment, which will be 142 ft. high, 600 ft. wide at the bottom, 40 ft. wide at the top, and 1,100 ft. long at the crest. Both sides of the fill, built on a 2:1 slope, will be covered within 10 ft. of the top by water impounded in Palisades reservoir, and the water level on both sides will fluctuate as the reservoir water level rises and falls. Because of this, the embankment design is very similar to that of an earth-fill dam.

The center and greater portion of the embankment, designated as Zone 1 on the drawing, will consist of impervious materials available from roadway excavation. The limits of this zone, as shown on the typical section of the drawing, have a top width

of 16 ft., and side slopes of 1.4:1. The outer portions of the embankment, designated as Zone 2 on the drawing, consist of pervious material to be obtained from Big Elk borrow pit located downstream. The limits of this zone, as shown on the drawing, are the 1.4:1 line on the inside and the 2:1 slope on the outside of Big Elk fill, both upstream and downstream sides being the same. The 2:1 slopes on both sides of the embankment are to be covered with a layer of rock riprap having a thickness of 3 ft. normal to the slope.

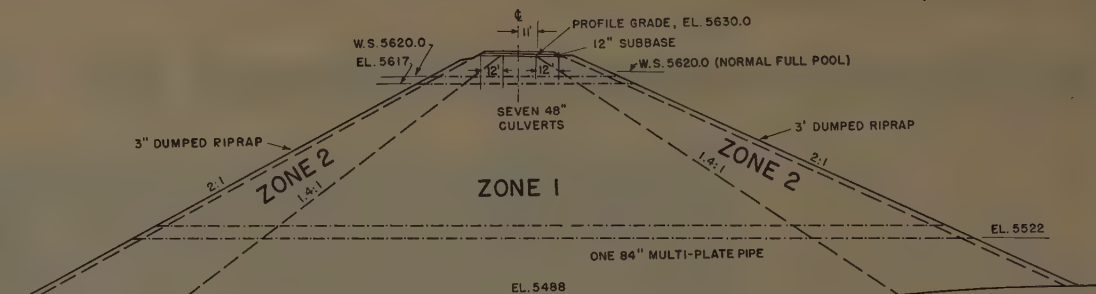
WORKMAN tightens bolts on the corrugated sheets which make up the 84-in. pipe that will carry Big Elk Creek through the fill.



Designing this type of embankment with zones of pervious material on the outside and impervious material on the inside with riprapped faces has a very significant purpose. The layer of riprap on the faces eliminates erosion and damage from wave action. The pervious Zone 2 material, with a high coefficient of permeability along with the riprap layer, serves as a protective layer to support the center impervious zone. The impervious Zone 1 material, although properly compacted to maximum density with the optimum moisture content, contains a certain amount of voids between soil particles. As water in the reservoir rises, the voids become filled with water and there is a slow percolation of water into the embankment. As the water level in the reservoir is lowered, the water contained in the voids cannot escape from the soil at a sufficient rate to maintain a level with the reservoir water and as a result the soil, lubricated by the existence of water which also increases the weight, would be liable to slough out of the embankment. The protective Zone 2 material and layer of riprap, both being comparatively free-draining, serve as a support to hold the impervious Zone 1 material in place. Without this pervious Zone 2, it would be necessary to place the impervious Zone 1 material on a much flatter slope, thus increasing the yardage required.

Pipe to carry flow

The design calls for one 84-in. diameter, 8-gauge, corrugated metal pipe to be placed through the embankment 40 ft. above the creek bottom. This pipe will carry Big Elk



TYPICAL SECTION OF BIG ELK CREEK EMBANKMENT

Creek flow through the embankment until the reservoir water level rises above the pipe. When the pipe is submerged by reservoir water, it will allow the water to maintain the same level above and below Big Elk fill.

Seven 48-in., 12-gauge corrugated metal pipes will be placed through the upper part of the embankment, so that the top of the pipes at the inlet ends will be 1 ft. above the normal full reservoir level. These pipes will insure an equal level of the water surface above and below Big Elk Creek fill at all times while the reservoir is full. They also will insure adequate escape for any flash flood or excessive runoff from Big Elk Creek basin, while the reservoir is full and the freeboard is at the minimum.

Construction of the section of relocated highway, including Big Elk

Creek fill is part of the prime contract for construction of Palisades Dam and Power Plant and relocation of roads. Kiely Construction Co. of Butte, Montana, received the subcontract for highway work from prime contractors J. A. Jones Construction Co. and Chas. H. Tompkins Co.

Construction of Big Elk Creek fill began on July 30, 1952. A channel was excavated along the left abutment through which the flow was diverted. The foundation was stripped of all vegetation and unsuitable material, after which placement of material in the respective zones began.

The central portion of the embankment, designated as Zone 1 on the drawing, is being constructed of materials obtained from roadway excavation. Cobbles, boulders, and rock fragments more than 7 in. in size are

removed from this portion of the embankment and placed in either Zone 2 or in the layer of riprap. The material is placed in layers not more than 8 in. in thickness after being compacted.

The material is compacted with a sheepfoot roller. Sufficient passes are made with the roller on each layer to obtain the required density. Where embankment materials do not contain moisture to insure satisfactory compaction, additional moisture is provided by sprinkling as the layers of material are placed on the embankment.

Four-pass compaction

The outer portions of the embankment are being constructed of material obtained from a borrow area located below Big Elk Creek fill. This material is placed in layers not more than 12 in. in thickness after being compacted. During or immediately before compaction, the material is thoroughly wetted by sprinkling. Compaction of the material in this zone is accomplished by four passes of the treads of a crawler tractor weighing about 40,000 lb.

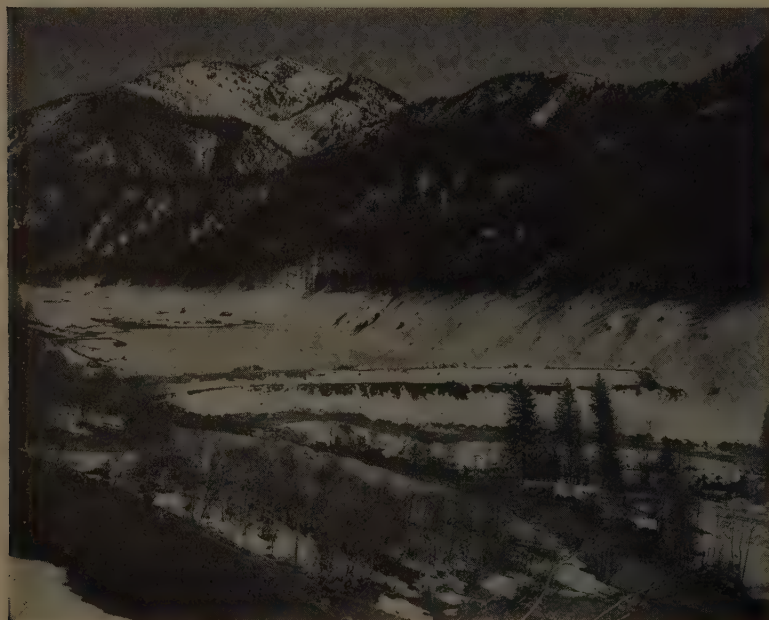
The riprap material placed on the embankment slopes is obtained from roadway excavation and borrow areas. The rock used is dense, hard, and durable with a maximum size of $\frac{1}{2}$ cu. yd., and is graded uniformly from the maximum size to rock or spalls not less than $\frac{1}{8}$ cu. ft. in volume.

Lab techs check

Control of embankment moisture and density is maintained by laboratory and field density tests taken constantly as the embankment placement progresses. Laboratory technicians keep the field inspectors informed as to the results of tests. If the tests show that the material is either too dry or too wet, the moisture is corrected by either adding more water or allowing the material to dry. If laboratory tests show that the densities are low, additional rolling is immediately accomplished.

Concluded on page 144

STOPPED BY WINTER—This is how Big Elk Creek looked when snow stopped construction work. The top of the cleared area around the basin will be the high-water line of Palisades reservoir and the ultimate height of the highway fill.



California's sand equivalent determination is —

A fast test for highway materials

Measuring overall stability on the basis of the volumes of soil fractions represented, the new test also recognizes that the chief concern is the behavior of wet soil

IN ORDER to measure the ability of soils and granular materials to sustain loads, many tests have been devised. One of the best known is the California Bearing Ratio, which has recently been replaced by the stabilometer in the laboratory of the California Division of Highways.

The testing procedure now followed requires the preparation of soil specimens by first introducing sufficient water to fill the expected void space, then compacting to produce a structural arrangement and a state of density comparable to that developed in most highway bases and basement soil layers. The next step is to determine the final equilibrium moisture content and then to measure the resistance to deformation. The stabilometer test and the elaborate compaction equipment required to produce specimens that are characteristic of soils in place in the roadbed means that this test procedure is virtually restricted to a fairly large, well equipped laboratory.

It is essential, however, that the field engineer should also have a convenient testing method readily available. First, of course, in order to select adequate materials for all layers in the roadbed, he must understand

By
F. N. HVEEM
Materials and
Research Engineer
California Division
of Highways



something of the properties of soil materials, especially those properties that affect the load supporting ability when the soil is wet. But then, he must have test methods at hand for detecting or evaluating those properties.

New test is fast.

In order to speed up the soil testing operation—by avoiding the need for weighing the sample and drying out in an oven—a test has been developed

NOTE: Augmented by some more recent comment by the author, this article is adapted from Mr. Hveem's presentation before the Highway Research Board at its meeting in January 1953.

called the "Sand Equivalent Determination." Some review of the principles governing the test may be in order.

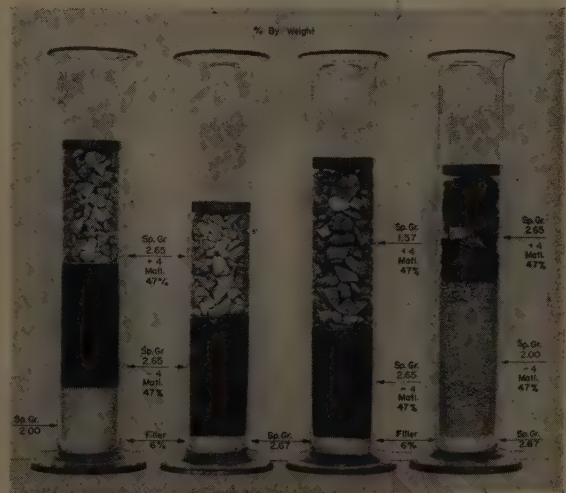
It is a matter of common knowledge among highway engineers that an excessive amount of asphalt in an otherwise normal mixture of sand and gravel will cause instability—because the asphalt binder is also a lubricant and provides mobility or plasticity to the mass. It may be noted, however, that when compared on the basis of weight, apparently less asphalt will be required to produce instability than is the case with clay. For example, a dense graded aggregate will usually be unstable with 7% of asphalt by weight, while over 10% of plastic clay soil might be required to produce the same effect.

This difference exists only in the weight relationships. The volume of asphalt corresponding to 7% of the dry weight of the aggregate is about equal to the bulk volume of wet clay corresponding to 11% of the aggregate weight. It should be apparent that lubrication does not become serious until a certain volume of lubricant has been introduced. It should not be necessary to dwell upon this unduly, but the conclusion is inescap-

VOLUME DIFFERENTIAL is shown by five 100-gr. samples of dry mineral powder, often referred to as "filler dust." There is a 300% variation in volume, the quality that determines stability.



THESE COMPOSITE samples have the same weight percentages for each sieve fraction. But variations in specific gravities cause great differences in bulk. Which sample will be the poor road material?



How does water affect soil strength?

MOST THEORETICAL discussions on soil mechanics recognize that the entire structural strength of soils rests upon two distinct properties; namely, internal friction and cohesion.

Variations in frictional resistance may be defined in the terms used by Amontons, one of the first to investigate these particular phenomena. Amontons' law states that resistance to sliding between adjacent solid surfaces varies with the nature of the surfaces, directly with the pressure which holds the surfaces together, and that it is largely independent of the speed and the apparent areas in contact.

Cohesive effect

The definition of cohesion in soil mechanics texts does not correspond to the dictionary definition. Soil mechanics usage generally states that the cohesive resistance in soils is that part of the resistance which does not vary with the pressure. This observation agrees with one of the characteristics of viscous liquids: the internal friction of liquids is virtually independent of the pressure, and the resistance developed by a film of viscous liquid between two solid bodies varies directly with the area and directly with the speed of movement, but is largely independent of the pressure. It may be observed therefore that the behavior of dry solid bodies in contact is almost

diametrically opposed to the behavior of viscous liquids in thin films.

A bed of crushed stone or sand represents a case where the ability to sustain loads rests entirely upon interparticle friction and no cohesive forces are involved. Portland cement concrete is a substance capable of sustaining compressive loads due to moderate cohesive strength and the high internal friction characteristic of dry stone particles in contact.

A well designed asphaltic pavement is an engineering material with relatively low tensile strength, but its frictional resistance can be maintained at a high level so long as an excess of asphalt is not introduced. Asphalt is a viscous liquid and virtually all viscous liquids are lubricants.

Moisture changes properties

Under certain conditions water may also act as a lubricant. It is a matter of common observation that water alone will not produce a measurable effect on a layer of clean crushed stone. But, water and clay mixtures have marked lubricating properties.

When a sufficient quantity of clay is intermixed with the coarser granular portion of the soil, lubrication will develop and the mixture becomes plastic whenever enough water is absorbed or accumulated. As the ability of soils to resist deformation depends very largely

upon internal friction, wet clay has the effect of reducing or canceling out the frictional resistance. While the so-called cohesive resistance of the mixture is almost entirely due to the clay, the gain in cohesive strength does not compensate for the loss due to reduction in friction.

It must be emphasized, of course, that water is the essential factor causing loss in resistance, as finely ground dry clay particles exhibit no cohesive properties and are not very effective lubricants. When water is added to a dry soil mixture, the cohesive strength will normally increase with the addition of moisture and compaction, and in most cases a certain optimum of water will be tolerated before the frictional resistance is greatly impaired. However, above a certain moisture content the resistance due to friction will diminish even though the cohesive strength may continue up to some second point of higher moisture content. Finally, values of both friction and cohesion will diminish as the soil approaches a completely fluid state.

Plastic soils, clay bearing gravels, or rich asphaltic mixtures, all having high cohesive values but little internal friction, are rarely adequate to sustain repeated vehicle loads. In other words, an excessive amount of clay is detrimental to highway bases and foundations. Soils or gravels containing high percentages of clay invariably become unstable and lack supporting power when wet.

able that the fundamental relationship in all design of aggregate mixtures—whether for concrete, bituminous pavements, or gravel bases—rests upon the relative volumes of each ingredient and not upon weight percentages. This fact is often overlooked.

Volume makes the difference

The control of bituminous mixtures is simplified by the fact that paving asphalts do not vary widely in specific gravity. But mixtures of clay and water do vary in weight. Thus, for equal weights, the volumes of dry materials may spread over a wide range. This is illustrated in accompanying photographs.

The problem becomes more complex when mineral aggregates are batched from several types of stone particles, each size group having a different specific gravity. Gradation by weight may be unchanged from one sample to another, but the volume proportions are vastly different. Troublesome as these variations can be, it is nevertheless possible to de-

termine the specific gravity of each size group and, by calculation, arrive at the true volume relationship. This is routine procedure in concrete mix design but is usually overlooked in other cases.

It should be readily apparent to any engineer that a sieve analysis of mineral aggregates expressed as the weight percentages of each size does not give a true picture of the relative volume or mass of material represented by the size groups.

Another factor is often involved when water is introduced into soils or untreated base materials. Certain clays may expand considerably and the effective volume of wet lubricating clay may be greatly increased. This condition is most marked in the montmorillonite class of clays, of which bentonite is a well-known example. In any event, an estimate of the effective amount of clay may be very misleading when based upon sieve analysis, hydrometer analysis, or upon any other means which leads to an expression in terms of weight percentages.

The average engineer is usually interested, however, only in the overall effect of a particular clay when the soil becomes wet. The primary question is the effect on structural stability which, as stated in the accompanying box, really boils down to whether or not there is any reduction in internal friction. The question is well answered by the Sand Equivalent Determination, or Sand Equivalent Test.

Test procedure

As we have established that the lubricating effect of clay or other material tends to increase with the volume (the thickness of film between the particles), the most fundamental relationship is that reflected by the potential volume of wetted clay that exists in each mixture. The Sand Equivalent Test is applied to a sample of material passing a No. 4 sieve, and the relationship between the quantity of clay present and the amount of coarse sand particles is developed on a volume basis. The test results indicate whether the volume of "sand"

THE ACTUAL IS LIMITED:

THE POSSIBLE IS IMMENSE

NEW LINCOLN PLANT CREATED BY INCENTIVE-INSPIRED CO-ACTION IN DEVELOPING POSSIBILITIES IN PRODUCT

© LE Co. 1953

LINCOLN WELDING SPEEDS BRIDGE REPAIRS

...helps maintain
Rapid Transit schedules

By **Paul K. Jones,**
Director of Transportation
Shaker Heights Rapid Transit
Shaker Heights, Ohio

By taking advantage of arc welding in simplifying repairs, it was possible recently to save considerable time in the reinforcing of a bridge on the Shaker Heights Rapid Transit right-of-way. Cross braces that had been weakened by rusting had to be replaced with heavier members of angle iron. As this work required removal of right-of-way track, it was imperative that every effort be explored to eliminate delay in getting the track replaced. Arc welding achieved this result in addition to eliminating rivets thus making the bridge easier to paint to lower future maintenance costs.



▲ Fig. 3. Double track right-of-way on Shaker Heights Rapid Transit System. Weakened cross braces were replaced in minimum time with arc welding.



Fig. 4. Lincoln 200 amp "Shield-Arc" engine driven welder used for faster, easier replacement of cross braces.

SIMPLIFIES BRIDGE REPAIRS



Fig. 1. Rusted-out Braces originally riveted to flanges of bridge girders are cut out quickly with torch.

CUTS DOWNTIME



Fig. 2. Faster Construction. Angles sawed to length are fillet welded to web of girder with Lincoln "Fleetweld 5" type electrode.

SAVES MAINTENANCE

Studies in Structural Arc Welding free on request. Designers and engineers write on your letterhead to Dept. 4302.

THE LINCOLN ELECTRIC COMPANY

CLEVELAND 17, OHIO

THE WORLD'S LARGEST MANUFACTURER OF ARC WELDING EQUIPMENT

is either high or low—hence the name “Sand Equivalent.”

Essentially, the test is performed by shaking vigorously a sample of the fine aggregate in a transparent cylinder containing a special aqueous solution and noting the relative volumes of sand and of the partially sedimented clay after standing for 20 min. The entire operation can be carried through in less than 40 min.

CaCl solution

In order to speed up the sedimentation of the fine clays or colloidal particles, a flocculating agent is required, and a solution of calcium chloride has been selected on account of its relatively low cost, stability and non-irritating properties. After some early experience with the calcium chloride solution, it was found that the addition of a small amount of glycerin produces a stabilizing effect. Finally, it was noted that the calcium-chloride-glycerin solution alone is not sterile and certain molds tend to grow. In order to sterilize the solution, formaldehyde is added.

When the Sand Equivalent Test was

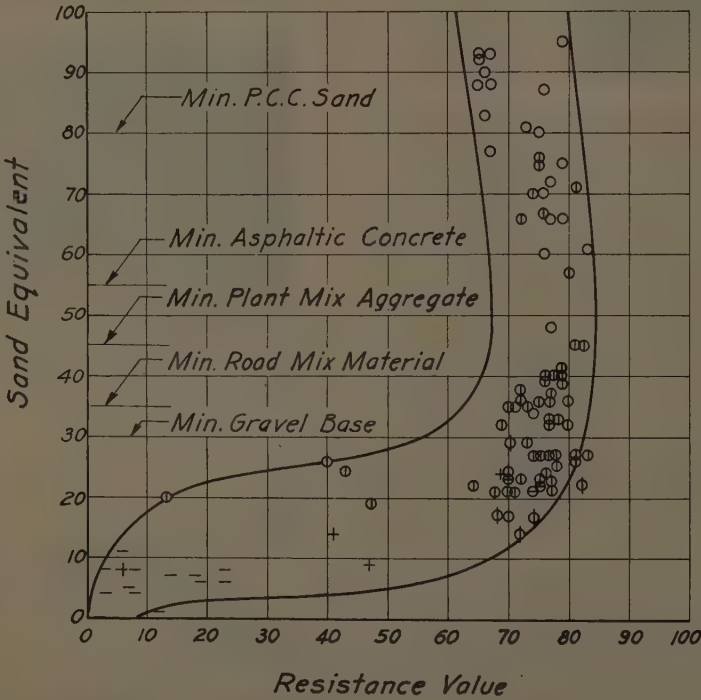
first developed, it was hoped that it would furnish a good indication of the overall resistance value of the soil. A correlation does exist but it is not sharply defined throughout the scale. The reasons for this are not difficult to understand if it is recognized that the ability of a mass of soil or granular material passing a No. 4 sieve to resist deformation will depend upon the following factors :

- 1. The volume of lubricant mixed with the sand fraction; i.e., asphalt, clay-and-water, etc.
- 2. The “efficiency” of the lubricating fraction.
- 3. The degree of roughness or irregularity of the sand grains or rock particles.
- 4. The amount of void space in the sand fraction of the soil.
- 5. The amount of intermingled coarse rock retained on a No. 4 sieve.

We readily perceive that of these five variables the Sand Equivalent Determination is primarily an indication of No. 1 (expanded clay volume). It attempts to compensate for No. 2 by means of the type of solution used.

COMPARISON of stabilometer and Sand Equivalent values for various materials relates the new test to established procedures. Most generally reliable highway materials have SE values between 30 and 70. Clean cohesionless sands show even higher SE values.

Minor Component	LEGEND		
	Major Component		
	Sand	Silt	Clay
Sandy	○	φ	⊖
Silty	⊗	|	+
Clayey	⊙	+	—



APPARATUS couldn't be simpler. Funnel assists in placing soil in cylinder. Straight tube below hose clamp is for irrigating sample during test. Weighted rod establishes height of sand at conclusion of 20-min. settling time.

It cannot indicate the variation caused by Item 3, and as presently performed does not make allowance for No. 4, although it seems possible that means for making this correction may be worked out. Allowance for the effects of No. 5 need to be made if the coarse aggregate exceeds 25% or 30% of the total. Therefore, in order to evaluate the combined effect of all factors, some test such as the stabilometer is necessary. However, experience has shown that one of the principal variables is the amount of clay present. As there is relatively little difference in sands, it may readily be determined that when the Sand Equivalent value is greater than 30, the clay fraction does not have much influence.

Application

Very small amounts of clay may be detrimental to the performance of

PICK THE BEST BATCHER FOR YOUR JOB

INVESTIGATE THESE NOBLE Batcher

For General Dry Batching and Ready-Mix: Clamshell-type semi-automatic batcher gives you automatic control of cement, manual control of aggregate through double clamshell gates. Long, easy-to-operate control levers lessen operator fatigue.

For Fast Dry Batching on highway jobs: Clamshell-type automatic batcher fills all requirements of State Highway Departments. Gates are double clamshell, permit free flow of material, yet assure fast, positive cut-off.

For Big Jobs requiring fast batching and extreme accuracy: Slide gate automatic batcher with dribble control meets exacting specifications of U. S. Engineers and U. S. Bureau of Reclamation. NOBLE two-position batch gates automatically close to predetermined "dribble" position, cut off instantly and positively when indicator signals final weight.



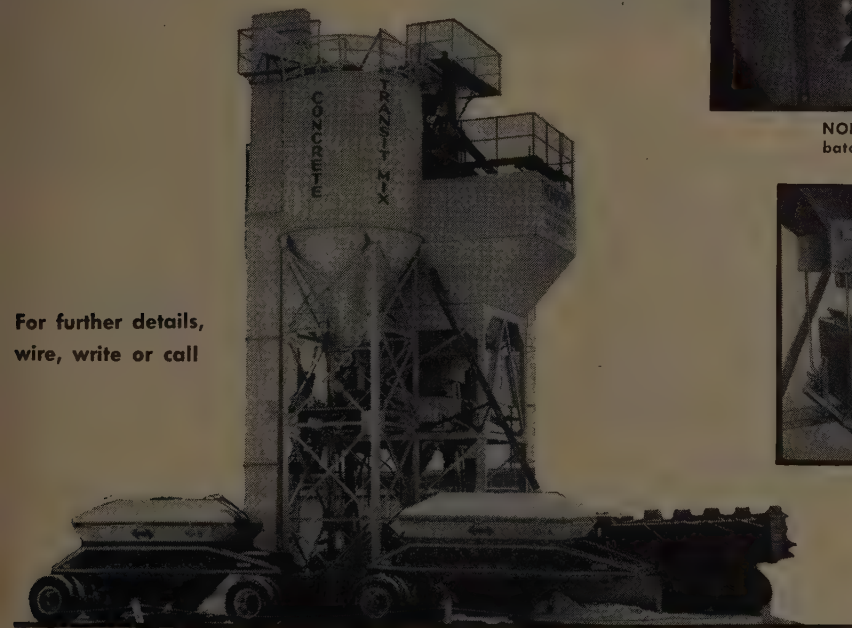
NOBLE semi-automatic batcher uses double clamshell gates, manually operated.



NOBLE clamshell gate full automatic batcher.



NOBLE dribble gate, full automatic batcher.



NOBLE semi-automatic CA154.

For further details,
wire, write or call

DESIGNERS AND BUILDERS

CEMENT AND AGGREGATE BATCHING PLANTS
BULK CEMENT PLANTS • AGGREGATE BINS
CEMENT SILOS • CONVEYORS AND ELEVATORS

NOBLE COMPANY

1840 SEVENTH STREET • OAKLAND 20, CALIFORNIA • TEMPLEBAR 2-5785

Los Angeles Office: 117 1/2 West Manchester Blvd., Inglewood, Phone ORE 8-4457. Seattle Office: 518 First Avenue N., Phone ALDER 1025

Save Manhours!

DRILL A FOOT A MINUTE!

FASTER—DEEPER—WIDER! SAVE TIME and MONEY with MODEL HBL!

Here's an earth drill designed for faster prospecting, soil testing, blast hole drilling and shallow well drilling, the powerful Buda HBL sets up in seconds by hydraulic action, pulls 20 feet of auger at one time without moving the truck! Speed and pressure of drill feed is controlled by operator. Model HBL is self-powered by Buda diesel or Buda gasoline engine—no extra power accessories are needed—permits drilling larger diameter holes. For fast drilling, rugged service and widest variety of hole depths and diameters, investigate Buda Model HBL Earth Drill.

Largest Range of Depths and Diameters

- 6 inch diameter to 100 foot depth
- 8 inch diameter to 100 foot depth
- 10-12 inch diameter to 50 foot depth
- 6-42 inch diameter to 7 or 10 foot depths
- 16-18 inch diameter to 30 foot depth

New versatile Y-1 bores

STRAIGHT OR ANGLE HOLES UP TO 12 FT. DEEP!

Quickly set up for guard rail drilling, power poles, foundations, piers, posts and many other uses, the Buda Y-1 bores holes 6 to 36 inches in diameter to 12 feet deep—vertically or at almost any angle desired. Economical in operation and maintenance, the self-powered Y-1 is built on a skid frame ready for mounting on a 1½ to 2½ ton vehicle. Full view operating position affords faster operation and maximum safety; hydraulic action gives complete control of speed and pressure. For fast, low cost, versatile drilling see your nearest Buda distributor for complete details on the Buda Y-1.

BUDA — A SUITABLE EARTH DRILL FOR YOUR DRILLING JOB!

BUDA

The Buda Company, Harvey, Illinois

bituminous mixtures, especially when the clay exists as a coating on the surfaces of the sand grains. As the Sand Equivalent Determination furnishes a ready means for detecting the presence of such fine materials, a tentative scale of values has been set up to permit rapid testing and quick determination in the field. At the present time, SE values are being included in the specifications of the California Division of Highways. The following limits are proposed for each of the classes of aggregates listed:

	Sand Equivalent minimum
Crusher run or gravel base materials	30
Aggregates and selected materials for road-mix bituminous treatment.....	35
Aggregates for plant-mix bituminous surface	45
Aggregates for asphaltic concrete or Class A plant-mix	55
Concrete sand	80

By comparing SE test values to other test results, it was found that the majority of soils showing high expansion under soaking may also be identified by means of the sand equivalent. It has been the general practice in California in the past to consider that any soils showing an expansion greater than 5% on specimens prepared for the CBR will be unsuitable for placing in the upper levels of the roadbed. It appears that the same class of soils can be identified and segregated by stipulating that soils having a SE less than 10 should not be placed in the upper layers of the roadbed. They are also likely to develop excessive expansion and certainly will have little supporting power when saturated.

Dust effects on SE values

Sand Equivalent values are definitely influenced by the amount of fine dust in the sample, and a plot of SE values versus either percentage of "sand" or percentage of dust will usually result in a smooth curve for each material. However, there is a marked difference in the relationship depending upon the type of dust or fine material present.

For example, there is the relationship between SE values and the total percentage of dust added to a sample of standard Ottawa sand. Only about 6% of clay is required to produce a SE value of 30, whereas it will require 33% of fine quartz dust or 44% of limestone or rock dust.

As a further illustration of the differences in type of dust, it has been shown that addition of a "natural" dust to a sample of fine aggregate reduces the SE more rapidly than does addition of crusher dust. If one were to specify a minimum SE value of 55, not more than 9% of "natural dust" could be tolerated in the sand frac-

tion, whereas 13% of crusher dust would be acceptable.

An accompanying figure is an illustration of the values developed from a variety of materials which have been tested in the stabilometer and the SE values determined. There is evidence that mixtures of sand, silt and clay develop optimum resistance values when sand equivalents fall in the range of 30 to 70, while clean sands without dust tend to drop off somewhat in R-value. While certain materials do show an adequate resistance value with a SE as low as 20, many others fall off very markedly. It is therefore believed that any material having a SE less than 30 will be too critical and offers too small a margin of safety to be used in important layers of base or sub-base intended to support a costly highway surface course.

Test applications

From the foregoing, it will be apparent that the SE is useful in detecting the presence of adverse amounts of clay in granular base materials. It may also be used to limit the amount of fine dust or clay that may exist as a coating on particles of mineral aggregate intended for bituminous mixtures. It may be used as a quick field test to control the amount of adverse clays in concrete sands. The junior engineer or inspector who performs the test should in time become very much aware of the effects of the clay fraction in pavement and base materials.

Conclusions

In conclusion, it may be stated that the suitability of soils for engineering purposes depends largely upon their ability to remain in place and to support whatever loads may be placed upon them either by a permanent engineering structure or by transient vehicle loads. The civil engineer responsible for construction of any form of earth work should be informed not only concerning the quantity of clay materials that are present but also should know something of their nature and their potential influence on the engineering properties of the soil.

Arizona cuts budget

LEGISLATIVE CUTS of \$62,000 in the Arizona State Highway Department's operating budget for 1953-1954 will make it necessary to lay off 138 employees on July 1, it was revealed. The new budget provides \$3,987,035. About 90% of those to be laid off are more than 65 yr. old, however, and are eligible for the newly-created retirement program for state employees. Thus the personnel reduction is not expected to cause any noticeable drop in road building and maintenance activities.

STRAND & SONS General Contractors



Masonite Corporation
111 Sutter Street
San Francisco 4, California

Gentlemen:

It gives us great pleasure to advise you of the economical and successful advantages we have enjoyed from using Masonite Concrete Form Presdwood on the Men's Residence Hall at the University of Washington in Seattle.

We have used it eight times to date and feel confident it will stand up for the entire 12-time use required for this 12 story building.

In addition, it has proved very economical, because the extreme smoothness of the concrete surface has reduced our labor for sacking and grinding. In fact, your Concrete Form Presdwood gives us the smoothest surface we have ever been able to produce.

Yours very truly,

STRAND & SONS

By *Ray W. Strand*

CONCRETE EVIDENCE

that
MASONITE CONCRETE FORM PRESWOOD
can be used again and again!

You can profit by the experience of others. You can save time and cut costs with this tough, grainless, all-wood hardboard. Comes in handy 4' x 8' and 4' x 12' panels...easy to cut and fit.

Here's a tip: For unpainted surfaces, pour against the screen side of Concrete Form Presdwood®. You'll cut hand-rubbing time 50% or better!

- Won't split, splinter or crack.
- Can be curved for arches, columns, etc.
- Easily worked with carpentry tools.
- Insures complete, uniform hydration.

Send for the complete facts about
Masonite Concrete Form Presdwood



MASONITE CORPORATION

Dept. WRC-6, 111 Sutter St., San Francisco 4, California

"Masonite" signifies that Masonite Corporation is the source of the product
Please send me your brochure on Masonite Concrete Form Presdwood.

Name.....
Address.....
City.....
County.....
State.....
Zone.....

Western Hardboards for Western Construction



No lost time with this rig! While the truck is rolling, the driver releases the hopper gate, spreading gravel evenly.

Doubles Payload—

Cuts Costs in Half—

Marlin Curtis wanted greater hauling capacity without sacrifice of maneuverability. He got the capacity with his specially-designed hopper-body semis. The functional design of White's new 3000 tractor supplied the maneuverability.

It will pay you to discover how the White 3000 answers your particular hauling problem. See, for yourself, the logical reasons why White *earns more, costs less* through the years.

Your local White Representative is ready to demonstrate. Plan to call him soon.

SHORTER TURNING RADIUS



Short turning radius of the White 3000 tractor permits U turns on the roadbed ... saves valuable time on every job.

THE WHITE MOTOR COMPANY

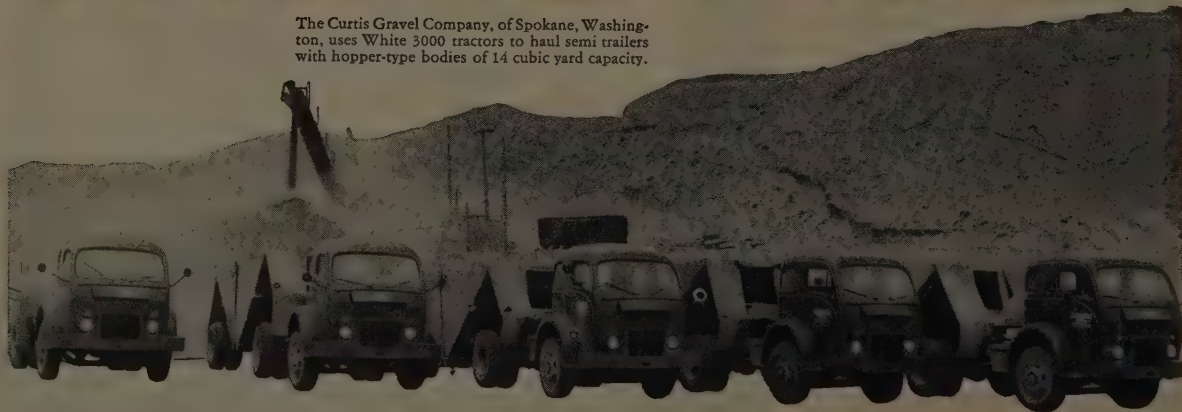
CLEVELAND 1, OHIO

Factory Branches, Distributors and Dealers Everywhere



WHITE 3000

The Curtis Gravel Company, of Spokane, Washington, uses White 3000 tractors to haul semi trailers with hopper-type bodies of 14 cubic yard capacity.



FOR MORE THAN 50 YEARS THE GREATEST NAME IN TRUCKS



In the Northwest, poor base material can be improved by —

Emulsified asphalt treatment

State and county engineering departments treat top of base course to hold fines before wearing course is placed—Simplicity of method is a big point, says Multnomah County, Oregon

SINCE DEPLETION of suitable aggregate supplies for highway construction is becoming a matter of concern to engineers in many sections of the country, methods of enlarging the use of present supplies of good materials, or improving the quality of poorer types of foundation and base aggregates, are attracting the interest of progressive engineers.

The improvement of less desirable aggregates used in bases for our pavements is one method of extending our material supplies. Soil stabilization, base treatments, and similar processes will, as time goes on, play a larger role in the construction of the nation's highways.

Limitations of method

The process of treating top course surfacing with emulsified asphalt cannot be placed in the same category as soil stabilization or treated bases, but it does offer another means of improving poor quality surfacing materials. An important feature is that this process can prevent the loss of fines in top course surfacing. This feature is particularly applicable on sections of surfaced highway subjected to traffic before placing the final wearing course. An additional advantage is

gained in the elimination of the asphalt prime used by many agencies to set up the top course surfacing on new work.

OK for pit-run material

Top course aggregates containing cohesive material can be improved by this method, since the moisture absorption of these particles is considerably reduced by the addition of emulsified asphalt to the sprinkling water and subsequent processing. In cases where lack of funds prevents the use of crushed rock in base construction, this process may be applied to pit-run material.

Several names have been used in an attempt to describe this process in order to distinguish it from soil stabilization. The title of "Emulsified Asphalt Treated Top Course," used by Multnomah County, Oregon, is probably as good an over-all descriptive name as could be selected. It should be pointed out that this method is limited to the upper portion of the

base rock—usually about 2 in. of the top course surfacing lying immediately under the asphalt wearing surface. Emphasis is placed on simplicity, in both the use and operation of equipment. Manipulation is kept to a minimum. The only equipment used is that which is normally required for any surfacing project—motor grader, roller, and water tank. Preferably, the water tank should have a sprinkler bar rather than a splash type spreader for more even distribution.

Emulsified asphalt added

The primary difference in this treatment and that usually followed in processing top course surfacing is the addition of emulsified asphalt to the sprinkling water.

Specifications, as adopted by Multnomah County, outline construction details for "Emulsified Asphalt Treated Top Course," as follows:

1. "During the normal blading and processing of the top course base material, sprinkling shall be done with a mixture of emulsified asphalt, SS-1, and water. Sprinkling shall be done in such a manner so as to provide a uniform application of emulsified asphalt, before dilution, of from 0.30 to 0.35 gal. per

AT THE TOP OF THE PAGE:

MOTOR GRADER processes top course surfacing before emulsified asphalt is added, near Eugene, Oregon.



ROLLER starts compaction on section of highway in Multnomah County, Ore., while motor grader lays out processed surfacing.

sq. yd., per in. of thickness of treated top course material. Water shall be added to the undiluted asphalt at the rate of from 25% to 50%, or as the Roadmaster may direct. The amount of diluted mixture to be spread will be varied to meet the condition at the time of application.

2. "The application of the mixture of emulsified asphalt and water, and the blading and processing, shall be done in a thorough and uniform manner to insure complete dispersal of emulsion mixture and aggregate fines, providing Top Course Base Material of the maximum density and uniformity.
3. "Compaction of the treated Top Course Base Material shall follow blading and processing in such time as to provide compaction of the material at a moisture content which will give maximum density.
4. "Following final rolling, the treated base material will be sealed with a flush coat of emulsified asphalt,

SS-1, and water. The net rate of application of emulsified asphalt before dilution shall vary from 0.10 to 0.15 gal. per sq. yd. A mixture of approximately 50% emulsified asphalt and 50% water shall be used unless varied by the Roadmaster. Cover aggregate will not be required on the flush coat unless so designated by the Roadmaster."

State provisions

The Oregon Highway Department has elaborated to some extent on the procedure as set up by Multnomah County. Special provisions included in two recent projects specify approximately 0.50 gal. per sq. yd. of SS-1 emulsified asphalt in three applications.

The first application of the dilution is applied to the leveling course surfacing before compaction. The mixture is applied at a rate of approximately 0.50 gal. per sq. yd. in the proportion of two parts water to one part emulsified asphalt.

After application of the mixture,

the leveling course is bladed, processed, and shaped to cross-section and thoroughly compacted. Within 24 hours, a flush coat of 1 to 1 mixture is applied to the finished surface at a rate of approximately 0.40 gal. per sq. yd. Within 24 hours after the second application, a third spread of 1 to 1 mixture is applied at an approximate rate of 0.20 gal. per sq. yd. The total amount of SS-1 emulsified asphalt approximates 0.50 gal. per sq. yd. of surface.

Oregon Highway Department standard specifications for sprinkling apply in this work. The only change is the addition of emulsion to the sprinkling water. "SS-1 Emulsified Asphalt in Sprinkling" is included in the unit payment items.

Wide usage

The City of Tacoma, Wash., has been using variations of this type of work for the last 4 or 5 years. Kirkland and Renton, Wash., also completed projects incorporating similar methods in some of their street work last year. In all three of these cities, most of the work was done with pit-run aggregates.

Douglas County, Oregon, and the Oregon State Highway Commission also laid short sections of treated top course in 1952.

To date, cost estimates on this type of work are scarce. Based on a small job done by Multnomah County last year, it appears that 15 cents per sq. yd. will cover the complete operation. 4,300 sq. yd. were processed at a cost of \$630.58. This total included rental on the motor grader, distributor, and roller; the emulsion, and supervision.

Advantages

Costs on this particular job indicate that this method will compare favorably with the cost of a prime coat. Projects to be contracted on a larger scale this season by both Oregon and Washington highway departments should give a sound basis for determining costs on this kind of work.

This method of treating surfacing materials promises to be another tool available to highway engineers in their search for better construction practices. The principal factors in favor of this operation are:

1. The cohesive properties of top course surfacing are improved.
2. The material is bound together more firmly.
3. The treated aggregate gains a substantial resistance to moisture absorption.
4. No special equipment is necessary.
5. Manipulation is kept to a minimum.
6. The loss of fines, raveling, and dusting is prevented where roadways are subjected to traffic before placing the final wearing surface.

THIS STREET FLUSHER has been converted to a sprinkler for the purpose of applying emulsion mixture. Equipment belongs to the city of Renton, Wash.



Here are the results of...

Colorado's truck size-weight study

Combination vehicles jump in average weight from 22,700 to 4,300 lb. between 1936 and 1952 — Axle loads of 18,000 lb. or more increase from 3.7 to 37.0 per thousand

RAILROADS did it the other way. Years ago, engines ran on 85-lb. rails which were sufficient to handle the traffic. Then came heavier equipment and higher speeds, and larger rails were laid prior to allowing operation of heavier and faster units. About the same time, highways were also suffering from growing pains. But the highway problem was met in a different way, with bigger and better trucks allowed on the old roads.

Colorado's 1952 Truck Size and Weight Study shows that, since loadometer operations were first conducted in 1936, definite changes have occurred in the pattern of commercial vehicles and loadings. While it is true there were fluctuations from year to year, the overall figures indicate an upward trend. An all-vehicular traffic increase of 69% was registered between 1936 and 1952. Passenger car and truck traffic, as general groups, increased at about the same rate. But differences are radical when the groups are broken down to kinds and sizes.

Combinations increase most

The large increase is in the weight of combination vehicles as against that of single-unit trucks: Average weight of single-unit trucks in 1936 was 7,400 lb. compared with 7,700 lb. in 1952, while the average weight of combination vehicles increased from 22,700 to 41,300 lb. during the same period. Combinations were equipped with 319 axles per 100 vehicles in 1936 and with 398 axles per 100 vehicles in 1952.

In a comparison of figures for the year of 1936 against those of 1952, it

By HAROLD N. KINDRED
Administrative Assistant
Colorado Department of Highways

is evident that the per cent of passenger cars, buses and pickups has remained fairly constant. For the same years, single-unit trucks decreased while combinations show an increased percentage. Notice these figures:

	1936	1952
	%	%
Passenger cars.....	83.57	84.37
Buses	0.50	0.45
Pickups	6.93	7.32
Single-unit	7.65	4.27
Combinations.....	1.35	3.59
All vehicles	100.00	100.00

In pavement designing, Colorado's engineers believe that the amount of truck travel presumed to be on a specific road is of great importance. But they believe that gross weights and their relation to axles per vehicle are more important. An almost constant increase year by year of both loaded and empty average gross weights is a matter of record.

In measuring the quantity of loads imposed upon the highway system, Colorado's engineers computed the number of 5,000-lb. Equivalent Wheel Loads by usage of a California developed formula. Despite fluctuations occurring through the years since

CORRESPONDING trend for trucks weighing less than 20,000 lb. showed a sharp decline, while the 20-30,000-lb. and 30-40,000-lb. groups remained reasonably steady at about 7.5 per hundred for the former, 5.0 per hundred for the latter.

1942, most of the wheel load groups increased at about the same rate of 2:1.

An increase of average loads between 1936 and 1952 was caused by the higher frequency of loads 40,000 lb. and over. In 1936 there were only 6.4 vehicles out of every 1,000 with gross loads of 40,000 lb. or more. In 1952 the number of such vehicles increased to 113 out of every 1,000.

Shortening pavement life

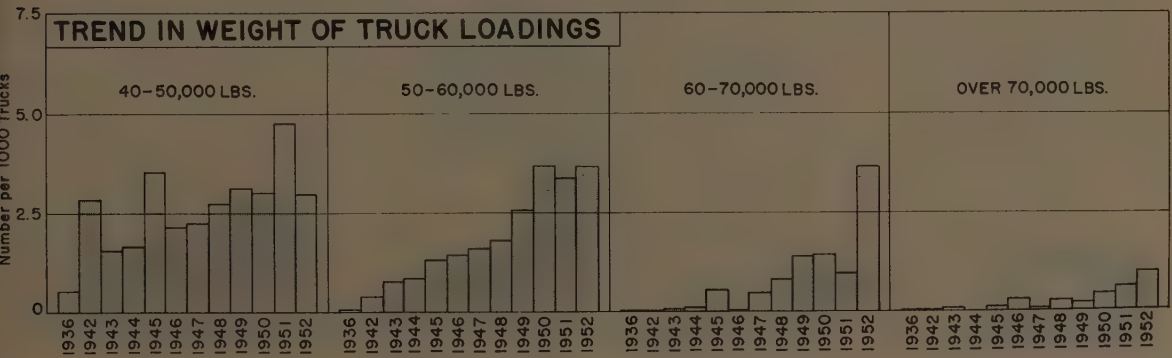
Colorado's state law regarding axle limitation is in accordance with recommendations of the American Association of State Highway Officials which is set at 18,000 lb. The tremendous increase in heavy loads can be shown in this comparison: Frequency of axles weighing 18,000 lb. or more was 3.7 per thousand in 1936, and increased to 37.0 per thousand in 1952.

"It is apparent," say the Colorado engineers, "that the number of larger vehicles, the number of larger gross loads and the number of larger axle loads are increasing at a much faster rate than any other increment of truck traffic. But it is assumed that the critical point of loading—the 16,000-lb. axle—is still within a reasonable margin of safety. The problem thus resolves itself into the threat of foreshortening the life of the pavement structure due to the increasing frequency of axle loads of 16,000 lb. or more."

In the application of size and weight tables, developed in the study, to the designing of highways, the Colorado engineers say:

"Loadometer surveys in recent years have shown persistent increases in the frequency of heavy vehicles. While these heavy loads are found on only a small percentage of the trucks, they are highly critical in relation to the durability of existing highways.

"In the design of any highway, three prime factors must be considered; namely, subgrade soils, type of



10,000 WATTS A.C.



MODEL 10CW
10,000 watts A.C.

the New ONAN "10 CW" Electric Plant

Check these advantages!

- ★ High capacity for big jobs.
- ★ Twin-cylinder, horizontally-opposed, air-cooled, alternate-firing engine.
- ★ Aluminum-alloy cylinder heads.
- ★ Extra-large, replaceable bearings.
- ★ Full-pressure lubrication, 6-quart oil capacity, oil filter.
- ★ Impulse-coupled, high-tension magneto ignition; radio suppressed.
- ★ Quiet, vacuum air cooling of generator and engine.
- ★ Excellent accessibility; snap-off housings.
- ★ Extremely quiet running.
- ★ High performance generators.
- ★ Completely equipped with controls and instruments.

Costs less than any other complete electric plant!

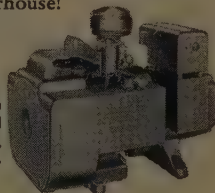
You can't match it anywhere in performance, equipment or value. The sensational new Onan 10CW gives you everything you've wanted in an electric plant plus exceptional mobility for a unit of its capacity.

On large construction jobs, where wattage requirements for power tools are high, or where floodlighting of extensive work areas is essential, the Onan 10CW delivers all the electric power you need.

Before you buy another electric plant for any purpose, take a good look at this new low-cost powerhouse!

Model 5CW 5,000 watts

Same advanced design as the 10CW with all its exclusive advantages. Built for heavy duty, economical operation.



AUTHORIZED DISTRIBUTORS:

ETS-HOKIN & GALVAN
551 Mission St., San Francisco, Calif.
218 N. Avalon Blvd., Wilmington, Calif.

FREMONT ELECTRIC COMPANY
744 North 34th, Seattle, Washington

BUDA ENGINE & EQUIPMENT CO.
2580 N.W. Upshur, Portland, Oregon

foundation reinforcement and pavement, and last the vehicle loads. The subgrade can be designed to resist moisture and ballasted to carry certain loads. The pavement can be designed to withstand known loads. Its ability to serve efficiently is then predicated on the assumption that loads greater than the design basis will not be allowed.

"Loadometer information can be readily applied to the design of bridges, roadway foundations and to determine the type of surfacing required to withstand the vehicular loads. However, unless more rigid control over the loading of vehicles is exercised, design to meet legal weights and axle loads seems superfluous."

Designs and laws

The Department designs rigid pavement slabs in essential conformity with procedures recommended by the Portland Cement Association. The method provides for repeat stresses on the basis of wheel loads of varying magnitude, and the axle factor developed from data between 1949 and 1952 indicates that 2.5 axles per commercial unit may be used.

Colorado's laws concerning overweight are enforced to the extent permitted by the personnel available. The state's statutes provide for these restrictions:

- 1—Load on any axle not to exceed 18,100 lb.
- 2—Any 2-axle vehicle not to exceed 30,000 lb.
- 3—Any 3-axle (or more) vehicle not to exceed 46,000 lb.
- 4—Any vehicle or combination of vehicles not to exceed wheel base length plus 40 times 800.

The first size and weight study made in 1936 covered 54 stations. From 1942 to 1949 there were 10 stations in operation. Since then, 13 stations have been used each year. Stations are located on main highways at points selected not only to give a representative picture of traffic moving through the area but also to reflect data concerning interstate and intrastate commerce and farm produce carriers.

Gathering data

Information gathered consists of vehicle type, commodity carried, whether private or for hire, length of axle spacings and wheel loads. Also, classification counts are made of all vehicles passing each station during the period of operation.

A four-man party performs the field work using two portable scales which are used to sample both directions of travel during the operation. Sampling is at random, modified to the extent that all types of vehicles are represented in the sample, thus obtaining a higher percentage for vehicle types of lesser frequency.

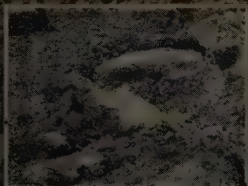


Repair or Rebuild roads and streets the modern way



AFTER SCARIFYING

AFTER GRID ROLLING



The GRID ROLLER way for faster salvaging of black-top at less cost!

No other single piece of road building equipment can match the Hyster Grid Roller in dollars returned per dollar invested! Progressive road builders and officials of counties, townships and municipalities throughout the country are adopting the Grid Roller method because it results in a *better* job, yet makes possible *substantial* savings. For limited or fixed budgets this means *more miles of road can be repaired or rebuilt*.

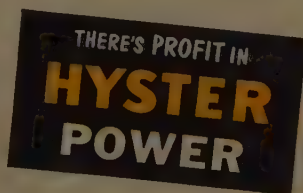
Key to savings is the fact that the Grid Roller performs three functions: (1) salvages the old surface material, (2) compacts the base, (3) rolls the new surface. On the job illustrated here, for example, involving only 1.6 miles of rebuilt road, savings approximately *matched the cost of the Grid Roller!*

A new 16 MM sound motion picture will be available soon showing the Grid Roller in action on different types of black top jobs, including the job illustrated here. Make arrangements now to see this motion picture at your Caterpillar-Hyster dealer, or write for information to:

HYSTER COMPANY

2951 N. E. Clackamas St.
Portland 8, Oregon

1851 N. Adams St.
Peoria 1, Illinois



Call the CATERPILLAR-HYSTER DEALER in your area for profit-building ideas!

ALASKA

NORTHERN COMMERCIAL COMPANY

ARIZONA

ARIZONA MACHINERY CO.
BRADEN MACHINERY CO.

CALIFORNIA

BERGLUND TRACTOR & EQUIP. CO.
BRIZARD-MATTHEWS MACHINERY CO.
BUDD & QUINN, INC.
JAMES CASHMAN CO.
CRATER LAKE MACHINERY CO.
DAVIES MACHINERY CO.
DITZ BROS.

FAUKE TRACTOR & EQUIPMENT CO.

HALTON TRACTOR CO.

HARTNETT MACHINERY CO.

HERRICK TRACTOR CO.

HOLT BROS.

JOHNSON TRACTOR CO.

MARYSVILLE TRACTOR & EQUIP. CO.

JOSEPH G. MOORE CO.

PETERSON TRACTOR & EQUIPMENT CO.

PRINGLE TRACTOR CO.

SAN DIEGO TRACTOR & EQUIP. CO.

SHEPHERD TRACTOR & EQUIP. CO.

SIERRA TRACTOR & EQUIPMENT CO.

TREANOR EQUIPMENT COMPANY

VALLEY TRACTOR & EQUIPMENT CO.

WALLACE MACHINERY CO.

WEAVER TRACTOR CO.

I. G. ZUMWALT COMPANY

COLORADO

MCCOY COMPANY

IDAHO

BUNTING TRACTOR CO., INC.

NEZ PERCE TRACTOR & EQUIP. CO.

PARKINSON TRACTOR CO.

PETERSON TRACTOR SERVICE, INC.

MONTANA

CENTRAL MACHINERY CO.

NASH-DAVIS MACHINERY CO.

TRACTOR & EQUIPMENT CO.

WESTMONT TRACTOR & EQUIP. CO.

NEVADA

JAMES CASHMAN CO.

SANFORD TRACTOR & EQUIP. CO.

NEW MEXICO

R. L. HARRISON CO., INC.

OREGON

BUNTING TRACTOR CO., INC.

CRATER LAKE MACHINERY CO.

EMPIRE MACHINERY CO.

INLAND MACHINERY CO.

INTERSTATE TRACTOR & EQUIP. CO.

UTAH

PETERSON TRACTOR SERVICE, INC.

WHEELER-KERSHAW CO.

WASHINGTON

BRADEN TRACTOR & EQUIPMENT CO.

BYRNE-FERRIS MACHINERY CO.

COLLINS MACHINERY CO.

COLUMBIA TRACTOR CO.

INTERSTATE TRACTOR & EQUIP. CO.

MURPHY-CAMPBELL CO.

WEBB TRACTOR & EQUIPMENT CO.

WYOMING

WORTHAM MACHINERY COMPANY



Construction speed has been boosted by —

THE PORTABLE ROCK PLANT

Workhorses of today's projects have been perfected to deliver added tons of material to meet ever-tougher specifications — Origin and development described



By
**MELVIN
OVESTRUD**
President
Pioneer Engineering
Works, Inc.
Minneapolis,
Minn.

LATE IN THE SUMMER of 1951, a nationally-known contractor drove in to his biggest job—a freeway contract in Southern California. The place was alive with activity. Tractors and scrapers crawled like full-bellied beetles loaded with dirt. Up ahead, a power shovel ate a path through a rocky cut. Fast rubber-tired hauling units snarled as they sped to the high fill nearby.

"Your job looks good, Lou," he said to his superintendent. "Any troubles?"

"No, I guess not," answered the superintendent. "But we've got to make up our minds about our base-course aggregate."

"I've done some local checking. There are two commercial stationary plants," the superintendent went on. "Between them they might be able to give us the 300 tons an hour we'll

need. What do you think? Should we buy and haul on this one?"

"No. There's too much danger," said the contractor quickly. "I'll pull our 46 VE off the Ridge Route job. The time limit on this one is critical, and I don't want to run a chance of a rock slowdown before the rains hit."

"That could sure ruin us, all right," agreed the superintendent. "We'll just bring our portable plant down here and we'll know our base course won't be holding us up later on."

Building a reputation in 25 years

What that contractor said is a tribute to the portable rock plant, workhorse of the modern highway job. It is a tribute which is being repeated in

many forms by rock producers, contractors, and engineers in charge of the vital projects today which call for crushed or screened rock, Nature's No. 1 building material. For in a short quarter of a century, the portable rock plant has grown from a clumsy instrument to an efficient, high-capacity performer.

So precise and dependable is the modern portable plant that design engineers nowadays call for closely controlled material, knowing that it will be delivered at high daily tonnage.

And some of the tonnages stagger the imagination, to say the least. Near Elephant Butte, New Mexico, Lowdermilk Brothers of Denver tangled with a 1½-inch minus crushing job in malapai boulders. Malapai is one of the hardest rocks in North America, and contractors have gone broke in the past on many a malapai job. Lowdermilk Brothers knew what their portable plant would do. It operated for 3 months at 85% of its rated 300-ton-an-hr. capacity without a major breakdown. When the job was done, the plant moved to an easier pit and hit over 400 tons an hr.

About the author . . .

RECENTLY RETIRED as president of Pioneer Engineering Works, Melvin Ovestrud is currently consulting as an engineering consultant to the company. His experience in the field of aggregate production goes back to 1928, when he joined Pioneer as chief engineer. He has served also as works manager, vice president, and first vice president. He was elected president in 1951.

He has contributed many successful ideas to aid the production of aggregates which have led to the higher capacities and closer control over output so much in evidence today.—*Editor.*

Early days

How the modern portable rock plant was conceived and perfected is one of the interesting stories in American construction. Its present perfection would do credit to the inventive skill of Don Ameche or the artistry of Warner Brothers, but fortunately or unfortunately — depending on your point of view—the portable plant was developed less spectacularly. It grew naturally, the only pressure being one of public need in a rapidly developing civilization.

In the early days, say 25 years ago, the manufacture of crushed rock was not the precise science it is today. Concrete didn't have to be so strong. Alkali reactions were unknown. Highway loads were light. Flexible bases under both asphalt and concrete roads

PICTURED ABOVE . . .

HORSES of yesterday dragged the material across the bridge where their loaded scrapers could be dumped into a trap and carried up the conveyor belt to the crusher's hopper. This is a Russell screening and loading plant of 1926-1928 vintage.

were practically nonexistent. The theory of strength in particle interlock was still too new to be widespread. Large-scale construction of all types, as we know it now, was still in its infancy. Small wonder, then, that the first early portables were hardly more than a jaw and a screen or two. Since large tonnages were seldom necessary, no special emphasis was placed on high hourly output.

It's true that some of the building aggregates of that day required finer control. But these important structures were usually found in cities, where stationary commercial plants had already been established to take care of the need. There was little rivalry between stationary and portable plants at the time for two reasons. The end products were usually different, and the early portable had little to offer as much of a challenge.

America expands

Suddenly, in the 1920's, America began to grow up. A hue and cry went up to get the farmer out of the mud, and the highway industry was born. Water-supply and irrigation projects began to multiply to serve a growing population. By 1931 that biggest aggregate-production job of them all up to that time—Hoover Dam—came into being. The nation entered the aviation age, and airports began to crowd into the construction picture.

Flood-control projects, buildings, housing like the nation had never seen, and highways, above all, crowded every construction calendar. It was inevitable that much of the construction volume was destined for remote places, particularly in the field of highway building. Highways were the bridges, the natural transportation links joining the population centers.

For a time the early roads were laid mostly on raw earth, because there was neither the money nor knowledge to buy and haul flexible base aggregate long distances. When the weight and operating speed of heavy trucks increased to take care of an expanding demand for motor transport service, those early roads failed.

Searching for an answer, engineers discovered that a crushed rock cushion or blanket under an asphalt or concrete pavement would have both an insulating and bearing value. They learned to design this flexible base thickness scientifically in relation to the normal bearing value of the soil beneath.

Invention follows need

That engineering advancement was perhaps the most significant factor of any in the conception of the modern portable rock plant. And a real need for the portable plant was born with that discovery.

With the need came the invention. History records that one John Gunnison, materials engineer for the State of Wisconsin, had been noting the corrugated roads produced by

screened gravel alone. His active mind went to work and figured that crushed rock mixed with the gravel would have a binding effect whereby the road material could better be held in place. Gunnison purchased a shaker screen from the Russell Grader Co., a Blake type jaw crusher from an Eastern concern, and placed the two together on a wheeled chassis. This was the first portable plant. It was patented in the early '20's, but the patent subsequently was defeated by an earlier German patent.

History further records that demands for greater proportions of better graded crushed gravel for road-building in Wisconsin led to the development of the bottom-deck-feed type portable plant, about which more is said later on.

Portable plants today often turn out as high as 450 tons an hr. in moderate crushing and sizing. They bear small resemblance to early models. They come in units now; units of jaw crushers and rolls with screening systems so scientifically designed that engineers no longer question a portable's finished product. They will move 100 mi. to some remote location, set up in a day, and then sit there and grind out flash tonnage month after month.

Jack Kasler, contracting partner of Frederickson & Kasler in California, where specifications are as tough as they are anywhere, said, "We can produce 1¼-in. minus material, even with quite a percentage of crushing involved, for a little less than 50 cents a ton. This plant," and he pointed to his 46 VE Duplex Pioneer portable, "just finished 600,000 tons on the same set of jaws it had when we bought it new."

Today's portable plants have en-

gine power more nearly commensurate with rated speed at full load, for producers have found that optimum efficiency is reached when the rated speed is maintained. Jaw crushers now make a clean break of rock fragments instead of rubbing the material.

Lack of common sense

Some of the lessons which had to be learned as the portable plant was developed seem now to be almost humorous commentaries on man's lack of common sense. For years plant operators took it as a matter of course to carry raw material to a top screen deck, even that portion which already met requirements of size, and somehow to choke it all through screens, jaws, and rolls.

Somebody finally realized that the passage of all that good material through the plant needlessly wore down crusher jaws and screens, reduced plant efficiency, disturbed the crushing ratio, and clogged the system. Today Pioneer, for example, brings in the raw material to a bottom deck where the already acceptable fines are quickly screened out and sent to storage. Oversize material is then routed through jaws and rolls where all crushing effort can be used on material which needs breaking.

Found out for himself

Harvey Slocum, dam-building's Mister Big, discovered that principle independently for himself on the big stationary aggregate-production plant at Bull Shoals Dam in Arkansas. Corps of Engineers specifications for that job called for all concrete aggregates, even minus-200 mesh material, to be crushed from a single quarry. The idea was to get thermal compatibility, something the concrete busi-

UP TO 500 cu. yd. could be handled in a 10-hr. day in this old Pioneer screening, crushing, and loading Plant No. 12. It cost about \$8,000 and weighed 32,350 lb. This pit scene was photographed about 1930.





THIS 46VE plant turned out more than half a million tons of base course and hot mix aggregates for Winston Brothers to use on 40 mi. of the world's toughest mountain construction, knocking out the curves on California's famous Ridge Route.

ness will hear a lot more about in the future.

When Slocum started the plant under the first setup, crusher output was decidedly subnormal. Harvey scratched his head, made a common-sense analysis of the plant from start to finish, and bellowed loud and long when he found acceptable sand being routed through some of the crushing equipment. In his unique, profane way he quickly gave the order to alter the plant, pulling the sand out for storage ahead of the reduction machinery. Crusher output rose immediately.

Crusher variation compensates

Radical improvements in today's portable plants also include the principle of crusher variation to compensate for the variances in pit-run raw material. For years—and it still exists to some extent—it has been painfully prevalent for plant operators to simply keep machinery running without regard for input or output. That situation has been corrected so that a modern plant operator, if he wishes, can adjust his machine to meet these variances in raw input.

In some plants this is accomplished by a change of screens. Such an adjustment takes time, and the plant must be shut down to make the change. An indifferent operator will often run a plant at reduced efficiency rather than shut down to make the screen adjustment. But even that difficulty has now been overcome.

A simple adjustment of the jaw crusher, which can be made while the machine is running, now permits the operator of one portable plant to compensate for any material coming in. If too many fines are present he does not let his jaw crusher loaf while the rolls work themselves into an overload. He tightens down on the jaw to

let it do its share of the crushing. Conversely, if the pit changes to predominantly coarse material, the jaw is opened. This lets a coarser product pass to the rolls. The end result in this plant doesn't depend on the screens, because pay material comes off both the top and bottom decks with the crusher adjustment actually boosting the effective screen capacity nearly 100%.

When an operator has such modern mechanical adjustments available for intelligent use, he can turn out enormous tonnage consistently.

Advances in metallurgy have also played a major role in today's portable plant. The screening area especially is affected by the strength and abrasion resistance of metal. Finer screen wire on today's plants lasts longer, increases the effective screening area on the deck, and is lighter in weight than the thick-wired screens of yesteryear.

Today's modern portable plant is all anti-friction bearing equipped. Tumbler shafts, cut steel sprockets with high speed roller chain, and V-belts have replaced to a large extent the bulkier, less efficient drives of earlier models. Plants are mounted on overstuffed pneumatic tires for overland or fast highway travel, and are equipped with air, vacuum, or manually operated brakes for safety on grades. Hydraulic rams raise and lower lofty screens and conveyors, and centrally located controls bring one-man operation nearer reality. Electrically-operated plants, with power furnished from hi-line or from diesel-generator sets, have cut maintenance costs to a new low.

The portable vs. stationary controversy

Not long ago, a salesman for a manufacturing company which makes

both stationary and portable equipment called on a commercial rock producer in the Pacific Coast area. The producer was blunt.

"We know your stationary equipment is as good or better than any on the market," he told the salesman. "But we're not buying so long as you continue to manufacture competitive portable equipment."

This is a familiar story to any rock plant salesman, but does it mean that a genuine controversy exists? Hardly. Rather, a lack of perception on the part of a few people prevents the deeper appraisal of the construction industry which is badly needed in any analysis of the situation.

Basically, there is no controversy between the stationary and portable plant for the simple reason that each type has a definite place in modern construction. The stationary plant is designed to furnish steady tonnage for a given area. The tonnage can be high or low, depending entirely on the material market in that locality.

The portable plant, on the other hand, has been developed through a natural chain of circumstances to handle flash tonnage, either in spurts or steadily over longer periods of time. The portable plant is so successful because it combines the dependability and preciseness of the stationary plant with high-speed mobility.

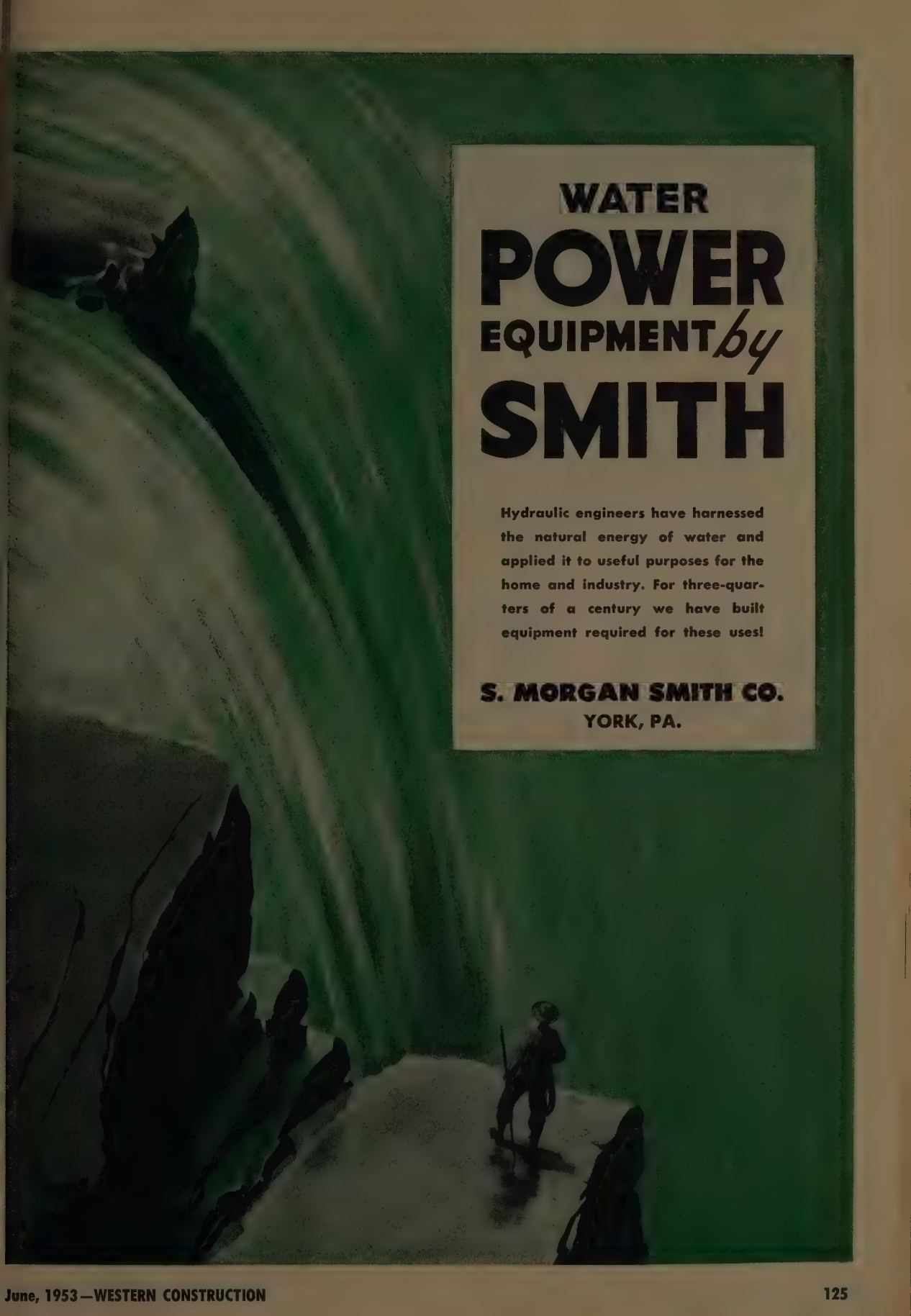
The important fact cannot be ignored that the modern portable plant has made available a much better grade of public work in remote places than was ever possible before. Instead of buying and hauling heavy loads of aggregate over highways already overcrowded, contractors take a portable plant to the job site, set it up in a day, and use native material closely by which might actually be far better for the purpose than the more distant commercial deposit, though not necessarily so.

Served in South Pacific

During the island hopping campaigns of the last world war, the Hawaiian Islands were the closest commercial source of aggregate to the far Pacific. But ships didn't try to haul material 2,500 mi. Portable rock plants came in to Guam, Saipan, and such places and turned out astronomical amounts of crushed coral. Military airports with sub-bases capable of supporting B-29 bombers went in rapidly. Portable crushers even handled andesite on Iwo Jima to make a B-29 runway, and andesite on Iwo is almost as tough as malapai in New Mexico.

The portable plant is truly a contractor's tool. There is little reason for a contractor to buy commercial aggregate and haul it some distance when he can produce it himself faster, more efficiently, and often at lower cost with a portable plant of his own.

Wise contractors also know that a modern portable is more efficient than



WATER POWER EQUIPMENT *by* SMITH

Hydraulic engineers have harnessed the natural energy of water and applied it to useful purposes for the home and industry. For three-quarters of a century we have built equipment required for these uses!

S. MORGAN SMITH CO.
YORK, PA.



STIFF BASE COURSE specifications on the new 55-ft. expressway between Salt Lake City and Parley's Canyon were met by this portable 46VE plant. It turned out an average of 750 tons of material per 8-hr. shift for Parsons & Fife, contractor.

an obsolete 25-yr. old stationary plant, even though the stationary plant might still be economically sound and well suited to the production of aggregates in a given locality. Several years ago, a major heavy-construction and roadbuilding contractor, Western Contracting Corp. of Sioux City, became sufficiently concerned to spend thousands of dollars in research, cataloging all stationary rock-production facilities in a 30-state area. Production rates and every item of equipment was listed and analyzed. Jack Kasler, who at the time was a traveling superintendent for Western, explained it this way:

"We had to make that study," he said. "Suppose you've got a tight time limit and need 350 tons of base an hour to make it. Suppose you make your bid on the basis of some stationary plant owner's overestimate of his production capacity. It's your name that's on the contract, not his, and when they sock the penalty clause to you, he's in the clear. You're not. That's why we got rid of one source of uncertainty by getting our own portable plants."

As a matter of fact, many stationary

plant owners who have business over wide areas now have turned to the portable plant to help meet peak needs. Several such producers use portable plants and bid on the production of aggregates for highways, dams, airports, and irrigation and flood control works. Between jobs they often use the portable plant as a semi-stationary setup.

Operation: key to high output

In spite of all the recent mechanical developments, sustained high output of the portable rock plant, like any other machine, depends in large measure on the skill and knowledge of its operator.

For example, at the time when Lowdermilk Brothers were turning in such an exceptional performance in New Mexico malapai with their 40-V, the next higher serially numbered plant of the same model was working a much easier pit in California, producing 2-in. material compared to the 1½-in. specification on Lowdermilk's job. Instead of 85% efficiency, the California plant was running only at 60%. Why? Faulty operation is the only logical answer because the crush-

ing ratio in both cases was approximately the same.

Trucks bunch up

One of the worst practices of all is to assign the right number of trucks to a plant and then permit their drivers to bunch up. In that case the trucks bunch up empty in front of the plant part of the time, while the plant has to shut down at other times to wait for them to become un-bunched out on the job. These are fundamentals, but the lack of tough, intelligent supervision to handle the situation is often appalling.

On the other hand, good operation of crushing equipment over the years is directly responsible for many of the sound advancements made in the last two decades. The field has largely been the proving ground, and grizzled old plant operators have been the best testing technicians. Many a refinement which is now standard on stock models started when a plant man with an idea dared to make a field change or write his suggestion to the engineering department of a manufacturer.

George Bell, an old timer who has perched on portables for over 20 yr., blames most of the rock plant failures on human laziness. He's the type of craftsman who's never too tired to clamber down and make a simple adjustment to equalize the load on all parts of his rig.

"A lot of men work only for Saturday night and payday," he said. "They're kidding themselves and gyping their boss. They neglect to make repairs or pay attention before trouble starts. One young guy here the other day let a log get into the jaw crusher. The jaw plugged, of course. But the damn' fool didn't seem to know anything was wrong until rock started building up to his knees on the walkway!"

Product acceptance is widespread

How about the acceptance of the product from portables? Is it general?

Emphatic affirmative answers to these questions appear in the ever-increasing use of portable equipment. Specifications, which get tougher and more precise, year by year, indicate plainly that engineering designers accept and appreciate the modern portable plant. Designers would hardly sharpen their specifications year by year, at a time when over-all highway construction in particular is lagging behind the demand, unless they realized that equipment was available to produce a better product at greater speed than ever before.

Where do we go from here?

Where will the portable rock plant fit in the construction picture 25 yr. hence? Will its future uses grow as rapidly as those since 1926?

These are interesting questions. No one, of course, knows the exact

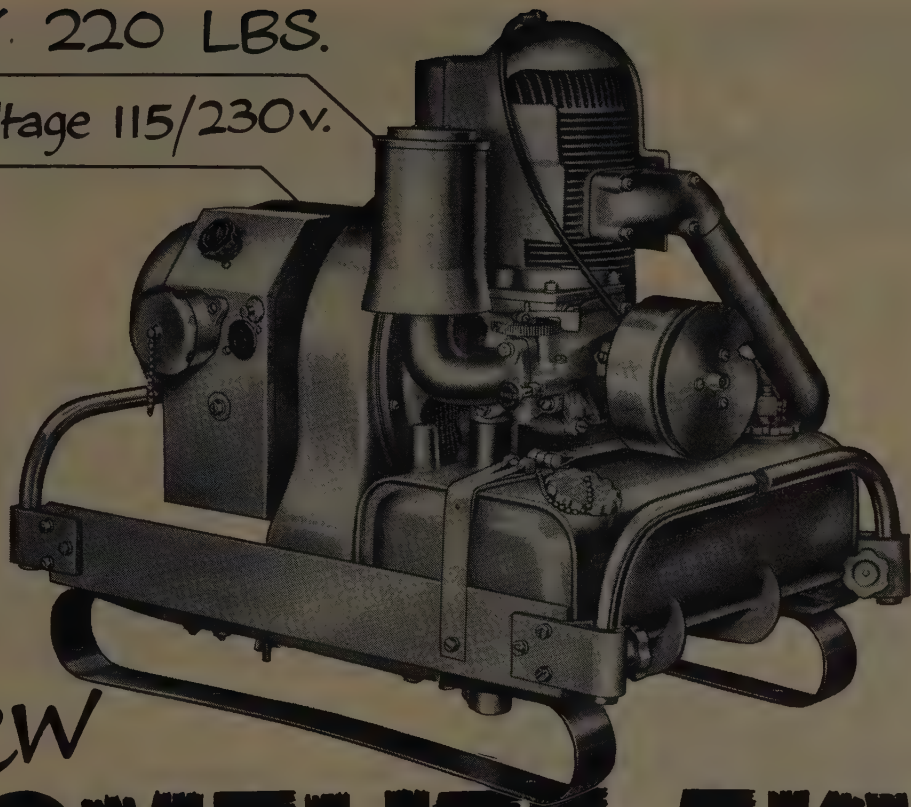
Concluded on page 161

DESIGNED for use in areas where ordinary gravel deposits are becoming depleted is this newest development in portable crushing plants. It produces usable material from large boulders by means of a 3 x 6-ft. scalping screen ahead of an 18 x 30-in. jaw crusher. Sizing and separation are done on a 4 x 10-ft. 1½ deck screen operating ahead of a 30 x 18-in. triple roll crusher.



ONLY 220 LBS.

Dual Voltage 115/230v.



New **HOMELITE 5KW**

GENERATOR for OPERATING POWER TOOLS



The New Homelite 5 KW Generator weighs only 220 pounds, complete with gasoline engine. Equipped with adjustable handles for easy carrying by 2 or 4 men.

Here is a new Homelite Generator that measures up to all the requirements for greatest efficiency with power tool operations. It's small, compact . . . light enough for two or four men to carry . . . and it gives you both 115 and 230 volt current up to its conservatively rated 5,000 watt capacity. With this new generator you can have all the power you need to operate light or heavy power tools any place you need it. You can oper-

ate electric saws, grinders, drills, routers, sanders, table or radial saws . . . with no drain on the generator or the efficiency of your tools.

You can operate these tools, or floodlights, when you need them, any place without worry over your power supply.

Write, for complete information on this new, rugged, dependable, high-powered Homelite Generator, today.

Manufacturers of Homelite
Carryable Pumps • Generators
Blowers • Chain Saws

Canadian Distributors: Terry Machinery Co., Ltd.,
Toronto, Montreal, Vancouver, Quebec.

PERFORMANCE • DEPENDABILITY
HOMELITE
CORPORATION
SERVICE

1306 RIVERDALE AVENUE • PORT CHESTER, N. Y.

HOW IT WAS DONE...

Canyon Ferry closure opens '53 season

FINAL CLOSURE of Canyon Ferry Dam, 17 mi. northeast of Helena, Mont., on the Missouri River, was made late in March when the two 10-ft. diameter temporary diversion tunnels which extended through the middle of the dam were blocked.

Sealing of the tunnels was accomplished by dropping reinforced concrete gates down guide slots on the up-



PLUGGING UP the upstream ends of the temporary diversion tunnels at Canyon Ferry Dam on the Missouri River starts the spring construction season. The four permanent outlet tunnels can be seen behind the trashracks, two at lower left and the others at lower right.

stream face of the dam. Then caissons were lowered to stop water from backing up into the downstream ends. The parts of the tunnels above water level were left open, the water was pumped out, and workmen crawled in and concreted a 20-ft.-long seal plug at the upstream end of each. Then a Pumpcrete was used to force concrete into

HIGH SPOTS of rock and overbreak, or surplus excavation, can be found in a hurry with this time-saving template, shown being used in one of the two 26-ft. diameter power and outlet tunnels at Palisades Dam in eastern Idaho. The template, made of 1/2-in. thin-walled, cross-braced conduit pipe, is rigid and easily handled by two men.



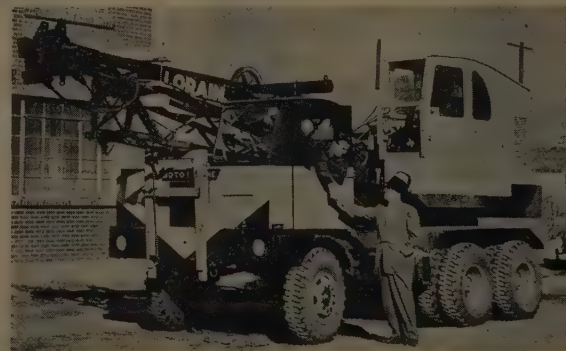
the remaining space. The operation took about six days.

The closure took place under a coordinated river-control plan. When the gates were ready to be dropped to seal the two tunnels, the flow of the river was cut at its headwaters at the edge of Yellowstone National Park by the Montana Power Co. Then flashboards were placed on the old Canyon Ferry Dam's superstructure, cutting off the river's flow entirely except for minor leakage. By the next morning the water level between the two dams had dropped sufficiently to permit lowering the reinforced concrete diaphragms to seal off the tunnels.

Closure of the tunnels opened the spring construction season on the \$29,500,000 project. Principal items remaining to be completed are the placement of about 28,000 cu. yd. of concrete, installation of four 34½ x 51-ft. radial gates in the spillway, erection of a 70-ton traveling gantry crane on the dam's crest, construction of an elevator tower from the dam's face to its crest, completion of five trash-rack structures, and hooking up the various pieces of equipment necessary for operation.

Buyer takes pleasure trip of 1,776 mi. in truck crane

SOME FOLKS like to travel the hard way, like pushing peanuts with their noses, walking backwards, or pedaling bicycles uphill. Compared with these methods of transportation, Harold Thornton of the Intermountain Crane and Rigging Co. of Salt Lake City did it the easy way.



"WELCOME HOME," says H. H. Nielsen, Thew-Lorain distributor in Salt Lake City, to Harold Thornton, who jockeyed the big Moto-Crane over 1,500 mi. in 8½ days. Nielsen sold the crane to Thornton, an impatient man who couldn't wait for the machine to be delivered.

All he did was drive his new 15-ton Lorain Moto-Crane Model MC-254, from the Thew Shovel Co. in Lorain, Ohio, back to Salt Lake City in 8½ days. At each evening stop he had the machine gassed and lubricated. The oil was changed twice during the trip.

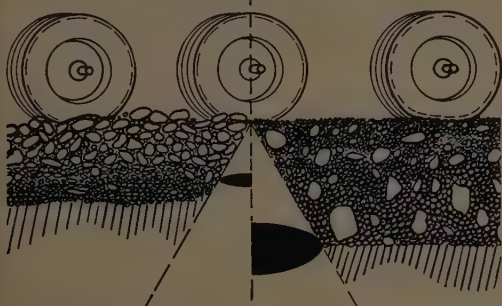
He averaged 200 mi. a day during the 1,776-mi. journey at an average speed of 20 mi. per hr. A heavy blizzard at Cheyenne, Wyo., made things worse, but he came through with no noticeable complications. The crane used 479 gal. of gasoline at a cost of \$132.29. Oil and grease amounted to \$27.18.

STOP GRAVEL SEGREGATION!

only the **SEAMAN**
provides the
most efficiently
mixed and
blended base



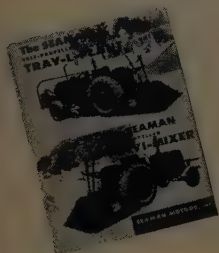
A gravel road in which bumps, undulations and rippling are developing because of gravel segregation. The loose gravel between wheel paths is dangerous and wasteful.



In segregated gravel (left above) the fines have sifted leaving larger stones on top. This is an unstable condition with low load bearing value.

Stabilized gravel (above right) is firmly blended and knit throughout, has a high load bearing value and requires little maintenance. This result encourages traffic to use all of roadway instead of causing traffic compacted ruts or paths.

FREE BOOK — The Seaman Self-Propelled Pulvi-Mixer and the SEAMAN Self-Propelled TRAV-L-PLANT are fully described in this new 12-page Bulletin. Also shown are many job scenes together with operational suggestions. Ask for Bulletin TPS. Send a postcard today.



The Seaman Self-Propelled Pulvi-Mixer, 7 foot mixing width. Gasoline or diesel powered. This unit will mix and finish one mile of 3 inch oil mix at a cost of less than approximately \$50.00.

SEAMAN
MOTORS
Inc.

285 N. 25th St.
MILWAUKEE 3, WIS.

HOW IT WAS DONE...

Engineers improvise storm drain where no natural run-off exists

RECURRING FLOOD conditions during heavy rains at a street intersection in El Segundo, Calif., where there was no storm drainage and no natural runoff, worried city engineers.

They consulted the Calco Division of Armco Drainage & Metal Products, Inc., which recommended that two holes be dug on either side of the street and 48-in. diameter, fully perforated, corrugated metal pipe be sunk to the depth necessary to provide good drainage.



LOWERING a 35-ft. section of corrugated metal pipe, workmen complete installation of an improvised storm drainage system at an El Segundo, Calif., street intersection.

The holes were dug to a depth of 20 ft., a 35-ft. section of pipe was lowered into place, the digging proceeded to full depth, and the pipe was lowered to full depth. A curb inlet, with a 12-in. corrugated pipe lead-in, was built to the sump. A cast iron ring and manhole cover were installed to permit cleaning.

Several heavy rains later the perforated pipe sumps were reported to be working satisfactorily. The City of Long Beach, after studying the experiment, ordered six similar sumps, each 45 ft. long.

Sand blanket used to protect chutes against abrasive action of dry sand

By H. B. McDERMID
Retired Construction Engineer

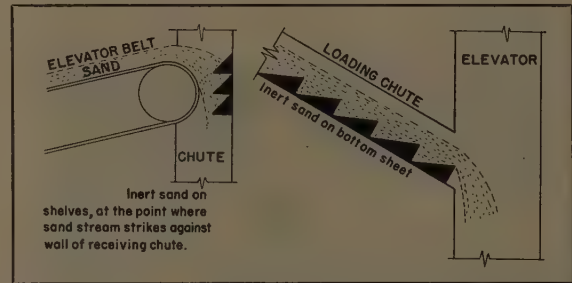
ABRASIVE ACTION of dry sand on steel chutes was causing a tremendous maintenance problem in the sand-handling departments of three huge non-ferrous foundries at a large war production plant during World War II.

Although thousands of feet of belt conveyors were used for the long straight runs, only steel chutes would do in the short distances around sharp bends. At points where severe service was required, the abrasive sand wore rapidly through the best of steel. Since the plant was running 24 hr. a day, 7 days a week, no unnecessary repair work could be done.

One particularly bad spot was a loading chute for a vertical belt elevator, where the $\frac{1}{4}$ -in. sheet steel bottom of the hopper chute wore out regularly every three weeks. Since the apparatus could seldom be spared (if it failed, the whole foundry had to shut down), the only feasible method of repair was to get another steel sheet ready and weld it right onto the bottom of the existing worn sheet without stopping the operation.

After several bottom sheets were superimposed on each other, the crew could often cut them away when the failure of some other part of the system forced a shutdown. Then a single sheet would be placed, bringing the hopper back to its original condition.

One of the field engineers, who learned of the situation and spent some time studying it, finally came up with a design idea that apparently solved the trouble.



He found by experiment the sand's "angle of repose," and, based on it and the angle from the horizontal of the chute bottom, he spaced several baffle sheets or strips across the top side of the bottom sheet, set at 90 deg. to the line of the sand flow.

These strips were made of $\frac{1}{4}$ x 2-in. steel, tack-welded to the top of the bottom sheet with the 2-in. dimension projecting up from the sheet at 90 deg., and were set about 5 in. apart. Their effect was to dam up the sand flow behind each baffle until the main bottom sheet was fully covered back to the next baffle, thus protecting it from the abrasive wear of the sand.

Each baffle protected the area behind it until the whole sheet was covered with inert sand, which moved very slightly if at all, while the fast-moving stream could touch nothing but the inert sand blanket and the top edges of the baffle strips, which proved to wear imperceptibly.

A number of different spots were afterwards safeguarded. The main idea is to so locate the baffle strips that they may hold a small "cover pile" of inert sand just where the stream of moving sand would normally strike. Properly placed, it always works.

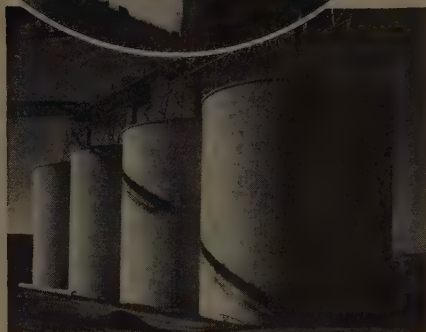
Now let's do a little figuring on the savings represented by the idea. At \$25.00 an application, which is what it cost us to do the job every three weeks, we saved 16 applications a year. Multiply that by four, or more, and you have a pretty fair sum, even if you limit it to this one plant.

New BASALITE "CONSTRUCTION"

REQUIRES LESS

STEEL! CEMENT!

NEW BASALITE "rounded coated particle" expanded shale aggregate* is entirely new... an ideal aggregate of a type long sought by builders. It is very strong and very low in absorption. Used in the production of portland cement concrete, it will hold curing-shrinkage to an absolute minimum.



*NEW BASALITE aggregate is produced by calcining shale to incipient fusion of particle surface after the raw material has been crushed and graded. Individual particles are well rounded and have a tough skin that surrounds a vesicular interior.

And NEW BASALITE Aggregate Concrete Reduces...

...STEEL REQUIREMENTS!

NEW BASALITE aggregate makes possible finished concrete that is very strong, yet very light. Concrete can readily be made with maximum weights of 100 lbs. per cubic foot, utilizing conventional slumps to give proper placement. Structural and reinforcing steel requirements are sharply reduced, since costly steel need not be wasted supporting "dead weight".

...CEMENT REQUIREMENTS!

NEW BASALITE is a stronger aggregate. It does not demand the high cement content needed by pumiceous aggregates to produce physically strong concrete. Compressive strengths of 2,500 to 3,500 PSI can be had utilizing conventional water-cement ratios.

...AND THAT'S NOT ALL!

Workability and placement characteristics of NEW BASALITE concrete are excellent. Insulative properties are approximately four times greater than river gravel concrete of the same water-cement ratio. NEW BASALITE ready-mix lightweight concrete will be supplied by leading ready-mix plants throughout Northern California.

This superb new aggregate also provides its advantages in NEW BASALITE Lightweight Masonry Units—the finest block material for sequence unit construction available today!

Investigate now! For only by your own investigation can you realize how much more
NEW BASALITE Aggregate concrete and NEW
BASALITE Lightweight Masonry Units have
to offer than competitive materials.

Write for all the facts. Today!

ROUNDED EXPANDED

SHALE AGGREGATE

Specify New

BASALITE

Throughout

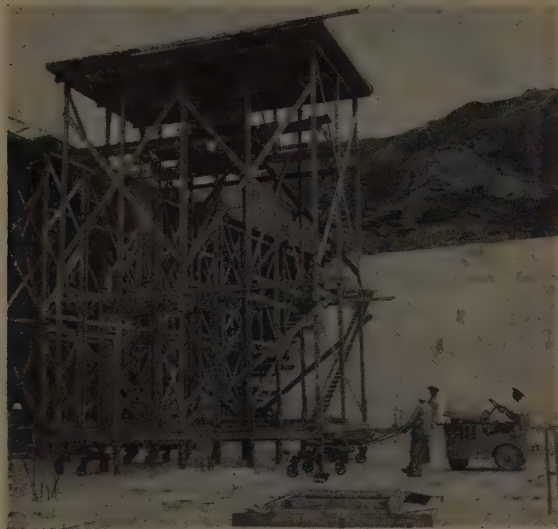
LIGHTER • STRONGER • BETTER

BASALT ROCK COMPANY, INC.
Napa, California

June, 1953—WESTERN CONSTRUCTION

133

HOW IT WAS DONE...



MAKING FALSEWORK PORTABLE by using ordinary garage jacks on wheels as dollies was the ingenious idea of L. G. (Bud) Waigand, superintendent on the 40,000,000-gal. concrete reservoir built in Salt Lake City by Peter Kiewit Sons' Co. The falsework was used to pour 60 x 90-ft. roof sections on the 270 x 420-ft. reservoir. Four sets of forms were used eight times each, amounting to a considerable saving in time, material, and wear and tear on the superintendent's nerves.

Cinder mountain whittled down

WHITTILING a mountain of cinders down to grade is the 5-yr. task assigned to a TD-14 Drott Bulclam owned by Bishop Bailey. The brittle, black-grey mountain, some 60 mi. west of El Paso in the New Mexico desert near the Mexican boundary, is composed entirely of volcanic ash, used by the Haliburton Oil Co. to manufacture oil well lining.

The shovel's lip has been built up to hold 3 cu. yd. of the light stuff. As each bucketful is peeled off, it is deposited in a hopper which feeds into railroad cars on a nearby track. The operation produces three carloads a day.

Because of the loading method employed, it is never necessary to carry the load in the air. The operation is so organized that no twisting or turning is necessary for the tractor, with the result that maintenance costs and time are kept to a minimum. The machine's tilting feature enables the operator to speed up each cut-back on the extremely steep slopes.

A BUCKETFUL of cinders is pushed to the loading hopper at the end of the ramp by Bishop Bailey and his Drott Bulclam in New Mexico.



Blazes its own trails!



Ploughed fields look like parkways to the Land Rover! Sure of foot and packed with power, it takes you where even bird-dogs fear to tread. A man-of-all-work, too — it'll tow anything from a trailer to a tree, saw and spray with its power takeoffs, handle all sorts of jobs. Seats 3 in front, more behind. Farmers! Lumbermen! Truckers! Sportsmen! See the Land Rover today at your nearest dealer.

TRY AND TIE THIS . . . 4 cyl., 50 hp Rover F-head engine . . . 4-wheel drive, front free wheeling . . . 8 speeds forward . . . Two power takeoffs.

AND THE RELIABLE LAND ROVER IS THRIFTY, TOO

LAND-ROVER

ROOTES MOTORS, INC.

403 North Foothill Road, Beverly Hills, Calif.
465 California Street, San Francisco, Calif.
42-14 21st Street, Long Island City, N. Y.

WESTERN CONSTRUCTION NEWS

JUNE 1953

Show Low shindig features highway tunnel opening

SHOW LOW, Arizona, opened its doors to the 23rd annual convention of the U. S. Highway 60 Association on May 15 and 16, with dedication of the new Queen Creek Tunnel on Highway 60-70 between Miami and Superior, Arizona, on May 16 as its feature attraction (*Western Construction*—Oct. 1951, p. 61; May 1952, p. 112; and Nov. 1952, p. 51).

Governors Edwin L. Mechem of New Mexico and Howard Pyle of Arizona led a motorcade to the tunnel and marked the occasion with appropriate remarks. The tunnel, built by the Fisher Construction Co., is 1,217 ft. long, 22 ft., 10 in. high, and has a 38-ft. road width and a 42-ft. face. Special safety features include a whistle strip, a corrugated dividing line that makes a loud whirring sound whenever a tire crosses it, thus warning the driver that he is too close to the opposite lane. Another gimmick is an electronically-controlled lighting system, operating 24 hr. a day.

Salt Lake street potholes irritate residents

POTHOLES pitting the streets of Salt Lake City are irritating residents these days despite the assurance of city and county officials that they are doing everything possible to alleviate the situation. (See page 63 of this issue for one answer on how to do it.)

Delay in the patching program is due to the fact that the city's asphalt plant is being remodeled, according to Roy W. McLeese, city engineer. He promised increased efficiency and output when the plant was put back in operation. He said that three crews are assigned to the patching program and are working as fast as possible.

Big pours at Chief Joseph

NEARLY 1,000 cu. yd. of concrete a day is being added to the 922-ft.-long spillway monoliths of Chief Joseph Dam on the Columbia River in Central Washington as the summer construction season swings into full action. (*Western Construction*—Oct. 1951, p. 106; May 1952, p. 70; March 1953, p. 110; April 1953, p. 100).



FIRST CONSTRUCTION on the San Rafael-Richmond (California) bridge across the northern part of San Francisco Bay is a \$16,000 office building for engineers, shown going up here on the Richmond side of the Bay. The dredge (left) is clearing the way for four 12 x 36-ft. piers. The first steel pilings were driven early in April to prepare for the permanent structure. The \$14,234,550 contract for the substructure went to Ben C. Gerwick, Inc., and Peter Kiewit Sons' Co. (*Western Construction*—February 1953, p. 119). The job is expected to take 3½ yr. and employ a crew of 2,000 men at the peak of operations.

NO TRAFFIC JAMS occurred on this pour even though 46 ready-mix trucks hauled concrete to 20 chutes from 4 batch plants to this blast furnace foundation on the current expansion job at the Kaiser Steel Corp. Fontana, Calif., plant. The job, being handled by a 30-man Kaiser Engineers crew, was specified as a monolithic pour. Some 2,321 cu. yd. was poured in 12 hr., 3 min., by this method. A. L. Fischer, construction manager for the entire expansion project; H. V. Zilm, superintendent of construction, and Bert Denham, concrete superintendent, are in charge.



CLEVELAND TRENCHERS



deliver

MORE TRENCH



- 4-Speed Main Transmission
- Wheel-Type—Fastest Digging Method
- 12-Speed Crawler Transmission
- Wider Range of Trench sizes
- Generously Powered

IN MORE PLACES



- Compact—Built To Fit More Jobs
- Full-Crawler Mounting—Completely Maneuverable
- Fast Boom Hoist
- Shiftable Conveyor
- Truck-Speed Portability—Safer, Faster Job Moves

AT LESS COST



- One Machine for Many Types of Jobs
- Digs All Soils in All Weathers
- Less Property Damage—Crawlers Save Lawns, Walks, etc.
- Unit-Type Construction
- Lower Maintenance Costs
- Longer Life

California highway construction booms

HIGHWAY CONSTRUCTION in California is booming, according to Frank B. Durkee, state director of public works. Every major construction project included in the original 1952-1953 state highway budget is either completed, under contract, or advertised for bids, he said.

Some 45% of the \$76,114,000 budget for 1953-1954, amounting to \$34,000,000, has already been awarded, including pending award, or is advertised for bids. This has been made possible by a state law which permits highway contracts to be awarded beginning April 1 for the fiscal year which starts three months later, he said. This enables the Division of Highways to take advantage of favorable construction weather instead of having to wait until July.

Meanwhile the state legislature was considering several bills to establish a 4,000-mi. system of mainline highways marked for improvement and building into freeways.

The only trouble was that each lawmaker had his own ideas as to which roads should be considered necessary to the system, and the introduction of many amendments threatened the entire bill. Another point of controversy was whether to increase the gasoline tax 1 or 1½ cents a gal. to pay for the scheme.

One senator reported his opposition to both a mainline system and tax increase. He proposed, instead, toll road from Los Angeles to San Francisco, to be paid for by its users.

THIS GARGANTUAN DENTURE projects from the concrete floor of the stilling basin at Davis Dam on the Colorado River. The teeth will take the brunt of the water cascading down the spillway's steep slopes, thus lessening its erosive effect. Note tiny figure of workman on the catwalk.



The
CLEVELAND TRENCHER CO.
Pioneer of the Modern Trencher
20100 ST. CLAIR AVENUE • CLEVELAND 17, OHIO



Landscaping Paving - Grading with **HUBER MAINTAINERS**

Hartford Contractor Keeps Two HUBERS Busy

Service station installations, roadways, parking areas and playgrounds are typical jobs in which the Kessler Construction Company of Hartford, Connecticut, specializes. They serve an area within a 50-mile radius of Hartford.

A pair of Huber Maintainers helps them get work done quickly and efficiently. The Hubers perform a variety of jobs, including rough and finish grading. R. E.

Kessler, who founded the firm in 1940, likes the over-all efficiency of the Hubers.

Let your nearest Huber Distributor give you the facts about this 6,000-lb., 42½ H.P. machine and attachments that enable it to handle nine different kinds of work. Or write us for a free 16-page booklet fully describing the versatile, dependable Maintainer.

THE HUBER MANUFACTURING COMPANY — MARION, OHIO, U. S. A.

Represented by

Southern California Equipment Co. Los Angeles 21, Calif.
Jenkins & Albright Reno, Nevada
Contractors' Equipment & Supply Co. Albuquerque, New Mexico
Feenaughty Machinery Co. Portland 14, Oregon
Feenaughty Machinery Co. Spokane 2, Washington
Feenaughty Machinery Co. Seattle 4, Washington
Coast Equipment Co.

Feenaughty Machinery Co. Boise, Idaho
Foulger Equipment Co., Inc. Salt Lake City 8, Utah
The Colorado Builders' Supply Co. Denver 9, Colorado
The Colorado Builders' Supply Co. Casper, Wyoming
Montana Powder & Equipment Co. Helena, Billings, Montana
The O. S. Stapley Co. Phoenix, Arizona
San Francisco 1, Calif.

PUMP RENTAL is a "RUGGED BUSINESS"



James King, General Manager of Birmingham Rock Bit Company says:

"We operate one of the largest pump rental fleets in Alabama, and our pumps are Marlow exclusively. We wanted pumps that would stay on the job longer without maintenance, that's why we chose Marlows. Our customers are well satisfied with Marlow Performance."

. . . and MARLOWS are built to take tough on-the-job abuse!

Sure! Marlow Pumps are built to take tough day-in-and-day-out use in the field without shutdown for maintenance or repair. That's why more and more rental fleet operators are *standardizing* on these dependable Marlow Engine-Driven Self-Priming Centrifugals, and that's why contractors, too, are *buying more Marlows than any other pump*, because Marlows have the features they demand.

Marlow builds models in all A.G.C. ratings from 4M to 200M, 1½" to 10"—plus many other models including the Famous MARLOW "Mud Hog".

For complete information on these modern self-priming centrifugal pumps, see your Marlow dealer or write for bulletin C-52.

337

- SIMPLE CONSTRUCTION
- LONGER LIFE
- LOWER MAINTENANCE
- FASTER PRIMING
- HANDLES TRASH
- HIGH EFFICIENCY
- LOW FUEL COST

MARLOW PUMPS

RIDGEWOOD, NEW JERSEY

Branch Plants: DeQueen, Arkansas
West Chicago, Illinois

Other factories in France and England, Distributors and Dealers everywhere

Tri-Dam financing given green light

GOVERNOR Earl Warren of California has given the green light on the sale of \$52,000,000 worth of bonds to finance the Tri-Dam project on the Stanislaus River (*Western Construction*—May 1953, p. 164) by signing a bill authorizing savings banks to invest in the bonds. (See the Unit Bid section, p. 170 of this issue, for a breakdown on the contract awards.)

Backers of the bill told legislators they don't expect the banks to buy all, or even a majority, of the bonds. They explained they would be in a good position to get lower interest rates on the bonds by opening the market to the banks. Thus the project could be built for less money.

The project is to be underwritten by a contract with the Pacific Gas and Electric Co., which will market the power produced.

Tourists bog down in U. S. 66 mud

HEAVY RAIN late in April caused tourists to bog down in the mud on a U. S. Highway 66 construction project 26 mi. east of Albuquerque, New Mexico (see page 66 of this issue for more information on this highway).

Ralph Jones, a member of the State Highway Commission, reported that Skousen-Hise Construction Co., the contractor, had been keeping the detour in good shape generally but that the heavy rains had caught them off guard. Three road graders were utilized by the contractor to help free the trapped cars.

Atkinson gets contract for Skagit River bridge

LOW BID of \$1,033,464 resulted in the awarding of a contract to the Guy F. Atkinson Co. to build a swing bridge across the Skagit River at Mount Vernon, Wash.

The present bridge, built 45 years ago, carries 7,500 vehicles daily. This number is expected to rise to 9,000 by 1960. The new bridge will have several times the capacity of the existing structure. The contractor will be required to keep the present bridge in operation until 180 days before steel delivery is promised, probably some time in August. Construction is expected to take 300 days.

Estimated quantities of material needed for the new bridge include 650 sq. yd. of concrete pavement for the approaches, 1,825 cu. yd. of riprap for main pier protection, 6,000 cu. yd. of excavation for the piers, 5,500 cu. yd. of concrete for piers and bridge floor, 167 tons of steel reinforcing bars, 532 tons of structural steel, 46 tons of machinery for the swing span, 26,000

n. ft. of untreated piling for river pier footings, 18,000 ft. of treated timber piling for fenders and draw rest, 900 ft. of precast concrete piling for support of the piers above the water line, and 128,000 ft. of treated lumber.

Total length of the bridge will be 75 ft. It will include two reinforced concrete girder spans of 54 and 53 ft., a Warren steel swing span 288 ft. long, a through Warren steel truss span 160 ft. long, and two more concrete girder spans, 53 and 54 ft. long. The bridge roadway will be 28 ft. wide as compared with 17 ft. on the present bridge. A 4½-ft.-wide sidewalk will be placed on the south side of the roadway.

The main pier supporting the swing span will be 347 ft. long and 53 ft. wide. It will rest on piling at an elevation of 35 ft. below the mean low-water level. The top of the pier, which will be 70 ft. high, will be 4 ft. higher than the crest of the dike. The bridge floor will be 42 ft. above low-water level. Approach grades will be 7.4% at the east end and 5.3% at the west end. The upper nose and sides of the main pier will be sheathed by treated piling and timber for protection against vessels which might strike it.

District Engineer D. D. Forgey of Seattle will supervise the engineering for the State Highway Commission. The designs were prepared by the bridge department at Olympia under the direction of George Stevens.

Rain again halts work on Folsom projects

OLD JUPE PLUVIUS seems to have a personal grudge against the Folsom construction projects on California's American River. Rain again raised the river to the point where it interfered with operations at the Nimbus Dam and Folsom Power Plant sites (*Western Construction*—March 1953, p. 96; February 1953, p. 92).

Bureau of Reclamation engineers reported that an estimated 50,000 cfs. swept down the channel April 27, completely flooding the construction excavation on the right bank of the Nimbus job. "The water started going over the top of the cofferdam on the right side," said A. T. Evans, project manager for the Winston-Johnson company, "so we breached it ourselves. That way we saved a part of the dam which would have washed away completely if we had let it alone."

Evans estimated that it would take at least two weeks before pouring can be started again. He said that seven pumps and other small pieces of machinery were lost in the flood.

The only damage at the power plant site was where water overflowed a cofferdam into the excavation. De-watering operations were expected to take only a day or two, however.

MORE CONTRACTORS BUY MARLOWS

FIRST CHOICE...

of contractors by a wide margin, are Marlow pumps... built to meet the tough and exacting requirements of the job.

Marlows' have the features that contractors demand.

- *Simplicity of construction*, with a minimum of parts, for better operation, lower maintenance and longer life.
- *Faster, and more dependable priming* even at high suction lifts.
- *Ability to handle trash* without clogging or losing prime.
- *High efficiency and low fuel cost.*

All contractors' pumping needs are more dependably handled with just two types of Marlows — Marlow Self-Priming Centrifugals for high capacity pumping — Marlow Mud Hogs for muddy, sandy and trash laden water.

Buy Marlow and get the best in pumping performance. For complete information see your Marlow dealer or write for "Marlow Contractors Pumps" bulletin C-52.



Marlow manufactures the world's largest line of contractors' pumps.

313

MARLOW PUMPS

Other factories in France and England.

RIDGEWOOD, NEW JERSEY

Branch Plants: DeQueen, Arkansas
West Chicago, Illinois

Distributors and Dealers everywhere

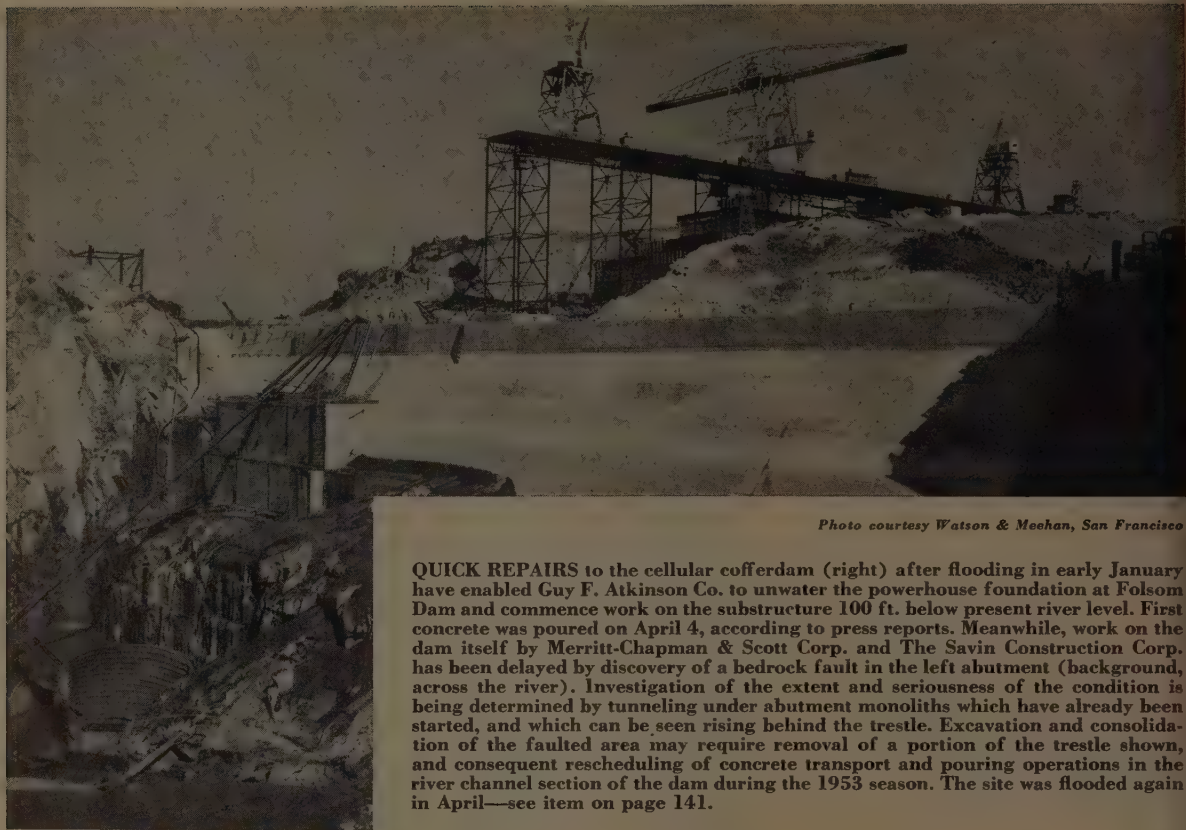


Photo courtesy Watson & Meehan, San Francisco

QUICK REPAIRS to the cellular cofferdam (right) after flooding in early January have enabled Guy F. Atkinson Co. to unwater the powerhouse foundation at Folsom Dam and commence work on the substructure 100 ft. below present river level. First concrete was poured on April 4, according to press reports. Meanwhile, work on the dam itself by Merritt-Chapman & Scott Corp. and The Savin Construction Corp. has been delayed by discovery of a bedrock fault in the left abutment (background, across the river). Investigation of the extent and seriousness of the condition is being determined by tunneling under abutment monoliths which have already been started, and which can be seen rising behind the trestle. Excavation and consolidation of the faulted area may require removal of a portion of the trestle shown, and consequent rescheduling of concrete transport and pouring operations in the river channel section of the dam during the 1953 season. The site was flooded again in April—see item on page 141.

WELLMAN *Williams Type*

FAST BUCKET OPENING SPEEDS OPERATIONS

- Double-hinge construction on Wellman's multiple-rope bucket permits faster opening than a single hinge. This speeds up operations, also gives a bigger spread in the open bucket for the same headroom.

Wellman's welded-design buckets offer you better performance and longer service. In all types and sizes you'll do better with Wellman!

Want Facts?

Write for free descriptive bulletins.

CLAMSHELL • DRAGLINE
CUSTOM-BUILT BUCKETS
STONE AND WOOD GRABS

THE WELLMAN ENGINEERING COMPANY

7000 Central Avenue • Cleveland 4, Ohio

ARIZONA—Lee Redman Company, Phoenix, Ariz.

CALIFORNIA—Coast Equipment Co., San Francisco, Calif.

OREGON—P. L. Crooks & Co., Inc.

Portland, Oregon

WASHINGTON—Construction Equipment Corp.

Spokane, Wash.

Clyde Equipment Company, Seattle, Wash.

For "busting" rock...



for "pumping" in sand...



on your toughest jobs

put Edwards Wire Rope to the test

When a wire rope handles your toughest jobs we know that you won't worry about it on the "easy going."

Next time you're crowding the bank with

your shovel or trying for heaped loads with your scraper, rig up with Edwards Wire Rope. Prove to yourself that there's an Edwards rope built to handle *every* tough construction job.



EDWARDS WIRE ROPE
E. H. EDWARDS COMPANY

General Office: SOUTH SAN FRANCISCO, CALIF., Los Angeles, Houston, Seattle, Portland

What more could We say ?

From the General Office of

INDUSTRIAL ASPHALT

April 14, 1953

CRESTVIEW 1 5123
100 80. BEVERLY DRIVE
LOS ANGELES 16, CALIF.

Mr. M. B. Freeman, Vice President
Standard Steel Corporation
P. O. Box 15252
Los Angeles 58, California

Dear Mr. Freeman:

I would like to take this opportunity to thank you and your organization for the wonderful cooperation and prompt services rendered in connection with the purchase, construction, and installation of our new Standard Steel, Model R B, electric driven asphalt plant at our location in Sun Valley, California.

This new Standard Steel plant was officially christened on April 11th, 1953 and went on commercial production April 13th, 1953. Our plant manager at Sun Valley, Mr. Frank S. McGinnis, reported today that this new plant was running at full capacity and with more ease, speed and efficiency than any of our other four Standard Steel plants in the Los Angeles area.

Our employees like this new plant so much they are all fighting for priority to be transferred to its operations.

I would be very ungrateful not to express my appreciation for the help your engineering department gave to our superintendent during the course of assembling this great plant.

Yours very truly,

INDUSTRIAL ASPHALT

By *W. E. Hunt*
W. E. Hunt, Its Executive Manager

Join the hundreds of completely satisfied users of Standard Asphalt Plants. Speed your operation — decrease your maintenance and operation costs — increase your profits the Standard way.

UNIT BUILT—8 SIZES, 500 to 6,000 pound batch capacities.
WRITE TODAY FOR FULL DESCRIPTIVE LITERATURE

STANDARD

STANDARD STEEL CORPORATION

5049 Boyle Avenue, Los Angeles 58, California

IDAHO FILL

... Continued from page 104

Embankment was placed on the entire foundation, except for the narrow channel along the left abutment which carried Big Elk Creek flow. As embankment placement progressed, it was built up on a 1:1 slope from the edge of the channel. It was desirable to accomplish the diversion of creek flow through the 84-in. multiple-plate corrugated metal pipe during the fall low runoff period. Consequently, the embankment in the vicinity of the pipe location was concentrated upon and built to the bottom of pipe grade, approximately 40 ft. above the stream bed.

Installation of the 84-in. multiple-plate corrugated metal pipe, which took only 24 days, was finished on October 24, 1952, by Armco Drainage & Metal Products, Inc. Compacted backfill was placed and tamped around the entire length of the pipe to a depth of 6 in. over the top of the pipe with a top width of twice the diameter of the pipe and within planes sloping at 1:1 from the edges of such top width to intersections with embankment surface.

Plugging the diversion

Flow through the diversion channel along the left abutment was blocked on October 22, 1952, and fill was placed at a rate sufficient to keep ahead of the rising water being impounded behind the main embankment. The channel fill reached the level of the rest of the embankment, about 5 ft. above the top of the 84-in. drainage pipe, on October 28. On November 1, the level of the water impounded behind the fill had risen to the point where it began flowing through the big pipe.

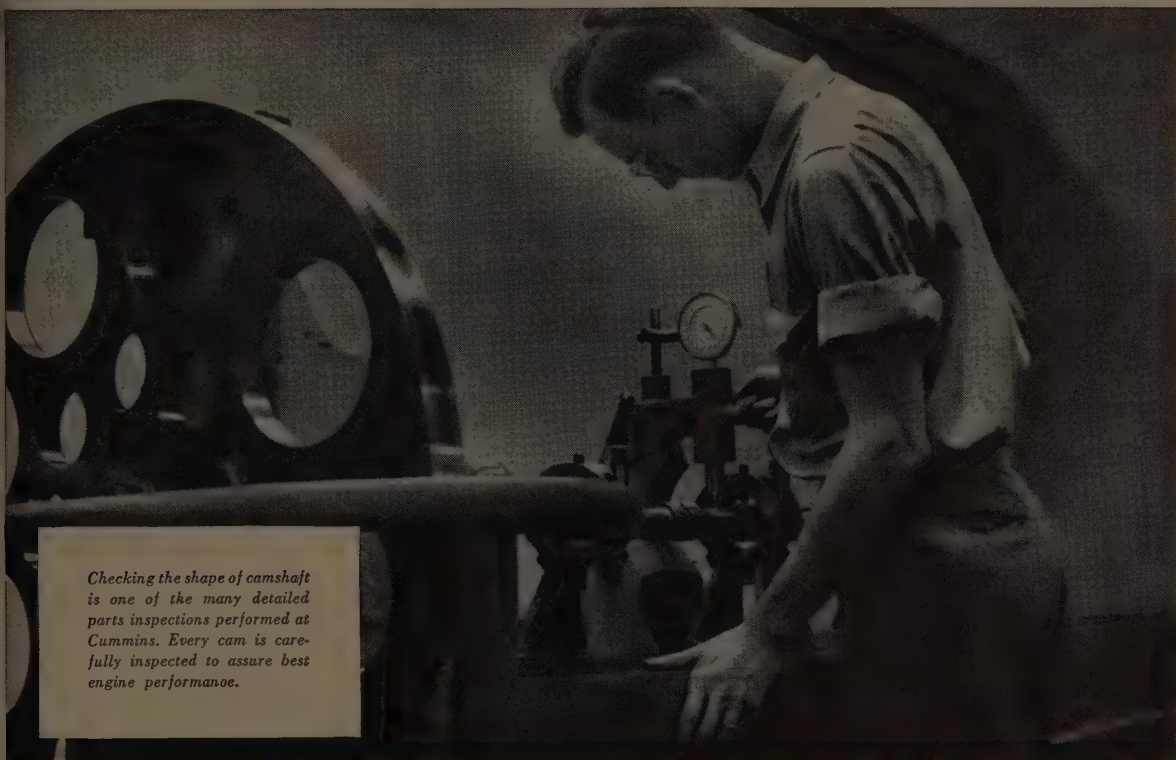
After the diversion of Big Elk Creek flow through the 84-in. pipe had been successfully completed, the upstream No. 2 zone was concentrated upon and built up to an elevation approximately 15 ft. above the top of the pipe. This was done to insure sufficient freeboard for the coming spring runoff before winter weather forced embankment placement to cease. As soon as weather permits the construction will be resumed and will be carried to completion this season.

This highway fill is a part of the prime contract for Palisades Dam and power plant under the general supervision of Louis B. Ackerman, Bureau of Reclamation construction engineer. Earl Wick, reservoir and roads engineer for the Bureau, and P. E. Oxley, construction engineer for the Idaho State Department of Highways, furnished the information on which this article is based.

The dam's final dimensions will be 301 ft. high from lowest point of excavation to crest, and 40 ft. wide and 2,100 ft. long at crest.

CUMMINS® DIESEL PARTS

give more service!



Checking the shape of camshaft is one of the many detailed parts inspections performed at Cummins. Every cam is carefully inspected to assure best engine performance.

...because we take *twice* the care

Every Cummins Diesel is custom-built to fit your job... give you years of dependable, profitable service. To make the most of Cummins performance—and keep “down time” at a minimum—it pays to use Cummins Warranted Parts for maintenance. Every Cummins Warranted Part fits perfectly, lasts longer... because it's manufactured with *twice the care*. So *always* insist on Cummins Warranted Parts — available only from Cummins dealers coast to coast. See the dealer nearest you.

Diesel power by

CUMMINS

CUMMINS ENGINE COMPANY, INC., COLUMBUS, INDIANA

SPOKANE: Cummins Diesel Sales, Inc.

Authorized Sales & Service: MISSOULA—Taber's Truck Stop.

PORTLAND: Cummins Diesel Sales of Oregon, Inc.

Branches: EUGENE; BAKER; COQUILLE; GRANTS PASS; PENDLETON.

SAN FRANCISCO: Watson & Meehan

Branches: FRESNO; REDDING.

Authorized Sales & Service: STOCKTON—Connell Motor Truck Company; SACRAMENTO—Frank J. Coyle; EUREKA—Fred E. Barnett; RENO—Nevada Transit Company.

LOS ANGELES: Cummins Service & Sales

(4-2-53)

Branch: BAKERSFIELD. Authorized Sales & Service: BISHOP—Inyo Diesel Service; INDIO—Crow Motor Company; BLYTHE—Leo's Diesel Service; COLTON—Smith's Diesel Sales; EL CENTRO—Rhyne's Automotive Service; SAN LUIS OBISPO—San Luis Truck Service; SAN DIEGO—F. R. Laux Diesel Service; SANTA MARIA—Hanson Equipment Co.; BAKER—Newton Automotive Service.

PHOENIX: Cummins & Moran

Branches: ALBUQUERQUE; EL PASO. Authorized Sales & Service: YUMA—Cooper Tractor Service; FARMINGTON—H. G. Cozzens Company; LAS VEGAS—Stirling Diesel Service.

DENVER: Cummins Diesel Sales of Colorado, Inc.

Branch: CASPER. Authorized Sales & Service: DURANGO—La Plata Repair Shop; CORTEZ—Cortez Diesel Sales; SCOTTSBLUFF—Western Motor Truck Company.

By CLIFFORD S. CERNICK, Anchorage

FULL SPEED AHEAD: Green light has been given by Uncle Sam on \$254,000,000 in Alaska construction projects, a good share of which had been held up pending a review of "essentiality." Alaska construction program now shaping up promises to be biggest ever undertaken here in the north. However, many projects still are "frozen" because of lack of appropriations. Housing for Weather Bureau and Civil Aeronautics Administrations outposts in Alaska was slashed to the tune of \$2,160,000. Another \$600,000 was cut from the budget request for maintenance and operation of the international airports in Fairbanks and Anchorage.

JOB RUSH BOOMING: Contractors have already set up shop on job sites and in most cases are moving ahead briskly with scheduled work. Meanwhile, job officials in Alaska's major cities report there are still as many as four or five workers seeking every available job—but this ratio will diminish as more and more construction opens up. Heavy traffic of job-seekers over the Alaska highway is reported by the Alaska highway patrol. Construction employment in both Fairbanks and Anchorage shows heavy increase—now stands well ahead of past year averages. Only government employment has taken a nosedive. Trade, service, transportation categories indicate employment rise.

LEAVE HER HOME: Employment officials have issued a warning to construction men who come to Alaska with their wives in hopes of having their spouses obtain office employment or other work while hubby works on construction... these folks generally are in for disappointment because job picture for women is extremely poor, with hundreds seeking work in Anchorage and Fairbanks.

SHIPPING DIFFICULTIES are looming which may hold up Alaska-bound construction cargoes. Government has refused to allow Alaska Steamship Company to recharter two Liberty ships, prompting statement from D. E. Skinner, vice president and general manager of the firm, to the effect that vital supplies needed by Alaska contractors will be subject to delay, creating serious burdens and additional costs by reason of these materials not being available during the favorable construction season. Many Alaska contractors are turning more and more to air freight for delivery of lighter, more compact sup-

plies. Northwest Airlines, one of the main carriers, set a new cargo record last month, bringing 603,307 pounds from Seattle to Anchorage. Alaska air shipping outlook was clouded by government's order to Air Transport Associates to discontinue Alaskan flights for alleged violation of Civil Aeronautics Board regulations.

BOOM IN HOUSING: Work is proceeding on more than 1,000 individual housing units in the Anchorage area alone, with most of the houses slated to sell at more than \$10,000. Substandard shacks seem to be on the way out as more and more units are placed on the market. One Alaskan construction firm has announced plans to build 300 homes in the Fairbanks area next year, most of them to be in the \$14,000 to \$15,000 price range.

ROAD CONSTRUCTION: Big chunk of construction cash slated for expenditure on Alaska's highways this year. Total amounts to more than \$95,000,000 for 1953, with about \$15,700,000 of this to be spent on Alaska Highway and \$27,750,000 on new road from Seward to Anchorage which has opened up the highly scenic Kenai area to Alaska's road network. Alaska Road Commission, a governmental agency, is under fire from contractors who charge it is doing too much work on its own and should be forced to put up more Alaskan road projects for competitive bidding by private contractors.

COST STUDIES IMPORTANT: Estimators in Alaska are taking more care in drawing up cost figures in view of recent suggested legislation prompted by over-expenditure on Alaska's Eklutna power project. It's estimated Eklutna will cost about \$15,000,000 more than originally anticipated, drawing heavy criticism in Congress.

MINING IN ALASKA seems on the upgrade with recent report that the Kennecott Copper Corporation is again interested in developing its Alaska copper properties... at same time, it was announced that Canadian interests are to put up \$20,000,000 in risk capital to establish a Southeast Alaska copper mining operation 100 miles east of Ketchikan, almost exactly on the Alaska-Canada border line. Alaska is making loans to firms interested in developing mining potential, with one loan going to Earl R. Pilgrim, Fairbanks operator who has an antimony mine near Mt. McKinley

and another going to the Alaska Metals Mining Company now developing tungsten properties not far from Fairbanks. Gold mining has begun in earnest at Fairbanks and Nome with several big dredges chewing up the gold-bearing gravel. Lode mining in Alaska at a new low, with only one gold lode operation functioning—the Creighton mine near Fairbanks. Current Alaska gold production comes principally from 199 placer outfits which range in size from giant dredges down to shovel-and-slucibox ventures.

SUPPLY BOTTLENECK CRACKED: Good news for contractors on lumber-devouring housing jobs is report that Alaska Plywood's new \$1,200,000 Juneau plant is scheduled for opening early this construction season. Heavy machinery is now in final installation stages. All standard plywood thicknesses will be manufactured. Mill's location will allow drastic slash in delivery time from mill to Alaskan job site.

FOR SMALL CONTRACTORS—HAPPY HUNTING: Small contractors are getting a fair shake from the government in the parceling out of this year's construction bonanza. At least a hundred of this year's contracts are for less than \$500,000. Sixty-eight are for less than \$200,000; twenty-four are under \$50,000 and a large number are under \$2,000.

SHARP PLANNING VITAL: Contractors in Alaska must gauge construction schedules giving close attention to Alaska's early winter. Most builders plan to have structures sufficiently under way by September and October so inside work can proceed despite extreme Alaskan cold. Last winter, more than 40 per cent of the jobs were closed in time for interior work.

BUILDING BARGAIN? An Alaskan contractor needing temporary buildings might do well to look over 67 buildings at the Ft. Abercrombie Military reservation near Kodiak, now being offered for sale by the Army. Twenty-eight of the structures are Quonsets, with a number of elephant shelters, frame, concrete and steel buildings making up the remainder. Buildings must be removed from the premises by Aug. 30, 1953. Submit bids or inquiries to Alaska District Engineer office in Anchorage before June 1.

DEATH OF RFC, scheduled to take place in the coming months, is causing some concern among Alaskan builders. This is because a large number of new commercial buildings, hotels, motels and other enterprises were made possible only through financing provided by RFC. High construction costs in the territory and scarcity of venture capital here have

used many small builders to rely on RFC for working capital in creating new industries or expanding existing ones. Most recent RFC loans directly affecting Alaskan economy range all the way from a \$40,000 loan for a small hotel in the seacoast town of Kenai to \$150,000 to the Munter Construction Co. to complete a defense contract for heavy construction work in the territory.

RUSH FOR BLACK GOLD: Unusual interest in Alaska oil potential has been building up, with land offices in Anchorage reporting filing of oil leases on more than 500,000 acres, mostly in the Cook Inlet area of western Alaska. Possibilities of an oil bonanza are not being overlooked by large petroleum firms in the States, including Phillips and Shell, both of which have extensive leases and plan exploratory investigations this year with possible drilling to follow.

Striking oil in the coastal area believed to be "geologically favorable," it is believed, would start a northward rush unrivaled since the Klondike stampede. However, warnings are going out from Alaskan chambers of commerce and businessmen's associations about shaky oil promotions. And it's known that the Securities Exchange Commission is keeping a close eye on all ventures of this kind. Also, much interest has been dealt a serious blow by announcement that the Navy is pulling out of the Point Barrow field, considered a likely oil producing area.

HERE AND THERE ON ALASKA CONSTRUCTION SCENE . . . Juneau may get an addition of \$400,000 to the existing \$300,000 appropriation for an airport project if government honors recent request . . . Petersburg voters have approved a \$1,000,000 bond issue for a new power plant . . . City of Ketchikan has called for bids on new \$2,000,000 high school . . . Juneau is planning a combination high school and community center costing about \$4,000,000 . . . A \$1,641,815 arterial viaduct is going up on Ketchikan's waterfront . . . One of Alaska's biggest single projects is the \$12,328,228 army indoctrination school at Big Delta being constructed by Peter Kiewit & Sons' Co. of Omaha and Fred J. Early, Jr., Co., Inc.

Eklutna project is 40% complete

ON SCHEDULE is the report from the Eklutna hydroelectric project in Alaska, according to Joseph M. Morgan, Bureau of Reclamation Alaska director. The project stands 40% complete, with last details expected to be finished late in 1954.

Eklutna is expected to provide 30,000 kw. of power to Anchorage facilities.



Increase Dozer Profits

WITH ESCO BLADES AND END BITS

Experienced dozer operators depend on ESCO Manganese Blades and alloy steel End Bits to get them through the toughest jobs... *and make more profit!* ESCO Cutting Edges give more production hours per dollar because they are specially cast from ESCO Manganese steel... your assurance of long trouble-free service.

There's the right ESCO Blade and End Bit for all popular makes of dozers, angledozers, graders and scrapers. Your ESCO Dealer carries a wide selection in stock. He will be glad to recommend the

right ESCO Blade and End Bits for your equipment and job. Call Your ESCO Dealer today!



The rougher the going, the tougher your ESCO Blades and End Bits get... because they are cast of special work-hardening ESCO Manganese and High Alloy Steel.

REPRESENTATIVES IN ALL MAJOR CITIES



Offices and Warehouses: Honolulu, Hawaii; Houston, Texas; New York, New York; Los Angeles, San Francisco, California; Seattle, Spokane, Washington; Centralia, Pennsylvania; Eugene, Medford, Oregon; Salt Lake City, Utah. In Canada: Vancouver, B. C., and Toronto, Ontario.

ELECTRIC STEEL FOUNDRY CO.

2163 N. W. 25TH AVE., PORTLAND 10, ORE.

712 PORTER ST., DANVILLE, ILL.

For maximum capacity, strength and durability, specify CONCRETE PIPE



For culverts that really last under the loads and the impacts of modern traffic, there's nothing quite so durable and efficient as concrete pipe that has been properly designed, bedded and backfilled.

Concrete pipe for culverts, storm drains and sanitary sewers is made **Right** in your own district.

For specific information and address of your nearest association manufacturer-member, write to Western Concrete Pipe Association, Department C.

Western CONCRETE PIPE Association
P.O. BOX 152 FRESNO CALIFORNIA

BITUMINOUS BASE

... Continued from page 9

each specimen, approximately 100 grams of the cured mixture are placed in the 2-in. diameter forming mold and compacted by the double-plunger method. Two compaction plungers are used, one above the mixture and one below, each plunger being free to move inside the mold as the mixture is being consolidated. This method of compaction assures a more uniform density throughout the specimen.

After duplicate specimens have been molded, one is tested immediately for stability, as previously mentioned. The duplicate specimen is tested for water absorption, swell characteristics, and stability after being subjected to 1/2-in. immersion for a period of 72 hr.

When using the testing machine, developed by the Colorado Materials Laboratory, in the field it was found that in order to obtain uniform results from the samples taken from the windrow to be molded and tested it was necessary to let the mix cool down to 75 deg. F. This mix was then placed in the mold and compacted by applying a 10,000-lb. load, which is approximately 3,000 psi. The stability was then run according to the Hubbard-Field method.

Colorado's present design values require a Hubbard-Field stability of 1,200 lb. for the specimens not subjected to immersion, and 500 lb. for the specimens subjected to the 72-hr. immersion. The maximum permissible volumetric swell due to immersion is 5%. It was found in the field that when the specimens reached 1,000-lb. stability the mix was ready to be laid down and compacted.

The seal was not put on last season, and the bituminous base course, without the seal, stood up during the past winter under moderately heavy farm truck traffic without any evidence of raveling, dusting or spalling. This has surprised most of the engineers, as they felt that most bituminous bases using this type of aggregate are not capable of withstanding the abrasive action or attrition of traffic without a wearing surface. A seal, however, will be placed this summer.

This project turned out so successfully that the same type of construction will be used on several other projects in Colorado during 1953, where surveys indicate that bituminous stabilized bases are more economical than importing coarser aggregates from long distances.

Personnel

The personnel on the project for the Colorado Highway Department follows: A. Bunte, staff materials engineer; C. Lowrie, engineer of special tests; Geo. Miles, division engineer; L. Hart, resident engineer, and J. Miller, district materials engineer. Jack Edwards was superintendent.

SAFETY

Job accidents take their toll

THESE were the accidents that resulted in death or serious injury on the West's construction jobs during the last reported month:

Carl Lee Cypher, 42, vice president of the Paul E. McCollum Co., and Jack D. Southard, 22, a company employee, died of burns suffered April 13 when a company crane touched an 11,000-v. line on a Placer County, Calif., road near Auburn. Cypher was in charge of the construction company's contract to widen and surface 2.58 mi. of county road. Roy Cameron, the crane operator, suffered some shock but no serious injury in freeing them.

Homer W. McDonold, 55, was fatally injured April 7 when he was run over by a dump truck at Box Canyon Dam, 3 mi. from Ione, Wash. Police officials said that McDonold, a truck spotter for the Pacific Construction-Shea contractors, backed into the blind side of a truck and was knocked down and run over.

Arthur A. Garcia, 26, was killed and Arthur R. Jacobsen, 40, was badly burned on the left hand and both feet when a 60-ft. steel beam struck a high-voltage wire at the United States Steel Corporation's Pittsburg, Calif., plant April 15. The men, both riggers, were helping cranimen load the beam on a truck when the accident occurred.

Maurice Lockard, a construction worker, was killed April 27 when he was crushed between the moving cab of a crane and a concrete wall at the Hanford, Wash., atomic energy works. This accident happened just eight days after the news was released that the Hanford operations office had won first place with a no-injury record in 1952 in a safety competition with other AEC offices of the nation.

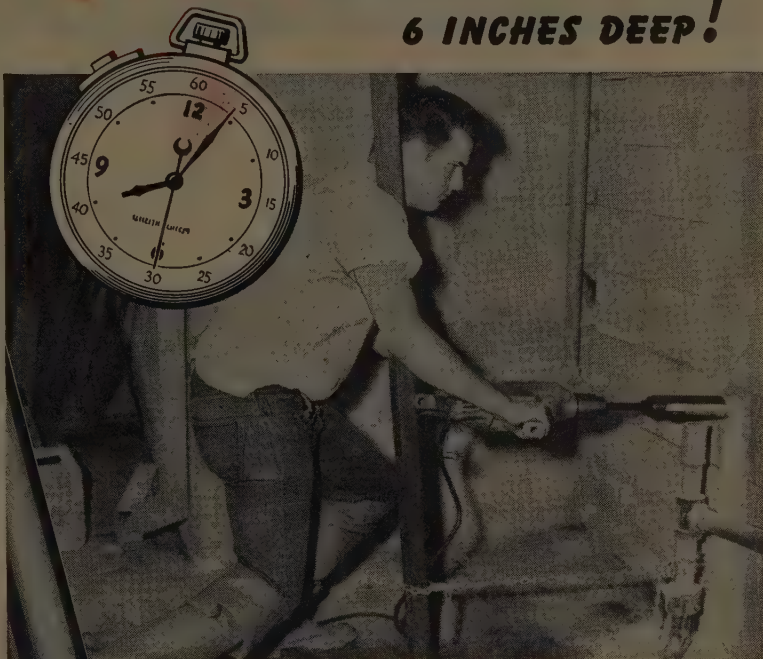
Jacob D. Ebminson, 28, was killed May 5 when he touched a 4,000-v. line while working on a pole in Kentfield, near San Francisco. He had been employed by Pacific Gas & Electric Co. as a lineman.

Harold Rishling, 48, an employee of the N. G. Johanson Co., was critically injured April 25 near Spokane, Wash., when he was pinned under a dirt-loading machine he was operating.

Pio Tapia Padila, 37, was crushed to death April 23 by a huge concrete slab which fell on him as he was helping dismantle a huge tank at the Anaheim, Calif., municipal water works. It took other workmen considerable time to get inside the tank and pry the slab off Padila with jacks.

4 1/2 MINUTES

TO DRILL THIS HOLE! 6 INCHES DEEP!



TILDEN ROTARY KONKRETE KORO DRILLS

cut reinforcing rods in concrete!

Patented Core
Slot Expels
Cuttings
Automatically!

Under the actual on-the-job conditions shown above, a Tilden 2 1/2" diameter Rotary Konkrete Koro Drill cut through 6" of concrete—including crossed steel reinforcing rods—in just 4 1/2 minutes! The straight, clean, ready-to-use holes permitted immediate running of 2" pipe. You consistently get 5 to 7 times more holes without resharpener with a Tilden Drill—and free factory sharpening is still available on sizes from 3/16" to 4" diameters. Tilden Drills can be used with ordinary electric or rotary air motors. Interchangeable shanks are available for any depth hole.

Find out about this revolutionary drill TODAY! Consult our Engineering Department without obligation, on your drilling problems.

Sold Through Distributors Everywhere

U. S.
Patent No.
Re. 23539

WRITE TODAY
for free illustrated
catalog. Please de-
scribe your drilling
problem in detail.

TILDEN TOOL MANUFACTURING COMPANY
211 Los Molinos, San Clemente, Calif.

Gentlemen: Please send me without obligation, complete information on the Rotary Konkrete Koro Drill.

Name _____ Title _____
Company _____
Address _____

ENGINEERS ON THE MOVE

Marvin C. Nichols has been selected new Commissioner of Reclamation by Secretary of the Interior Douglas McKay. Nichols, a member of the civil engineering firm of Nichols & Freese, Ft. Worth, Tex., is credited with having played a prominent role in the reclamation and water resource development in Texas during the last 10 years. From 1940 to 1950, the state increased its irrigated acreage from 1,045,224 acres to 3,148,115—a larger total gain in irrigated acreage than any other state in the nation. Nichols, 56, has actively participated in helping with water problems in Texas municipalities. He was county and city engineer in a number of counties and cities in Texas before becoming a partner in Nichols & Freese. He holds a civil engineering degree from the University of Texas, a Master's Degree in theoretical and applied mechanics from the University of Illinois, and is a member of the American Society of Civil Engineers.

G. L. McLane, recently retired Arizona district engineer for the Bureau of Public Roads, was presented with the U. S. Department of Commerce's silver medal for exceptional service. Presentation was made by Charles C. Morris, retired division engineer for the Bureau in San Francisco, and formerly McLane's boss for many years. McLane has been credited with an important role in building Arizona's present-day highway system.

Maintenance engineer for the Washington State Highway Commission is John Stackhouse, who was recently appointed to that position by William A. Bugge, Director of Highways. Since 1935 Stackhouse has been assistant construction engineer in charge of bituminous construction and special detail work, and for the last year he has supervised PCC paving construction.

Carl P. Vetter, for 9 years chief of the Bureau of Reclamation's Regional Office of River Control at Boulder City, Nev., is on leave of absence during the next 18 months in order to assist the Government of Iraq in the solution of river control and diversion problems on the Tigris and Euphrates rivers. During his sojourn in Iraq, Vetter will be associated with Knappen-Tippetts-Abbott-McCarthy, consulting engineering firm, New York City, which has been engaged to make

the investigations and to prepare plans and specifications for dams and other structures. His present assignment is the latest colorful note in a varied career which has taken the Danish-born engineer to posts all over the world. He joined the Bureau's staff in the Chief Engineer's Office, Denver, in 1934. In August 1944 he went to Boulder City where he organized the Regional Office of River Control, which administers the Bureau's responsibilities on the Colorado River from Lee Ferry to the Mexican border. The Tigris and Euphrates, he observed, "resemble in many respects the rivers of our Southwest, the Colorado and the Rio Grande, with the problems of which ... I have been closely associated for many years." John W. Stanley, Vetter's assistant, has been named acting chief of the Office of River Control. Vetter is chairman of the United States Committee on Large Dams.



Vetter



Holmgren

Richard S. Holmgren, since 1945 assistant general manager and chief engineer of the San Diego County Water Authority, has been appointed to the top position. He succeeds the late Joseph L. Burkholder. Holmgren, who has been engaged in various phases of engineering activities since 1920, is a specialist in hydraulics. Through his close association with Burkholder during the past years he has acquired an intimate knowledge of the operations of the important agency. The Authority is currently building the second barrel of the San Diego Aqueduct, which, when completed, will double that area's supply of Colorado River water.

New president and senior member of the California Debris Commission is Col. Paul D. Berrigan, South Pacific Division Engineer, Corps of Engineers. Berrigan's appointment was the result of a nomination by President Eisenhower. The 60-year-old Commission is responsible for debris-

control works which prevent the waste materials from hydraulic mining operations from impairing the usefulness of the main stream channels for navigation and flood-carrying purposes. Other members of the commission are Col. C. C. Haug, Sacramento District Engineer, and Col. W. R. Shuler, Los Angeles District Engineer.

The Wyoming State Highway Department recently announced the transfer of William C. Ainsley, project engineer at Rock Springs, to Sheridan as maintenance engineer replacing John H. Myers, who was sent to Casper. C. C. Lusby, maintenance engineer at Casper, became project engineer for that district.

The Moles, an association of tunneling and heavy-construction men, elected Richard E. Dougherty, a New York consulting engineer, president at their annual meeting in New York May 5. Other new officers are George F. Ferris, first vice president; William A. Durkin, second vice president; Theodore M. Avery, sergeant-at-arms; Harry T. Immerman, secretary, and Edward G. Johnson, treasurer. William Denny, Frank P. Di Menna, Harry J. Hush, and Richard M. Johnson were elected to three-year trusteeships.

The Seattle firm of Hubbell & Waller Engineering Corp. has been retained as consultants for the City of Skagway, Alaska.

William A. Dittmar, power manager for the Bonneville Power Administration since 1940, has accepted a position as power manager for Kaiser Aluminum & Chemical Corp. with headquarters at Spokane, Wash.

Arthur Robinson, District 1 road supervisor of Clallam County, Wash., has been appointed county road superintendent. His old job will be taken by Ray Olson.

Two employees of the State of California, Logan M. Muir, Jr., and Timothy S. Train, recently resigned in order to establish a civil engineering and surveying partnership located in the Mitau Building, Sacramento.

Joseph L. Harrison has been appointed Kittitas County (Wash.) road engineer, succeeding Charles Riggs, who resigned in January to become city engineer of Puyallup, Wash.

Lt. Col. Henry E. Helmboldt, military assistant to Col. E. C. Itchner, North Pacific Division Engineer, Corps of Engineers, has been reassigned to Goose Bay, Labrador, as

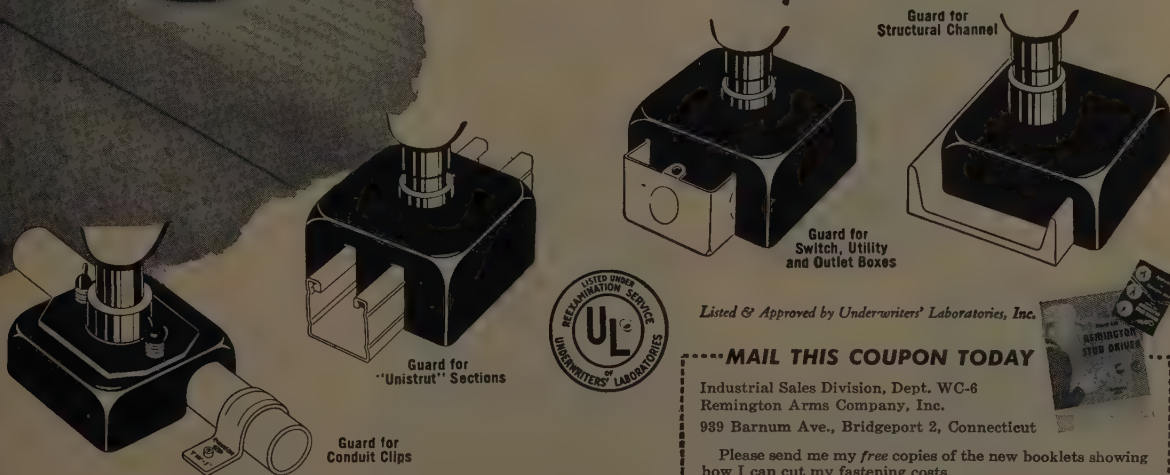
Now...set fastening studs
wherever they're needed

MODEL 450 REMINGTON STUD DRIVER

Here's new economy...new speed in construction fastening! The Remington Stud Driver joins wood or steel sections to concrete or steel surfaces in seconds...easily sets as high as 5 studs a minute. Powerful 32 caliber charges drive studs arrow-straight. The tool's light weight—only 5½ pounds—simplifies handling wherever studs are needed.

New guards for specific uses now make the self-powered Remington Stud Driver more versatile than ever. These attachments take all the guesswork out of stud location...assure fast, accurate fastening for every job. Illustrated are just 4 of these special guards. For full information about the complete line and about the Remington Stud Driver, send the coupon below.

*A complete line of guards
for special applications*



Listed & Approved by Underwriters' Laboratories, Inc.

MAIL THIS COUPON TODAY

Industrial Sales Division, Dept. WC-6
Remington Arms Company, Inc.
939 Barnum Ave., Bridgeport 2, Connecticut

Please send me my free copies of the new booklets showing how I can cut my fastening costs.

Name _____
Position _____
Firm _____
Address _____
City _____ State _____

"If It's Remington—It's Right!"

Remington

area engineer in charge of construction. In his former capacity, Helmboldt was responsible for large Army and Air Force construction programs in the Pacific Northwest and Alaska.

John J. Berry, formerly with the Corps of Engineers, San Francisco District, begins working for the Veterans' Administration in June as superintendent of construction (hospital construction) in Indianapolis, Ind.

Washington's director of highways, **William A. Bugge**, was awarded the first certificate of recognition ever given by the student chapter of the

American Road Builders' Assn. The occasion was at the close of the Northwest Road Builders' clinic at Washington State College, Pullman. President **John C. Moser**, Huron, So. Dak., presented Bugge with the honor for "outstanding performance in the interest of better highways."

William J. Johnson was recently appointed city engineer of Carson City, Nev.

After 12 years with the San Diego Unified School District, **Robert M. Gregory**, construction engineer, recently retired. The retirement marks the end of a long career which was

closely connected with the development of the Southern California city. From 1925 to 1929 Gregory was city superintendent of streets; from 1929 to 1933 he was city manager; from 1933 to 1937 he was district engineer for the federal government. In 1941 he joined the city schools as maintenance engineer. Gregory has been succeeded by **George R. Saunders**, formerly associate civil engineer in the city water department, and since September assistant construction engineer for the schools.

Jay E. Jellick, manager of the Portland Cement Information Bureau San Francisco, was elected to a three-year term with the American Concrete Institute at the Institute's recent Boston convention. Officers for 1953 will be headed by **Henry L. Kennedy**, Manager, Cement Div., Dewey & Almy Chemical Co., Cambridge, Mass.

New sales engineer of Johnson & Mape Construction Co., Inc., Menlo Park, Calif., is **Norman (Red) Strader**, who recently left his position as assistant coach of the San Francisco 49ers professional football team. Strader was a sales representative with J. A. McNeil Construction Co., Los Angeles, for several years prior to entering the sports world.

Bert W. Goodenough has been appointed chief construction engineer for the Tri-Dam Project. This \$48,000,000 program for hydro power and irrigation is being built by the Oakdale and South San Joaquin Irrigation Districts on the Stanislaus River in central California. A general review of the project, which includes a 7.2-mi. tunnel, appeared in *Western Construction*, Nov. 1952. **T. P. Stivers**, chief engineer of the South San Joaquin Irrigation District, will be executive engineer for the project. Bids were opened for the entire job last month and the three-year construction program will be started at once.

Charles Tryck, city engineer of Anchorage, Alaska, recently submitted his resignation. Tryck will begin working for Rutledge & Johnston, Anchorage engineering firm.

O. Newell Parker, electrical engineer, formerly construction engineer for the Bureau of Reclamation, and since 1948 project manager and estimator for San Francisco contractors, recently has been appointed general superintendent on construction of the transmission lines and installation of the underground power plant equipment at the Alcan project in British Columbia. **Morrison-Knudsen** of Canada is general contractor on the gigantic undertaking.

Installing an Armco bridge is as easy as

1

2

3

It is easy to bid low on small bridge jobs with Armco MULTI-PLATE Structures—and still retain a good profit.

There are just three steps in installation. First, prepare the site. Next, assemble the Armco MULTI-PLATE Pipe or Pipe-Arch. Finally, backfill and finish.

There is no delay for curing, no special tools. Workmen simply bolt the pre-curved corrugated metal plates together. The job goes fast in almost any kind of weather.

Use Armco MULTI-PLATE Pipe, Arch or Pipe-Arch for large culverts, small bridges, underpasses, conduits, or relining existing structures. Wide range of sizes. Write for details.

ARMCO DRAINAGE & METAL PRODUCTS, INC.

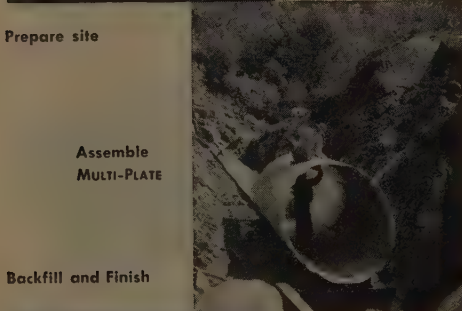
CALCO • NORTH PACIFIC • HARDESTY DIVISIONS

Berkeley • Los Angeles • Seattle • Spokane
Portland • Salt Lake City • Denver

Armco Drainage Structures



Prepare site



Assemble
MULTI-PLATE



Backfill and Finish

DEATHS

Adolph Teichert, Jr., 68, chairman and general manager of the well-known California construction firm of Teichert and Son, Inc., died May 1 in a San Francisco hospital. Teichert, who was born in San Francisco, received a civil engineer-



Adolph
Teichert,
Jr.

ing degree from the University of California at Berkeley in 1908. He then joined his father as a partner in the contracting firm which the elder Teichert had established in Sacramento in 1878.

The Teichert firm received one of the first three highway contracts awarded by the State of California, in 1913. Since then the company has finished many road and highway jobs throughout the state. Other projects included construction of the Sacramento Bypass Weir, grading and tunnel work for railroad relocation around Shasta Dam, and a number of jobs for the Armed Forces.

Teichert was a former national president of the Associated General Contractors, and a member of the Consulting Construction Engineers.

Joseph L. Burkholder, 68, general manager and chief engineer of the San Diego Water Authority, died April 6. A long career devoted mostly to solving water problems began in 1910 with the Bureau of Reclamation. Before coming to San Diego he had been superintendent of construction and assistant general manager of the Metropolitan Water District of Southern California. Burkholder was also well-known for his engineering achievements on the Rio Grande Reclamation Project in New Mexico.

Charles William Gompertz, 84, prominent Bay Area contractor and one-time president of the San Francisco Builders' Exchange, died April 8 in Oakland.

E. N. Torbert, 50, formerly a project-planning engineer with the Boise, Idaho, regional office of the Bureau of Reclamation, died of poliomyelitis at Karachi, Pakistan, May 1. He had been serving with a State Department mission in Afghanistan when he became ill and was flown to Karachi.

Does

the wire rope you use win this kind of praise?

"I have preferred Hercules Red-Strand wire rope since 1909," says an operations superintendent. "I just wouldn't use any other." Another operator reports a truly remarkable record: "Red-Strand outlasted any other rope by three times!"

HERCULES Red-Strand earns it

Why do these men, among others, praise Red-Strand so highly? In a few words, it's because *higher-than-rated quality* in Red-Strand wire rope means *longer-than-expected service* . . . year in, year out.

Next time, use Hercules Red-Strand. You'll experience the difference too.

HERCULES
Red-Strand wire
rope made by
A. Leschen & Sons
Rope Company,
St. Louis 17,
Missouri

LESCHEN
WIRE ROPE
AND SLINGS

In business only to
make wire rope
better wire
rope since 1857

DISTRIBUTORS IN ALL PRINCIPAL CITIES

SUPERVISING THE JOBS

On the Nomellini Construction Co. job to build a \$365,000 armory at Fresno, Calif., **Steve O'Connor** is project manager, **Joe Hurtado** is general superintendent, **Henry Ollman** is assistant superintendent, **Don Hanson** is steel foreman, **John W. Albright** is electrical foreman, and **G. A. Wasson** represents the Corps of Engineers.

Ernie Wright, project manager; **George Trivitt**, general superintendent; **Ray Basham**, assistant superintendent; **Howard Hufford**, carpentry superintendent; **Merl Hobbs**, carpentry foreman, and **Carl Wright**, master mechanic, are working on the Stolte-Pacific canal project near Madera, Calif.

School buildings are being erected at Castle Air Force Base, Calif., by **L. L. Cherrington**, project superintendent; **Pat Birch**, general superintendent; **Hugh Monger**, carpentry foreman, and **Robert C. Funk**, office manager, of the Bishop-Younger-Bradley Co.

A \$1,000,000 contract to erect masonry and concrete buildings at the University of California campus at Riverside is being carried out by **Alison Honer Co.** **Bill Bouck** is general superintendent, **Jim Higginbotham** is assistant superintendent, and **Ralph Chase** is office manager. The job was begun by **Andy Jenson**, who was forced to take an extended vacation because of poor health.

U. C. Elliott is supervising a job to build a motel at Williams, Ariz., for Contractor **Ben W. Arnold**.

Constructing a canal southeast of Madera, Calif., is occupying construction forces of **H. Earl Parker, Inc.** Job personnel are **Edward S. Alt**, general superintendent; **Carl D. Alt**, structure superintendent; **George L. White**, assistant superintendent; **Joe De Vault**, office manager; **C. W. (Slim) Story**, master mechanic; **L. W. Brown**, **C. A. York**, **I. H. Posten**, and **Cliff Cotter**, equipment foremen; and **Murray Devlin**, **L. O. Fraizer**, **F. E. Headley**, **D. E. Simeroth**, **Dave Dodge**, and **H. M. Hunter**, structure foremen.

Big Carson Dam, which is being constructed in San Rafael, Calif., for the Marin Municipal Water District, is where you will find **Earl Barnard**,

superintendent; **W. F. (Dan) Boone**, engineer; **Dave Soden**, **Thurman Foster**, and **Jay J. Woods**, foremen. The \$1,439,530 contract was awarded to **John Delphia**.

Robert E. Perkins, superintendent, is heading the job for **Munn & Perkins** for about 7 miles of surfacing near Modesto, Calif. **Tom Croft** is plant foreman and **Kenneth E. Jones** is office engineer.

J. B. Christenson is supervising **Engineers Ltd. Pipeline Co.**'s work on installation of emergency power units and a water distribution system at **Armitage Field**, **Inyokern**, Calif.

Up North at **Elmendorf Air Force Base**, Alaska, **A. R. Thompson** is project manager on a job for **L. E. Baldwin, Inc.**, to construct 47 eight-family quarters buildings at a cost of \$5,844,300.

At a hydroelectric plant recently started adjacent to **Diamond Lake**, Ore., **H. L. Leventon**, project manager, and **Larry Wicks**, general superintendent, are heading the work for **Contractor Morrison-Knudsen Co.**,

Max Marshall is superintendent on **Morrison-Knudsen** job 2 mi. east of **Glenns Ferry**, Idaho, on job to feed 20,000 cu. yd. of sand to dragline in a borrow pit. The sand is loaded into railroad ballast cars, later used by **Union Pacific** in bedding floors of stock cars.



PRELIMINARY WORK for a proposed dam and powerhouse near **Bliss**, Idaho is carried on by **John A. Wardle** (left) a catskinner, and **D. C. Thomas**, job superintendent.

Inc. John Erdle, project engineer, directs the supervision of various crafts. A complete list of important men on the job is as follows: **V. O. Berstler**, master mechanic; **D. L. Hoover** and **M. J. Mack**, shop foremen; **Bill Edmundson**, welding foreman; **George Colrig**, shovel foreman; **Lloyd Condit** and **Harry Lentz**, carpentry foremen; **R. C. (Pete) Bassette**, pile driver foreman; **Ralph Rennemo**, **L. G. Bennett** and **Fred Clark**, clearing foremen; **Del Hutchings** and **Mel Stoddard**, grade foremen; **Hugh Lewis**, road maintenance foreman; **Steve Miller**, gunite foreman; **W. A. Piercy**, office manager; **John Atkins**, purchasing agent; **David C. Bowers**, safety engineer; **Ted Romaine**, paymaster; **Jim Armistead**, camp manager, and **Art Reyers**, warehouseman.

A father and son team, **George E. Blaisdell, Sr.**, and **George E. Blaisdell, Jr.**, of **Blaisdell & Son Construction Co.**, are in the field supervising a \$155,880 road job on **P.S.H. No. 1**, **Snohomish County**, Wash. Senior is on the job during the first shift, and his son takes over on the second. **Chuck James** is holding the fort in the office.

Jesse C. Moore is superintending work for **Taggart Construction Co.**'s contract for metal cribbing and miscellaneous work on the **Shoshoni-Riverton** road in **Fremont County**, Wyo. **Glen Harvey** is foreman and **Oren Osborne** is backhoe operator.

R. K. (Dick) Griffith, superintendent; **Otis R. Johnson**, engineer, and **C. O. (Chuck) Davin**, office manager, are heading work on pipe installation between **Sutherland Dam** and tunnel in **Southern California**. **Engineering Constructors, Inc.**, has the \$187,756 contract.

At **Ladd Air Force Base** in Alaska, **Grove, Wilson, Shepherd & Kruge, Inc.**, is putting up two organizational maintenance shops and two gas stations at a cost of \$1,018,361. **R. E. Hix**



DAVE GUSTAFSON & CO., INC.
HIGHWAY CONTRACTORS

502 EAST SIXTH

PHONE 2-3111

SIoux FALLS, S. D.

January 9, 1953

Caterpillar Tractor Co.
Peoria,
Illinois

Gentlemen:

Our experience in the contracting business dates back to 1926. Our original equipment consisted of one Caterpillar Model Sixty Tractor.

When Caterpillar came out with the DW10 rubber-tired Tractor, we bought two of these units with scrapers as we felt that moving dirt on rubber-tired rigs was a better way of getting the job done. Caterpillar didn't let us down!

In July of 1951 we bought our first DW21 Tractor-Scraper outfit. The performance of this machine was so good that we added two more units in February 1952. Since that time we have purchased four more DW21 Tractor-Scraper outfits; two in April and two more in September of 1952 for our road building projects in South Dakota, because we have found that this is the cheapest method known today for handling dirt on projects such as ours.

When we bought the two DW21 Tractor-Scraper units in September we had just started work on a sub-contract from Peter Kiewit Sons Co. for grade construction of the "four lane highway" from Weaver Airforce Base to Rapid City, South Dakota, consisting of 650,000 cubic yards to be moved in 90 calendar days. Hauls on this job ranged from 400 feet up to 2 1/4 miles one way. Working a single ten hour shift, six days a week our DW21s really put it across on time.

In addition to our DW21s, we have ten Caterpillar crawler Tractors, and five Caterpillar No. 12 Motor Graders.

Our DW21s have the power and stamina to stay on the job and keep the dirt "moving" without costly breakdowns and delays. We feel that Caterpillar performance is second to none and is backed up by the best parts and service facilities to be found.

Very truly yours,

DAVE GUSTAFSON & CO.

L. S. Malm
L. S. Malm
Vice President



Dave Gustafson & Co., Inc., of Sioux Falls, S. D., bought its first Caterpillar DW21 and Scraper in July, 1951. By September, 1952, it had a fleet of 7 of these earth-eating Cat* units.

Why?

L. S. Malm, vice president of the company, has a telling explanation:

"We have found this is the cheapest method known today for handling dirt on projects such as ours."

Don't keep throwing good money after bad on less

capable earthmoving equipment. Have your Caterpillar Dealer demonstrate the money-saving advantages of having DW21s on your side.

Caterpillar Tractor Co., San Leandro, Calif.; Peoria, Ill.

CATERPILLAR*

*Both Cat and Caterpillar are registered trademarks - ©

**NAME THE DATE...
YOUR DEALER
WILL DEMONSTRATE**

is the firm's Alaskan projects manager; **Frank Fleshman**, superintendent; **Don Clark**, project engineer; **Vic Foss**, office manager; **Ray Young**, carpenter foreman; and **Bob Rouse**, general labor foreman.

Equipment repair work going on at Klamath Falls, Ore., for Morrison-Knudsen Co., Inc., is headed by: **Mark N. Smith**, equipment superintendent; **V. O. Berstler**, master mechanic; **Don Herman** and **Stan Margison**, shop foremen; **W. A. Piercy**, office manager; **Ted Romaine**, paymaster, and **John Atkins**, purchasing.

E. Tramel is superintendent over a job for placing reinforcing steel at Bisbee, Ariz., for Fontana Steel, subcontractor to Phelps Dodge Corp.

Installing turbines at Oregon's McNary Dam powerhouse are **Ken Gooding**, project superintendent, and **J. L. (Lee) Myers**, master mechanic. Cascade Constructors, Inc., is doing the job.

Edward Noon is now excavating foreman for Morrison-Knudsen Company, Inc., at the Lookout Point Dam, Lowell, Ore.

Glen Prorise is supervising construction on the new electronics building for Douglas Aircraft Co. at Long Beach, Calif. **M. J. Brock & Sons, Inc.**, is contractor.

C. R. O'Neil, contractor, lists **Don Saxton** as general superintendent over road relocation work in the vicinity of Dexter Dam, Ore. **Charles Roberts** and **Bill Erb** are grade foremen, **Mark Jordan** is master mechanic, and **W. K. Ashdown** is inspector.

Doug Holms is supervising 7 miles of paving in Oregon for **J. C. Compton**, contractor. **Fred Walker**, foreman; **Sam Welsh**, plant foreman; **Vern Henry**, office manager, and **Bob Henry**, mechanical welder, complete the list of personnel.

The excavation contract on a \$3,000,000 defense housing project in San Diego County was awarded to **M. S. Van Meter**. His job personnel include **Henry Sherman**, project manager; **J. W. Guyer**, general superintendent; **H. H. Ainsworth**, assistant superintendent, and **C. W. Owen**, master mechanic.

Frank S. Bryant, general superintendent, is head man on a \$659,580 job for **J. H. Trisdale, Inc.**, to grade about 8 miles of roadways and to erect a bridge near Shasta Dam in California. Other supervisory personnel are:



Hugh Macauley directs clearing of the right-of-way under a 69,000-v. transmission line for Clallam P. U. D. No. 1 at Port Angeles, Wash. He is district engineer.

John L. Manner, shop foreman; **Frank M. Davidson**, grade foreman; **Louie Schloesser**, pipe foreman; **Tom Fodge**, labor foreman; **Bill Ellison**, master mechanic. **Kenneth H. Moody** is resident engineer, and **Rudy Friebe** and **Carl Shirley** are inspectors for Shasta County.

Art Carson and **Harold Prosser** are superintendents on a job for **George H. Buckler Co.**, which is a million dollar high school in Albany, Ore.

T. W. Thompson, job superintendent, and **Roy Newman**, field superintendent, are heading work on a low rent housing project in Bakersfield, Calif., for **Fred S. Macomber**, contractor.

L. H. Becker is supervising construction of a concrete bridge and 5 miles of paving along the Cascade Highway in Oregon. **Acme Construction Co.** holds the \$161,885 contract.

H. B. Gilbertson, superintendent, **Bob Kelly**, foreman, and **Henry Clayton**, concrete foreman, are busy at the site of a short stretch of highway widening and surfacing in Los Angeles County, Calif., for **J. A. Thompson & Son**, contractor.

George Grant is general superintendent for **Erwen Construction Co.**, which has a contract to erect 7 pumping stations and to place riprap on 11 miles of dike at **Kennewick, Wash.** **John Ostella**, **Johnny Davis**, and **Art Shattuck** are Grant's assistants.

A \$1,000,000 joint venture of **Claude C. Wood** and **Rothschild, Raffin & Weirick** is to construct two earthfill dams and generator foundation for the new **Murphy's Powerhouse** at **Angels Creek, Calif.** **Barney Eather-**

ton, superintendent, and **Carl Ellingson**, carpentry foreman, are at the helm for **Rothschild, Raffin & Weirick**. **Jim Rinaudo** does the supervising for **Claude C. Wood Co.**

Herman Smith, superintendent; **Hal Scott**, paving foreman; **Hose Rea**, grade foreman, and **Sal Mauro**, mechanic, are heading the job for **Teichert & Son, Inc.**, for 3.1 mi. of grading and surfacing in **San Joaquin County, Calif.**

Larry Ashworth, superintendent; **Ray Pereria**, foreman; **Harry Leighton**, and **Herman Volstead** are at the site of a \$196,987 award to **Gallagher & Burk, Inc.**, for surfacing 3½ miles in **Contra Costa County, Calif.**

William E. Kovick, project manager for **Kovick Bros. Construction Co.**, **Walt Eagleman**, general superintendent, and **Thayne Johnson**, Eagleman's assistant, are key men on a \$750,000 job to lay pipelines near **Madera, Calif.**, for the **Bureau of Reclamation**. Foremen are **Clyde Kepley** and **Ernie Houx**, and **Travis Moody** is master mechanic.

Railroad tunnel lining going on in **Siskiyou County, Calif.**, for **Morrison-Knudsen Co., Inc.**, is headed by **P. M. (Whitey) Lee**, general superintendent; **"Heavy" Holman**, assistant superintendent; **Roy W. Fellows**, master mechanic; **Dave Agee**, general foreman; **Harry Ward** and **Howard Smith**, gunite foremen; **A. M. Brown**, electrical superintendent; **Romeo Bergeron** and **Ed Dalton**, miner foremen; **Roy Cummings**, steel foreman. **Frank Dully** and **Rex Baymiller** are engineers representing **Southern Pacific Railroad Co.**

Erection of an \$885,000 Physical Science building at the University of California's Riverside campus is under the supervision of **P. N. Schmoker**, project manager. Other job personnel are **P. D. Schmoker**, general superintendent; **L. R. Sours**, assistant superintendent, and **C. A. Scott**, concrete foreman. **H. M. Hodges** is the contractor.

William E. Roche, Jr., is general superintendent for **Peter Kiewit Sons' Co.**'s \$2,552,000 award for work on the **Eastshore Freeway** in **Emeryville, Calif.** Other important personnel are: **Brad Lockwood**, project engineer; **Al Ashley**, office manager; **Homer Olsen**, structure superintendent; **Henry Vogt**, master mechanic; **William Mabry**, mechanical engineer; **Dave Scott**, structure engineer; **Pete Janopaul**, grade engineer; **Jim Wilson**, steamfitter foreman; **Orville Saalfeld**, **Frank Wiggs** and **Ray McClarrinon**, carpentry foremen; **Bill**

BIG RED TEAM *



* Bucyrus-Erie scraper and TD-24 tractor.

PAYS OFF WITH ***More Paydirt!***

BIGGER LOADS EVERY TRIP...

You get heaped loads faster with a Bucyrus-Erie scraper's boiling-action loading. This has been proved time and time again in actual field tests. The loading action breaks up big chunks to give you a compact and uniform fill, and extra pounds of dirt in every cubic yard.

MORE TRIPS PER DAY...

Big tires, low center of gravity and increased all around stability give you the flotation and maneuvering ability for extra trips every working day. The streamlined gooseneck permits short turns. Dumping is quick and clean with positive rolling ejection. It all adds up to faster hauling cycles... and more dirt moved per day.

See your International Industrial Tractor Distributor soon for all the facts about the Big Red Team... it will pay you to use the equipment that delivers the most paydirt for your money.

12T53C

THREE **B**-TYPE

SCRAPERS TO CHOOSE FROM

Model	Capacity	
	Struck	Heaped
B-250	22 cu. yd.	27 1/2 cu. yd.
B-170A	16 cu. yd.	21 cu. yd.
B-113	10 cu. yd.	14 cu. yd.

BUCYRUS-ERIE COMPANY



SOUTH MILWAUKEE, WISCONSIN

SEE YOUR INTERNATIONAL INDUSTRIAL TRACTOR DISTRIBUTOR



POWER! That's what you get with this MM loader unit—big-capacity lifting plus real power down-crowding performance.



WHEELERS

COST LESS TO OWN . . . LESS TO OPERATE . . .
and, they're HEAVY DUTY . . . ALL THE WAY!

You get ALL the benefits of Modern Manufacture when you specify MM Wheelers. Standardized, heavy duty parts and modern assembly procedures cost you less to begin with. Quality control in parts and assembly offers maximum precision for longer service on the job. And, those same efficient production methods permit special MM design features that give *better* loading performance—*greater* loading capacity.

Every day, more and more careful buyers are getting the facts from MM distributors . . . *buying* MM Wheelers for lower *first cost*—lower *operating costs*.



TALK ABOUT CAPACITY! Here's an MM loader unit handling a log 45" thick, 18' long.

MINNEAPOLIS-MOLINE

MINNEAPOLIS 1, MINNESOTA

WESTERN MACHINERY CO., Phoenix, Arizona; EDWARD R. BACON CO., San Francisco, Oakland, Stockton, Fresno, Sacramento, California; CASEY-METCALF MACHINERY CO., INC., Los Angeles, California; GUNDERSON-TAYLOR MACHINERY CO., Denver, Colorado; THE SAWTOOTH CO., Boise & Idaho Falls, Idaho; THE FARM MART, Bainville, Montana; CROSKREY MOTORS, Kalispell, Montana; CENTRAL MACHINERY CO., Great Falls, Montana; TRACTOR & EQUIPMENT CO., Miles City, Montana; MISSOULA MERCANTILE CO., Missoula, Montana; CONTRACTORS EQUIPMENT CORP., Portland, Oregon; TAYLOR MACHINERY CO., North Salt Lake, Utah; BOW LAKE EQUIPMENT CO., INC., Seattle, Washington; MODERN MACHINERY CO., INC., Spokane, Washington; TORRINGTON IMPLEMENT CO., Torrington, Wyoming; MUTUAL MACHINERY CO., Pueblo, Colorado; SIERRA MACHINERY CO., INC., Reno, Nevada.

Turnbow, concrete foreman; Bob Brown, labor foreman, and John Kaufmann, grade foreman.

A. C. Hearn, project manager; Robert McElvery, general superintendent and R. H. Clough, assistant superintendent, are at work on an Indian hospital being constructed in Albuquerque, N. Mex., by Bernalillo County. Contractor is Lembke-Clough & King Co.

Horace Follis is general superintendent over the construction of a uranium reduction mill being built by Southwestern Transfer Co., Inc., for the Anaconda Copper Mining Co. Location is Grants, N. Mex.

Ed Funderburk, assisted by J. C. Jensen, is supervising highway work in Roseburg, Ore., for Funderburk Construction Co.

R. W. Finke, supervisor; Bob Steele, assistant engineer, and Roy Garlick, pile driving superintendent, are at work on the \$3,364,025 Chehalis River bridge at Aberdeen, Wash. MacRae Bros. is contractor.

R. H. Nance is general superintendent and Russ Chaussee is foreman on construction of an underpass under the Great Northern Railroad tracks near Trinidad, Wash. Lockyear & White holds the contract.

W. W. Hannuksela, supervisor, and G. E. Markham, foreman, are heading the job to construct a sewage treatment plant at Toppenish, Wash. Freigang Construction Co. holds the \$219,010 contract.

Jack Evans is supervising for Harry Trotz's award for 133 miles of rolling and sealcoating at various locations in New Mexico.

Chris Eastin, project manager, and Stan (Irish) Hart, assistant superintendent, are working on dam construction for Hinman Bros., contractor, near Albuquerque, N. Mex.

Robert E. McKee, General Contractor, Inc., is doing new building and remodeling at the New Mexico State Capitol in Santa Fe. J. R. Brennan is project manager; W. G. Hatfield is general superintendent, and C. B. Hartley is assistant superintendent. The job is expected to end in July at a cost of about \$2,000,000.

The P. R. Burns \$90,000 contract to build a sewage disposal unit at Gallup, N. Mex., finds O. O. Graves as general superintendent.

PORTABLE ROCK PLANT

... Continued from page 126

answer. But every indication points toward a steady upsurge in the need for crushed rock from portable plants. Barring a major calamity, American civilization will continue to produce a higher standard of living for more people here and abroad.

Concrete technicians are unfolding many of the hitherto-unknown secrets about particle interlock and behavior in a mix. Looming just ahead in the flood-control picture is the possibility of small dams and reservoirs in the headwaters to augment large dams on the main streams. The smaller structures will have to stand just as long, and who will doubt that sometime soon, portable crushers, perhaps with hammermills or impactors in addition to jaws, rolls and screens, will crush and size every speck of aggregate for the spillways and outlet structures of these smaller barriers?

More future uses

The entire highway system of the United States must soon be overhauled to higher standards, or maintenance costs will become ruinous. This job alone means a tremendous increase in tonnage of crushed material for sub-bases. Significant, too, is the steady growth of plant-mixed asphaltic concrete, which is replacing earlier types. The mineral filler for plant mix requires a much higher degree of preparation and control than does the material used in road mix.

And there is sure to be a trend toward more crushing-screening and a trend away from pure screening jobs. For one thing, deposits of native aggregates in places are becoming exhausted. For another, engineers are discovering that angular particles in a mix add stability to the result. Already there has been developed a plant designed especially to salvage the large boulders heretofore too large to be handled by present plants. It is now available to reclaim aggregates from pits in depleted areas. It means only this: that portable crushers will continue to do a large share of this work as they labor during the years ahead.

Right now the weight of many of the larger portable duplexes is a problem so far as their transportation over the highways is concerned. But that is being solved the same as many another issue has been ironed out; by adding more axles or by splitting the plants to meet present highway loading limitations. There are plants in operation today consisting of two, three, four, and even more units, individually mounted on separate chassis for quick hook-up as needed.

As the portable rock plant grew during the past to meet the needs of a growing nation, so will it continue to grow and improve in the future.

Looking for Pumps? You Name It! CARVER'S Got It!

CARVER has the complete line of self-priming construction dewatering pumps starting with the 1½" Model KN1½L — 4000 gallons per hour — the lightest 4M rated pump on the market.

Every CARVER Contractor Pump ... right up through the 10" giant which will pump 250,000 gallons per hour — has the same simple design, sturdy construction, rugged durability that means efficient performance on every job. No loose parts, only two wearing parts, easily and economically replaced. All models with gasoline, diesel or electric drive.

As for diaphragm pumps, CARVER makes one that will handle the roughest, toughest jobs with ease.

CARVER also manufactures a full line of high-pressure jetting pumps for jetting well points, timber and steel piling, flushing, etc.

For the complete quality line of pumps see your CARVER Distributor today!



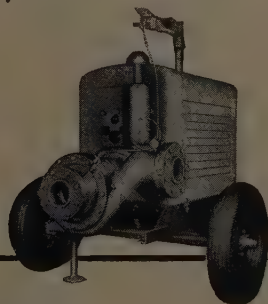
1½" SELF-PRIMING
4000 G.P.H.



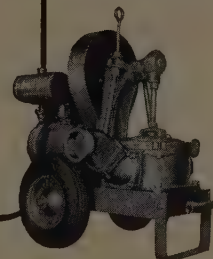
3" SELF-PRIMING
30,000 G.P.H.



10" SELF-PRIMING
250,000 G.P.H.



HIGH PRESSURE
JETTING PUMP



4" DIAPHRAGM PUMP
6000 G.P.H.

O. S. STAPLEY CO., Phoenix, Arizona
MINE & MILL MACHINERY CO., Los Angeles 13, Calif.
RIDLEY CO., San Francisco 3, Calif.
ANDREWS & ANDREWS EQUIPMENT CO., Portland, Oregon
ANDREWS MACHINERY OF WASHINGTON, INC., Seattle 4, Wash.
BLACKWELL-COLEMAN EQUIPMENT CO., Spokane, Wash.
MUSSELLSHELL VALLEY EQUIPMENT CO., Roundup, Montana
GEHRING EQUIPMENT CO., Casper, Wyoming
CONSTRUCTORS EQUIPMENT CO., Denver 5, Colorado
CLINE EQUIPMENT CO., Salt Lake City, Utah

CARVER PUMP COMPANY, 1416 Hershey Ave., Muscatine, Iowa



CARVER PUMPS

CONTRACTS

Summary of bids and awards for major Western projects

Alaska

\$2,220,000—**Sam Bergesen**, 5402 San Francisco, S.W., Tacoma—Award for heating and power plant, Kodiak Naval Air Station; by U. S. Navy.

\$1,070,270—**S. Birch & Sons** and **Lytle & Green**, Central Bldg., Seattle—Award for Tongass highway project nr. Ketchikan; by BPR.

\$1,473,015—**S. Birch & Sons** and **Lytle & Green**, Central Bldg., Seattle—Low bid for Schedule 1, Ketchikan waterfront arterial, including 1,650 lin. ft. of tunnel, sea-wall, conc. viaduct; by Alaska Public Works.

\$1,419,465—**S. Birch & Son** and **Lytle & Green**, Central Bldg., Seattle—Low bid for 2 warehouses with outside utilities, Elmendorf Air Force Base; by C. of E.

\$4,206,268—**S. Birch & Son** and **Lytle & Green**, Central Bldg., Seattle—Award for family housing at Ladd Air Force Base; by C. of E.

\$2,665,520—**S. Birch & Son** and **Lytle & Green**, Central Bldg., Seattle, and **Wyatt & Kipper**—Low bid for extension to existing central heating and power plant at Eielson Air Force Base; by C. of E.

\$678,000—**Carson Construction Co.**, 1236 E. 6th Ave., Helena, Mont.—Award for extension of utilities system, Kodiak Naval Air Station; by U. S. Navy.

\$12,328,224—**Peter Kiewit Sons' Co.**, 1300 Aloha St., Seattle, and **Fred J. Early, Jr., Co.**—Award for arctic indoctrination and training school facilities, Big Delta; by C. of E.

\$1,027,140—**S. Macri Construction Co.**, Box 938, Anchorage—Award for crashboat facilities at Kodiak Naval Station; by U. S. Navy.

\$1,432,292—**Morrison-Knudsen Co., Inc.**, 319 Broadway, Boise, Idaho—Award for 2 warehouses at Elmendorf Air Force Base; by C. of E.

\$434,000—**L. R. Sommer**, Balboa, Canal Zone—Award for outside electrical distr. system, Elmendorf Air Force Base; by C. of E.

Arizona

\$798,531—**Fisher Contracting Co.**, 2201 S. 19th Ave., Phoenix—Low bid for 12.9 mi. of grading, base course and bitum. treatment, south approach to Grand Canyon Natl. Park, Cocino County; by BPR.

\$120,779—**Eddie Givens Construction Co.**, Box 470, Phoenix—Low bid for 7.4 mi. of Clifton-Springville hwy. beginning about 16 mi. north of Clifton. Work includes aggregate base and bitum. surf.

\$282,666—**W. J. Henson**, Box 471, Prescott—Award for 7¼ mi. of grading and draining over a new alignment, U. S. 66 beginning about 15½ mi. east of Flagstaff; by St. Hwy. Dept.

\$313,463—**Isbell Construction Co.**, Box 2351, Reno, Nev.—Low bid for 4¾ mi. of grading and draining, Kingman-Ashfork hwy. beginning 16 mi. west of Ashfork; by St. Hwy. Dept.

\$176,073—**Phoenix-Tempe Stone Co.**, Box 1670, Phoenix—Award for construction of an overpass and connecting roads 8 mi. east of Phoenix and 1 mi. from Tempe; by St. Hwy. Dept.

\$578,190—**San Xavier Rock & Sand Co.**, Box 1031, Tucson—Award for 1.1 mi. of grading, select material, aggregate base, conc. paving, and bitum. plant mix, Tucson controlled access hwy.; by St. Hwy. Dept.

\$243,353—**M. M. Sundt Construction Co.**, Box 2592, Tucson—Award for 8.3 mi. of clearing, grubbing, grading, draining, select material and aggregate base, beginning at McNary on McNary-Eagar hwy.; by St. Hwy. Dept.

\$241,590—**Tanner Bros.**, 731 N. 19th Ave., Phoenix—Award for 3¼ mi. of grading, select material, aggregate base and bitum. plant-mix surf., west of Wickenburg on hwy. to Ehrenberg; by St. Hwy. Dept.

\$122,585—**L. M. White Contracting Co.**, Box 6008, Tucson—Award for grading, aggregate base and bitum. road-mix, two sections on rd. nr. east city limits of Tucson; by St. Hwy. Dept.

California

\$890,000—**Jerry Artukovich** and **M. A. Artukovich Construction Co.**, 723 Union Ave., Montebello—Low bid for Bushart St. trunk and treatment plant trunk sewers, Santa Ana; by Orange County Sanitation Districts 1, 2, 5, 6, and 7.

\$190,030—**Jerry Artukovich & M. A. Artukovich Construction Co.**, 723 Union Ave., Montebello—Low bid for Ellis Ave. trunk sewer, Santa Ana; by Orange County Sanitation Districts 1, 2, 5, 6, and 7.

\$3,389,766—**Guy F. Atkinson Co.**, Box 259, Long Beach—Award for 6.3 mi. of grading and PCC surf. on cement-treated base, and 4 bridges and 3 pedestrian undercrossings to provide a freeway with a 4-lane divided hwy., Pomona and Claremont Los Angeles County; by Div. of Hwys.

\$335,151—**Gordon H. Ball-San Ramon Valley Land Co.**, 685 Delaware St., Berkeley—Low bid for a reinf. conc. girded bridge across San Benito River 1 mi. west of Hollister on Sign Rt. 156, San Benito County; by Div. of Hwys.

\$139,667—**Barton Construction Co.** and **B. & B. Steel Erectors**, Barrett Ave. & 1st, Richmond—Award for redecking the Giannelli Bridge across the Sacramento River west of Chico on St. Sign Rt. 32; by Div. of Hwys.

\$172,606—**Basich Bros. Construction Co.**, R. L. Basich & N. L. Basich, 1148 N. San Gabriel Blvd., Garvey—Award for 8.6 mi. of grading and plant-mix surf. on untreated rock base, about 5 mi. so. of Olancha betw. Dunsmuir and Haiwee, Inyo County; by Div. of Hwys.

\$346,749—**Basich Bros. Construction Co.**, 1148 N. San Gabriel Blvd., Garvey—Low bid for 2.3 mi. of grading and plant-mix surf. on cement-treated base, betw. Whitewater and Garnet, Riverside County; by Div. of Hwys.

\$391,628—**M. W. Brown** and **R. E. Hertel**, Box 222, Redding—Low bid for grading and surf. 2.3 mi. of U. S. 299 betw. 4 mi. so. of Weaverville and Douglas City, and constructing a reinf. conc. bridge, Trinity County; by Div. of Hwys.

\$135,915—**Clements Construction Co.**, Box 277, Hayward—Low bid for 4 mi. of surf., U. S. 299 betw. Adin and Rush Creek, Modoc County; by Div. of Hwys.

\$387,660—**Coast Pipeline Contractors**, 580 Bragato Rd., Belmont—Low bid for Schedules I, IV, V, VI, Trans-Vallejo pipeline connecting Fleming Hill treatment plant with Swanzy reservoir, Vallejo; by City.

\$357,949—**V. R. Dennis Construction Co.**, Box F, Hillcrest Sta., San Diego—Award for 2.5 mi. of widening and PMS surf. on PCC base, curbs, gutters, etc., El Cajon Blvd., betw. San Diego and La Mesa; by Div. of Hwys.

\$558,525—**Eaton & Smith**, 1215 Michigan St., San Francisco—Low bid for clearing and grading 4.1 mi., Huntington Lake, Sierra Natl. Forest, Fresno County; by BPR.

\$363,420—**Erickson, Phillips & Weisberg**, 350 Market St., Concord—Low bid for a prestressed reinf. conc. reservoir, Richmond; by East Bay Municipal Utility District.

\$567,100—**Franks Dredging Co.**, Pier E, Berth 120, Long Beach—Award for beach protection betw. Los Angeles County flood control channel and municipal auditorium, Long Beach; by City.

\$2,716,785—**Fredrickson & Watson Construction Co.**, 873 81st Ave., Oakland, and **M & K Corp.**—Award for Sly Park earth-fill dam and dike, El Dorado County; by USBR.

\$239,985—**Fredrickson & Watson Construction Co.**, 873 81st Ave., Oakland—Award for steel and reinf. conc. bridge approaches on Washington Ave., Oakland; by Alameda County.

\$610,762—**Griffith Co.**, 1060 So. Broadway, Los Angeles—Award for grading and plant-mix surf., 3½ mi. of State Rt. 196 betw. U. S. 101 in Oceanside and 3½ mi. east, San Diego County; by Div. of Hwys.

\$1,170,026—**Griffith Co.**, 1060 So. Broadway, Los Angeles—Award for 5.7 mi. of grading and surf. and 3 reinf. conc. bridges on U. S. 101, Ventura County; by Div. of Hwys.

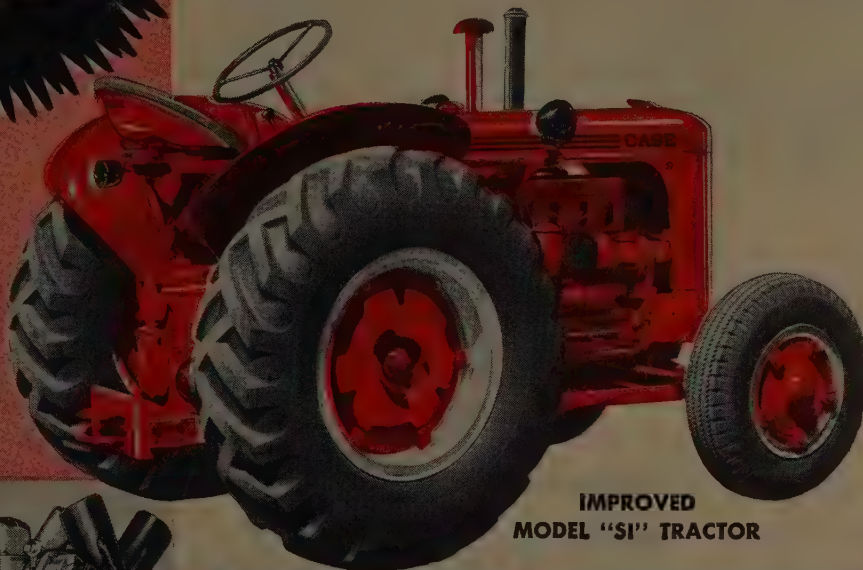
\$2,165,364—**Chas. L. Harney, Inc.**, 575 Berry St., San Fran-

MORE POWER

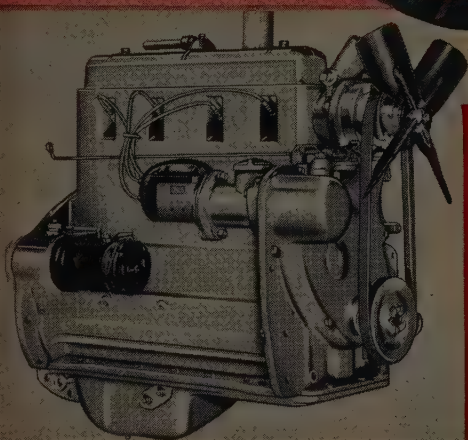
**GREATER
CAPACITY
FOR
FRONT-MOUNTED
REAR-MOUNTED
PULL-TYPE
EQUIPMENT**

PLUS ADDED STRENGTH ... MORE CONVENIENCES

Here is greater tractor capacity than ever before with more power to lift and lug heavier loads . . . make maximum use of front-end loaders, scrapers . . . do bulldozing, digging, or any tough job. What's more, you get added strength in axle and chassis to absorb the stresses and strains of heavier weight and rougher work that this new Model "SI" Tractor lets you do. Yet, you get so much more comfort too—easier steering with a completely new steering-assembly design . . . new Case-made foot-operated clutch . . . improved double-disk differential brakes.



**IMPROVED
MODEL "SI" TRACTOR**



Powerful valve-in-head engine, built to hang on to the load when engine speed is pulled down, still gives the same durable, dependable, economical operation with cylinder bore that is $\frac{1}{8}$ -inch larger and horsepower substantially increased. Gear-type oil pump provides full-pressure lubrication for long life. Famous Case sealed magneto gives long, hot spark.



Foam-rubber cushion seat makes a day's work less tiring. Controls are easy to reach, panel easy to watch.



Heavier front axle and wishbone assembly handle the demands of increased power, yet provide easier steering.

CASE



Superior Equipment Co., Phoenix, Ariz.; Contractors Machinery Co., San Francisco, Calif.; Growers Tractor & Implement Co., Sacramento, Calif.; Electric Tool & Supply Co., Los Angeles and San Bernardino, Calif.; Equipment Sales & Service, Stockton, Calif.; Liberty Truck & Parts Co., Denver, Colo.; Western Equipment Co., Boise and Idaho Falls, Idaho; Hilton's, Inc., Las Vegas, New Mexico; Foulger Equipment Co., Salt Lake City, Utah; Montana Powder & Equipment Co., Helena and Billings, Montana; Columbia Equipment Co., Portland, Ore.; Star Machinery Co., Seattle, Wash.

cisco—Low bid for 1.7 mi. of grading and paving on Bayshore Freeway betw. Hester Ave. and Alemany Blvd., and for 7 bridges, two pedestrian overcrossings, two pedestrian undercrossings, and hwy. lighting and traffic signals, San Francisco County; by Div. of Hwys.

\$278,440—Chas. L. Harney, Inc., 575 Berry St., San Francisco—Low bid for overlay and widening runway, Hamilton Air Force Base; by C. of E.

\$280,450—Healy-Tibbitts Construction Co., 411 Brannan St., San Francisco—Low bid for sewer in 7th St. from Bay to Terminal St., Oakland; by City.

\$595,498—R. V. Lloyd & Co., Box 391, Coachella—Award for 11 mi. of earthwork, pipe lines, and structures, Part 2 of Unit 8, Coachella Valley Distr. System; by USBR.

\$142,115—Lowrie Paving Co., Inc., 1755 Evans Ave., San Francisco—Low bid for repairs on Clay St. betw. Scott St. and Arguello Blvd., San Francisco; by City.

\$633,897—Madonna Construction Co., Box 910, San Luis Obispo—Award for 6.4 mi. of grading and placing imported sub-base material, and construction of a bridge crossing San Marcos Creek, San Luis Obispo County; by Div. of Hwys.

\$139,914—Mercer, Fraser Co. and Mercer, Fraser Gas Co., Inc., 2nd and Commercial Sts., Eureka—Low bid for 9.9 mi. of surf., Sign Rt. 36 betw. 11 mi. east of Alton and 3½ mi. west of Bridgeville, Humboldt County; by Div. of Hwys.

\$128,680—Munn & Perkins, Box 1092, Modesto—Award for 6.8 mi. of surf. on Scenic Dr.-Old Oakdale Rd., beginning from east of Modesto, Stanislaus County; by Div. of Hwys.

\$247,140—Oswald Bros., 366 E. 58th St., Los Angeles—Low bid for improvements on 4.3 mi. of Osage Ave., Los Angeles; by Los Angeles County.

\$656,392—H. Earl Parker, Inc., 12th & F Sts., Marysville—Low bid for North Section, Unit 1, earthwork and structures, laterals, sublaterals, and wasteways, Madera Distr. System, Central Valley Project; by USBR.

\$384,424—Rice Bros., 8th & Yuba Sts., Marysville—Award

for 9 mi. of plant-mix surf. on U. S. 99E, Butte County; by Div. of Hwys.

\$144,555—Edward R. Siple Co., 2545 San Fernando Rd., Los Angeles—Low bid for enlarging sewage treatment plant, Lancaster; by Los Angeles County.

\$126,900—Smale & Robinson, Inc., 1033 Avalon Blvd., Wilmington—Low bid for outfall sewer extension for Terminal Island treatment plant, Los Angeles; by City.

\$179,756—L. C. Smith Co., Box 610, San Mateo—Award for 2.4 mi. of grading and plant-mix surf. nr. Woodside, San Mateo County; by Div. of Hwys.

\$141,037—Thomas Construction Co., 4929 Hedges Ave., Fresno—Award for 5 reinf. conc. slab bridges and approaches, betw. 9.6 mi. southeast and 7.1 mi. northwest of Ventura-Santa Barbara County line; by Div. of Hwys.

\$350,320—N. J. Tomovich and J. P. Evans, Inc., 354 S. Spring St., Los Angeles—Low bid for relief sewer, Ohio Ave. and Federal Ave., Los Angeles; by City.

\$207,675—Transocean Engineering Corp., 15890 Hesperion Blvd., San Lorenzo—Award for 4 mi. of grading and seal-coating, Secondary County Rt. 1075, and a reinf. conc. bridge over Cow Creek nr. Whitmore, Shasta County; by Div. of Hwys.

\$283,280—G. Vella Construction Co., 1212 E. Huntington Dr., Duarte—Low bid for sanitary sewers in Glen Ave., Altadena; by Los Angeles County.

\$235,806—Walsh Construction Co., 785 Market St., San Francisco—Award for 2 steel girder bridges and approaches across Middle Fork, Feather River, and over Western Pacific Railroad tracks in Portola, Plumas County; by Div. of Hwys.

\$609,860—J. E. Young, Pipeline Contractor, Inc., 931 E. Rosecrans Ave., Los Angeles—Low bid for earthwork, pipe lines, etc., Laterals 2 to 9, Goleta Distr. System, Cachuma Project; by USBR.

Colorado

\$1,700,000—R. T. Bickhard Construction Co., 4001 Jason St.,

Fastest Western Service ...Asphalts, Cutbacks, Bitumuls®



**AMERICAN
Bitumuls & Asphalt
COMPANY**

200 BUSH STREET • SAN FRANCISCO 4

- Out of fully equipped and well stocked storage tanks and terminals, a fleet of transport and distributor trucks augments rail and water shipment of asphalt, road oils, cutbacks and Bitumuls asphaltic products—to give Western contractors fastest job-site service.

For Service—Contact

OAKLAND 1, CALIFORNIA
INGLEWOOD, CALIFORNIA
PORTLAND 7, OREGON
SEATTLE, WASHINGTON
TUCSON, ARIZONA

**READ HARSH
RY CONCRETE
FAST**

BLAW-KNOX CONCRETE PAVING SPREADERS

with the Automatic Transverse Blade

MODERN harsh, dry mixes of 1½" to 3" slump concrete are extremely difficult to spread manually or by makeshift methods with speed and economy. That's why Blaw-Knox Spreaders have become standard equipment in so many high-speed paving operations. This Spreader with the Transverse Blade is the *only* spreader that automatically moves the concrete longitudinally and transversely at the same time, spreading it uniformly to the width and elevation required, no matter where it is placed on the subgrade.

A Vibratory Attachment may be added to compact the concrete simultaneously with the spreading operation, increasing its density and strength and insuring dense pavement edges, free from honeycomb. Blaw-Knox Spreaders easily keep pace with the output of two 34-E pavers.

Available in two standard adjustable widths—10' to 15' and 20' to 25'.



**ASSURE A
SMOOTH-RIDING
FINISH**

BLAW-KNOX FINISHING MACHINES

This double-screed pavement finisher assures high daily production and a smooth-riding finish regardless of the type of concrete mix used. Its rigid and sturdy structural frame is combined with proper weight distribution to minimize weaving and lateral thrust on the side forms, even when operating on concrete that is dry, harsh and difficult to manipulate. The large, wide front and rear screed ends prevent wastage of concrete over the side forms. Both standard sizes—10' to 15' and 20' to 25'—are easily and quickly adjustable for width. Screeds are telescopic.

Blaw-Knox Finishing Machines are available with a Vibratory Attachment for consolidating and compacting difficult mixes of concrete, assuring a smooth finish while maintaining maximum production schedules.

**MECHANIZE THE
ENTIRE JOB
FOR**

HIGH-SPEED, LOW-COST CONCRETE PAVING CONSTRUCTION

Mechanization is the key to greater efficiency and economy in modern concrete paving operations. And the key that opens the door to greater profit on *your* job is 100% mechanization with the Blaw-Knox "Complete Package" of concrete construction equipment, developed to bring unified, balanced, "assembly-line" methods to road building operations. The Blaw-Knox "Complete Package" of cost-cutting equipment contains every piece of equipment you need, from forms to finisher, to give you the step-by-step mechanization that assures high-speed, low-cost concrete paving construction.

Blaw-Knox is your *only* source for a completely mechanized outfit . . . a one-responsibility "package" available on one order, in one shipment and with only one financial arrangement. One responsible distributor organization simplifies maintenance and supply of genuine factory replacement parts. One Blaw-Knox trained man can service *all* your "package" equipment. Start mechanizing your paving outfit today to get your share of the big jobs. See your nearest Blaw-Knox distributor for complete details.



BLAW-KNOX

BLAW-KNOX COMPANY

Blaw-Knox Equipment Division

Farmers Bank Bldg. • Pittsburgh 22, Pa.

GET THE FACTS FROM YOUR
NEAREST BLAW-KNOX DISTRIBUTOR

CONTRACTORS EQUIPMENT CORPORATION
2727 S. E. Union Ave., Portland 2, Oregon
FOULGER EQUIPMENT CO.
P. O. Box 87, 1361 S. Second W.,
Salt Lake City 8, Utah

LE ROI-RIX MACHINERY CO.
6403 E. Slauson Ave., Los Angeles 22, Calif.
2648 Cherry Ave., Long Beach, Calif.
1331 - 33rd Street, Bakersfield, Calif.
THE O. S. STAPLEY CO.
P. O. Box 960, 723, Grand Ave.,
Phoenix, Arizona

WASHINGTON MACHINERY & STORAGE CO.
7329 East Marginal Way, Seattle 8, Wash.

C. H. GRANT CO.
2515 Willow St., Oakland 7, Calif.

COLORADO BUILDERS' SUPPLY CO.
Box 4280, S. Denver Sta., Denver 9, Colorado

LIVELY EQUIPMENT CO.
2601 N. Fourth St., Albuquerque, New Mexico
P. O. Box 1436, 1423 E. Missouri St.,
El Paso, Texas

INDUSTRIAL EQUIPMENT CO.
415 N. 27th St., Billings, Montana

HORMONT EQUIPMENT CO.
420 Third Ave., So., Great Falls, Montana

NEW YORK • CHICAGO • PHILADELPHIA • BIRMINGHAM • WASHINGTON • SAN FRANCISCO

Denver—Award for 11-story office bldg., Denver; by National Farmers Union.

\$236,185—Colorado Constructors, Inc., 725 W. 39th Ave., Denver—Low bid for construction on U. S. 6-24, Weld County; by St. Hwy. Dept.

\$117,105—Peter Kiewit Sons' Co., 1950 So. Colorado Blvd., Denver—Low bid for detention dam at Lowry Air Force Base nr. Aurora; by C. of E.

\$6,000,000—Mead & Mount Construction Co., 240 Railway Exchange Bldg., Denver—Award for a 23-story steel office and club bldg., Denver.

\$216,340—Northwestern Engineering Co., Box 567, Denver—Low bid for superstructure modifications on two viaducts in Denver; by St. Hwy. Dept.

\$245,930—Schmidt Construction Co., Box 66, Grand Junction—Low bid for stabilization and surf. 8½ mi. on U. S. 40 betw. Red Wash bridge and Massadona, Moffatt County; by St. Hwy. Dept.

Idaho

\$295,981—Marion J. Hess, Box 247, Malad City—Award for 17½ mi. of a road-mixed bitum. surf. rd. and 3.3 mi. of surf., Cassia County; by St. Dept. of Hwys.

\$211,600—Morrison-Knudsen Co., Inc., 319 Broadway, Boise—Award for 1.3 mi. of grading, and surf. along North Fork of Payette River, Valley County; by BPR.

\$121,291—Murphy Bros., 3728 E. Broadway, Spokane, Wash.—Award for 5.6 mi. of reconstruction and crushed rock surf., Selle Rd., Bonner County; by St. Dept. of Hwys.

\$188,828—Arnold Williams and C. R. Anderson, Idaho Falls—Award for additional steam plant and boiler facilities at Natl. Reactor Testing Station, Arco; by AEC.

Montana

\$150,075—Hansen & Parr Construction Co., 1103 N. Calispel, Spokane, Wash.—Award for a 324-ft. steel and concrete bridge

over Bitterroot River, Corvallis, Ravalli County; by St. Hwy. Comm.

\$857,085—McLaughlin, Inc., 331 Ford Bldg., Great Falls—Award for grading, gravel surf., road-mix oiling on 4 mi. of Great Falls-Armington rd., Cascade County; by St. Hwy. Comm.

\$154,007—McLaughlin, Inc., 331 Ford Bldg., Great Falls—Award for 13.7 mi. of plant-mix oiling, Bearmouth-Dee Lodge rd., Powell County; by St. Hwy. Comm.

\$119,866—Narancho & Konda, 2000 Aberdeen, Butte—Award for 10.3 mi. of gravel surf. and road-mix oiling, Dillon-Twist Bridges rd., Madison County; by St. Hwy. Comm.

\$156,350—O'Brien Construction Co., 1127 Smelter Ave., Great Falls—Award for 6.6 mi. of grading, gravel surf., and road mix oiling, Cascade-Ulm Loop hwy., Cascade County; by St. Hwy. Comm.

\$110,113—O'Neil Construction Co., Box 1151, Havre—Award for 7 mi. of gravel surf. and road-mix oiling, Havre-Simpson-Canadian Line hwy., Hill County; by St. Hwy. Comm.

\$177,300—Robertson & Cave, Inc., Great Falls—Award for 7.4 mi. of grading, U. S. 89, Meagher County; by BPR.

\$314,005—Sather & Sons, Yardley, Wash.—Award for 9 mi. of West Gallatin Forest hwy. so. of Gallatin Gateway, Gallatin County; by BPR.

\$109,945—Walling Construction Co., 408 Huron St., Lewiston—Award for 1.13 mi. of grading, gravel surf., road-mix oil, and draining, Forsyth-Mills City hwy., Custer County; by St. Hwy. Comm.

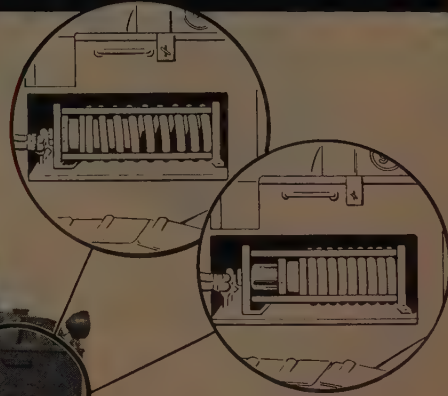
Nevada

\$248,083—Dodge Construction, Inc., Fallon—Award for 11½ mi. of roadway, ending 18½ mi. south of Palisade, Eureka County; by St. Dept. of Hwys.

\$200,111—Wells Cargo, Inc., 1800 E. 4th St., Reno—Award for 14½ mi. of excavation and road-mixed asph. surf., White Pine County; by Dept. of Hwys.

TAKE IT EASY—BUT DO MORE WORK

The SKID SHOVEL is the only loader equipped with the Drott Hydro-Spring, a super shock-absorber that saves wear and tear on equipment and operator. On International TD-6, TD-9, TD-14A, TD-18A Tractors.



DROTT
MANUFACTURING CORP.
MILWAUKEE 8, WISCONSIN

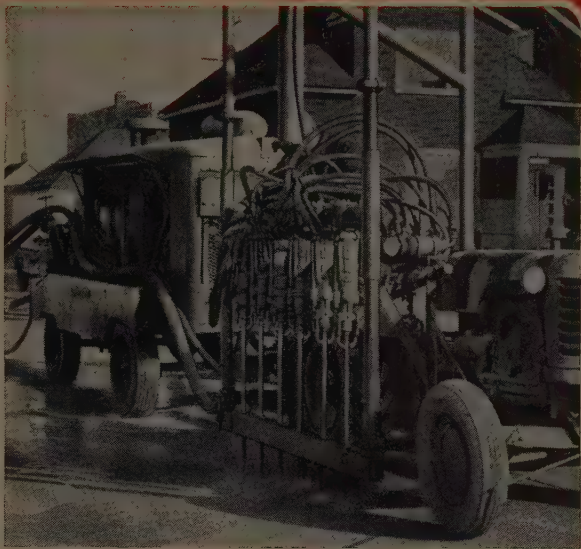
CONTACT YOUR DROTT-INTERNATIONAL DISTRIBUTOR TODAY

GM DIESEL
CASE HISTORY No. 5211-4

USER: R.L. Coolsaet Construc-
tion Co., Dearborn, Mich.

INSTALLATION: GM Diesel-powered
Ingersoll-Rand 600 cfm rotary
compressor replacing a 500
cfm compressor, supplies air
to a tractor-mounted multiple
drill—six drills 12" apart.

PERFORMANCE: Previous Diesel
compressor supplied 75 lbs. of
air to each drill and took time
to build up pressure after each
move. GM-powered compressor
supplies steady 95 lbs.,
starts drills immediately and
saves 20% in fuel costs. Unit
drills 600 lineal ft. per day.



NEW GM DIESEL-POWERED RIG CUTS PAVEMENT-BREAKING TIME IN HALF

R. L. Coolsaet figures his pavement-breaking time is cut right in half with this rig when compared to the old way with one man on each drill. Now he drills six holes at once—gets twelve holes drilled in six feet and moves up for the next series, all in three minutes, and one operator handles the job.

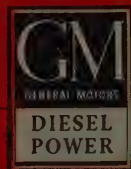
This is another good example of how General Motors Diesel-powered equipment gets work done faster and reduces costs at the same time. Two-cycle operation

delivers a smoother, steadier flow of power—gives instant response to overcome sudden load changes. Simple design makes it easier to maintain—lower-cost parts make it cheaper to maintain. Add it up and you'll see why GM Diesels give you power at the lowest cost per horsepower hour—for any job.

DETROIT DIESEL ENGINE DIVISION
GENERAL MOTORS • DETROIT 28, MICHIGAN
SINGLE ENGINES . . . 16 to 275 H.P. MULTIPLE UNITS . . . Up to 840 H.P.

It pays to standardize on

*Write for booklet "A 50,000,000 Horsepower
Insurance Policy" that tells you why.*



\$155,864—**Young & Smith Construction Co.**, 306 Beason Bldg., Salt Lake City—Award for a portion of St. hwy. system from Lovell Wash to Mountain Springs Summit, Clark County; by St. Dept. of Hwys.

New Mexico

\$1,302,800—**Lembke, Clough & King**, Box 144, Albuquerque—Award for a brick and conc. high school and gymnasium, Roswell; by City.

\$752,569—**Lowdermilk Bros.**, Espanola—Award for 14.4 mi. of asph. surf., Santa Rosa-Cuervo rd. (U. S. 66), Guadalupe County; by St. Hwy. Dept.

\$1,257,300—**Robert E. McKee, General Contractor, Inc.**, Box 562, El Paso, Tex.—Award for engineering test bldg., White Sands Proving Grounds, Las Cruces; by C. of E.

\$3,653,050—**Robert E. McKee, General Contractor, Inc.**, Box 562, El Paso, Tex.—Low bid for 2 double-cantilever bomber hangars, a 600,000-gal. steel water tank, a water pump station, and water lines, Kirtland Air Force Base; by C. of E.

\$539,766—**J. H. & N. M. Monaghan & Associated Cos.**, Rt. 1, Derby, Colo.—Award for 3.7 mi. of approaches and a steel and conc. bridge over Canadian River, Logan and vicinity on U. S. 54, Quay County; by St. Hwy. Dept.

\$647,217—**Northwestern Engineering Co.**, Box 567, Denver, Colo.—Award for 11 mi. of asphalt surf., Gallup-Grants rd. (U. S. 66), Valencia County; by St. Hwy. Dept.

\$416,830—**D. D. Skousen & Son**, 201 Springer Bldg., Albuquerque—Award for 21.2 mi. of asph. surf., Taos-Eagle Nest rd. (U. S. 64), Taos and Colfax counties; by St. Hwy. Dept.

\$396,509—**Skousen-Hise Contracting Co.**, 201 Springer Bldg., Albuquerque—Award for 21.8 mi. of asph. surf., Gallup-Grants rd. (U. S. 66), McKinley County; by St. Hwy. Dept.

Oregon

\$137,750—**Acme Construction Co.**, Box 306, Eugene—Low bid for 18 street paving projects, Medford; by City.

\$221,585—**Empire Construction Co.**, 0234 S.W. Bancroft St. Portland—Low bid for sewage disposal plant, Springfield; by City.

\$880,110—**Morrison-Knudsen Co., Inc.**, 319 Broadway, Boise Idaho—Low bid for auxiliary forebay addition (earth-fill dike to Oak Grove project, upper Clackamas River; by Portland General Electric Co.

Utah

\$621,640—**W. W. Clyde & Co.**, Springville—Award for 7.3 mi. of 3-in. plant-mixed bitum. surf., Ogden Hot Springs-Five Points, Weber and Box Elder counties; by St. Rd. Comm.

\$130,327—**Gibbons & Reed Co.**, Box 1113, Salt Lake City—Award for 1½ mi. of a bitum. conc. rd., Salt Lake City; by St. Rd. Comm.

\$528,927—**Enoch Smith Sons Co.**, 1441 Becks St., Salt Lake City—Low bid for 1.68 mi. of 3-in. bitum. conc. surf., State St., 9th So. to 21st So., Salt Lake County; by St. Rd. Comm.

\$336,706—**Sorensen Bros. Co. and D. W. Brimhall**, 1330 W. 4200 So., Murray—Low bid for 7.2 mi. of 2-in. road-mixed bitum. surf., Coalville-Upton rd., Summit County; by St. Rd. Comm.

\$401,955—**Thorn Construction Co., Inc.**, Box 111, Springville—Award for 5.1 mi. of 3-in. plant-mixed bitum. surf., Gillyuly-Soldier Summit, Utah and Wasatch counties; by St. Rd. Comm.

Washington

\$3,529,540—**T. C. Bateson Construction Co.**, Lovefield Sta., Dallas, Tex.—Low bid for double cantilever maintenance hangar, Fairchild Air Force Base; by C. of E.

\$225,167—**W. B. Edmiston & Sons, Inc.**, Yakima—Low bid for sewage treatment plant, Pasco; by City.

\$857,600—**Ferenti Electric, Inc.**, New York—Low bid for furnishing six 56,600-kva. transformers for McNary Dam; by C. of E.



Hopkins Volcanic Oil Dryer Unit at Dunbar Slag Co.

AT THE
**DUNBAR
SLAG CO.**
SHARON, PA.

**"HOPKINS UNITS
Give us a DRIER HEAT...
Less Fuel Consumption"**

- Shown at the left (below) is a large Tandem Dryer Asphalt Plant, using two Hopkins Volcanic Dryer Units which were installed three years ago. These units replaced old-style steam atomizing burners, which actually added extra moisture, thereby presenting additional problems. Mr. Karl Dunbar says, "We now get a much better drying job than before. Hopkins units give us a drier heat . . . less fuel consumption, and better temperature control."

Other contractors, too, have reported excellent results with Hopkins units—have found that Hopkins equipment steps up production, provides greater efficiency, and reduces fuel cost. Why not get these cost-cutting, time-saving features for your asphalt plant? A letter or phone call will bring you descriptive literature and complete details.

HOPKINS VOLCANIC SPECIALTIES, INC.
ALLIANCE, OHIO



\$454,444—Gibbons & Reed Co., Box 1113, Salt Lake City—Award for clearing, draining and grading 2.54 mi. of P.S.H. No. 1, junction P.S.H. No. 12 to Salzer Creek, Lewis County; by St. Hwy. Comm.

\$144,043—F. R. Hewett Co., Box 46, Parkwater—Award for 21 mi. of crushed stone surf. and light bitum. treatment, S.S.H. No. 3-D, junction P.S.H. No. 3 to Eureka, Walla Walla County; by St. Hwy. Comm.

\$142,800—Larsen Construction Co., Colman Bldg., Seattle—Low bid for replacing pier at Naval and Marine Corps Reserve Training Center with precast conc. deck on wood piling, Seattle; by U. S. Navy.

\$306,286—Midland Constructors, Inc., 3332 E. Florence Ave., Huntington Park, Calif.—Low bid for clearing and construction for relocating 4.4 mi. of Bonneville-Grand Coulee 230-kv. lines, Nos. 1 & 2, and removal of existing lines in Wind River area; by BPA.

\$278,795—Pacific Sand & Gravel Co., Box 628, Centralia—Award for clearing, grading, surf., and asph. conc. paving, 6.7 mi. on P.S.H. No. 5, Morton to Kosmos, Lewis County; by St. Hwy. Comm.

\$243,440—M. A. Pithoud, Vancouver—Award for 44½ mi. of 115-kv. transmission lines, Colville to Republic, Ferry County; by BPA.

\$397,637—Charles A. Power, Box 1220, Spokane—Award for 2 reinf. conc. girder bridges on ¼ mi. of P.S.H. No. 2, Spokane; by St. Hwy. Comm.

\$133,209—P. L. Saddler, Box 898, Wenatchee—Award for 2.5 mi. of rd. and a bridge, Stevens Pass Hwy., Chelan County; by BPR.

\$4,197,525—S. Morgan Smith Corp., York, Pa.—Low bid for supplying six 100,000-hp. hydraulic turbines for Chief Joseph Dam; by C. of E.

\$187,777—Washington Utilities Construction Co., 5235 South Tacoma Way, Tacoma—Low bid for modification and extension of existing electrical distr. system, Larson Air Force Base, Moses Lake; by C. of E.

**REDUCE TILT-UP
CONSTRUCTION COSTS**

with

**Thompson's
WATER SEAL**

**for surface slabs
and tilt-up panels**

- Locks out moisture, acts as bond breaking agent.
- Permits easy lifting of panels without suction.
- Eliminates hairline cracks for smoother concrete surfaces.
- Gives slower, more uniform curing.
- Protects against seepage, prevents efflorescence.

MANY OTHER CONSTRUCTION USES:

For lasting protection against moisture, use Thompson's Water Seal for plywood forms, concrete blocks, brick, tile, stucco, plasterboard and any other porous material.

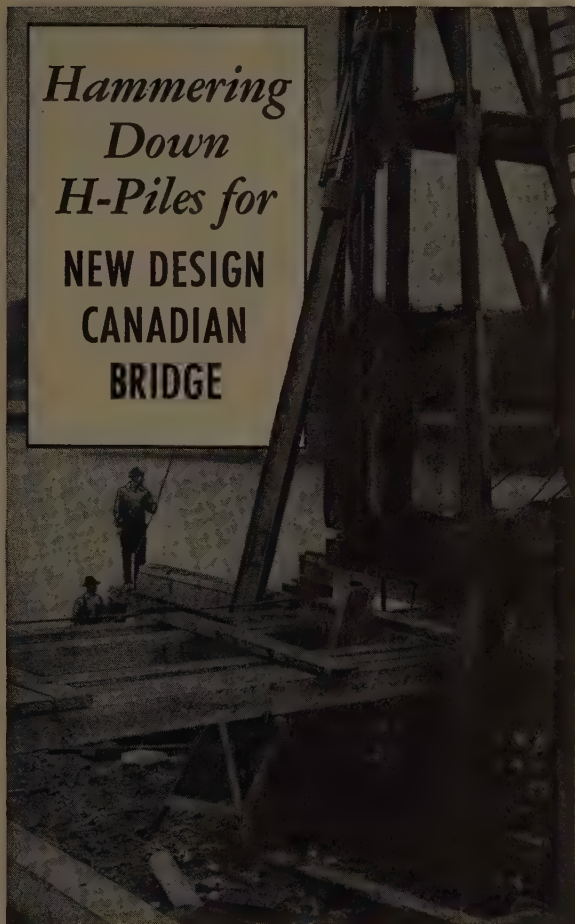
Sold in 1, 5, 30, 55 gal. sizes. Ready to use — no mixing. Applied easily by spraying, brushing, mopping or dipping.

Available at paint, hardware or building supply dealers.

BY-CHEMICAL PRODUCTS CO.

1355 Market Street • San Francisco 3, California

Hammering Down H-Piles for NEW DESIGN CANADIAN BRIDGE



A new bridge across the Stave River in British Columbia is the first of its type in the world. Its design results in less construction time and lower costs than required by conventional methods. Naturally, the contractor, Northern Construction Company & J. W. Stewart, Ltd., selected a McKiernan-Terry Double-Acting 9-B-type Hammer to drive the necessary H-piles.

Samples taken below the river bottom indicated that pile driving conditions were not ideal. Piles had to be driven to refusal in silt and varying layers of coarse and fine sand. The McKiernan-Terry Hammer, however, quickly drove 75-ft batter piles to desired penetration—with the piles projecting up into the Prepak-concrete which was used.

The complete McKiernan-Terry line includes 16 sizes of hammers and 2 sizes of extractors. Write for bulletin.



McKIERNAN-TERRY CORPORATION, MANUFACTURING ENGINEERS

16 PARK ROW, NEW YORK 38, N.Y.
Plants: Harrison, N. J. and Dover, N. J.

MK 317A

UNIT BID PRICES

Selected abstracts for Western projects

Tri-Dam Project—a constant-angle concrete arch dam, an earth- and rock-fill dam, and a concrete gravity dam.

California—Tri-Dam Project—Oakdale and South San Joaquin irrigation districts. Six schedules cover construction of Donnels, Beardsley and Tulloch dams, their powerhouses, and revisions to existing Goodwin Dam. The project was described on pages 64-65 of Western Construction, November 1952.

General Construction Co., Pacific Bridge Co., The Shea Co. (sponsor) and Henry J. Kaiser Co., 2801 W. Mission Rd., Alhambra, Calif., were low at \$8,201,567.44 on Schedule I (Donnels Dam), at \$7,119,487.21 on Schedule II (Donnels tunnel and penstocks), and at \$1,251,544.76 on Schedule III (Donnels powerhouse).

Winston Bros. Co. (sponsor) and Al Johnson Construction Co., 1532 S. California Ave., Monrovia, Calif., were low at \$7,926,673.00 on Schedule IV (Beardsley Dam and powerhouse).

Macco Corp., Morrison-Knudsen Co., Inc. (sponsor), and River Construction Corp., P. O. Box 450, Boise, Idaho, were low at \$6,557,202.25 on Schedule V (Tulloch Dam and powerhouse).

John C. Gist Co., 2909 C St., Sacramento, Calif., was low at \$218,680 on Schedule VI (revisions to Goodwin Dam).

The abstract of bids and unit bid prices follow:

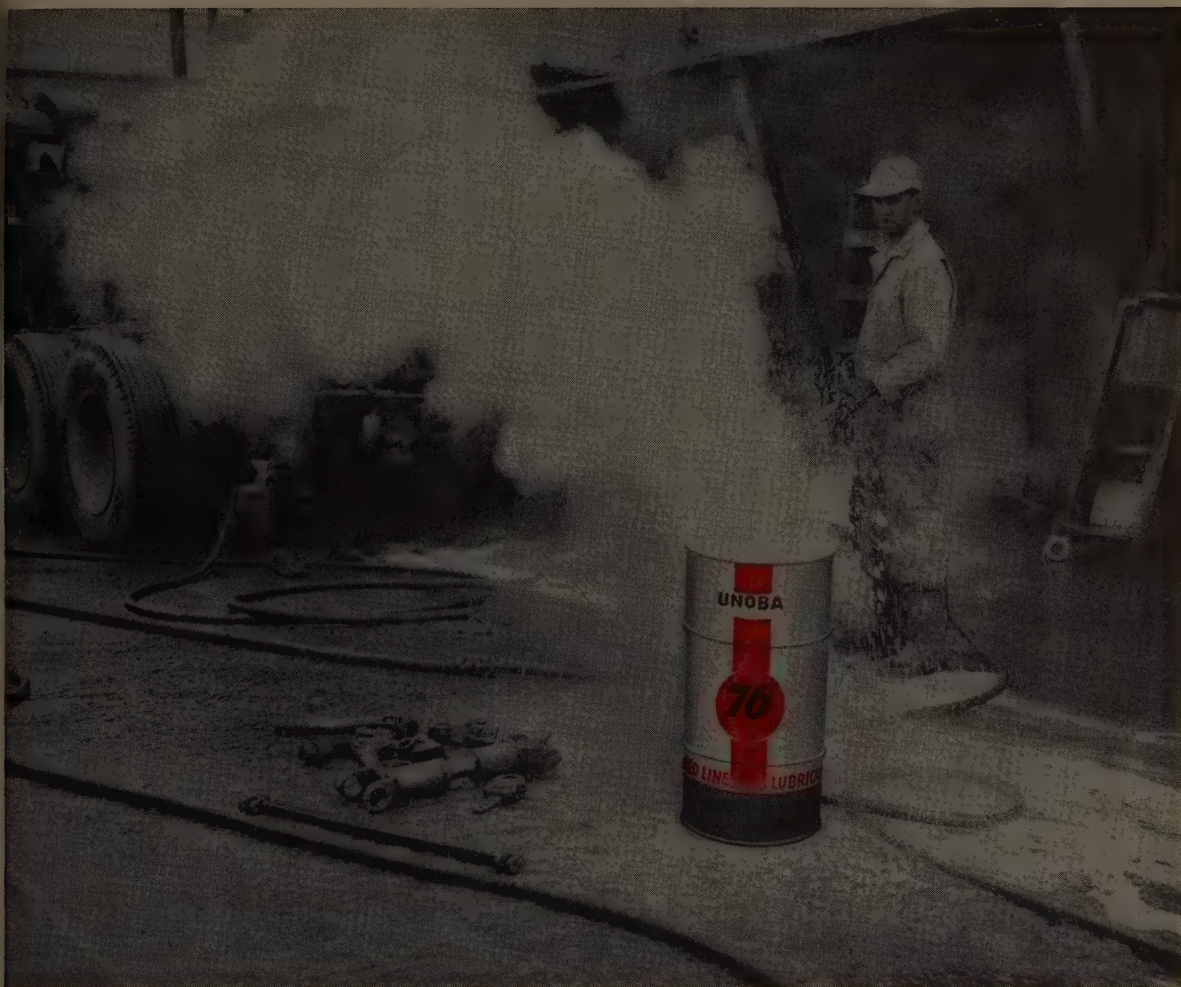
	SCHEDULE					
	I	II	III	IV	V	VI
(1) General Construction Co., Pacific Bridge Co., The Shea Co. (sponsor), and Henry J. Kaiser Co.						
Basic	\$ 8,669,733.02	\$ 7,525,885.00	\$ 1,322,986.00	No bid	\$ 6,972,570.00	\$ 276,353.00
(a) Revised	8,201,567.44	7,119,487.21	1,251,544.76	No bid	6,902,844.30	273,589.47
(b) Revised	8,218,906.90	7,134,538.98	No bid	No bid	No bid	No bid
(2) Winston Bros. Co. (sponsor), and Al Johnson Co.	No bid	No bid	No bid	7,926,673.00	6,637,320.00	No bid
(3) Macco Corp., Morrison-Knudsen Co., Inc. (sponsor), and River Construction Corp.	No bid	No bid	No bid	8,343,978.00	6,557,202.25	339,972.25
(4) John C. Gist Co.	No bid	No bid	No bid	No bid	No bid	218,680.00
(5) The Arundel Corp., L. E. Dixon Co., Guy F. Atkinson Co., and W. E. Kier Construction Co.						
Basic	8,916,552.70	9,140,792.00	1,439,500.00	8,669,000.00	7,516,150.00	295,000.00
Revised	8,381,559.54	8,592,344.48	1,439,500.00	8,669,000.00	7,516,150.00	295,000.00
(6) Utah Construction Co.	11,669,703.40	9,518,929.00	1,524,083.00	10,881,447.00	7,949,499.80	231,870.00
(7) Tri-Dam Associates (J. A. Jones Construction Co., Chas. H. Tompkins Co., S. A. Healy Co., and A. Teichert & Son, Inc.)	9,733,057.40	10,150,634.00	1,242,537.00	8,879,425.00	7,538,652.00	304,555.00
(8) Foley Bros. Inc., Donovan Construction Co. and C. F. Lytle Co.	No bid	No bid	No bid	No bid	7,594,388.00	248,000.00
(9) C. F. Lytle Co., Donovan Construction Co., and Foley Bros. Inc.	No bid	No bid	No bid	9,049,717.00	No bid	No bid
(10) T. E. Connolly, Inc., and Wunderlich Construction Co.	No bid	7,830,097.00	1,401,939.77	7,980,409.50	7,287,964.91	No bid
(11) Morrison-Knudsen Co., Inc., Peter Kiewit Sons' Co. and Macco Corp.	10,305,351.90	8,711,830.20	1,535,898.75	No bid	No bid	No bid
(12) Grate-Callahan Construction Co., Floyd Shofner, and David G. Gordon	No bid	9,887,615.00	No bid	No bid	8,633,359.75	No bid

STIPULATIONS:

- Basic bid for single award of any schedule.
- Revision (a) for award of Schedules 1, 2, 3 together (5.4% reduction) for award of Schedules 5, 6 together (1% reduction).
- Revision (b) for award of Schedules 1, 2 together (5.2% reduction).
- None
- None
- None
- Basic bid for single award of any schedule except Schedule 3, for award of Schedules 1, 2, 3 together, for award of all schedules together.
- Revision for award of all schedules except Schedule 3 (6% reduction on Schedules 1, 2 only).
- Basic bid for single award of any schedule except Schedule 6.
- Schedule 6 accepted only with Schedule 5.
- \$400,000 reduction for award of Schedules 1, 2 together.
- \$600,000 reduction for award of Schedules 1, 2, 3 together.
- \$950,000 reduction for award of Schedules 1, 2, 3, 4, 5 together.
- \$200,000 reduction for award of Schedules 1, 4 together, 1, 5 together, 2, 4 together, 2, 5 together, or 4, 5 together.
- All or none.
- Schedule 6 accepted only with Schedule 5.
- None
- Schedule 3 accepted only in conjunction with another schedule.
- All or none.
- Alternate bid submitted for Schedule 2, \$9,893,115.00. Will accept award of Schedule 2 or 3 alternate and Schedule 3 only in combination (sic).

	SCHEDULE I					
	(1)	(5)	(7)	(11)	(6)	
15,000 cu. yd. roadway excav. (repair exist. access rd. betw. Sta. 0+00 and Sta. 140+25).....	1.85	2.00	2.40	4.82	5.00	
21,700 cu. yd. roadway excav. (constr. access road betw. Sta. 140+25 and Sta. 172+50).....	1.70	2.25	2.60	3.29	6.00	
Lump sum, maintenance of access road betw. Sta. 0+00 and Sta. 172+50 for entire life of contract.....	\$30,800	\$75,000	\$77,000	\$95,400		
Lump sum, contractor's construction camp	\$320,000	\$400,000	\$481,500	\$461,000		
Lump sum, mobilization of excavating equipment.....	\$375,000	\$400,000	\$400,000	\$1,128,000		
Lump sum, establishment of concrete plant for dam construction	\$1,400,000	\$1,250,000	\$860,000	\$1,443,026		
Lump sum, river diversion and control	\$1,000,000	\$250,000	\$690,000			
50 M.B.M. decking merchantable logs	31.00	50.00	65.00	28.30	100.00	
41,000 cu. yd. Class I excav. for spillway	5.00	4.50	4.00	3.30	5.00	
2,700 cu. yd. Class II excav. for thrust block and retaining wall	5.00	10.00	6.50	3.30	6.00	
52,000 cu. yd. Class III excav. for arch dam above elevation 4630	6.00	7.50	6.30	5.02	8.70	
Lump sum, Class IV excav. of loose rock, sand, gravel, talus and boulders in stream bed below elev. 4630	\$1,490,000	\$800,000	\$500,000	\$1,155,000	\$1,903,000	
28,000 cu. yd. Class V excav. of solid rock for arch dam below elev. 4630	10.00	6.00	7.50	6.88	15.50	
600 lin. ft. drilling grout holes less than 25 feet deep	3.35	3.50	3.00	3.15	3.50	
1,600 lin. ft. drilling grout holes 25 to 40 feet deep	3.35	3.50	3.00	3.40	3.50	
1,950 lin. ft. drilling grout holes over 40 feet deep	3.35	3.50	3.00	3.40	3.50	
150 lin. ft. core drilling grout holes less than 25 feet deep	7.20	7.00	6.50	4.35	3.50	
550 lin. ft. core drilling grout holes 25 to 40 feet deep	7.20	7.00	6.50	4.60	3.50	
650 lin. ft. core drilling grout holes over 40 feet deep	8.10	8.00	7.00	6.20	6.50	
5,250 lb. furn. and installing pipe and fittings for foundation grouting	.84	1.00	.70	.60	1.00	
5,500 cu. ft. pressure grouting	3.25	4.00	3.00	5.85	2.50	
3,490 lin. ft. furn. and placing dumbbell shaped extruded water stops (where Type I conc. is used for all construction)	6.10	5.25	4.50	5.50	6.00	
13,580 cu. yd. Type I, Class "B" concrete in dam below elev. 4540	12.00	20.50	22.00	12.80	22.50	
30,370 cu. yd. Type I, Class "B" concrete in dam above elev. 4540 and below elev. 4630	11.00	16.50	22.50	13.90	23.50	
140,640 cu. yd. Type I, Class "B" concrete in dam above elev. 4630	10.00	18.00	24.00	14.00	24.25	
5,600 cu. yd. Type I, Class "B" concrete in thrust block and retaining wall	11.40	16.50	23.00	15.25	27.00	
3,800 cu. yd. Type I, Class "B" concrete in Ogee spillway	14.10	18.00	25.00	14.20	29.00	
475 cu. yd. Type I, Class "B" concrete in spillway apron	9.60	30.00	24.00	16.40	40.00	
50 cu. yd. Type I, Class "B" concrete in valve house and generator house	136.00	210.00	150.00	188.00	290.00	
180 cu. yd. Type I, Class "A" concrete in spillway bridge and ramp	93.50	110.00	120.50	198.00	175.00	
850 cu. yd. Type I, Class "A" concrete in spillway piers	28.00	55.00	57.00	51.50	68.00	
195,800 bbl. portland cement (where Type I concrete is used for all construction)	4.00	4.75	4.75	5.80	4.25	
67,320 lb. furn. and placing steel reinforcement	.136	.11	.12	.14	.12	
9,900 sq. ft. steel trowel finishing curved spillway crest and bucket	1.55	.60	.30	.37	.30	
23,300 sq. ft. wood float finishing flat top surfaces of concrete	.50	.20	.08	.19	.15	

(Continued on page 172)



How an empty barrel proved

UNOBA RESISTS STEAM!

"Last week I told one of my men to steam out an empty UNOBA barrel for use as a trash container. In about an hour he came back complaining that it couldn't be done. He had used the steam cleaner, with chemicals, for over 30 minutes without visible success. The UNOBA, though slightly lighter in color, was still clinging to the sides of the barrel, and still looked and felt good enough to use. You see,

we've been sold on Union's products by their performance."

In this unplanned "test," William Gardner, Equipment Superintendent for J. H. Welsh & Son, Contracting Company, of Phoenix, Arizona, proved again that UNOBA grease resists *extremes* of temperature and moisture.

Like other leading firms, Welsh & Son have found through experi-

ence that UNOBA's amazing ability to cling to metal gives outstanding protection against rust and corrosion. And multi-purpose UNOBA has saved them time and money by reducing grease inventories and eliminating the use of the wrong lubricants on expensive equipment.

Give *your* equipment and machines the dependable protection of multi-purpose UNOBA grease.

OFFICES: LOS ANGELES: Union Oil Building • NEW YORK: 45 Rockefeller Plaza • CHICAGO: 1612 Bankers Building
CINCINNATI: 2111 Carew Tower Building • NEW ORLEANS: 917 National Bank of Commerce Building

UNION OIL



COMPANY OF CALIFORNIA

UNIT BID PRICES... CONTINUED

	(1)	(5)	(7)	(11)	(6)
Lump sum, furnish and install trash rack, in place.....	\$4,570	\$5,000	\$4,700	\$6,100	\$3,200
Lump sum, furnish and install 20-in. and 48-in. embedded pipes for outlet works.....	\$12,500	\$15,000	\$12,500	\$17,440	\$8,200
Lump sum, furnish and install one 48-in. O. S. & Y. wedge gate valve, complete.....	\$9,750	\$20,000	\$16,000	\$15,680	\$14,000
Lump sum, furnish and install one 20-in. ring follower gate valve, complete.....	\$5,400	\$8,000	\$5,700	\$6,640	\$14,000
Lump sum, furnish and install one 48-in. free discharge butterfly valve, complete.....	\$17,600	\$30,000	\$21,000	\$23,460	\$19,500
Lump sum, furnish and install one 20-in. free discharge regulating valve, complete.....	\$17,400	\$24,000	\$12,000	\$9,780	\$16,000
1 each turn. and install 35-ft. x 19-ft. welded steel tainter gate, complete in operating condition.....	\$16,800	\$30,000	\$24,500	\$24,000	\$13,000
1 each turn. and install 144-in. x 70-in. Model 120 Armco radial gate with automatic control, complete in operating condition.....	\$2,400	\$2,500	\$2,350	\$3,600	\$2,500
Lump sum, furnish and install traveling gate hoist, complete in operating condition.....	\$16,510	\$18,000	\$7,500	\$18,500	\$13,500
Lump sum, furnish and install electrical work, complete in operating condition.....	\$19,100	\$4,000	\$13,750	\$19,200	\$15,000
1,560 lin. ft. furnish and install standard 2-in. post handrail, complete in place.....	7.10	9.00	5.00	8.25	4.00
690 lin. ft. furnish and install aerating 4-in. post handrail, complete in place.....	13.10	15.00	9.00	12.00	7.50
180 sq. ft. furnish and install galvanized grating with 1-in. x ½-in. bars.....	3.70	6.00	3.50	4.17	3.00
450 sq. ft. furnish and install galvanized grating with 1¾-in. x 3/16-in. bars.....	5.60	9.00	7.00	6.50	7.00
4,800 lb. furnish and install miscel. metal.....	.95	.80	.70	.71	.75

SCHEDULE II

	(1)	(10)	(11)	(5)	(6)	(12)	(7)
7,000 cu. yd. excav., uncl., in open cut at tunnel inlet.....	5.60	2.60	5.75	5.00	6.00	2.50	13.00
8,000 cu. yd. excav., uncl., in open cut at tunnel outlet.....	5.60	6.60	5.25	5.00	6.25	2.00	12.00
16,000 cu. yd. excav., common, for penstock.....	3.35	3.30	2.90	2.50	5.00	1.00	1.50
8,000 cu. yd. excav., rock, for penstock.....	9.00	5.50	5.65	5.00	8.25	3.10	6.50
100 cu. yd. excav., common, for penstock supports.....	5.60	20.00	6.20	5.00	7.50	9.00	5.80
600 cu. yd. excav., rock, for penstock supports.....	9.00	20.00	13.60	15.00	35.00	30.00	29.00
2,750 cu. yd. excav. of intake gate shaft and tunnel transitions.....	33.60	33.00	25.90	35.00	55.00	65.00	37.00
5,200 cu. yd. excav. of surge shaft.....	35.00	33.00	19.20	35.00	57.50	59.00	37.00
5,500 cu. yd. excav. in outlet end of tunnel.....	24.80	18.00	28.70	25.00	35.00	40.50	40.00
650 cu. yd. backfill.....	5.60	3.00	3.80	2.00	4.50	.80	3.50
4,000 lin. ft. drilling grout holes.....	3.30	4.00	4.00	2.50	3.50	5.60	4.00
4,000 cu. ft. pressure grouting.....	2.50	1.50	3.30	1.50	2.50	1.50	4.00
500 lin. ft. drilling holes for anchor bars.....	1.70	4.00	2.20	1.00	3.00	1.20	1.50
3,000 lb. placing anchor bars.....	.06	.20	.145	.15	.30	.25	.35
320 cu. yd. concrete in intake.....	50.70	48.00	51.60	85.00	86.00	80.00	160.00
1,600 cu. yd. conc. in intake gate shaft and transitions.....	56.00	52.00	38.60	75.00	70.00	90.00	68.00
200 cu. yd. concrete in hoist house.....	50.00	85.00	127.50	125.00	150.00	130.00	125.00
150 cu. yd. concrete in adit plugs.....	55.00	38.00	25.50	75.00	90.00	92.00	52.00
500 cu. yd. concrete in surge shaft.....	59.00	60.00	91.50	115.00	140.00	115.00	118.00
200 cu. yd. concrete in rock trap.....	49.00	40.00	63.60	78.00	100.00	130.00	95.00
2,800 cu. yd. concrete backfill around steel liner.....	48.60	36.00	26.40	60.00	45.00	40.00	42.00
100 cu. yd. concrete in butterfly valve house.....	53.00	85.00	142.00	145.00	150.00	190.00	147.50
1,000 cu. yd. concrete in penstock anchors and encasement.....	48.00	35.00	35.40	67.50	50.00	52.00	53.00
450 cu. yd. concrete in penstock supports.....	53.00	80.00	49.20	89.00	90.00	55.00	96.00
55,000 bbl. portland cement.....	4.75	4.00	5.62	4.20	4.00	5.50	5.00
450,000 lb. steel reinforcement—bars.....	2.25	2.00	11.60	3.40	6.00	10.00	11.00
7,000 lb. steel reinforcement—mesh.....	.11	.11	.1345	.125	.11	.20	.12
Lump sum, construction of Adit No. 1.....	\$71,300	\$220,000	\$133,000	\$150,000	\$250,000	\$200,000	\$107,500
Lump sum, construction of Adit No. 2.....	\$206,964	\$220,000	\$385,000	\$312,000	\$330,000	\$197,600	\$175,000
32,000 lin. ft. construction of unlined tunnel.....	142.80	146.00	158.95	176.00	161.00	165.00	189.00
2,400 lin. ft. construction of concrete lined tunnel.....	188.00	212.50	252.00	231.00	280.00	325.00	280.00
2,000 lin. ft. constr. of conc. lined tunnel with steel supports in mod. ground.....	170.00	244.00	280.00	246.00	325.00	380.00	332.00
150 lin. ft. constr. of conc. lined tunnel with steel supports in heavy ground.....	250.00	250.00	347.00	441.00	600.00	520.00	443.00
600 lin. ft. constr. of conc. lined tunnel with timber supports.....	215.00	253.00	298.00	291.00	360.00	400.00	406.00
450,000 lb. steel tunnel supports.....	.17	.11	.268	.188	.20	.25	.20
25,000 lb. roof bolts.....	.35	.10	.43	.42	.80	1.75	.80
30,000 FBM. timber supports.....	.25	.30	.43	.265	.55	.32	.35
36,000 lb. intake trashracks.....	.28	.20	.37	.20	.25	.50	.40
11,000 lb. intake gate transition liner.....	.37	.28	.48	.30	.34	.65	.50
60,000 lb. tunnel adit liners and bulkheads.....	.50	.28	.59	.33	.38	.55	.55
Lump sum, sand trap sluice valve.....	\$1,490	\$3,600	\$4,111	\$4,000	\$4,500	\$5,780	\$5,750
50,000 lb. miscel. steelwork and piping.....	.36	.70	.51	.42	.86	.80	.60
Lump sum, installing guides and frame for bulkhead.....	\$1,100	\$1,000	\$2,320	\$3,000	\$1,200	\$2,580	\$2,200
Lump sum, installing monorail and chain dog for bulkhead.....	308.00	400.00	493.00	200.00	250.00	730.00	440.00
Lump sum, installing bulkhead hoist.....	260.00	800.00	436.00	200.00	350.00	290.00	370.00
Lump sum, installing bulkhead.....	450.00	\$1,100	841.00	500.00	500.00	\$2,200	\$1,030
Lump sum, installing guides and frame for intake gate.....	\$3,500	\$1,300	\$3,115	\$2,750	\$2,200	\$5,700	\$5,200
Lump sum, installing intake gate.....	\$1,100	\$1,500	\$1,936	775.00	\$1,150	\$2,480	\$1,475
Lump sum, installing intake gate hoist.....	\$2,100	\$3,000	\$2,797	\$1,150	\$2,100	\$2,200	\$3,700
Lump sum, installing 96-in. butterfly valve.....	\$3,700	\$1,800	\$3,416	\$1,800	\$2,600	\$2,770	\$3,500
Lump sum, installing 96-in. butterfly valve operating system.....	\$1,450	\$2,500	\$1,653	\$1,250	\$1,200	\$1,478	\$1,750
Lump sum, installing reducer nipple down-stream of 96-in. butterfly valve.....	630.00	400.00	\$1,354	750.00	\$2,100	\$1,780	880.00
Lump sum, installing butterfly valve by-pass line and air valves.....	560.00	\$1,300	344.00	300.00	300.00	440.00	220.00
2,850,000 lb. installation of steel penstock.....	.056	.055	.05	.037	.053	.075	.06
470,000 lb. installation of steel plate tunnel liner.....	.056	.07	.08	.045	.09	.13	.12
Lump sum, constr. of intake gate hoist house, except concrete.....	\$3,400	\$2,400	\$2,550	\$2,600	\$2,500	\$6,330	\$2,950
Lump sum, constr. of butterfly valve house, except concrete.....	\$1,700	\$2,200	\$2,560	\$2,000	\$2,500	\$5,260	\$2,950
320 lb. storage battery.....	1.875	1.10	3.23	1.60	1.70	2.50	2.50
100 lb. battery charger.....	4.70	6.00	8.78	7.00	4.25	6.00	8.00
100 lb. exposed electrical metal conduit, 1¼ in. and smaller in diam.....	1.50	2.00	1.14	1.00	1.40	2.00	1.00
350 lb. embedded electrical metal conduit 1¼ in. and smaller in diam.....	1.30	2.00	1.01	1.10	1.20	1.50	.90
40 lb. 600-volt grade insul. elect. conductor, size No. 6 AWG and smaller.....	10.50	10.00	2.52	6.50	9.50	14.00	2.50
250 lb. lighting systems.....	1.60	3.50	3.57	4.50	1.50	2.00	2.00
220 lb. grounding systems.....	1.60	2.50	3.54	2.50	2.50	3.50	2.00
340 lb. installation of station-service switchgear.....	1.60	2.00	1.15	2.00	1.50	2.00	.85
Lump sum, installation of engine-driven generator.....	\$1,900	\$2,000	\$1,805	\$1,750	\$1,800	\$2,550	\$2,000

SCHEDULE III

	(7)	(1)	(10)	(5)	(6)	(11)
4,000 cu. yd. excav., common, for powerhouse.....	2.00	3.38	1.90	6.00	2.50	7.10
15,000 cu. yd. excav., rock, for powerhouse.....	5.75	4.40	5.00	11.00	10.00	7.10
20,000 cu. yd. rockfill.....	.70	.41	3.10	1.10	3.00	1.35
100 cu. yd. screened gravel or crushed rock.....	10.50	8.00	5.00	18.00	27.50	14.50
1,750 sq. yd. waterbound gravel surfacing.....	2.00	1.60	1.05	2.00	3.80	1.89
1,100 sq. yd. gravel surfacing.....	2.50	1.51	.25	2.00	4.00	2.45
150 lin. ft. wire cable guard rail.....	6.00	5.94	3.10	7.50	10.00	5.90
1,800 cu. yd. concrete in powerhouse substructure.....	66.50	38.33	62.50	60.00	93.00	76.50
1,450 cu. yd. concrete in powerhouse intermediate structure.....	109.00	74.70	65.50	120.00	120.00	121.50
600 cu. yd. concrete in powerhouse superstructure.....	175.00	275.14	87.00	220.00	300.00	223.00
750 cu. yd. second stage concrete in powerhouse.....	74.00	114.22	78.00	87.00	134.00	80.00
50 cu. yd. concrete in equipment bases and blockouts.....	99.00	286.60	120.00	150.00	200.00	124.50

(Continued on page 174)

Stop run-away costs...

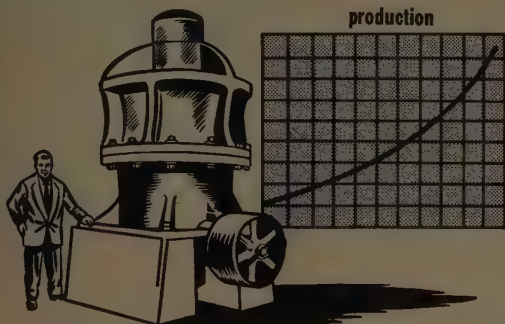


with
the right
equipment



The Traylor TY Crusher's compact design, non-chokable Bell Head, and curved concaves, assure maximum efficiency for producing aggregate on the job.

production



Compare a Traylor TY's tonnage per horse power. Check its low maintenance costs with any other secondary crusher and you'll agree . . .



There's no need to buck high aggregate costs today. A Traylor TY insures EXTRA profits through increased efficiency.



Traylor

LEADS TO GREATER PROFITS

TRAYLOR TY Reduction Crushers cut aggregate costs 3 ways:

- Lower Power Costs per ton
- Produce a more uniform, cubical product
- Reduce Waste Fines to a minimum

Send me the full story on how a Traylor TY will stop "run-away costs" for me.

Name: _____

Position: _____

Company: _____

Address: _____ State: _____

TRAYLOR ENGINEERING & MANUFACTURING CO.

548 MILL ST., ALLENTOWN, PA.

West Coast Br.: 607 Sharon Bldg., 55 New Montgomery St., San Francisco 5, Calif.
Northwest Distr.: Balzar Machinery Co., 2136 Southeast 8th Ave., Portland, Ore.



Primary Gyratory Crushers



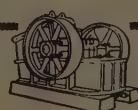
Rotary Kilns



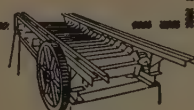
Secondary Gyratory Crushers



Ball Mills



Jaw Crushers



Apron Feeders

UNIT BID PRICES CONTINUED

	(7)	(1)	(10)	(5)	(6)	(11)
25 cu. yd. concrete fill in generator floor.....	74.00	118.40	90.00	130.00	95.00	83.50
3,800 sq. ft. bonded concrete floor finish.....	.55	.61	2.50	1.00	1.25	1.32
300 cu. yd. concrete in switchyard and yard area.....	\$65.50	\$191.54	47.00	105.00	117.00	149.00
8,000 bbl. portland cement.....	5.00	5.28	5.20	4.30	4.00	6.05
600,000 lb. steel reinforcement bars.....	.12	.11	.13	.14	.11	.141
1,000 lb. steel reinforcement mesh.....	.30	.24	.26	.22	.30	.17
160 sq. yd. membrane waterproofing.....	2.75	2.00	2.50	4.00	8.00	4.25
1,300 sq. ft. cork-tar mastic.....	2.00	1.39	.19	1.25	5.00	1.40
1,700 concrete block masonry.....	1.25	1.23	1.25	2.00	3.50	2.30
85 sq. yd. two-coat gypsum plaster.....	7.00	2.40	3.10	6.00	6.00	7.40
35 sq. yd. three-coat gypsum plaster including metal lath.....	10.00	5.80	4.70	8.00	8.00	7.90
30 sq. yd. two-coat cement plaster.....	9.00	3.50	3.75	6.00	6.00	7.40
35 sq. yd. three-coat cement plaster, including metal lath.....	12.00	5.80	5.00	9.00	8.00	7.90
35 sq. yd. suspended ceiling constr., excluding metal lath and plaster.....	7.00	8.20	4.40	6.00	8.00	9.95
10 sq. yd. ¼-in. steel channel furring, excluding metal lath and plaster.....	12.00	4.60	3.75	13.00	5.00	4.90
30 sq. yd. four-inch steel studs in place with runner channels, but excluding metal lath and plaster.....	6.00	10.50	4.69	6.00	6.00	14.75
700 sq. ft. acoustical tile ceiling.....	.90	2.28	.56	1.50	2.00	4.95
1,225 sq. ft. perforated asbestos board.....	.60	1.28	.375	1.40	1.40	1.95
1,050 sq. ft. asphalt tile flooring.....	.60	.70	.83	.50	1.00	1.20
1,625 lin. ft. rubber base.....	.60	.96	1.50	1.00	2.00	.85
160 sq. ft. ceramic tile.....	4.00	2.90	2.20	3.50	3.00	3.30
Lump sum, metal doors, frames and hardware.....	\$7,350	\$7,267	\$7,088	\$6,000	\$6,500	\$5,050
Lump sum, steel windows.....	\$2,850	\$4,404	\$7,800	\$5,000	\$4,500	\$3,295
Lump sum, glass and glazing.....	\$1,050	\$1,275	\$4,500	\$1,500	\$1,500	\$2,000
6,600 sq. ft. roofing.....	.55	.32	.38	.65	.40	.80
Lump sum, sheet metal.....	\$2,100	\$2,434	\$3,100	\$2,400	\$2,500	\$2,500
Lump sum, toilet partitions, steel lockers and bathroom accessories.....	850.00	464.00	\$1,100	700.00	750.00	\$1,223
Lump sum, carpentry.....	800.00	\$1,507	320.00	900.00	\$5,000	\$1,690
11,500 sq. ft. floor hardener.....	.07	.03	.06	.05	.15	.82
Lump sum, painting of powerhouse.....	\$5,650	\$4,806	\$13,800	\$5,000	\$5,000	\$6,380
350,000 lb. structural steel powerhouse frame.....	.26	.19	.21	.20	.20	.28
350 lin. ft. switchyard fence.....	5.00	6.80	6.25	15.00	5.00	6.00
35,000 lb. transformer tracks.....	.28	.39	.21	.22	.15	.37
20,000 lb. miscellaneous metalwork.....	.60	1.15	.53	.55	.75	.52
Lump sum, raw water and fire protection systems.....	\$35,000	\$54,352	\$69,000	\$50,000	\$50,000	\$54,000
Lump sum, transil and lubricating oil systems.....	\$20,000	\$21,832	\$29,800	\$20,000	\$18,500	\$23,000
Lump sum, compressed air and CO ₂ systems.....	\$25,000	\$14,067	\$21,300	\$20,000	\$13,750	\$19,000
Lump sum, plumbing and drainage systems.....	\$25,000	\$16,657	\$34,400	\$30,000	\$15,250	\$22,500
Lump sum, additional mechanical facilities.....	\$8,500	\$2,816	\$11,500	\$6,000	\$6,000	\$7,400
Lump sum, installing turbine shutoff valve.....	\$11,000	\$14,100	\$12,500	\$7,500	\$9,000	\$11,650
Lump sum, installing shutoff valve operating system.....	850.00	\$1,275	\$6,250	\$1,500	\$1,900	\$1,550
Lump sum, installing shutoff valve bypass line.....	550.00	\$1,567	\$1,875	830.00	\$1,000	\$1,500
Lump sum, installing turbine tailrace liner.....	275.00	765.00	178.00	700.00	500.00	620.00
Lump sum, installing turbine and governor.....	\$14,900	\$5,214	\$23,800	\$23,000	\$6,500	\$7,075
Lump sum, installing turbine flow meters.....	\$66,500	\$69,930	\$176,000	\$75,000	\$41,500	\$92,000
Lump sum, installing powerhouse crane.....	850.00	\$1,727	\$4,650	900.00	\$1,000	\$1,915
6,200 lb. station battery.....	\$24,750	\$23,875	\$35,400	\$37,700	\$23,000	\$41,250
1,250 lb. battery chargers.....	1.50	1.41	1.43	1.30	1.50	2.80
650 lb. lighting transformer.....	3.20	2.48	2.50	2.70	4.00	5.30
10,500 lb. exposed electrical metal conduit, 1¼-in. and smaller in diam.....	1.80	1.66	1.77	1.60	1.50	2.75
16,500 lb. exposed electrical metal conduit, larger than 1¼-in. in diam.....	1.00	1.22	1.25	.85	1.05	1.30
300 lb. embedded electrical metal conduit, 1¼-in. and smaller in diam.....	.75	.93	.94	.65	.80	1.00
2,500 lb. embedded electrical metal conduit, larger than 1¼-in. in diam.....	.60	.77	.84	.95	.70	1.00
700 lin. ft. electrical non-metallic conduit.....	1.00	1.09	1.20	.95	1.00	1.00
1,800 lb. 600-volt grade insulated electrical conductor, size No. 6 AWG and smaller.....	2.50	4.06	4.10	1.80	3.50	2.65
1,200 lb. 600-volt grade insulated electrical conductor, size No. 4 to No. 4/0 AWG inclusive.....	1.60	2.26	2.22	1.55	1.80	1.90
6,200 lb. 600-volt grade insulated electrical conductor, size 250,000 circular mils and larger.....	1.70	1.44	1.47	1.40	1.20	2.00
50 lb. 15-kw shielded single-conductor generator neutral leads.....	4.00	1.48	1.58	4.30	1.30	4.50
30 lb. indoor-type multiple-conductor electrical telephone cable.....	10.50	7.00	7.53	5.80	6.50	9.70
30 lb. outdoor-type multiple-conductor electrical telephone cable.....	1.40	3.80	4.11	5.80	4.00	2.10
3,000 lb. multiple-conductor 600-volt grade insulated electrical control cable.....	3.20	3.19	3.27	3.25	2.70	3.25
1,650 lb. parkway-type cable.....	.94	1.56	1.60	1.28	1.50	1.50
6 lin. ft. insulation of high-tension conductors.....	45.00	25.00	13.25	55.00	11.00	38.00
11,500 lb. lighting system in powerhouse and switchyard.....	2.10	2.20	2.21	1.90	1.80	2.80
2,000 lb. grounding systems.....	1.90	3.91	4.13	1.85	3.50	4.00
Lump sum, telephone equipment.....	\$4,800	\$2,756	\$2,723	\$2,100	\$2,300	\$5,400
8,000 lb. metal support for conduit and cable trays.....	1.50	2.41	2.45	1.50	2.00	1.55
550 lb. metal cable trays.....	1.50	1.66	1.79	1.30	1.50	1.55
Lump sum, installing high-tension cubicles.....	\$1,100	\$1,960	\$2,000	\$2,800	\$1,700	\$1,630
120 lin. ft. installing metal-enclosed bus.....	8.50	62.30	63.00	47.00	5.20	7.50
Lump sum, installing 13.8-kv air-blast circuit breaker.....	700.00	\$1,612	\$1,600	\$1,500	\$1,400	875.00
Lump sum, installing power transformers and lightning arrestors.....	\$5,600	\$20,797	\$21,000	\$21,000	\$17,000	\$5,700
Lump sum, installing 115-kv switchgear.....	\$3,500	\$10,278	\$10,300	\$3,000	\$8,300	\$4,420
Lump sum, installing 115-kv conductors, insulators, and devices.....	\$1,500	\$2,349	\$2,400	\$1,800	\$2,000	\$1,630
Lump sum, installing metal-enclosed duplex switchboard.....	\$1,200	\$2,090	\$2,130	\$2,000	\$1,750	\$1,575
Lump sum, installing carrier-current communication equipment.....	200.00	\$7,209	780.00	\$1,000	700.00	650.00
1,800 lb. installing supervisory control equipment.....	.13	.58	.64	.55	.56	.37
15,000 lb. installing station service unit substation.....	.06	.24	.25	.15	.25	.20
9,000 lb. installing station service switchgear.....	.30	.29	.30	.40	.25	.40
Lump sum, installing engine-driven generator.....	\$2,850	\$2,257	\$2,310	\$4,200	\$2,000	740.00
11,000 lb. erecting steel structures in switchyard.....	.30	.19	.20	.20	.17	.33
Lump sum, main generator work, except erection.....	\$28,300	\$47,467	\$18,250	\$15,000	\$24,000	\$26,800

SCHEDULE IV

	(2)	(10)	(5)	(3)	(7)	(9)	(6)
Lump sum, care of river and unwatering at Beardsley dam.....	\$120,000	\$50,000	\$341,146	\$150,000	\$161,100	\$190,636	\$465,000
200 acre clearing and grubbing Beardsley dam.....	\$40.00	325.00	200.00	300.00	340.00	\$1,000	400.00
410,000 cu. yd. excav., common, for foundation of Beardsley dam.....	.95	.64	.50	.95	.54	.60	.85
45,000 cu. yd. excav., rock, for foundation of Beardsley dam.....	2.50	4.40	7.00	2.65	4.35	1.80	4.00
110,000 cu. yd. excav., common, for abutments of Beardsley dam.....	.95	.90	1.75	2.54	1.00	.60	1.30
94,000 cu. yd. excav., rock, for abutment of Beardsley dam.....	2.50	1.80	2.90	2.54	4.35	1.93	3.10
15,000 cu. yd. excav., uncl., for permanent dam access road.....	2.00	1.65	1.90	2.73	1.75	.71	2.65
15,000 cu. yd. excav., uncl., in borrow pit for permanent dam access road.....	1.00	1.25	.70	2.73	1.75	.79	1.80
2,500 cu. yd. excav., common, for tunnel portals and tailrace.....	2.60	.62	2.50	4.20	1.80	.55	1.40
25,000 cu. yd. excav., rock, for tunnel portals, powerhouse and tailrace.....	2.60	2.20	2.50	4.20	4.35	2.72	5.00
160,000 cu. yd. excav., common, for spillway.....	.80	.50	.55	2.00	.80	.54	1.25
285,000 cu. yd. excav., rock, for spillway.....	2.20	1.90	3.00	2.00	2.00	1.88	3.10
51,000 cu. yd. excav., common, for railroad relocation.....	.80	.60	.80	1.50	.80	.86	1.00
20,000 cu. yd. excav., rock, for railroad relocation.....	1.90	1.70	2.80	1.50	2.00	2.70	3.50

(Continued on page 176)



OWEN

The Universally Popular

BUCKETS

ARE IDEALLY ADAPTED TO ALL
KINDS AND MAKES OF CRANES

There are dozens of types and kinds of cranes—each with its own features but *one* outstanding clamshell bucket.

Observe these various machines in action and you'll find an impressively large percentage of them equipped with Owen Buckets.

This preference has been gained through years of unequalled digging ability, speed of operation and durability.

You can obtain an Owen Bucket from us exactly suited to your present crane or have it delivered as a part of the complete crane unit.

For the utmost in performance and service *on any crane* investigate and purchase an Owen Bucket. Write for the Owen Catalog.

"A MOUTHFUL



AT EVERY BITE"

THE OWEN BUCKET CO.

6060 Breakwater Avenue • Cleveland 2, Ohio

Branches:

New York, Philadelphia, Chicago, Berkeley, Calif.

UNIT BID PRICES . . . CONTINUED

	(2)	(10)	(5)	(3)	(7)	(9)	(6)
7,100 cu. yd. excav., uncl., for powerhouse access road	1.90	1.35	3.00	3.30	2.00	.91	3.00
4,200 cu. yd. excav., in tunnel and shaft for structs.	30.00	26.00	36.00	30.00	25.00	40.00	53.00
20,000 cu. yd. compacted fill	.87	.70	.80	1.40	.75	2.27	2.30
600 cu. yd. dumped riprap	1.30	1.00	6.00	2.00	2.00	1.50	6.00
620 cu. yd. screened gravel or crushed rock	7.00	3.50	11.00	4.00	7.30	7.70	10.00
8,100 sq. yd. waterbound gravel surfacing	.70	3.50	1.30	.85	1.50	1.04	2.50
400 sq. yd. gravel surfacing	.80	3.50	1.70	1.00	2.00	1.04	1.50
170 lin. ft. 18-in. corrugated metal pipe	6.50	5.00	15.00	2.80	5.50	9.00	6.00
450 lin. ft. 24-in. corrugated metal pipe	9.50	7.00	18.00	14.00	9.00	14.00	8.00
300 lin. ft. 36-in. corrugated metal pipe	18.00	13.00	24.00	24.00	16.00	25.79	15.00
310 lin. ft. wire cable guard rail	3.40	4.50	7.50	5.00	3.00	6.80	4.00
14,000 FBM. timber guard rail and roadway planking	.30	.45	.50	.30	.40	.86	.40
16,000 lin. ft. drilling "A" grout holes	3.70	2.40	4.60	3.75	3.00	2.90	3.50
1,000 lin. ft. drilling "B" and "C" grout holes	3.70	3.10	4.40	3.95	3.50	2.90	3.50
16,000 cu. ft. pressure grouting	3.00	1.20	1.75	2.05	3.00	2.20	2.50
5,000 lb. grout pipe	.50	.50	1.20	.60	.60	2.27	1.50
7,500 lin. ft. 6-in. sewer pipe drain with uncemented joints	1.40	1.60	3.50	.70	3.50	1.95	1.50
1,450 lin. ft. 8-in. sewer pipe drain with uncemented joints	1.70	2.20	5.00	1.00	3.50	2.50	2.00
450 lin. ft. 12-in. sewer pipe drain with uncemented joints	2.70	3.20	6.00	2.00	3.50	4.40	3.00
2,400 lin. ft. split tile drains with cemented joints	1.90	4.00	4.50	2.00	4.50	5.90	3.00
400 cu. ft. porous concrete	.85	15.00	3.00	10.00	4.00	5.68	2.00
20,000 lin. ft. drilling holes for anchor bars	.95	1.00	1.35	1.50	1.20	1.56	1.50
170,000 lb. placing anchor bars	.11	.20	.18	.14	.20	.20	.25
900,000 sq. ft. preparation of embankment foundation	.03	.10	.15	.10	.13	.20	.13
250,000 cu. yd. stripping borrow area	.26	.22	.35	.30	.36	.34	.35
800,000 cu. yd. earth fill for impervious transition zones in embankment	.57	.46	.59	.80	1.07	.77	1.05
1,900,000 cu. yd. sand, gravel and cobbles in embankment	.37	.57	.41	.70	.67	.66	.88
15,000 cu. yd. special compaction of earth fill in impervious and transition zones	3.70	5.00	5.50	4.30	2.70	5.22	4.00
510,000 cu. yd. rock fill in embankment	2.60	3.00	6.00	4.30	2.70	4.43	3.00
5,500 cu. yd. concrete in spillway crest and skimmer gate apron	.61	.38	.25	.47	.40	.84	.88
2,500 cu. yd. concrete in spillway piers	38.00	41.00	48.00	38.00	44.00	43.00	45.00
1,700 cu. yd. concrete in spillway right abutment wall	32.00	41.00	35.00	34.00	34.50	33.30	42.00
2,100 cu. yd. concrete in spillway left abutment wall	32.00	41.00	30.00	31.00	33.50	34.00	42.00
900 cu. yd. concrete in approach channel counterfort wall	83.00	60.00	70.00	108.00	86.00	94.80	88.00
45 cu. yd. concrete in spillway gate hoist deck	110.00	50.00	175.00	210.00	138.00	250.00	215.00
350 cu. yd. concrete fill below spillway chute floor slab	35.00	26.00	39.00	38.00	34.00	25.50	40.00
5,800 cu. yd. concrete in spillway chute floor slab	32.00	36.00	39.00	25.00	32.50	33.20	35.00
5,000 cu. yd. concrete in spillway chute walls	47.00	44.00	45.00	40.00	43.00	52.40	50.00
180 cu. yd. concrete in tunnel portal structures	87.00	40.00	105.00	90.00	76.50	109.00	105.00
40 cu. yd. concrete in intake trashrack structure	10.00	50.00	175.00	150.00	150.00	143.00	215.00
150 cu. yd. concrete in intake shaft lining	82.00	66.00	120.00	80.00	109.00	136.00	125.00
90 cu. yd. concrete in hoist and generator house	155.00	73.00	200.00	200.00	158.00	159.00	250.00
500 cu. yd. concrete in intake gate shaft above rock surface	63.00	60.00	60.00	65.00	55.00	122.00	100.00
1,900 cu. yd. concrete in intake gate shaft lining and transitions	63.00	66.00	88.00	45.00	52.00	122.00	62.00
350 cu. yd. concrete in diversion bypass	40.00	66.00	37.00	40.00	44.00	61.00	53.00
40 cu. yd. concrete in penstock piers	100.00	110.00	90.00	210.00	114.00	120.00	200.00
450 cu. yd. concrete in penstock and control valve encasement	38.00	63.00	45.00	30.00	40.00	47.00	70.00
20 cu. yd. concrete in outlet valve structure and access stairway	110.00	125.00	165.00	200.00	127.00	113.00	150.00
500 cu. yd. concrete in Beardsley dam foundation fill	27.00	27.00	30.00	80.00	27.50	26.00	35.00
2,000 cu. yd. concrete in powerhouse substructure	41.00	41.00	48.00	35.00	42.00	38.40	50.00
420 cu. yd. concrete in powerhouse intermediate structure	106.00	65.00	115.00	80.00	114.00	115.00	125.00
420 cu. yd. concrete in powerhouse superstructure	130.00	40.00	190.00	120.00	150.00	211.00	210.00
585 cu. yd. second stage concrete in powerhouse	50.00	62.00	50.00	35.00	45.00	73.00	70.00
12 cu. yd. concrete in equipment bases and blockouts	185.00	110.00	150.00	200.00	74.00	120.00	125.00
15 cu. yd. concrete fill in floor	62.00	66.00	150.00	70.00	44.00	89.00	55.00
300 sq. yd. bonded concrete floor finish	2.00	3.00	7.50	7.00	4.50	4.72	4.00
220 cu. yd. concrete in switchyard and yard area	51.00	45.00	90.00	30.00	59.00	67.00	70.00
210 cu. yd. concrete in tailrace retaining wall	38.00	48.00	50.00	30.00	41.00	44.00	45.00
60,000 bbl. portland cement	4.70	4.50	4.75	4.35	4.90	5.00	4.25
2,000 sack gunite	5.50	3.35	12.00	10.00	10.00	4.00	4.00
2,000,000 lb. steel reinforcement—bars	.115	.12	.135	.12	.12	.12	.11
1,000 lb. steel reinforcement—mesh	.14	.30	.22	.20	.26	.45	.20
1,250 lin. ft. construction of lined tunnel, unsupported	350.00	519.00	275.00	320.00	370.00	315.00	450.00
200 lin. ft. construction of lined tunnel, supported	440.00	551.00	400.00	350.00	425.00	355.00	550.00
45,000 lb. steel tunnel supports	.17	.14	.40	.18	.24	.20	.20
2,350 lin. ft. laying railroad track and deck on spillway bridge	11.00	11.00	15.00	16.00	20.00	25.00	15.00
225 lin. ft. laying railroad track and deck on spillway bridge	40.00	108.00	53.00	15.00	56.00	86.00	60.00
100 lin. ft. laying transformer transfer track on ties	14.00	19.00	13.00	20.00	13.00	31.80	15.00
4,000 lb. steel water seals	.40	2.20	.90	.50	.60	.43	1.50
1,000 lb. copper water seals	1.00	2.60	1.50	2.00	2.00	3.06	2.00
103 sq. ft. preformed expansion joint filler	.75	2.10	1.50	2.00	1.25	1.36	3.00
500 sq. ft. cork-tar mastic	.80	1.70	1.50	.70	2.00	1.10	2.00
550 sq. yd. dampproofing	.90	1.60	3.00	1.50	1.00	1.00	4.00
3,300 sq. ft. concrete block masonry	2.00	1.35	1.60	2.70	1.25	1.00	2.00
85 sq. yd. two-coat gypsum plaster	2.60	2.50	7.00	4.00	7.00	2.40	6.00
50 sq. yd. three-coat gypsum plaster including metal lath	7.50	3.75	10.00	5.00	9.00	4.00	8.00
60 sq. yd. two-coat cement plaster	2.70	3.00	7.50	4.00	8.00	2.00	6.00
60 sq. yd. three-coat cement plaster including metal lath	5.50	4.00	10.00	5.00	12.00	3.50	6.00
75 sq. yd. suspended ceiling construction excluding metal lath and plaster	3.40	3.50	8.00	5.00	7.00	2.20	8.00
15 sq. yd. ¾-in. steel channel furring excluding metal lath and plaster	1.60	3.00	16.00	4.00	12.00	2.20	5.00
40 sq. yd. 4-in. steel studs in place with runner channels, but excluding metal lath and plaster	9.00	3.75	7.50	10.00	6.00	4.50	6.00
700 sq. ft. acoustical tile ceiling	2.10	.65	1.30	1.50	.90	1.10	2.00
1,200 sq. ft. perforated asbestos board	1.80	.45	1.20	1.70	.60	.85	1.00
1,000 sq. ft. asphalt tile flooring	.30	1.30	.65	.90	.60	.60	1.00
500 lin. ft. rubber base	.70	1.75	1.00	.70	.60	.85	1.50
275 sq. ft. ceramic tile	4.40	2.45	4.20	2.00	4.00	2.20	3.00
Lump sum, metal doors, frames and hardware	\$5,500	\$3,780	\$4,500	\$3,650	\$6,700	\$5,000	\$6,000
Lump sum, steel windows	\$1,200	\$4,510	\$2,500	\$2,750	\$1,600	\$2,000	\$3,000
Lump sum, glass and glazing	\$1,800	\$2,260	\$1,000	\$1,580	\$700	\$1,300	\$1,200
5,000 sq. ft. roofing	.27	.34	.50	.65	.50	.44	.40
Lump sum, sheet metal	\$2,400	\$2,500	\$1,750	\$1,940	\$2,000	\$1,500	\$1,300
Lump sum, toilet partitions, steel lockers, and bathroom accessories	\$1,200	\$1,113	\$1,000	\$1,550	\$1,200	700.00	\$750.00
Lump sum, carpentry	\$2,400	250.00	750.00	\$1,670	600.00	600.00	730.00
6,850 sq. ft. floor hardener	.04	.20	.04	.50	.06	.10	.02
Lump sum unit kitchen	900.00	\$2,016	650.00	800.00	900.00	\$1,200	\$1,250
Lump sum, painting of powerhouse	\$11,500	\$13,750	\$3,100	\$4,500	\$5,400	\$3,000	\$6,000
115,000 lb. structural steel powerhouse frame	.18	.20	.29	.38	.24	.41	.20
38,000 lb. intake trashracks	.32	.35	.45	.33	.40	.28	.30
18,500 lb. intake gate transition liner	.43	.45	.60	.38	.40	.28	.60
280 lin. ft. switchyard fence	5.50	7.00	7.50	4.50	4.50	11.00	4.00
137,000 lb. spillway railroad bridge steelwork	.18	.20	.29	.30	.24	.25	.20

(Continued on page 178)

**For all-round economy,
specify "Century"
asbestos-cement pipe**

"Century" pipe, 4" Class 150,
ready for laying in trench in
Oakland, Oklahoma.

Every community is interested in saving money—which is why so many decide on water mains of "Century" pressure pipe!

Right from the first this sturdy piping helps keep costs low. Because it is light and easy to handle, work crews move and lay it more efficiently. The Simplex Coupling allows curves to be made economically and quickly up to five degrees at each joint.

And as the years pass, "Century" pipe stays economical. It keeps on serving at full flow longer because it cannot rust, will not tuberculate, and actually grows stronger with age!

If you should like more information about this economical pipe, write for your free copy of "Mains Without Maintenance"—an authoritative booklet containing data of value to anyone interested in water main pipes. Write today!



KEASBEY & MATTISON
COMPANY • AMBLER • PENNSYLVANIA

Nature made asbestos . . .
Keasbey & Mattison has made
it serve mankind since 1873



UNIT BID PRICES CONTINUED

	(2)	(10)	(5)	(3)	(7)	(9)	(6)
10,000 lb. transformer transfer track rails	.17	.14	.30	.39	.25	.15	.15
60,000 lb. miscellaneous metalwork	.60	.53	.70	.70	.60	.50	.75
Lump sum, raw water and fire protection systems	\$23,000	\$55,700	\$37,500	\$14,000	\$17,450	\$52,000	\$36,000
Lump sum, transil and lubricating oil systems	\$14,000	\$25,400	\$30,000	\$25,000	\$13,400	\$26,000	\$21,000
Lump sum, compressed air and CO ₂ systems	\$9,000	\$14,200	\$15,000	\$14,200	\$12,100	\$13,000	\$11,000
Lump sum, plumbing and drainage systems	\$11,000	\$40,600	\$30,000	\$25,400	\$9,400	\$24,000	\$28,000
Lump sum, treated water system	\$5,500	\$6,500	\$15,000	\$4,300	\$10,750	\$5,000	\$4,000
Lump sum, additional mechanical facilities	\$19,000	\$6,870	\$3,750	\$5,500	\$4,100	\$10,000	\$5,000
Lump sum, installing guides and frames for bulkhead	\$1,300	\$3,814	\$2,250	\$2,000	\$1,675	\$12,099	\$1,300
Lump sum, installing monorail and chain dog for bulkhead	390.00	270.00	1,125	350.00	540.00	1,021	300.00
Lump sum, installing bulkhead hoist	620.00	250.00	\$2,250	750.00	400.00	1,021	350.00
Lump sum, installing bulkhead	700.00	\$1,550	\$1,500	\$3,000	\$1,000	\$1,475	600.00
Lump sum, installing guides and frame for intake gate	\$3,450	\$3,258	\$5,250	\$4,500	\$3,700	\$14,782	\$2,500
Lump sum, installing intake gate	\$2,200	\$3,032	\$3,000	\$3,000	\$1,600	\$4,086	\$1,300
Lump sum, installing intake gate hoist	\$2,200	\$1,620	\$3,000	\$5,500	\$3,000	\$2,724	\$2,500
Lump sum, installing and removing constr. alterations to intake gate and frame	\$1,060	\$2,220	\$1,500	\$1,200	\$1,880	\$2,950	\$1,000
Lump sum, installing tainter gate anchorages, sills and side plates	\$8,900	\$4,400	\$19,000	\$10,000	\$13,400	\$16,360	\$7,500
Lump sum, installing tainter gate hoist bridge frames	\$2,800	\$4,950	\$3,000	\$9,000	\$4,000	\$5,800	\$6,000
Lump sum, installing tainter gates	\$38,000	\$34,650	\$85,000	\$35,000	\$53,700	\$59,837	\$40,000
Lump sum, installing tainter gate hoists	\$8,200	\$8,800	\$12,000	\$10,000	\$13,400	\$15,486	\$10,000
Lump sum, installing skimmer gate guides, frame and seals	760.00	605.00	1,125	\$2,200	\$1,075	\$1,262	\$1,200
Lump sum, installing skimmer gate seats and lift supports	840.00	550.00	\$1,500	\$1,000	130.00	375.00	250.00
Lump sum, installing skimmer gate	\$4,600	\$1,320	\$3,000	\$1,700	\$1,200	\$1,550	\$2,100
Lump sum, installing skimmer gate stems and lift	\$1,250	550.00	\$1,500	750.00	670.00	840.00	400.00
Lump sum, installing 48-in. shutoff valve and operator	\$2,100	\$3,668	\$11,250	\$3,500	\$8,275	\$5,809	\$3,400
Lump sum, installing conduit nipple adjacent to shutoff valve	560.00	195.00	750.00	\$1,000	335.00	808.00	900.00
Lump sum, installing 48-in. regulating valve and operator	\$1,500	\$2,900	\$4,500	\$2,400	\$3,800	\$2,077	\$1,700
Lump sum, installing turbine shutoff valve	\$2,700	\$3,330	\$6,750	\$3,500	\$4,100	\$4,892	\$2,600
Lump sum, installing shutoff valve operating system	\$1,500	\$1,025	\$3,900	\$2,000	\$1,340	\$3,008	\$1,100
Lump sum, installing conduit nipple upstream of shutoff valve	\$1,000	306.00	750.00	900.00	620.00	\$2,100	\$1,000
Lump sum, installing shutoff valve bypass line	380.00	124.00	375.00	300.00	270.00	749.00	\$1,300
Lump sum, installing draft tube liners	\$12,300	\$16,000	\$11,250	\$8,000	\$5,900	\$9,164	\$12,000
Lump sum, installing turbine and governor	\$27,000	\$108,000	\$52,500	\$32,708	\$24,150	\$52,269	\$19,000
Lump sum, installing turbine flow meters	450.00	\$4,200	750.00	\$1,200	670.00	908.00	800.00
Lump sum, installing pressure regulator	\$5,000	\$13,670	\$11,250	\$12,000	\$10,340	\$9,103	\$11,000
Lump sum, installing draft tube bulkhead frames	\$1,800	\$1,630	\$1,500	\$1,300	\$2,000	\$3,117	\$1,000
Lump sum, installing draft tube bulkhead guides and chain dogs	730.00	450.00	\$1,500	800.00	530.00	\$1,287	350.00
Lump sum, installing draft tube bulkhead hoist monorail and brackets	280.00	220.00	\$1,500	300.00	300.00	256.00	350.00
Lump sum, installing draft tube bulkhead hoist	430.00	170.00	\$1,500	120.00	135.00	220.00	350.00
Lump sum, installing draft tube bulkheads	280.00	360.00	750.00	500.00	670.00	527.00	\$1,500
Lump sum, installing powerhouse crane	\$5,600	\$11,635	\$20,000	\$7,500	\$9,400	\$27,000	\$7,500
460,000 lb. installation of penstock and outlet conduit	.06	.05	.105	.12	.13	.025	.07
7,400 lb. station battery	1.35	1.23	1.25	2.40	1.45	1.21	1.25
1,250 lb. battery chargers	2.80	2.24	2.70	4.40	3.20	2.60	2.10
700 lb. lighting transformers	1.50	1.60	1.40	2.45	1.70	1.37	1.60
6,000 lb. exposed electrical metal conduit, 1 1/4-in. and smaller in diam.	.90	1.20	.85	1.20	.94	.92	1.20
14,000 lb. exposed electrical metal conduit, larger than 1 1/4-in. in diam.	.65	.80	.65	.80	.62	.69	.80
750 lb. embedded electrical metal conduit, 1 1/4-in. and smaller in diam.	1.00	1.10	.90	1.00	.80	.88	1.10
1,600 lb. embedded electrical metal conduit, larger than 1 1/4-in. in diam.	.90	1.03	.85	.80	.50	.80	1.00
4,300 lin. ft. electrical non-metallic conduit	2.90	1.18	2.70	1.30	1.00	2.58	1.10
600 lb. 600-volt grade insul. elect. conductor, size No. 6 AWG and smaller ..	1.90	3.67	1.75	2.50	2.40	1.69	3.40
4,000 lb. 600-volt grade insul. elect. conductor, size No. 4 to No. 4/0 AWG inclusive	1.70	1.44	1.55	1.70	1.50	1.51	1.40
2,000 lb. 600-v. grade insul. elect. conductor, size 250,000 circ. mils and larger ..	2.70	1.23	2.55	1.80	1.60	2.45	1.30
2,700 lb. generator main and neutral leads	2.10	1.43	2.00	1.75	1.50	1.88	1.40
300 lb. high-tension leads to station-service unit substation	2.20	2.70	2.00	3.35	3.30	2.00	2.50
15 lb. indoor-type multiple-conductor electrical telephone cable	6.60	6.45	6.00	10.00	10.00	6.00	7.00
500 lb. outdoor-type multiple-conductor electrical telephone cable	2.25	1.43	2.10	1.55	1.30	2.03	1.40
3,000 lb. multiple-conductor 600-volt grade insul. elect. control cable	3.70	2.78	3.50	3.00	3.00	3.34	2.60
1,500 lb. parkway-type cable	1.35	1.95	1.30	1.30	1.00	1.22	1.80
50 lin. ft. insulation of high-tension conductors	9.50	11.45	9.00	38.00	42.00	8.50	11.00
8,500 lb. lighting system in powerhouse and switchyard	1.90	2.14	1.75	2.55	2.00	1.72	2.00
1,000 lb. lighting system for spillway	1.90	2.55	1.80	2.40	1.80	1.74	2.00
3,503 lb. grounding systems	2.00	1.42	1.85	3.40	1.90	1.77	1.30
Lump sum, telephone equipment	\$3,800	\$4,528	\$3,500	\$6,300	\$6,000	\$3,400	\$4,200
3,600 lb. metal supports for conduits and cable trays	1.60	2.21	1.50	1.40	1.40	1.44	2.10
900 lb. metal cable trays	1.40	1.60	1.30	1.40	1.40	1.23	1.50
Lump sum, installing generator neutral cubicle	490.00	309.00	500.00	800.00	280.00	480.00	300.00
Lump sum, installing 6.9-kv switchgear	\$1,900	\$2,004	\$1,800	\$2,900	\$2,700	\$1,735	\$1,900
25 lin. ft. installing metal-enclosed bus	60.00	30.70	60.00	25.00	24.00	57.20	29.00
Lump sum, installing power transformer and lightning arrestors	\$5,100	\$5,457	\$5,000	\$2,800	\$2,150	\$4,660	\$5,000
Lump sum, installing 115-kv switchgear	\$3,000	\$9,176	\$3,000	\$4,100	\$3,400	\$2,800	\$8,400
Lump sum, installing 115-kv conductors, insulators, and devices	\$1,900	\$1,573	\$2,000	\$1,200	\$1,100	\$1,700	\$1,500
Lump sum, installing metal-enclosed duplex switchboard	\$2,000	\$2,171	\$2,000	\$1,800	\$1,650	\$1,925	\$2,500
Lump sum, installing carrier-current communication equipment	\$1,000	\$1,268	\$1,000	600.00	190.00	940.00	\$1,200
4,000 lb. installing supervisory control equipment	.56	.50	.50	.30	.13	.52	.45
17,000 lb. installing station-service unit substations	.13	.22	.14	.25	.06	.13	.20
7,000 lb. installing station-service switchgear	.40	.47	.36	.50	.30	.38	.44
Lump sum, installing engine-driven generators	\$5,600	\$3,797	\$5,100	\$3,700	\$2,700	\$5,135	\$3,500
10,000 lb. installing steel structures in switchyard	.20	.21	.20	.26	.27	.18	.19
Lump sum, main generator work except erection	\$3,300	\$12,710	\$11,250	\$18,000	\$13,400	950.00	\$11,500
Lump sum, care of river and unwatering for Beardsley Afterbay dam	\$26,000	\$60,500	\$90,000	\$50,000	\$70,000	\$75,491	\$53,000
3 ac. clearing and grubbing Beardsley Afterbay dam	750.00	260.00	\$1,275	500.00	530.00	\$1,000	400.00
16,000 cu. yd. excavation, common, for Beardsley Afterbay dam	2.30	1.90	.25	.80	1.35	.70	2.00
5,000 cu. yd. excavation, rock, for Beardsley Afterbay dam	2.80	.40	5.25	4.00	4.70	1.80	4.70
17,500 cu. yd. impervious blanket for Beardsley Afterbay dam	1.35	.80	1.88	1.25	2.70	2.27	2.25
2,200 cu. yd. special compaction of impervious blanket for Beardsley Afterbay dam	4.00	5.00	6.00	4.30	4.00	5.22	3.50
8,500 cu. yd. filters in Beardsley Afterbay dam	4.60	3.50	3.75	5.40	5.20	2.20	5.00
6,300 cu. yd. fill in timber crib dam	1.75	1.10	1.50	2.40	5.20	1.84	3.00
21,000 cu. yd. rock fill and riprap	3.40	6.60	2.55	3.70	3.30	2.25	8.00
167,000 FBM, redwood planking in timber crib dam	.25	.44	.38	.35	.40	.39	.30
445,000 FBM, crosscut Douglas fir timbers in timber crib dam	.33	.52	.49	.40	.39	.65	.45
26,000 lb. galvanized steel plates for timber crib dam	.26	.74	.52	.95	.42	.53	.60
3,300 lb. piping for Beardsley Afterbay dam	.38	1.30	1.35	.83	1.00	.80	.35
Lump sum, installing discharge conduit in Beardsley Afterbay dam	\$11,000	\$30,000	\$11,250	\$12,000	\$20,000	\$8,778	\$25,000
Lump sum, installing gate tower in Beardsley Afterbay dam	\$1,000	\$6,000	\$6,000	\$2,000	\$2,275	\$2,158	\$4,000
Lump sum, installing sluice gate and lift in Beardsley Afterbay dam	500.00	700.00	\$2,250	\$1,000	\$1,075	\$430.00	\$1,400
5,000 lin. ft. three-phase distribution line to Beardsley Afterbay dam	2.90	5.15	2.70	5.00	1.90	2.57	3.00
1,050 lb. distribution transformers	1.50	.97	1.40	2.20	1.50	1.40	.90
5,000 lin. ft. messenger-type control cables to Beardsley Afterbay dam	1.05	1.18	1.00	.45	.40	.95	1.25
250 lb. multiple conductor electrical cable in Beardsley Afterbay dam	3.80	2.20	3.50	5.00	5.00	3.38	2.50
Lump sum, elect. install. in valve operating chamber and Beardsley Afterbay dam ..	\$2,600	\$1,145	\$2,500	\$2,000	\$1,350	\$2,430	\$1,100

(Continued on page 180)

You'll be tons and dollars ahead with American "Tailored" Conveyor and Elevator Belts!

NO "MISFITS" . . . your AMERICAN belt is "tailored" to your conveyor setup, the materials you handle, and to your operating conditions . . . at no extra cost. Belt shown is 36", 6-ply 36 oz. duck, 3/16" x 1/16" cover, 428 feet long.

LIGHTNING RIBBED CENTER BELTS grip and hold slippery, wet, round or slimy materials. Eliminate slippage, reduce abrasion for longer wear. Provide higher output at normal speeds, permit higher speeds for even greater output. Ideal for handling slippery materials on steep inclines.

BLOCK TYPE PULLEY LAGGING for heavy-duty conveyors prevents drive pulley slippage, eliminates excessive take-up tension, often permits use of fewer plies in belt. Block type (crowned or flat) is self-cleaning, won't ice up, is ideal for wet or slimy conditions.

Other AMERICAN Products for Construction, Rock, Ore and Lumber industries

Air hose
Cement hose
Steam hose
Sand suction and discharge hose
Water suction and discharge hose
Chute liners
Dredge sleeves
Fittings of all types
Gate seals
Water stop
...and many other items to meet your needs.

YOURS FOR THE ASKING . . . complete AMERICAN catalog, with helpful belt engineering data. Write now for your copy.

THE *American*
RUBBER MANUFACTURING CO.



Factory & General Offices: • 1145 Park Avenue • Oakland 8, California • Phone OLYmpic 2-0800

BRANCHES

SEATTLE: Smith Tower, SEneca 1727
PORTLAND: Dekum Building, Capitol 1708
SAN FRANCISCO: 7 Front St., SUTter 1-6068

LOS ANGELES: 711 E. Gage Ave., ADams 1-9279
BOISE: 1116 No. 18th St., Phone 2612
ST. LOUIS: 843 So. Lindbergh Blvd., WYndom 2226

UNIT BID PRICES CONTINUED

SCHEDULE V

	(3)	(2)	(1)	(10)	(7)	(8)	(6)	(12)
Lump sum, care of river and unwatering.....	\$153,500	\$300,000	\$324,285	\$209,600	\$448,500	\$244,913	\$413,800	\$565,000
12 acre clearing and grubbing.....	69.00	350.00	755.00	301.00	180.00	735.00	375.00	240.00
55,000 cu. yd. excav., common, for dam, spillway and powerhouse.....	.95	1.15	1.00	1.96	.80	.69	1.20	1.90
55,000 cu. yd. excav., rock, for dam, spillway struct. and powerhouse.....	4.40	3.60	5.00	4.52	4.25	5.05	5.40	4.25
67,000 cu. yd. excav., rock, for spillway apron, training walls and channel.....	1.75	2.50	4.25	4.58	2.50	3.41	3.50	2.90
10,000 cu. yd. excav., unclass. for powerhouse and switchyard road.....	1.36	1.70	3.99	2.03	1.90	2.02	2.75	2.60
22,000 cu. yd. excav., unclass., in Sect. "A", for perm. dam access rd.....	2.00	2.85	4.58	1.96	2.20	3.67	2.75	2.75
60,000 cu. yd. excav., unclass., except in Sect. "A" for perm. dam access rd.....	.64	1.50	3.95	1.96	1.70	1.47	1.85	2.69
70,000 sta. yd. overhaul.....	.02	.02	.02	.013	.01	.02	.02	.02
12,500 cu. yd. compacted fill.....	.53	1.60	.56	.63	1.50	1.84	1.75	2.25
800 cu. yd. dumped riprap.....	1.89	3.10	.99	6.31	2.75	5.51	5.00	4.50
500 cu. yd. screened gravel or crushed rock.....	9.40	8.00	3.10	5.10	5.50	8.27	7.00	9.10
4,500 cu. yd. rockfill.....	.51	1.00	1.00	3.27	1.50	.92	2.30	.90
3,100 sq. yd. waterbound gravel surfacing.....	.72	1.25	.63	.34	1.50	1.66	2.30	1.45
375 sq. yd. gravel surfacing.....	1.29	.80	.52	.26	1.80	2.00	2.00	1.40
80 lin. ft. 8-in. corrugated metal pipe.....	3.95	3.40	2.40	5.70	2.50	5.50	3.00	10.70
150 lin. ft. 18-in. corrugated metal pipe.....	8.00	6.00	4.44	8.09	5.50	6.50	6.00	11.50
350 lin. ft. 24-in. corrugated metal pipe.....	11.20	10.50	7.34	11.20	7.50	13.60	9.00	14.00
50 lin. ft. 36-in. corrugated metal pipe.....	17.80	18.50	13.20	20.24	15.00	23.90	15.00	18.00
60 lin. ft. 72-in. corrugated metal pipe.....	48.00	45.00	32.10	29.87	35.00	73.50	40.00	37.00
160 lin. ft. timber guard rail.....	4.20	2.75	2.50	.59	3.50	5.50	5.00	8.25
54,000 lb. metal bin-type retaining walls.....	.35	.35	.47	.72	.25	.57	.40	.55
6,000 lin. ft. drilling "B" and "C" grout holes.....	3.60	2.90	3.03	2.88	3.00	2.87	3.50	4.00
10,000 lin. ft. drilling "A" grout holes.....	3.45	2.90	3.03	2.22	3.00	2.87	3.50	4.00
3,300 lin. ft. drilling drainage holes.....	2.60	6.00	6.61	2.23	6.00	6.00	8.00	8.20
16,000 cu. ft. pressure grouting.....	6.45	2.20	2.52	1.11	3.00	2.30	3.00	3.00
10,000 lb. grout and drainage pipe.....	.55	.60	.71	.46	.55	1.65	1.00	1.50
1,550 lin. ft. sewer pipe drains with uncemented joints.....	1.15	1.80	2.34	2.03	2.00	1.84	2.00	4.10
750 lin. ft. split tile drains with cemented joints.....	3.35	2.74	4.36	3.60	3.50	2.40	2.50	7.60
300 cu. ft. porous concrete.....	1.95	.90	.47	15.72	3.50	1.84	2.00	4.00
250 lin. ft. drilling holes for anchor bars.....	1.90	1.50	.94	.92	1.50	1.84	2.50	15.00
1,000 lb. placing anchor bars.....	.05	.15	.25	.165	.35	.37	.41	1.50
220,000 cu. yd. concrete in gravity dam.....	12.60	12.75	12.60	12.43	16.70	13.50	16.40	16.00
8,000 cu. yd. concrete in spillway crest.....	15.60	15.85	14.80	12.70	18.50	16.31	25.00	19.00
3,750 cu. yd. concrete in spillway piers.....	38.10	27.50	24.90	32.09	35.00	32.50	53.00	46.50
1,000 cu. yd. concrete in spillway apron.....	18.20	16.00	22.70	23.58	20.00	13.27	27.60	32.00
750 cu. yd. concrete in spillway channel walls.....	30.20	21.00	24.20	39.30	27.00	25.10	38.00	35.00
400 cu. yd. concrete in spillway bridge and hoist deck.....	8.80	62.50	74.60	83.85	90.00	75.86	100.00	106.00
900 cu. yd. concrete in dam roadway surface, curbs and parapets.....	34.10	35.00	41.50	35.37	37.00	42.70	55.00	65.50
850 cu. yd. conc. in trashrack structs., maint. and operating decks.....	103.30	80.00	58.40	91.70	66.50	65.80	112.00	122.00
100 cu. yd. concrete in outlet structure.....	55.30	55.00	39.60	42.43	63.00	63.84	95.00	77.20
1,300 cu. yd. conc. in powerhouse substruct. below elev. 368.0.....	31.70	27.50	31.20	38.00	32.50	26.60	43.00	35.50
500 cu. yd. conc. in powerhouse substruct. about elev. 368.0.....	107.80	75.00	93.60	60.26	94.50	83.20	114.00	121.00
360 cu. yd. conc. in powerhouse superstruct.....	203.80	145.00	133.40	91.70	155.00	179.00	223.00	210.00
850 cu. yd. second stage conc. in powerhouse.....	38.30	31.50	44.90	57.64	45.50	38.76	54.00	70.00
15 cu. yd. conc. in equipment bases and blockouts.....	299.80	35.00	47.80	104.80	78.00	114.60	153.00	238.00
20 cu. yd. conc. fill in generator floor.....	74.10	85.00	28.10	93.86	41.00	39.00	50.00	61.50
3,000 sq. ft. bonded conc. floor finish.....	1.02	.70	.50	.92	.48	.60	.70	1.70
70 cu. yd. conc. in switchyard and yard area.....	56.80	45.00	56.50	52.25	54.55	49.50	80.00	113.00
450 cu. yd. conc. in tailrace retaining wall.....	27.60	25.00	24.30	48.47	31.00	34.80	40.00	38.50
250,000 bbl. portland cement.....	4.70	4.50	4.05	5.30	4.00	4.32	4.00	4.80
500 sack gunite.....	4.85	10.00	4.10	6.55	9.00	6.05	5.00	6.30
2,250,000 lb. steel reinforcement—bars.....	.116	.13	.11	.1275	.11	.106	.11	.145
1,000 lb. steel reinforcement—mesh.....	.239	.38	.25	.2751	.24	.22	.25	.31
6,000 lb. steel water seals.....	.43	.50	1.26	2.62	.50	.44	1.50	2.55
8,500 lb. copper water seals.....	1.90	2.20	2.40	2.62	1.80	3.64	2.50	3.00
1,800 sq. ft. preformed expansion joint filler.....	1.00	.55	1.95	1.95	1.20	1.86	2.00	1.25
1,000 sq. ft. cork-tar mastic.....	.85	1.00	.90	.201	1.80	4.60	1.50	3.00
200 sq. yd. dampproofing.....	1.30	2.20	1.00	1.208	.90	3.17	4.00	3.40
10 sq. yd. membrane waterproofing.....	3.15	7.00	5.00	3.93	12.00	2.80	6.00	27.50
45 lin. ft. constr. transformer track on ties.....	15.75	15.00	9.00	15.06	15.00	21.00	20.00	15.00
2,900 sq. ft. concrete block masonry.....	1.80	.85	1.35	1.31	1.20	2.76	2.00	2.00
65 sq. yd. two-coat gypsum plaster.....	3.80	2.20	2.60	3.27	7.00	3.80	6.00	10.50
50 sq. yd. three-coat gypsum plaster, including metal lath.....	5.00	4.50	6.30	4.91	9.00	5.50	7.00	15.00
35 sq. yd. two-coat cement plaster.....	3.80	3.60	3.80	3.93	8.00	3.40	6.00	10.50
40 sq. yd. three-coat cement plaster, including metal lath.....	5.00	5.00	7.60	5.24	11.00	12.60	8.00	15.00
75 sq. yd. suspended ceiling constr., exclud. metal lath and plaster.....	4.50	1.60	8.80	4.58	7.00	5.60	7.00	8.90
.5 sq. yd. 3/4-in. steel chan. furring, exclud. metal lath and plaster.....	3.80	2.00	5.00	3.93	11.00	11.00	6.00	8.90
20 sq. yd. 4-in. steel studs in pl., with runner chans., but exclud. metal lath and plaster.....	9.10	2.25	11.35	4.91	6.00	4.60	7.00	8.90
725 sq. ft. acoustical tile ceiling.....	1.25	1.00	2.32	.59	.80	1.40	2.00	3.00
1,140 sq. ft. perforated asbestos board.....	1.50	1.10	1.25	.69	.60	3.70	1.50	1.50
750 sq. ft. asphalt tile flooring.....	.55	.50	.80	.87	.50	.44	1.00	2.25
525 lin. ft. rubber base.....	.70	.60	1.00	1.57	.50	.60	1.00	1.35
225 sq. ft. ceramic tile.....	3.00	4.00	3.00	2.29	3.50	4.20	4.00	5.50
Lump sum, metal doors, frames and hardware.....	\$2,600	\$6,250	\$8,164	\$6,424	\$5,540	\$9,987	\$6,000	\$6,500
Lump sum, steel windows.....	\$2,150	\$2,500	\$4,964	\$7,703	\$1,940	\$5,181	\$3,000	\$4,650
Lump sum, glass and glazing.....	\$1,340	\$1,100	\$1,500	\$3,018	900.00	\$2,757	\$1,000	\$1,500
5,200 sq. ft. roofing.....	.55	.27	.30	.39	.45	.37	.35	2.70
Lump sum, sheet metal.....	\$2,280	\$1,750	\$1,339	\$4,284	\$1,575	\$2,205	\$2,000	\$2,250
Lump sum, toilet partitions, steel lockers and bathroom accessories.....	\$50.00	400.00	460.00	\$1,166	600.00	711.00	750.00	\$1,500
Lump sum, carpentry.....	\$1,425	600.00	\$1,086	469.00	550.00	\$1,645	\$4,000	590.00
9,000 sq. ft. floor hardener.....	.47	.035	.04	.19	.06	.06	.05	.44
Lump sum, painting of powerhouse.....	\$4,300	\$3,000	\$3,652	\$14,410	\$3,600	\$3,676	\$3,500	\$7,430
120,000 lb. structural steel powerhouse frame.....	.23	.24	.21	.22	.22	.328	.20	.25
200,000 lb. penstock and outlet conduits.....	.35	.40	.30	.37	.32	.42	.30	.42
120,000 lb. intake trashracks.....	.25	.34	.27	.25	.26	.40	.22	.48
300 lin. ft. switchyard fences.....	5.30	4.00	5.12	6.55	4.50	10.00	5.00	5.95
6,800 lb. transformer transfer track rails.....	.36	.23	.26	.22	.22	.27	.10	.33
Lump sum, penstock and outlet conduit filling pipes and valves.....	\$8,000	\$2,500	\$3,519	\$5,895	\$1,200	\$2,200	\$2,500	\$3,700
43,000 lb. railing along top of dam.....	.57	.55	.61	.59	.46	.70	.40	.59
80,000 lb. miscellaneous metalwork.....	.47	.49	.74	.55	.54	.87	.75	.75
Lump sum, raw water and fire protection systems.....	\$51,590	\$30,000	\$62,646	\$66,500	\$10,000	\$76,500	\$50,000	\$66,100
Lump sum, transil and lubricating oil systems.....	\$11,650	\$15,000	\$20,579	\$34,289	\$7,500	\$33,000	\$18,500	\$22,000
Lump sum, compressed air and CO ₂ systems.....	\$14,480	\$15,000	\$15,947	\$20,812	\$10,000	\$19,500	\$7,500	\$19,000
Lump sum, plumbing and drainage systems.....	\$20,835	\$15,000	\$16,874	\$32,155	\$7,500	\$22,000	\$21,000	\$30,000
Lump sum, additional mechanical facilities.....	\$10,750	\$6,000	\$11,117	\$24,831	\$5,000	\$10,450	\$6,000	\$8,200
Lump sum, installing guides and frames for penstock gates.....	\$2,770	\$2,850	\$3,047	\$2,954	\$3,100	\$5,260	\$3,500	\$5,250

(Continued on page 182)

UNIVERSAL Spirolocs

HEAVY DUTY TIES

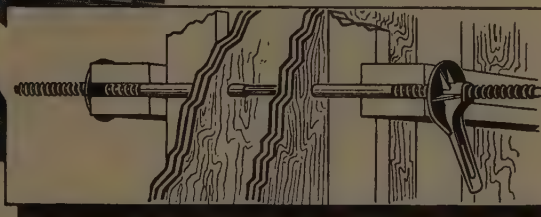
FASTEST—SAFEST—LOWEST COST



UNIVERSAL Spirolocs—*heavy duty Form ties...Permanent, reuseable equipment...fast acting Acme threads...washers and stud rods last indefinitely; only inexpensive threaded tie rods expended.*

Spirolocs provide fast erection...easy stripping...available in various time-saving combinations to fit the exact needs of your job.

RENTED...SOLD



Greater Tie Strength For less money with Spirolocs

- 5,000# Ties with $\frac{3}{4}$ -Tie Rods
- 9,000# Ties with $\frac{1}{2}$ -Tie Rods
- 14,000# Ties with $\frac{3}{4}$ -Tie Rods
- 20,000# Ties with $\frac{3}{4}$ -Tie Rods

SPIROLOC CONE NUT ASSEMBLY



The only fast acting form Tie with an absolutely positive spreader...assures smooth surfaced, watertight walls.

Write for complete details on SPIROLOCS and ask for catalog describing Universal Form Tying Accessories.



Spirolocs are Furnished with either Handle or Nut Type Washers

THE HANDLE WASHER
SLIP IT ON

THE NUT WASHER
SPIN IT ON

See Your UNIVERSAL FORM CLAMP Co. Distributor

K-C CONSTRUCTION SUPPLY CO.....Denver, Colo.

CONSTRUCTION EQUIPMENT CO....Spokane, Wash.

BOW LAKE EQUIPMENT CO.....Seattle, Wash.

McCRACKEN-RIPLEY CO.....Portland, Oregon

UNIVERSAL FORM CLAMP CO.....San Leandro, Calif.

General Offices and Factory • 1258 NORTH KOSTNER AVENUE • CHICAGO 51, ILLINOIS



Copyright 1953 by UNIVERSAL FORM CLAMP CO., Chicago 51, Ill.

UNIT BID PRICES — CONTINUED

	(3)	(2)	(1)	(10)	(7)	(8)	(6)	(12)
Lump sum, installing penstock gates.....	\$3,110	\$6,000	\$1,259	\$4,551	\$4,250	\$4,585	\$3,500	\$8,200
Lump sum, installing penstock gate hoists.....	\$3,800	\$3,250	\$1,510	\$1,589	\$3,600	\$3,161	\$2,300	\$4,500
Lump sum, installing guides and frames for outlet gates.....	\$2,140	\$3,200	\$3,638	\$1,753	\$2,460	\$4,903	\$3,100	\$5,000
Lump sum, installing outlet gates.....	\$1,260	\$5,000	\$03.00	\$1,677	\$1,570	\$1,838	\$2,000	\$6,000
Lump sum, installing outlet gate hoists.....	\$1,910	\$3,000	\$1,700	\$1,074	\$1,450	\$3,143	\$1,250	\$4,700
Lump sum, installing tainter gate anchorages.....	\$4,650	\$9,000	\$8,360	\$5,067	\$13,300	\$10,714	\$4,000	\$5,200
Lump sum, installing tainter gate guides, sills and seal plates.....	\$4,075	\$8,400	\$7,552	\$9,395	\$5,150	\$9,382	\$5,500	\$7,100
Lump sum, installing tainter gate hoist bridge frames.....	\$4,530	\$6,000	\$3,399	\$14,496	\$6,000	\$7,039	\$2,700	\$8,850
Lump sum, installing tainter gates.....	\$46,750	\$60,000	\$40,923	\$58,663	\$78,700	\$73,466	\$56,000	\$100,000
Lump sum, installing tainter gate hoists.....	\$17,000	\$14,000	\$9,438	\$13,249	\$19,350	\$17,918	\$12,000	\$22,850
Lump sum, installing skimmer gate guides, frame and seals.....	630.00	700.00	366.00	710.00	900.00	643.00	800.00	900.00
Lump sum, installing skimmer gate seats and lift supports.....	124.00	750.00	\$1,511	86.00	120.00	222.00	250.00	\$1,100
Lump sum, installing skimmer gate.....	755.00	\$1,250	\$1,057	757.00	900.00	\$3,374	\$2,100	\$3,250
Lump sum, installing skimmer gate stems and lift.....	655.00	700.00	201.00	223.00	600.00	\$1,139	400.00	\$1,750
Lump sum, installing 72-in. outlet regulating valves and operators.....	\$8,850	\$10,000	\$6,545	\$5,547	\$8,500	\$15,171	\$7,000	\$9,700
Lump sum, installing draft tube liners.....	\$8,500	\$21,000	\$2,374	\$27,991	\$11,250	\$14,500	\$21,000	\$7,450
Lump sum, installing turbines and governors.....	\$107,500	\$40,000	\$131,529	\$218,107	\$60,500	\$74,000	\$34,000	\$75,000
Lump sum, installing turbine flow meters.....	\$1,260	700.00	\$2,248	\$3,930	975.00	679.00	\$2,600	\$2,250
Lump sum, installing draft tube bulkhead frames.....	455.00	\$3,000	410.00	\$1,660	\$2,400	956.00	\$1,200	750.00
Lump sum, installing draft tube bulkhead guide and chain dogs.....	185.00	145.00	755.00	817.00	600.00	\$1,127	\$1,700	750.00
Lump sum, installing draft tube bulkhead hoist monorail and brackets.....	204.00	250.00	314.00	351.00	500.00	294.00	\$1,250	750.00
Lump sum, installing draft tube bulkhead hoist.....	155.00	135.00	113.00	112.00	180.00	163.00	600.00	750.00
Lump sum, installing draft tube bulkheads.....	405.00	\$00.00	202.00	\$37.00	900.00	\$88.00	\$2,000	600.00
Lump sum, installing powerhouse crane.....	\$5,200	\$5,000	\$4,719	\$6,120	\$9,100	\$7,167	\$7,000	\$12,400
8,500 lb. station battery.....	2.05	1.30	1.40	1.58	1.40	1.39	1.30	1.65
1,250 lb. battery chargers.....	3.90	2.80	2.54	2.64	3.00	3.02	3.00	3.00
800 lb. lighting transformers.....	2.20	1.60	1.80	1.87	1.60	1.64	1.60	2.15
8,400 lb. exposed elect. metal conduit, 1 1/4-in. and smaller in diam.....	1.05	.75	1.30	1.35	.90	.92	.90	1.55
21,000 lb. exposed elect. metal conduit, larger than 1 1/4-in. in diam.....	.85	.66	1.07	1.11	.60	.60	.60	1.25
3,300 lb. embedded elect. metal conduit 1 1/4-in. and smaller in diam.....	.90	.95	.93	.97	.80	.78	.75	1.10
8,300 lb. embedded elect. metal conduit, larger than 1 1/4-in in diam.....	.65	.45	.93	.97	.50	.50	.50	1.10
2,000 lin. ft. electrical non-metallic conduit.....	1.20	2.75	1.48	1.54	.94	.94	.90	1.75
750 lb. 600-v. grade insul. elect. conductor, Size No. 6 AWG and smaller.....	2.40	1.86	3.90	4.06	2.30	2.28	2.10	4.50
7,500 lb. 600-v. grade insul. elect. conductor, Size No. 4 to No. 4/0 AWG inclusive.....	1.65	1.50	1.69	1.77	1.50	1.45	1.40	2.05
1,100 lb. 600-v. grade insul. elect. conductor, size 250,000 circ. mils and larger.....	1.70	1.70	1.51	1.58	1.55	1.53	1.40	1.85
7,000 lb. generator main and neutral leads.....	1.70	2.45	1.60	1.63	1.55	1.52	1.40	1.90
250 lb. high-tension leads to station service substation.....	2.95	2.40	3.14	3.27	4.00	3.98	4.00	3.73
45 lb. indoor-type multiple-conductor elect. telephone cable.....	9.20	5.00	7.40	7.88	9.80	10.00	10.00	9.00
700 lb. outdoor-type multiple-conductor elect. telephone cable.....	1.45	2.00	1.47	1.53	1.25	1.25	1.15	1.75
4,000 lb. multiple-conductor 600-v. grade insul. elect. control cable.....	2.95	3.35	3.14	3.27	2.90	2.90	3.00	3.75
3,000 lb. parkway-type cable.....	1.10	1.30	1.77	1.84	.85	.87	.80	2.10
70 lin. ft. insulation of high-tension conductors.....	37.30	9.10	12.70	13.18	40.00	40.00	40.00	15.00
11,000 lb. lighting system in powerhouse and switchyard.....	2.35	1.85	2.40	2.50	2.00	2.00	2.00	2.85
5,700 lb. lighting system for spillway.....	2.20	1.70	2.27	2.37	1.85	1.85	1.70	2.70
6,500 lb. grounding systems.....	3.00	1.65	2.05	2.14	1.80	1.80	1.70	2.45
Lump sum, telephone equipment.....	\$6,438	\$4,250	\$5,529	\$5,755	\$6,100	\$6,147	\$5,700	\$6,500
7,000 lb. metal supports for conduits and cable trays.....	1.35	1.57	2.01	2.08	1.35	1.35	1.25	2.40
1,100 lb. metal cable trays.....	1.35	1.35	1.53	1.60	1.35	1.35	1.25	1.85
Lump sum, installing generator neutral cubicles.....	\$1,000	625.00	556.00	579.00	550.00	540.00	600.00	650.00
25 lin. ft. installing metal-enclosed bus.....	26.00	61.00	43.80	45.53	24.00	23.00	24.00	52.00
Lump sum, installing 6.9-kv. switchgear.....	\$3,000	\$1,990	\$2,373	\$2,471	\$2,600	\$2,574	\$2,400	\$2,800
Lump sum, installing power transformer and lightning arrestors.....	\$2,650	\$5,000	\$6,278	\$6,537	\$2,050	\$2,135	\$2,000	\$7,400
Lump sum, installing 115-kv. switchgear.....	\$3,830	\$3,850	\$10,113	\$10,523	\$3,250	\$3,244	\$3,000	\$12,000
Lump sum, installing 115-kv. conductors, insulators, and devices.....	\$1,250	\$1,850	\$2,025	\$2,107	\$1,100	\$1,062	\$1,000	\$2,400
Lump sum, installing metal-enclosed duplex switchboard.....	\$1,860	\$2,000	\$2,910	\$3,029	\$1,600	\$1,579	\$1,500	\$3,500
Lump sum, installing carrier-current communication equipment.....	\$1,660	950.00	\$1,161	749.00	180.00	178.00	200.00	850.00
1,800 lb. installing supervisory control equipment.....	.33	.55	.62	.64	.12	.12	.11	.72
18,500 lb. installing station-service unit substations.....	.27	.12	.24	.25	.06	.054	.06	.29
8,000 lb. installing station-service switchgear.....	.45	.39	.56	.58	.28	.275	.25	.65
Lump sum, installing engine-driven generator.....	\$2,300	\$2,500	\$2,278	\$2,371	\$2,400	\$5,550	400.00	\$2,700
8,000 lb. installing steel structures in the switchyard.....	.26	.24	.27	.27	.27	.26	.25	.32
Lump sum, main generator work except erection.....	\$8,950	\$22,500	\$8,058	\$7,107	\$18,200	\$28,688	\$24,000	\$15,000

SCHEDULE VI

	(4)	(6)	(8)	(1)	(5)	(7)	(3)
Lump sum, river diversion and control.....	\$6,000	\$12,000	\$38,321	\$3,131	\$38,710	\$57,300	\$6,300
25 cu. yd. removing reinforced concrete.....	70.00	70.00	42.60	90.00	110.00	33.00	100.00
50 cu. yd. removing mass concrete.....	36.00	60.00	34.00	33.00	65.00	28.00	87.00
150 cu. yd. earth and rock excavation, unclassified.....	27.00	30.00	15.30	12.00	13.00	11.00	58.50
6,500 sq. ft. chipping exist. conc. surfaces to provide bond with new conc.....	1.00	1.00	.31	.85	1.00	1.40	1.43
150 hole core drilling for dowels.....	10.00	23.00	45.00	39.00	11.00	34.00	31.10
200 lin. ft. core drilling grout holes less than 25-ft. deep.....	10.00	6.00	7.20	10.20	11.30	8.00	8.80
325 lin. ft. core drilling grout holes 25-ft. to 40-ft. deep.....	10.00	7.00	7.20	10.20	11.30	8.00	8.80
300 lin. ft. core drilling grout holes over 40-ft. deep.....	10.00	7.00	7.20	10.20	12.00	8.00	8.80
600 lb. furn. and installing pipe and fittings for pressure grouting.....	1.50	1.50	2.60	4.70	1.05	.80	.85
1,500 cu. ft. pressure grouting.....	1.50	4.00	3.30	4.70	2.80	3.70	5.75
460 lin. ft. furn. and placing dumbbell shaped extruded water stops in sliding joints.....	80.00	8.00	11.00	7.50	6.75	11.00	9.15
70 lin. ft. furn. and placing dumbbell shaped extruded water stops in contraction joints.....	5.00	7.00	10.00	8.00	3.40	14.50	7.60
1,975 sq. ft. furn. and placing Johns-Manville service sheet.....	4.00	2.00	2.00	1.00	2.30	2.80	1.65
1,000 lb. furn. and placing dowels.....	.60	.50	.55	.70	.22	1.25	1.20
550 cu. yd. Type "B" mass concrete in dam.....	50.00	50.00	48.00	92.00	47.50	62.00	90.00
1,150 cu. yd. Type "B" mass concrete in center thrust block.....	42.00	32.00	23.50	23.00	40.00	39.00	53.50
500 cu. yd. Type "B" mass conc., except in dam and center thrust block.....	50.00	41.00	37.60	103.00	60.00	51.00	62.40
470 cu. yd. Type "A" reinforced concrete.....	73.00	61.00	60.00	67.00	125.00	90.00	128.00
1,150 sq. ft. gunited slope protection.....	1.20	1.80	1.30	.80	1.60	3.50	2.15
2,750 bbl. portland cement.....	6.00	4.50	6.00	7.50	3.75	4.00	7.00
11,000 lb. furn. and placing steel reinforcement.....	.20	.20	.10	.14	.11	.15	.23
17,000 lb. furn. and placing miscel. metal.....	.45	1.00	.90	1.27	.60	.60	.85
2,950 sq. ft. steel trowel finish curved arch dam crest.....	2.00	.40	.52	.20	.30	.40	.30
Lump sum, rehabilitate and install one districts-furnished gate valve.....	\$1,650	\$2,500	\$1,800	520.00	\$1,340	\$2,850	\$3,500
600 lb. furn. and install new gate guides.....	2.00	7.00	1.20	1.95	1.40	2.25	1.75
80 lin. ft. furn. and install additional gate stem.....	20.00	2.00	12.00	3.90	7.15	28.00	7.25
3 ea. furn. and install electric gate hoist on joint intake.....	600.00	\$3,000	\$4,800	\$3,250	\$4,500	\$3,000	\$4,905
4 ea. furn. and install electric gate hoist on Oakdale intake.....	600.00	\$3,500	\$4,800	\$3,340	\$3,850	\$3,000	\$4,037
1 ea. remove one exist. hoist on joint intake and replace on sand sluice gate.....	150.00	\$5,400	510.00	760.00	650.00	\$1,450	527.00

(Continued on page 184)

PULLING THE PATCHER TO THE POTHOLE

... Continued from page 65

discharged onto the road, to a conveyor, or directly into the hauling truck.

The mixers usually turn in the same direction, although the direction of rotation can be changed to alternate mixing elements if desired. The mixers turn at a speed of 150 to 350 rpm., depending upon the aggregate size.

A small mixer of this kind has a greater capacity than a conventional mixer because the blades are able to turn at high speed, thus throwing the aggregates and bituminous materials together a great number of times while they are moved through the rough and discharged. In the Multi-Pug Mixer, less power is needed because the materials are not pushed and crowded through a trough in the process of mixing as they are in many conventional type mixers.

This mixer must be covered from inlet to discharge since the bituminous materials and aggregates are thrown against the mixer cover in the process of being mixed and moved toward the outlet. The raw materials are proportioned volumetrically into the mixer by continuous methods. The aggregates may be fed by a belt conveyor with an adjustable gate or by a feed rotor. In either case, the asphalt is fed in proper proportion by a variable volume positive displacement pump.

The HTD Mixer is used to lay driveways and parking areas, railroad crossings, walks, floors, filling station drives, and by road contractors, county and state highway departments, and municipal street departments.

Specifications on the Multi-Pug Mixer (Model HTD-B) include a cold-mix capacity of 10 tons per hr.; weight 1,500 lb.; overall dimensions, width 60 in., length 96 in. (113 in. with tray in working position), and height 107 in. to top of stack with extension; 7½-hp. Wisconsin air-cooled engine; two 13-R vapor-type oil burners; one Tuthill high-pressure, self-priming pump; and a 36-gal. fuel tank.

Wylie's Model PM-210 Patchmobile is a portable hot asphalt plant, designed and built for the purpose of producing a hot-patch material for use in maintaining streets, highways, airport runways, and parking areas. The unit also is used in building driveways, sidewalks, and for mixing mastic materials for floors and bridge decks. Patchmobile features a rotary dryer, twin asphalt tanks, pugmill, power asphalt pump with spray attachment, and asphalt tool-heating compartment all in one packaged unit. It requires no other piece of equipment to tow it, except a dump truck, which can be used to haul sand and gravel for the mix.

As the sand and gravel is conveyed through the dryer, it passes through

the blast of flame from the dryer burner into a batching hopper. The correct proportion of hot asphalt is added and the material discharges into the pugmill, thus giving an almost continuous flow of mixed material through the machine. The twin asphalt tanks make it possible to have one type of asphalt in one tank and another type in the other tank. This is convenient when using one type of asphalt for mixing and another for seal or tack coating. Both tanks may also be filled with the same type of asphalt, thus doubling the Patchmobile's capacity. Hot asphalt may be pumped from either of the tanks by means of the asphalt pump. A flexible metallic hose with spray bar and tip is furnished as standard equipment.

An adjustable hitch, standard equipment on all machines, has a right- and left-hand screw device for raising and lowering the front of the machine when it is hitched to a truck. This device makes a variation of 10½ in. in the elevation of the rotary dryer possible, permitting the aggregate to remain in the dryer longer if necessary or run through faster if the moisture content is low.

The kind of aggregate used in the Patchmobile is not limited to any special type or grade but will differ with the locality. The pugmill blades are spaced to mix ¾-in. minus aggregate, and the charging chute into the dryer is equipped with an oversize aggregate screen.

Any type of asphalt from low-penetrating to cutbacks may be heated in the kettles without danger of flash because of the construction and design of the firebox and location of the burner. The machine is equipped with an asphalt-metering bucket which discharges the correct proportion of

hot asphalt through a spray bar into the pugmill.

It is possible to produce hot aggregate out of the rotary dryer at a temperature of 225 to 350 deg.; and with the asphalt heated to 150 to 250 deg., dependent upon the type used, a finished mixed material of 175 to 300 deg. is possible.

Specifications on the Patchmobile include a hot-mix capacity of 5 tons per hr.; weight 3,100 lb.; overall dimensions, length 156 in., width 72 in., and height 84 in.; Model AEH four-cycle Wisconsin air-cooled engine; 48 in. long by 13 in. diameter pugmill with 30 mixing blades and replaceable liner; two 55-gal. asphalt kettles, and a ¾-in. Peerless rotary gear spray pump.

From the foregoing discussion, it would appear that there is a definite future field for the use of portable asphalt-mixing plants. The only question seems to be to what extent should they be portable and how large should they be.

Certainly the above manufacturers have spent considerable time and money studying the situation before they started producing this portable equipment, and their reports of increasing sales during the last year would seem to indicate that they didn't guess wrong.

The final proof, of course, will be an economic one—that is whether or not these portable mixers will come to be accepted by the majority of contractors and governmental units for whom they were designed. As always, where something new is introduced, there is a certain amount of resistance because people tend to keep doing things in their old, habitual ways. However, the economy of operation and better results claimed for their products by these manufacturers should lead to a much larger market over the long pull if their contentions prove correct.

THE PATCHMOBILE includes a rotary dryer built into the machine. A screw jack permits adjustment of the angle of the dryer, speeding or slowing aggregates as they pass through.



**ARE YOU
GETTING
THE NEW
ANGLES**



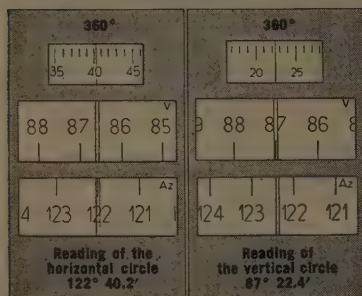
**...THE
MODERN
WILD
HEERBRUGG
WAY?**

WILD T-1

**OPTICAL REPEATING
TRANSIT**

Rugged, compact design
... with 20 years of proven service
under tough field conditions.

Both circles read from one single
station through microscope
alongside telescope eyepiece.
Optical micrometer eliminates
possibility of reading error.
Illumination is provided by
daylight mirror or by battery
attachment for night, underground
or mine work.



WILD surveying instruments, inherently
accurate, are Swiss precision designed
for stability under adverse conditions,
for sturdiness, and for ease in operation...
they provide lasting trouble-free service.

For details phone or write for Bklt WC 6

Extensive repair and servicing facilities
by factory trained specialists.

HENRY WILD
SURVEYING INSTRUMENTS SUPPLY CO.
OF AMERICA, INC.
MAIN & COVERT STS. PORT WASHINGTON, N.Y.
Port Washington 7-4843

UNIT BID PRICES... CONTINUED

AVERAGE CONTRACT BID PRICES FOR 1952 OREGON HIGHWAY CONSTRUCTION

Here are prices for all components of Oregon highway work last year, based entirely on the figures of successful bidders. For the Oregon highway department the prices are useful as a guide in the preparation of estimates for 1953 work; for contractors it's a good checklist on what to expect from an average competitor. These figures used in conjunction with highway construction cost indices, described earlier in this issue, provide an up-to-date highway contract price guide for typical Western projects. The compilation was prepared by E. H. Clymer, Chief Cost Analyst for the Oregon State Highway Department.

DESCRIPTION	NO. OF CONTRACTS	TOTAL QUANTITY	TOTAL BID	AVERAGE UNIT BID
EXCAVATION				
Structural excav., unclass.	72	53,385 cu. yd.	175,505	3.29
Trench excav., unclass.	33	9,720 cu. yd.	26,393	2.72
Common excav.	12	4,893,400 cu. yd.	1,562,115	0.319
Single class excav.	50	5,177,430 cu. yd.	2,114,554	0.408
Solid excav.	8	3,703,200 cu. yd.	3,645,120	0.984
Excav. and placing special fill (bridge ends)	1	2,300 cu. yd.	9,200	4.00
Single class excav. (cities)	6	3,230 cu. yd.	5,134	1.59
Removal of overburden	1	12,000 cu. yd.	1,800	0.15
Embankment in place	8	245,460 cu. yd.	146,680	0.60
Borrow excav.	9	1,337,000 cu. yd.	526,845	0.394
Rock borrow	1	27,000 cu. yd.	8,100	0.30
Material in sand blanket	1	200 cu. yd.	1,000	5.00
Short overhaul	46	47,260,300 yd. sta.	630,247	0.013
Long overhaul	45	1,306,572 cu. yd. sta.	599,048	0.46
Truck haul embankment measure....	3	449,000 yd. mi.	74,760	0.17
Truck haul on excav.	7	108,340 yd. mi.	21,676	0.20
Truck haul on borrow	5	617,900 yd. mi.	119,320	0.19
Hauling with trucks	2	4,800 hour	24,300	5.06
Rounding cutbanks	34	313,650 lin. ft.	54,619	0.17
Finishing R/B & slopes	54	215.76 mi.	161,668	749.29
Roadbed widening and shaping	1	2.6 mi.	1,300	500.00
Grader work	2	3.69 mi.	3,590	972.90
Grading with motor grader	9	610 hr.	6,400	10.49
Grading with shovel	2	1,300 hr.	17,225	13.25
Grading with tractor and dozer	2	400 hr.	4,600	11.50
Broken conc. slope protection	1	440 sq. yd.	880	2.00
Rock slope protection	4	20,000 cu. yd.	60,500	3.03
Air compressor—hour	1	100 hr.	450	4.50
Jackhammers—hour	1	200 hr.	800	4.00
Explosives	1	4,000 lb.	1,920	0.48

CONCRETE DRAIN PIPE

6-in. drain.....	6	470 lin. ft.	915	1.95
8-in. drain.....	1	60 lin. ft.	120	2.00

CONCRETE CULVERT PIPE

8-in. culvert	3	270 lin. ft.	420	1.56
12-in. culvert	42	22,510 lin. ft.	44,291	1.97
15-in. culvert	3	55 lin. ft.	152	2.77
18-in. culvert	49	41,070 lin. ft.	153,664	3.74
18-in. ext. str. culvert	6	5,240 lin. ft.	22,930	4.38
24-in. culvert	34	8,226 lin. ft.	41,033	4.99
24-in. ext. str. culvert	7	4,490 lin. ft.	27,014	6.02
30-in. culvert	12	1,260 lin. ft.	9,767	7.75
30-in. ext. str. culvert	2	1,000 lin. ft.	7,200	7.20
36-in. culvert	19	3,105 lin. ft.	30,634	9.87
36-in. ext. str. culvert	3	490 lin. ft.	5,190	10.59
42-in. culvert	2	210 lin. ft.	1,890	9.00
48-in. culvert	4	444 lin. ft.	6,412	14.44

CORR. METAL SECTIONAL PLATE

72-in. sectional plate.....	1	140 lin. ft.	7,420	53.00
77 - 57-in. sectional plate, arch-type..	1	60 lin. ft.	2,400	40.00
90-in. sectional plate.....	1	160 lin. ft.	8,000	50.00
105-in. sectional plate.....	1	150 lin. ft.	10,500	70.00
156-in. sectional plate.....	1	150 lin. ft.	14,250	95.00

(Continued on page 186)

FOR IRRIGATION & DRAINAGE CANALS



Briscoe Ditchers...

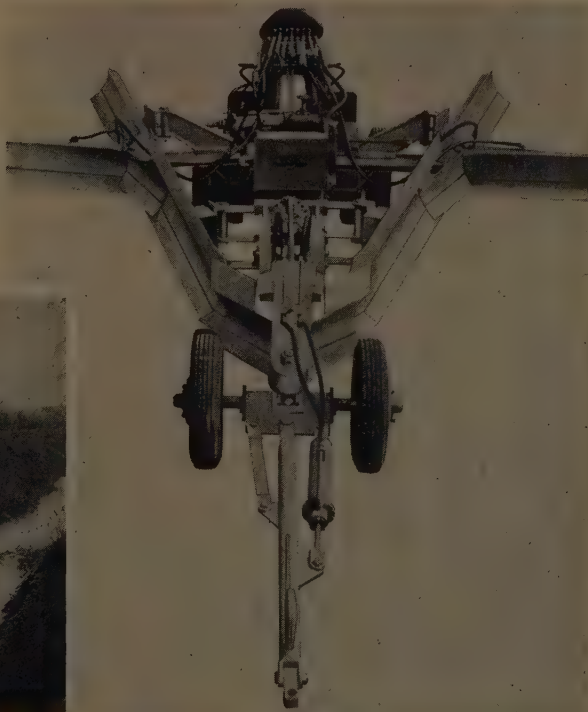
**DIG NEW DITCHES
CLEAN OLD ONES**

**SLOPE BANKS TO
 $\frac{1}{2}:1$ TO $1\frac{1}{2}:1$**

**DITCH CONSTRUCTION AND
MAINTENANCE AT LOW COST**



MODEL C-7 ON NEW CONSTRUCTION



WEED CONTROL—Government Project in Arizona

Briscoe Slopers...

(Pictured above and at right)

SLOPE AND REMOVE BERMS

WEED CONTROL

CLEAN AND SHAPE BAR PITS

WRITE OR WIRE FOR DETAILS:

E. V. Briscoe & Son

Route 2
Box 118

KERMAN
CALIFORNIA

Phone
8110

**SLOPING NEW CANAL BANKS—
California Central Valleys Project**



UNIT BID PRICES... CONTINUED

DESCRIPTION	NO. OF CONTRACTS	TOTAL QUANTITY	TOTAL BID	AVERAG UNIT BI
CONCRETE SEWER PIPE				
6-in. sewer	4	1,630 lin. ft.	1,808	1.11
8-in. sewer	14	4,966 lin. ft.	6,653	1.34
10-in. sewer	4	680 lin. ft.	996	1.46
12-in. sewer	13	12,140 lin. ft.	24,987	2.06
15-in. sewer	1	260 lin. ft.	676	2.60
18-in. sewer	5	6,230 lin. ft.	18,247	2.93
24-in. sewer	1	100 lin. ft.	400	4.00
24-in. sewer, reinforced	1	2,950 lin. ft.	12,242	4.15
30-in. sewer, reinforced	1	3,070 lin. ft.	17,345	5.65

CONCRETE SIPHON PIPE

12-in. siphon	1	520 lin. ft.	1,378	2.65
18-in. siphon	1	240 lin. ft.	912	3.80

CORR. METAL DRAIN PIPE

6-in. perf. drain	10	3,808 lin. ft.	7,434	1.95
6-in. drain	8	7,680 lin. ft.	13,777	1.79
8-in. perf. drain	13	27,860 lin. ft.	65,645	2.36
8-in. drain, coated	3	1,110 lin. ft.	2,817	2.54

CORR. METAL CULVERT PIPE

12-in. culvert	11	3,380 lin. ft.	9,542	2.82
15-in. culvert	3	34 lin. ft.	137	4.03
18-in. culvert	15	8,320 lin. ft.	37,368	4.49
18-in. culvert, ext. str.	1	1,600 lin. ft.	8,800	5.50
24-in. culvert	14	2,190 lin. ft.	15,165	6.92
24-in. culvert, ext. str.	2	890 lin. ft.	7,778	8.74
30-in. culvert	3	582 lin. ft.	5,586	9.60
36-in. culvert	6	418 lin. ft.	5,055	12.09
36-in. culvert, 8 gauge	1	600 lin. ft.	10,500	17.50
42-in. culvert	2	120 lin. ft.	1,800	15.00
48-in. culvert	4	324 lin. ft.	5,835	18.01
48-in. culvert, ext. str.	3	520 lin. ft.	12,055	23.18
60-in. culvert	2	140 lin. ft.	3,480	24.86
60-in. culvert, ext. str.	1	140 lin. ft.	4,900	35.00
60-in. culvert, ext. str., asbestos bonded	1	160 lin. ft.	5,600	35.00
60-in. culvert, prot. invert	1	160 lin. ft.	5,600	35.00
60-in. culvert, 8 gauge	1	190 lin. ft.	5,700	30.00
66-in. corr. metal	1	70 lin. ft.	2,170	31.00
72-in. culvert	1	200 lin. ft.	8,000	40.00
78-in. culvert, asbestos bonded	1	48 lin. ft.	3,120	65.00
84-in. culvert	3	594 lin. ft.	29,840	50.24
84-in. culvert, prot. invert	2	140 lin. ft.	7,906	56.48

CORR. METAL CULVERT, ARCH-TYPE

18 - 11-in. arch-type culvert	1	10 lin. ft.	100	10.00
22 - 13-in. arch-type culvert	1	50 lin. ft.	400	8.00
29 - 18-in. arch-type culvert	1	110 lin. ft.	1,100	10.00
36 - 22-in. arch-type culvert	2	86 lin. ft.	1,032	12.00
43 - 27-in. arch-type culvert	2	27 lin. ft.	492	18.22
58 - 36-in. arch-type culvert	3	456 lin. ft.	8,346	18.30
65 - 40-in. arch-type culvert	1	40 lin. ft.	1,400	35.00
72 - 44-in. arch-type culvert	4	540 lin. ft.	15,420	28.56

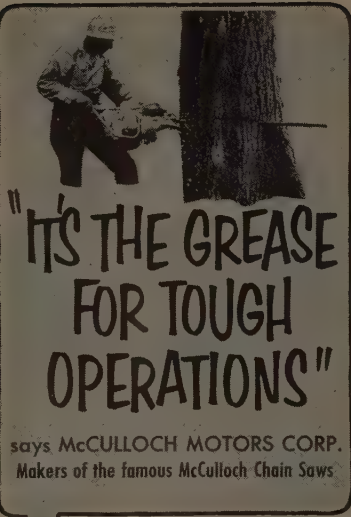
CORR. METAL, MISCL.

18-in. metal tide gate	1	3 ea.	120	40.00
30-in. metal tide gate	1	4 ea.	320	80.00
Salvaging culvert pipe	30	11,670 lin. ft.	20,542	1.76
Ext. for installing under pavement	10	1,196 lin. ft.	3,645	3.05
Rock backfill in drains	22	5,436 cu. yd.	28,970	5.33
24-in. metal headgate	2	3 ea.	275	91.67
Installing 18-in. metal pipe	1	92 lin. ft.	184	2.00
Installing 24-in. metal pipe	1	46 lin. ft.	115	2.50
Installing 36-in. metal pipe	1	48 lin. ft.	480	10.00

ASPHALTIC CONCRETE PAVING

Class "B" in wearing surface	60	475,060 ton	3,200,644	6.74
Rubber additive	1	700 lb.	525	0.75
Emulsified asphalt in seal coat	54	3,318 ton	153,510	46.27
Aggregate in seal coat	55	13,269 cu. yd.	65,715	4.95

(Continued on page 188)

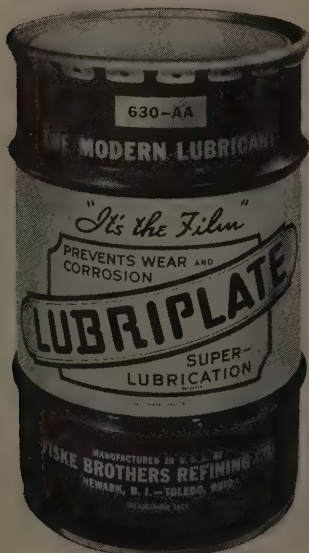


says McCULLOCH MOTORS CORP.
Makers of the famous McCulloch Chain Saws

"We tested all types and makes of lubricants for the Zerol gears in the transmission. The one grease selected for long, tough operation was LUBRIPLATE. Now that we have produced thousands of McCulloch Chain Saws, we more than ever recommend the use of LUBRIPLATE Lubricants in our tools."

For nearest LUBRIPLATE distributor, see Classified Telephone Directory. Send for free 56-page "LUBRIPLATE DATA BOOK"... a valuable treatise on lubrication. Write LUBRIPLATE DIVISION, Fiske Brothers Refining Co., Newark 5, N. J. or Toledo 5, Ohio.

**REGARDLESS OF THE SIZE
AND TYPE OF YOUR MACHIN-
ERY, LUBRIPLATE
LUBRICANTS WILL IMPROVE
ITS OPERATION AND REDUCE
MAINTENANCE COSTS.**



NEW 1953 EDITION

handiest time-saving equipment
reference ever published for
those who buy, use, repair or
maintain construction
equipment.

WESTERN CONSTRUCTION HANDBOOK

1953 EDITION

for **CONTRACTORS
DISTRIBUTORS
MANUFACTURERS**
and others engaged in
the CONSTRUCTION INDUSTRY

Published by
KING PUBLICATIONS
609 MISSION ST., SAN FRANCISCO 5, CALIFORNIA
YUKON 2-4343

Price \$5.00
Single Copy

ORDER Now!

REVISED
UP-TO-DATE
FAR MORE COMPLETE

The **ONLY** reference that gives
you **COMPLETE** equipment infor-
mation on who makes what,
who sells and services it
in the West!

Single Copies.....	\$5.00 Each
Two to five copies.....	\$3.50 Each
SIX OR MORE COPIES.....	\$3.00 Each

1. More Than 350 Manufacturers

listed, with names of Key Western
personnel, branch address, Western
dealers and distributors.

2. Over 500 Western Distributors, and Factory Branches

with names of key personnel, list of
lines handled, addresses and phone
numbers.

3. Complete Alphabetical Product Listing,

cross-referenced to manufacturer
section.

SAVE HOURS and DOLLARS... ORDER
YOUR NEW 1953 EDITION NOW!

MAIL THIS COUPON TODAY!

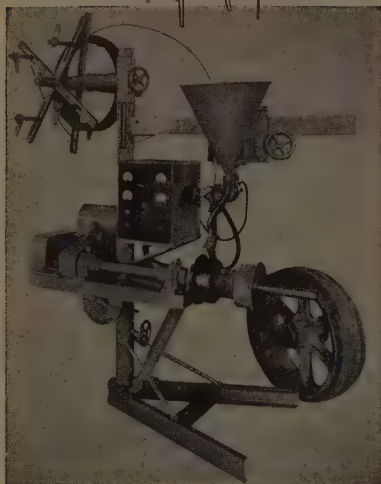
WESTERN CONSTRUCTION
609 Mission St., San Francisco 5, Calif.

YES, I enclose \$_____ for _____ copies of the 1953 WESTERN
CONSTRUCTION HANDBOOK. (Add 3% sales tax if ordering
from a California address.)

Name.....
Company.....
Address.....
City..... Zone..... State.....

WELDING THAT IS

Really Automatic



Rebuilding rollers, idlers, crusher rolls and other circular shapes is fast and simple — with a Rexarc Automatic Welder and Positioner.

Metal is deposited at a fast rate with complete control over low arc voltage and amperage, minimizing stress and dilution of the parent metal. High frequency starting and stabilization assures a steady arc. Welding can be lineal or cross-bead, continuous or in sequence.

Welding on tractor rails and other longitudinal surfaces is accomplished easily by transferring the welding head and controls to a flat-bed positioner. All types of positioners for special applications engineered upon request.

REXARC

AUTOMATIC WELDERS
AND POSITIONERS

Let Us Send You
Complete Information

THE SIGHT FEED GENERATOR CO.

43 EAST THIRD STREET

WEST ALEXANDRIA, OHIO, U. S. A.

UNIT BID PRICES CONTINUED

DESCRIPTION	NO. OF CONTRACTS	TOTAL QUANTITY	TOTAL BID	AVERAGE UNIT BID
BITUMINOUS MACADAM & OIL MAT WEARING SURFACE				
Furn. and place 120-150 asphalt.....	1	24 ton	1,680	70.00
Furn. and place 150-200 asphalt.....	23	5,697 ton	231,491	40.63
Furn. and place 200-300 asphalt.....	3	1,380 ton	55,857	40.48
Furn. and place MC-2 asphalt.....	5	594 ton	23,730	39.99
Furn. and place MC-3 asphalt.....	1	220 ton	9,900	45.50
Furn. and place RC-2 asphalt.....	1	56 ton	2,520	45.00
Furn. and place RC-3 asphalt.....	37	3,676 ton	164,678	44.80
Furn. and place emulsified asphalt.....	21	846 ton	39,596	46.80
Furn. and place aggregates.....	23	62,856 cu. yd.	212,488	3.38
Furn. and place aggregate (cinders).....	1	3,300 cu. yd.	10,560	3.20
Haul and place aggregates.....	1	1,900 cu. yd.	3,040	1.60
Placing aggregates.....	4	25,800 cu. yd.	26,145	1.01
Hauling aggregates.....	5	75,730 yd. mi.	15,585	0.21
Furn. and pl. ¾ - 0-in. in binder crse.....	51	25,825 cu. yd.	96,268	3.73
1 - 0-in. matl. in binder crse.....	1	1,000 cu. yd.	3,500	3.50
1 - 0-in. cinders in binder crse.....	1	2,200 cu. yd.	5,720	2.60
Prep. of base (new const.).....	50	215.79 mi.	47,244	218.94
Prep. of base (reolling).....	4	119.12 mi.	4,835	40.60

PITRUN MATERIALS IN SUBBASE & BASE

Selected R/B topping, haul extra.....	9	393,800 cu. yd.	186,420	0.47
Pitrun 3-in. - 0, haul inc.....	7	222,300 cu. yd.	355,312	1.60
Selected R/B topping, haul included.....	1	440 cu. yd.	880	2.00
Pitrun 3-in. - 0, haul inc.....	7	135,880 cu. yd.	207,721	1.53
Cinders in base, haul inc.....	1	44,500 cu. yd.	31,150	0.70
Quarry run rock, haul inc.....	7	64,780 cu. yd.	83,910	1.30
Cinder topping, haul extra (pitrun).....	1	53,000 cu. yd.	15,900	0.30
Hauling cinder topping.....	1	114,000 yd. mi.	9,120	0.08
Hauling R/B topping.....	9	1,366,700 yd. mi.	185,725	0.13

MISCELLANEOUS STREET WORK

Class "A" concrete in box culverts.....	15	3,430 cu. yd.	208,140	60.68
Class "A" concrete in misc. str.....	23	51 cu. yd.	2,571	50.41
Metal reinforcement.....	17	586,750 lb.	66,386	0.11
¾-in. x 18-in. dowel pins.....	4	1,400 ea.	790	0.56
Concrete pavement 7-in.....	1	650 sq. yd.	4,615	7.10
Concrete sidewalks.....	5	2,070 sq. yd.	7,060	3.41
Concrete curbs.....	13	1,112 cu. yd.	52,190	46.93
Concrete curbs and gutters.....	4	1,630 cu. yd.	71,840	44.07
Concrete in retaining walls and stairways.....	1	16 cu. yd.	1,088	68.00
Concrete driveways.....	2	400 sq. yd.	1,706	4.27
Concrete catch basins.....	26	225 ea.	16,757	74.48
Concrete catch basins, special.....	3	15 ea.	1,740	116.00
Concrete slab over tanks.....	1	63 sq. yd.	488	7.75
Concrete siphon boxes.....	1	10 cu. yd.	750	75.00
Type "B" manholes.....	10	60 ea.	16,720	278.67
Adjustment of manholes.....	13	43 ea.	1,820	42.33
Adjustment of catch basins.....	4	18 ea.	460	25.56
Adjustment of monument boxes.....	1	5 ea.	125	25.00
Removal of walks and driveways.....	3	5,900 sq. yd.	6,875	1.17
Removal of catch basins.....	10	60 ea.	1,728	28.80
Removal of pavement.....	7	24,300 sq. yd.	25,405	1.05
Removal of curbs.....	8	7,182 lin. ft.	3,226	0.45
Removal of manholes.....	2	4 ea.	185	46.25
Removal of misc. structs.....	1	20 cu. yd.	110	5.50
Cement rubble masonry.....	1	80 cu. yd.	4,000	50.00
Woven wire fence and metal post.....	1	4,100 rods	13,858	3.38
14-ft. x 42-in. steel gate.....	1	14 ea.	490	35.00
Expansion joints ½-in. x 6-in.....	1	160 lin. ft.	28	0.175
Expansion joints ½-in. x 9-in.....	1	160 lin. ft.	35	0.22

CRUSHED ROCK, GRAVEL OR CINDERS IN SURFACING

4 - 0-in. in base, haul incl.....	5	72,300 cu. yd.	124,020	1.72
3 - 0-in. in base, haul incl.....	19	296,750 cu. yd.	788,257	2.66
2½ - 0-in. in surf., haul incl.....	9	71,000 cu. yd.	251,835	3.55
2½ - 0-in. base, haul extra.....	2	3,150 cu. yd.	10,441	3.31
2 - 0-in. in base, haul incl.....	6	78,860 cu. yd.	168,425	2.14
1½ - 0-in. in base and leveling crse.....	7	45,600 cu. yd.	105,274	2.31
1½ - 0-in. cinders in base, haul incl.....	2	35,000 cu. yd.	75,750	2.16
1 - 0-in. cinders in base, haul incl.....	1	32,000 cu. yd.	51,200	1.60
1 - 0-in. in base and leveling course.....	2	21,300 cu. yd.	60,975	2.86
¾ - 0-in. in base, shldr. and leveling course, haul incl.....	76	347,550 cu. yd.	978,945	2.82

UNIT BID PRICES CONTINUED

DESCRIPTION	NO. OF CONTRACTS	TOTAL QUANTITY	TOTAL BID	AVERAGE UNIT BID
- 0-in. cinders in base, shldrs. and leveling course, haul incl.....	1	6,100 cu. yd.	15,250	2.50
- matl. in leveling crse., haul & pl.	1	150 cu. yd.	277	1.85
- sprinkling	87	62,897 M. gal.	157,888	2.51
- 1 emul. asph. in sprinkling.....	1	14,900 gal.	3,725	0.25

RUSHED ROCK, GRAVEL OR CINDERS IN STOCKPILE

- 0-in. cr. rock, haul incl.	1	500 cu. yd.	1,355	2.71
- ¼-in. cr. rock, haul incl.	2	9,340 cu. yd.	26,703	2.86
- 0-in. cr. rock, haul incl.	1	3,500 cu. yd.	11,725	3.35
- ½-in. cr. rock, haul incl.	20	56,070 cu. yd.	174,725	3.12
- 0-in. cr. rock, haul incl.	4	7,630 cu. yd.	25,437	3.33
- ¼-in. cr. rock, haul incl.	21	75,610 cu. yd.	241,491	3.19
- in. - 10-mesh cr. rock, haul incl.	5	14,100 cu. yd.	43,485	3.08
- 0-in. cr. rock, haul incl.	1	6,400 cu. yd.	28,800	4.50
- in. - 10-mesh cr. rock, haul incl.	19	43,250 cu. yd.	138,987	3.21
- 0-in. cr. rock, haul incl.	3	6,700 cu. yd.	19,233	2.87
- ½-in. cr. rock, haul extra	2	6,900 cu. yd.	17,848	2.59
- ¼-in. cr. rock, haul extra	2	8,800 cu. yd.	22,712	2.58
- in. - 10-mesh cr. rock, haul extra ..	2	5,400 cu. yd.	14,261	2.64
- 0-in. cr. rock, haul extra	1	2,900 cu. yd.	7,424	2.56
- ½-in. cr. gravel, haul incl.	7	19,870 cu. yd.	61,544	3.10
- ¼-in. cr. gravel, haul incl.	7	20,730 cu. yd.	64,563	3.11
- in. - 10-mesh cr. gravel, haul incl.	1	1,000 cu. yd.	2,900	2.90
- in. - 10-mesh cr. gravel, haul incl.	7	10,300 cu. yd.	32,689	3.17
- ½-in. cr. gravel, haul extra	1	5,200 cu. yd.	12,688	2.44
- ¼-in. cr. gravel, haul extra	1	5,200 cu. yd.	12,688	2.44
- in. - 10-mesh cr. gravel, haul extra ..	1	2,600 cu. yd.	6,344	2.44
- ½-in. cr. cinders, haul incl.	5	18,800 cu. yd.	43,916	2.34
- ¼-in. cr. cinders, haul incl.	5	22,400 cu. yd.	53,216	2.38
- 0-in. cr. cinders, haul incl.	1	1,000 cu. yd.	2,590	2.59
- in. - 10-mesh cr. cinders, haul incl.	5	15,100 cu. yd.	37,805	2.50
- 0-in. cr. cinders, haul incl.	2	2,700 cu. yd.	6,503	2.41
- hauling cr. rock or gravel to stklp.	3	187,000 yd. mi.	26,795	0.14

BRIDGES

Class "A" concrete	83	41,882 cu. yd.	2,713,627	64.79
Structural excav.	47	30,199 cu. yd.	202,362	6.70
Struct. excav. below elev. shown.....	45	560 cu. yd.	8,060	14.39
Compacted backfill	1	340 cu. yd.	1,700	5.00
Base concrete	4	2,130 cu. yd.	72,630	34.09
Metal reinforcement	54	8,626,600 lb.	909,379	0.11
Structural steel	1	17,000 lb.	5,610	0.33
Structural carbon steel	7	1,397,000 lb.	295,376	0.21
Structural low alloy steel.....	5	2,638,000 lb.	562,691	0.21
Metal handrail	21	16,697 lin. ft.	200,830	12.03
Open grid decking	1	3,640 sq. ft.	38,220	10.50
Filled steel grid decking	1	2,300 sq. ft.	9,200	4.00
Treated lumber	10	193.4 M. FBM.	49,620	256.57
Treated 2 x 2 decking	1	2,600 sq. ft.	2,860	1.10
Untreated lumber	1	12 M. FBM.	2,700	225.00
Furnish steel piling	8	10,610 lin. ft.	40,303	3.80

(Continued on page 190)

PREFERRED by CONTRACTORS

Less initial cost — Lower upkeep

1½ HP to
5 HP

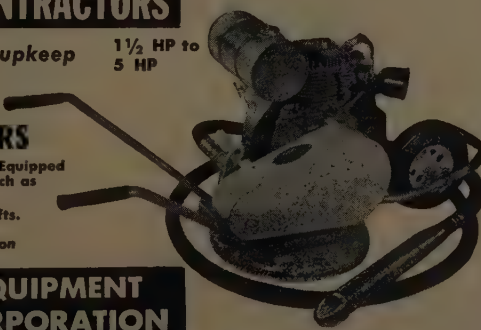
MARVEL CONCRETE VIBRATORS

GV-1, GV-2 & GV-3 Models Now Equipped
with Automatic Centrifugal Clutch as
Standard Equipment.

Interchangeable Flexible Shafts.

Write for full information

MARVEL EQUIPMENT CORPORATION
215-217 EAGLE ST. • B'KLYN 22, N. Y.



Tops in Protection



McDonald SAFE-T-HAT

Styled right for looks and comfort. Engineered right for super safety and rugged service. Weighs only 11¾ oz. complete. Headband instantly adjustable to size and easily replaceable.

Write for bulletin and prices.

B. F. McDONALD CO.



Manufacturers & Distributors of
Industrial Safety Equipment

5721 West 96th St., Los Angeles 45
Other offices in San Francisco and Houston

2

ways
to make
crane
operations
pay more



Rud-O-Matic Magnet Reel Tagline Combination

Steel tagline holds magnet steady and absorbs the load . . . protective slack is maintained in expensive magnet cable to avoid jerking, pulling loose at the terminals or snagging.

Standard with major crane manufacturers, made in five sizes for your present equipment.



Rud-O-Matic Tagline

steadies your clamshell buckets. Provides ample coil spring power at all boom angles to keep bucket lined up with the work. Makes more loads per day easier. Rud-O-Matics are fool-proof, trouble-free. Eight sizes meet all requirements. Available immediately. For full information see your dealer — or mail coupon below.

I'd like more information on ☐ Rud-O-Matic Taglines, ☐ Rud-O-Matic Magnet Reel-Tagline Combinations. Send literature and complete details.

Name

Company

Address

City Zone State

McCAFFREY-RUDDOCK

Tagline

CORPORATION

2131 East 25th Street • Los Angeles 58, California

UNIT BID PRICES CONTINUED

DESCRIPTION	NO. OF CONTRACTS	TOTAL QUANTITY	TOTAL BID	AVERAGE UNIT B
Furnish treated piling	35	138,683 lin. ft.	210,368	1.52
Furnish treated 12 x 12-in. piling.....	1	580 lin. ft.	1,160	2.00
Furnish pier foundation piling.....	1	2,200 lin. ft.	1,540	0.70
Furnish untreated piling	8	63,020 lin. ft.	43,174	0.69
Drive piling	35	4,481 ea.	197,212	44.01
Drive pier piling	1	72 ea.	2,880	40.01
Drive steel piling	8	197 ea.	12,250	62.18
Furnish and drive test pile.....	1	3 ea.	3,750	1,250.00
Concrete handrail	1	70 lin. ft.	1,050	15.00
Concrete slope pavement	3	930 sq. yd.	5,610	6.03
Concrete slab riprap	5	1,950 sq. yd.	12,200	6.26
Painting steel spans	1	1,050 ton	31,500	30.00
Membrane water proofing	2	320 sq. yd.	1,535	4.80

TRAFFIC CONTROL

Concrete traffic islands	3	410 cu. yd.	18,840	45.95
Concrete traffic separators	1	100 cu. yd.	4,200	42.00
Concrete median strips	1	230 cu. yd.	8,050	35.00
Metal guardrail with concrete posts..	16	34,000 lin. ft.	112,270	3.30
Concrete sight and guard posts.....	20	1,441 ea.	13,810	9.58
Salvaging sight post	1	20 ea.	10	0.50
Salvaging guardrail	1	680 lin. ft.	238	0.35
Asphaltic concrete markers	12	11,120 lin. ft.	11,820	1.06
Construct recesses	1	All	150	
¾-in. electrical conduit	1	250 lin. ft.	250	1.00
1-in. electrical conduit	4	640 lin. ft.	657	1.03
1¼-in. electrical conduit	3	810 lin. ft.	1,425	1.76

ROADSIDE IMPROVEMENT

Furnish and place topsoil.....	2	540 cu. yd.	975	1.81
Excavate and place topsoil.....	4	13,100 cu. yd.	12,775	0.98
Topsoil with tractor and dozer	1	100 hrs.	800	8.00
Truck haul on topsoil	2	3,000 cu. yd.	700	0.23
Hauling topsoil	1	200 yd. mi.	50	0.25
½-in. water pipe, galvanized.....	4	5,830 lin. ft.	2,431	0.42
¾-in. water pipe, galvanized.....	5	11,590 lin. ft.	6,112	0.53
1-in. water pipe, galvanized.....	5	13,540 lin. ft.	8,028	0.59
1¼-in. water pipe, galvanized.....	5	7,850 lin. ft.	5,898	0.75
1½-in. water pipe, galvanized.....	4	4,510 lin. ft.	3,769	0.84
2-in. water pipe, galvanized.....	3	6,150 lin. ft.	6,044	0.98
2-in. plastic supply main	1	300 lin. ft.	225	0.75
2½-in. water pipe, galvanized.....	2	1,800 lin. ft.	2,284	1.27
3-in. water pipe, galvanized.....	1	1,400 lin. ft.	2,632	1.88
½-in. drain valves	4	98 ea.	786	8.03
Shrubby heads	2	245 ea.	393	1.61
Pop-up non-revolving sprinkler hds.	4	1,592 ea.	6,407	4.02
Pop-up revolving sprinkler heads.....	3	77 ea.	938	12.19
¾-in. control valves.....	1	2 ea.	14	7.25
1-in. control valves	3	17 ea.	220	12.96
1¼-in. control valves.....	4	22 ea.	308	14.04
1½-in. control valves.....	3	36 ea.	582	16.18
2-in. control valves.....	3	94 ea.	2,012	21.41
¾-in. quick-coupling hose valves.....	2	64 ea.	405	6.34
Furnish and plant trees.....	1	10 ea.	135	13.50
Plant state furnished trees.....	1	50 ea.	450	9.00
Furnish and plant shrubs.....	1	200 ea.	578	2.89
Furnish and plant ground covers.....	1	6,750 ea.	1,957	0.29
Preparing soil and seeding lawn.....	2	10.5 acre	10,830	1,031.42
Preparing soil and seeding lawn.....	1	8,000 sq. ft.	400	0.05
Preparing soil and seeding slopes.....	1	142 acre	6,035	42.50
Highland Bent grass seed.....	3	702 lb.	664	0.95
Creeping Red Fescue grass seed.....	3	1,110 lb.	956	0.86
Alta Fescue grass seed.....	1	310 lb.	325	1.05
Aladak alfalfa	1	410 lb.	430	1.05
Kentucky blue grass seed.....	2	450 lb.	366	0.81
Tualatin oat grass seed	1	370 lb.	444	1.20
Crested wheat grass seed	1	550 lb.	440	0.80
Metal foxtail	1	90 lb.	180	2.00
Peat moss	1	500 bail	2,370	4.74
Inorganic fertilizer	3	152 cwt.	575	3.79
Ground limestone	1	40 cwt.	81	2.04
Ammonium sulfite fertilizer	1	320 cwt.	1,440	4.50
Sawdust mulch	1	25 units	375	15.00
Sinking well	1	20 ft.	300	15.00
6-in. casing in place	1	20 ft.	140	7.00

NEW LITERATURE

601

About Challenge truck mixers

In an attractive fully-illustrated 20-page bulletin, **Cook Bros. Equipment Co.** presents detailed descriptions of the six models available in the Challenge truck mixer line. Complete specifications are given, including an account of important parts which minimize the machines' operational and maintenance costs. Special note is taken of the side engine mount, which is said to permit larger sized mixers on shorter wheelbase for maximum payload.

602

On double roll crushers

Smith Engineering Works has published No. 282, a bright-colored, 8-page catalog about its line of Tel-smith double roll crushers. Pertinent information is given about the three sizes, 24 x 16, 30 x 18, and 40 x 22. Just a glance will tell you all about application, capacity and reduction ratio, construction, standard drives, feeders, adjustment, roll shells, housing, and lubrication. The firm recommends the roll crushers for reducing large capacities at low reduction ratios. Photographs and diagrams explain the machine's component parts. Clip and mail coupon for your free copy.

603

"Mild steel electrodes"

"Mild Steel Electrodes" is an interesting recently released 15-page bulletin describing the Murex welding electrodes manufactured by **Metal & Thermit Corp.** Attractively designed, the 2-color publication stresses specifications, chemical analysis, physical properties, and qualifications of Types R and A, Genex M, Type U, Alternex, Type HTS, and Type FHP. Presentation is both clear and complete.

604

Specifications booklet

This new 4-page brochure concerns welding machine specifications on new models, and also welding electrodes and accessories. Published by **A. O. Smith Corp., Welding Products Division.**

605

Athey loader bulletin

Complete description, specifications, and pictures of the Athey Model 3 Force-Free Loader are now available in a new 8-page bulletin by **Athey Products Corp.** Described as the original conveyor-type windrow loader,

the booklet covers everything you need to know about how it is made and how it works. Among the attachments described for this versatile machine are: an auger-feeder front end for stockpile loading, fully-winterized cab for year-around work, side discharge conveyor for faster loading of trucks, three rear axle arrangements to meet any type of power or flotation

requirements, a cleated belt for loading snow, and the availability of 3-ft. conveyor extensions for over-cab loading. For your free copy of this 2-color booklet, copy number above and send in coupon.

606

Complete information on T-35 Schield Bantam crane

Schield Bantam Co. has issued a new 6-page illustrated bulletin describing their 6-ton, $\frac{3}{4}$ -yd., Model T-35 truck crane. The bulletin provides detailed mechanical specifications, together with complete dimensions and operating data, including information on various truck mount-



110 Rigger's Block
Bronze Bushed



R-10 Rigger's Block
Timken Bearings



T6R Full-Sided
Block—Safe,
Fast, Tough, Light



WE BUILD BLOCKS TO YOUR SPECIFICATIONS



SKOOKUM CO., INC.

8504 N. CRAWFORD

PORTLAND 3, OREGON

big man

on the totem pole...

SKOOKUM

...of course

If you need a block to put on a pole, a boom or a spar... if you need a block for lifting, rigging, bronze bushed or with roller bearings (Timken, no less) and above all, if you want a block that is strong, safe and trouble free, *See your Skookum Dealer.* Ask the man who knows blocks best (your friend the logger) and he'll tell you the Big Man on the pole: spar pole, boom pole or totem pole is SKOOKUM.



NOW

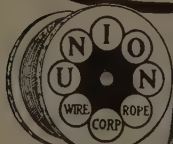
Can Save Up To 300%



Goodbye To Waste of Good Dozer Rope!

Tuffy Dozer Rope is specially constructed with the extra stamina needed to stand up under the rough dozer treatment. But Tuffy engineers went even further to cut your costs! They devised a special reel to carry 150' of Tuffy Dozer Rope on the tractor. When 10' or so of rope is crushed or cut on the drum, you just feed enough from the reel to replace the damaged part! The cut can be made and the machine back in use in 15 to 20 minutes—less than half the time normally needed! Figuring roughly, there are two Dozer Ropes to a reel. This gives you an approximate ratio of 6 to 2 . . . about 300% increased service! Mount a reel of Tuffy Dozer Rope just back of the wedge socket on your Dozer and see how much longer service you get! ½" rope, furnished in 150' reels.

Mail Coupon for FREE Folder on Tuffy Dozer Rope



UNION WIRE ROPE CORP.

Specialists in Wire Rope and Braided Wire Fabric

2146 Manchester Ave., Kansas City 3, Mo.

Please send me the FREE illustrated folder on Tuffy Dozer Rope.

Firm Name _____

By _____ Title _____

Address _____

City _____ Zone _____ State _____

ings and typical interchangeable attachments used with the Bantam crane boom. Large, easy-to-read charts show the machine's lifting capacities at various radii for both 2½- and 4-ton truck mountings using 25- to 45-ft. booms. A full page provides complete data on weights, applications, and approximate production output of eight different attachments.

407

"Eucs" and what makes 'em run

A new catalog has been issued by Euclid Road Machinery Co. The 3-color, 20-page booklet is all about the firm's line of earthmoving equipment powered by General Motors 2-cycle diesel engines. Pictured are heavy-duty trucks of from 10- to 34-ton capacity, bottom dumps, scrapers, and loaders. Illustrations of the various engine models and cutaway views of the Allison torque converter and torque transmission are also included. Featured for the first time is equipment now powered by General Motors 275-hp. 6-110 diesel engine. The catalog also contains a complete list of Euclid distributors and factory branches, and an extensive listing of GM diesel engine servicing points. This should be a helpful piece of literature for the construction library.

505

Guide to the uses of new reinforcing mesh

A 4-page brochure published by Adrian Peerless, Inc., covers important improvements in its line of masonry wall reinforcing, Wal-Lok. Fabricated entirely of 100,000-psi. tensile strength cold-drawn steel wire, new Wal-Lok is now deformed and knurled; #9 ga. cross bars are deep welded and project beyond 3/16-in. diameter longitudinal rods. Data contained in the release include all about pull test, side pressure test, and shrinkage crack test. Contains photographs and charts.

509

Steel building products explained in detail

A helpful guide to the many steel products manufactured by Bethlehem Pacific Coast Steel Corp. has been issued recently. All these many products are illustrated and described in detail, so that the user will know how and where to use them. Among the products described are: structural shapes, open web steel joists, long-span steel joists, concrete reinforcing bars, concrete forms, beth-co-loy sheets, galvanized sheets, beth-coweld pipe, and fabricated steel construction. Design table for steel joists covers 6 of the booklet's 16 pages. This comprehensive treatment should be useful as a handy reference. Put key number above on coupon for your free copy.



Saves Nearly 50% on Scraper Rope Costs!



"Outlasts (Other Rope) Almost 2 to 1"

Says Owner of a Middlewestern Construction Company
(Name on Request)

From his records of yardage and service life, this Nebraska construction company owner learned that he could save nearly 50% on scraper rope costs by switching to Tuffy! And there's a good reason why: Tuffy is specially made to stand up under the stresses and strains of wheeled scrapers. It's flexible to withstand more sharp bending and to wind snugly and smoothly on the drums. It is designed to resist drum crushing caused by cross-overs. And Tuffy is easy to order—just specify length, diameter and "Tuffy."

Get This FREE Folder on Tuffy Scraper Rope



MAIL COUPON TODAY

UNION WIRE ROPE CORP.

Specialists in Wire Rope and Braided Wire Fabric

2146 Manchester Ave., Kansas City 3, Mo.

Please send my FREE illustrated folder on Tuffy Scraper Rope.

Firm Name _____

By _____ Title _____

Address _____

City _____ Zone _____ State _____

610

solving problems solved

Skil Corp., manufacturer of portable electric and pneumatic tools, has published a 24-page manual on portable power saw cutting applications. **Skil Saw Problem Solver** mentions 10 different materials with the most effective method of cutting them. Information includes proper blade selection (with drawings), proper cutting technique, and various helpful suggestions.

611

specification booklets in Gar Wood units

Detailed information is presented in three new specification booklets released by **Gar Wood Industries, Inc.**, on its ¾-yd. Model 75A and Model 75B excavators and 75BT truck cranes. Also includes information on the Foundation Borer, right-angle drive, travel speeds, and power plants. Facts are provided concerning the capacities, ranges, reaches, and attachments available for the first three models mentioned.

612

learn about Cat HT4 shovel

A bright 2-colored folder (Form 0533) highlighting the mechanical features and specifications of the **Caterpillar HT4** shovel has just been released by **Caterpillar Tractor Co.** Points out the machine's component parts and also contains on-the-spot pictures of the versatile equipment in action.

Literature briefs . . .

613

SAW BLADES—Two new bulletins have been published by **Robert G. Evans Co.** to describe its Target diamond blades for masonry, concrete, and hand-power saws. The blades come in color—gold for hard, blue for medium, and red for soft materials. Included is a chart which tells what color blade to use for specific types of material.

614

STEEL PRODUCTS—**Bethlehem Steel Co.** has published an illustrated folder containing information on cold-formed shapes, Mayari-R low-alloy, high-strength steel, rolled and forged circular products, and Bethlehem wire.

615

PLASTIC PIPE—A four-page illustrated booklet on **Carlson L** rigid plastic pipe has been put out by **Carlson Products Corp.** It discusses various applications for which **Carlson L** is recommended, gives detailed information on how the sections are joined and connected to metal fixtures or pipelines, covers in detail the new compression coupling, and includes specifications and dimensional drawings of the plastic fittings.

616

ARC-WELDING ACCESSORIES—Arc-welding accessories are described in a 12-page booklet published by the **Westinghouse Electric Corp.** This line of products varies from electrode holders and ground clamps to

protective clothing and headgear. Illustrations and specification data for each are shown.

617

PIPELAYING—"Pipeline to Profit" is a new eight-page booklet published by the **Caterpillar Tractor Co.** It combines photographs of actual pipelaying operations to provide a unified picture-story of the various steps in a pipeline operation from start to finish.

618

DRAFTING SUPPLIES—A new 60-page catalog describing a complete selection of drawing and drafting supplies has been published by the **Alvin Co.**

619

TIMBER—A new 12-page, full-color booklet, "Modern Construction with Engineered Timbers," has been published as a guide and source of authoritative information for architects, engineers, and contractors by **Timber Structures, Inc.** It shows how timber is used in conjunction with other suitable materials as a modern engineering material with known structural values.

620

HARDFACING PRODUCTS—**Hardfacing Sales & Eng. Co.** has put out a new catalog illustrating and describing the line of heavy duty grouser shoes, shovel teeth, and hardfacing and welding products. The catalog, which contains specifications, procedures, and other data, was designed to be a source of ready reference data for operators of all types of construction equipment.

**CLIP AND MAIL
THIS COUPON**



▶▶ for your free copies of

NEW LITERATURE

▶▶ or for more information
on

NEW EQUIPMENT

described in the following
pages.

WESTERN

CONSTRUCTION

READER SERVICE
609 Mission Street
San Francisco 5
California

Please list below key numbers of items in which you are interested

.....		
.....		
.....		
.....		
.....		

Name.....

Address.....

Position.....

Organization.....

NEW EQUIPMENT

More information on any of the items in this section may be obtained by using coupon on page 193.

621

Power and speed ranges increased on new Terra Cobra scraper

The 17.5-yd. rubber-tired Wooldridge Terra Cobra 142 is said to be the first two-wheel tractor-type self-propelled scraper to be equipped with a heavy-duty constant mesh

transmission which provides ten speeds forward (up to 35 mi. per hr.) and two in reverse. The manufacturer designed this new model with versatility in mind, and job operations are said to indicate that it has a far greater range of power and speed and increased maneuverability. Powered by a 225-hp. Cummins Diesel, the machine incorporates modern open bowl design, high 25-in. ground clearance, and shorter turning radius. Its capacity is 14.0 cu. yd. struck and 17.5 heaped. Manufacturer is Wooldridge Manufacturing Co.

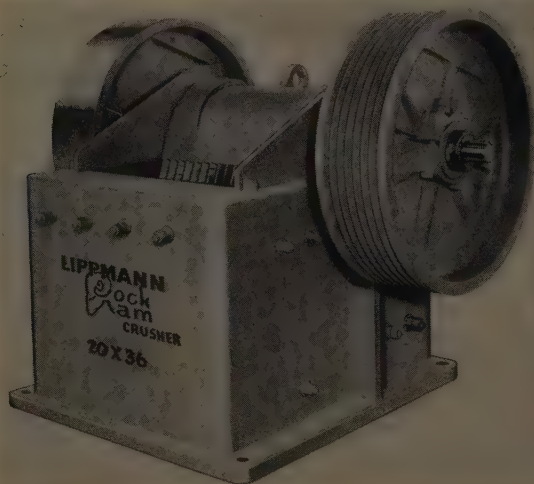


transmission which provides ten speeds forward (up to 35 mi. per hr.) and two in reverse. The manufacturer designed this new model with versatility in mind, and job operations are said to indicate that it has a far greater range of power and speed and increased maneuverability. Powered by a 225-hp. Cummins Diesel, the machine incorporates modern open bowl design, high 25-in. ground clearance, and shorter turning radius. Its capacity is 14.0 cu. yd. struck and 17.5 heaped. Manufacturer is Wooldridge Manufacturing Co.

622

New line of crushers introduced by Lippmann

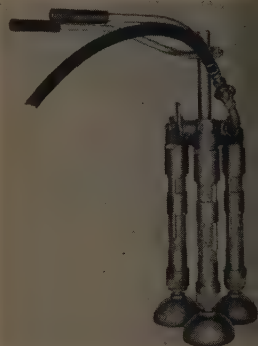
The Lippmann Rock-Ram is a new fabricated-type jaw crusher introduced by Lippmann Engineering Works, and containing the mechanical features of the manufacturer's line of Grizzly-King crusher. The Rock-Ram will be avail-



623

One-man tamper can replace 5 of 'em

A one-man tamper recently introduced is said to replace five hand-operated tampers, thus saving the contractor labor costs, air compressor service and fuel consumption. Known as the TT11 Triple Hand Tamper, it consists of three standard No. 11 Back Fill Tampers assembled to a common head wherein the easily-accessible air control valve is incorporated. Long handle bars keep operator away from the instrument in order to avoid injury, and a swivel air inlet keeps the air hose away from the ground. The equipment is recommended for all earth back-fill work requiring speed and firmness of tamping. It is said to be ideal for narrow tunnel work, close foundation tamping or abutment work. Weight is 135 lb. Manufactured by Le Roi-Cleveland.



624

Flat-topped truck ideal for long, bulky cargo

Take another look. The picture doesn't show a highway-borne aircraft carrier but a heavy-duty truck designed for carrying pipe, lumber, structural steel, and other long, bulky cargo which would ordinarily require a tractor and semi-trailer. The flat top has other advantages, too, besides the maximum deck area for long loads: all-around vision for the driver from his high seat in the cab, quick parking, ease in backing and handling in traffic, low maintenance cost because of simple cab construction, and rugged frame and deck construction for long service life. Available with



THOMPSON RETREADING OF LARGE OFF-THE-ROAD TIRES SAVES YOU MANY DOLLARS!



**27.00 X 33 TIRE
BEFORE and AFTER
RETREADING BY
THOMPSON**

U. S. PATENT
NO. 168,714

Now, your large size tires can be retreaded to give new tire performance, wear and appearance at a fraction of replacement cost! *Thompson*, the world's largest retreader of airplane tires, provides retreading facilities for all sizes of construction tires through 27.00 x 33!

Thompson's newly-designed and patented tread is deeper, huskier and longer-wearing. It is a non-directional tread for use on all wheels . . . traction or free-rolling . . . and provides maximum grip with its self-cleaning design.

*Contact
Thompson for
Prompt and
Efficient Service*

THOMPSON *Aircraft Tire* CORPORATION

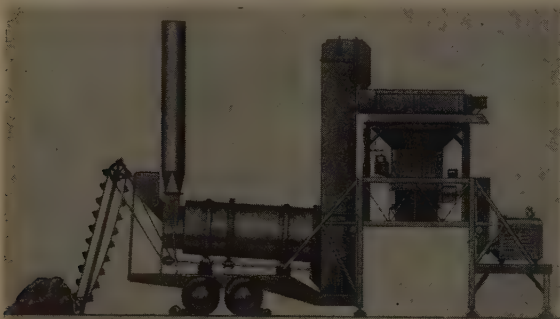
18th and Minnesota Streets • San Francisco 7, California • Mission 7-7320

both single-axle and dual-axle drive. The former has a 25-ft. deck length with a turning wheelbase of only 14 ft., 11 in., and the latter has a 30-ft. deck and a 17-ft. wheelbase. The single-axle model handles a payload of 10 tons, and the dual axle handles 15 tons. The big machine is powered by a 150-hp. White engine, which is mounted under the cab. Manufactured by Murty Bros.

625

Portable batch-type asphalt plant manufactured by Standard

A completely portable, integrally-powered batch-type asphalt plant has been manufactured by Standard Steel Corp. to meet the demand for county and rural work where costs of moving a large plant would be prohibitive. The new plant, which has a 1-ton capacity, is mounted on its own rubber-tired wheels. The mixing unit is raised by means of an elevator device, thus making the machine



ready for operation as soon as it arrives at its destination. In transit, the plant complies with highway clearance specifications and may be towed with a truck or tractor. The portability of this machine does not cut out its completeness. It is said to be unique because it combines the self-erecting, portable feature with full equipment for a gradation devices which are standard with the batch-type plant.

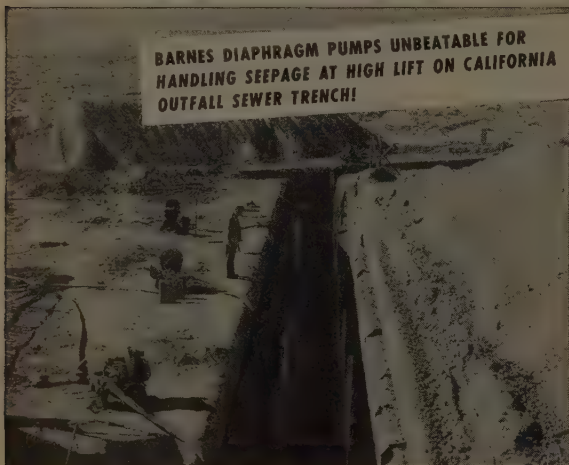
626

Front wheel lean and power circle turn available for A-C Model D motor grader

New accessories now available for Allis-Chalmers Model D motor grader increase the versatility of this machine.



BARNES DIAPHRAGM PUMPS UNBEATABLE FOR HANDLING SEEPAGE AT HIGH LIFT ON CALIFORNIA OUTFALL SEWER TRENCH!



Running a 24-inch concrete sewer outfall across the Mojave Desert for the City of Lancaster, Calif., contractors Vukich and Brown used a step-down berm construction of the 14-1/2-foot-deep sewer ditch. Three Barnes Diaphragm Pumps were used to handle the water seepage. Paul Vukich says, "These Barnes Pumps are the best made for our work. They're absolutely dependable. They run 24 hours a day at low cost, with a minimum of trouble. This is a high pump lift; but our Barnes Pumps are doing their job!"



Barnes BC 402 Diaphragm Pump is but one of many pumps in the complete Barnes Line, with capacities up to 120,000 G.P.H. and pressures up to 800 ft. or 250 P.S.I. Check with your distributor.

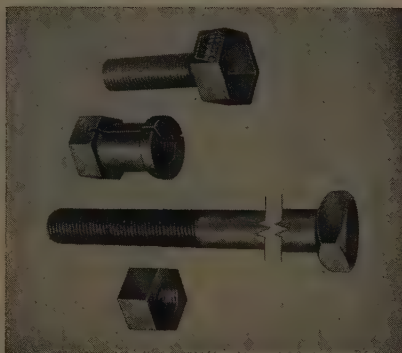
Distributors:

Central Equipment Co., Berkeley, Calif.
P. L. Cooks Co., Portland, Oregon
R. L. Harrison Co., Inc., Albuquerque, New Mexico
The C. H. Jones Equipment Co., Salt Lake City, Utah
Lee & Thatro Equipment Co., Los Angeles, Calif.
H. W. Moore Equipment Co., Denver, Colorado
The Rix Company, Inc., San Francisco, Calif.
Universal Equipment Company, Seattle, Wash.



BARNES MANUFACTURING CO., Mansfield, Ohio; Oakland 21, Calif.

NEW QUICK-ON TRACK TENSION BOLT PARTS



SBM-No. 8
QUICK-ON
(U. S. Pat. No.
2506619)

No. 805
ADJUSTING
NUT

No. 801
TENSION
BOLT
(37 1/4" long)

No. 803
SPRING
TENSION
NUT

...for D8's only

SILVER BOOSTER now gives you a complete "package" of tension bolt parts. Keep one of these Quick-On emergency kits on hand for every D8 . . . and guard against those costly delays due to broken tension bolts. Quick-On bolts can be installed right on the job! Saves you 6 to 8 hours on every breakdown. Order from your tractor dealer today or write direct. Immediate delivery.

SILVER BOOSTER MANUFACTURING CO.

132 W. VERDUGO AVE., BURBANK, CALIFORNIA

chine. A front wheel lean with a range of 25 deg. each way gives ample range for ditching and for counteracting side draft. Operation is made possible by moving the valve control lever. When control is in neutral position the wheels remain in position in their full 50 deg. range. By leaning the wheels, blade maneuverability is increased by more than one foot.

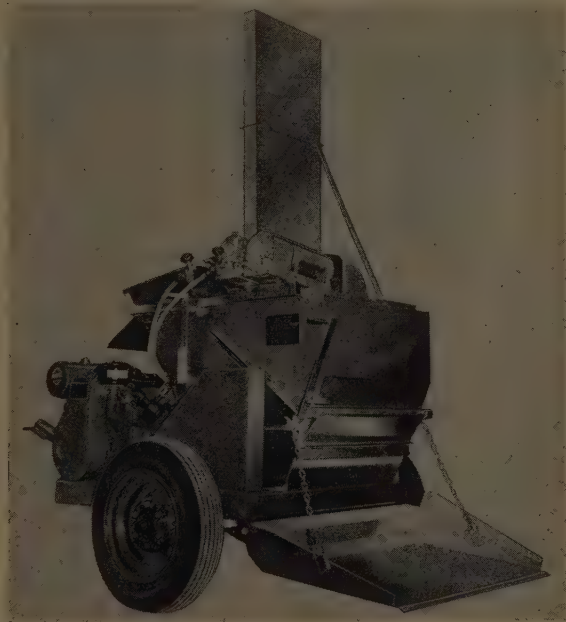
The power circle turn, operated by a hydraulic motor and reduction gear, provides precision control with a wide range of settings through its 135 deg. When finishing subgrade or blacktop, the moldboard can be rotated without disturbing the road surface. The toe of the blade can be swung well inside the front tire to give sufficient range for ditching. Other equipment designed to work with the Model D includes: rear mounted-loader, windrow eliminator, shoulder maintenance blade, hydraulically-controlled scarifier, V-type snow plow, and special minor accessories. Manufactured by Allis-Chalmers Manufacturing Co.

477

Fair weather or foul, it's all the same to this asphalt mixer

Bad weather doesn't affect this new portable asphalt mixer, said to be especially suited to hot- or cold-patching operations in any season under wet or dry conditions. The plant is the HTD-B Multi-Pug asphalt mixer and is designed for handling on-the-job mixtures of asphaltic concrete, sheet asphalt, sand asphalt, or mastic asphalt. It also processes tars, paving asphalts, cut-back asphalts, and emulsified asphalt. Performance specifications are as follows: it reactivates and prepares cold asphaltic mixtures

and heats stock pile mixtures at up to 10 tons per hr.; prepares hot asphaltic mixtures at up to 5 tons per hr.; dries various types of wet aggregates quickly and thoroughly, and removes both moisture and solvents from bituminous mixtures. Manufacturer is K. E. McConaughay.



7500

HOURS is a LONG TIME!

**CHAMPION
FLUORESCENT
LAMPS**

have guaranteed
average rated life of

**7500
HOURS**

(3-hr. or longer
burning cycles)

7500 hours means 40 hours a week for over 3 years and 7 months!

With CHAMPION improved cathode, 7500-hour Fluorescent Lamps you get more and longer lasting, color-correct light — reduce relamping and maintenance cost. For maximum illumination at minimum cost use CHAMPION Fluorescent and Slimline Lamps. Available in a complete range of sizes and colors.

For better LIGHTING—it's PANAMA

We represent leading manufacturers of lamps and lighting fixtures for industrial, commercial and residential lighting. Let us help you plan the most efficient lighting to meet any interior or exterior requirements.

Catalogues, calculating light rules and maintenance manuals available upon request.

PANAMA LAMP & COMMERCIAL CO., INC.

326 So. San Pedro, Los Angeles 13
Phone: MICHigan 0318

325 - 9th St., San Francisco 3
Phone: MArket 1-3251

568 1st Ave. So., Seattle 4
Phone: MUtual 2554

• Since 1897

BRANCHES AND DISTRIBUTORS IN KEY WESTERN CITIES

Rope control added to Harnischfeger's Zip-Lift

A new model Zip-Lift electric hoist is designed to be operated with the manufacturer's One-Hand rope control. The new unit actually is a standard Zip-Lift which, in addition to the

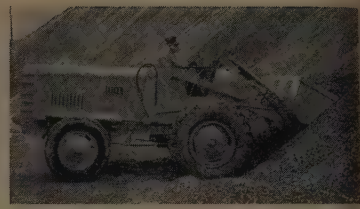


rope control, is also guaranteed to operate continuously during intermittent usage for 25% longer than the rated time limit. It is designed with a weight-overload safety factor of five times the rated capacity. The wire rope hoisting will be used because of its wider range of side pull and greater safety from hidden wear. Available in two models with lifting capacities of 500 and 1,000 lb. Hoisting rates are 25 and 13 ft. per min. Both are available with 12- and 18-ft. lift. Manufacturer is Harnischfeger Corp.

A29

New loaders feature torque converter drive

A line of Load Plus hydraulic tractor loaders now on the market features torque converter drive. The torque converter drive automatically applies the power need to enter material and fill bucket in one movement without shifting gears or need for impact loading. All load is centered on the large front wheels for maximum traction and balance. Rear axle steering with power booster makes possible a short turning radius and good maneuverability, and also insures steering control when front wheels are in soft ground. The machine also has a 5-speed transmission, and all its functions are under hydraulic control. Sizes range in capac-



ity from 1 cu. yd., 12 cu. ft., $\frac{5}{8}$ cu. yd. and $1\frac{1}{2}$ cu. yd. The loaders are suitable for handling bulk materials in construction work. Larger sizes are also adaptable for prime moving, railroad car pushing, bulldozing, snow plowing, and operating hydraulic hooks. Manufactured by Jaeger Machine Co.

B30

Two-piece steel scaffolding goes up in nothing flat

A frame and tie-bar, sole components of a new tubular steel scaffolding, so facilitate erection that one man is reported to have put up 182 ft. of scaffolding, 4 ft. high, in just 98 min. On another job two men put up a 65-ft.-high tower in 90 min. A unique slip-fit device eliminates bolts, pins, or screws, thus enabling speed of assembly. The scaffolding is said to be ideally suited for major construction projects because of its very simplicity and speed of assembly. Compact de-

IMPROVED

U.S. Highway Guard Rail and Supporting Post

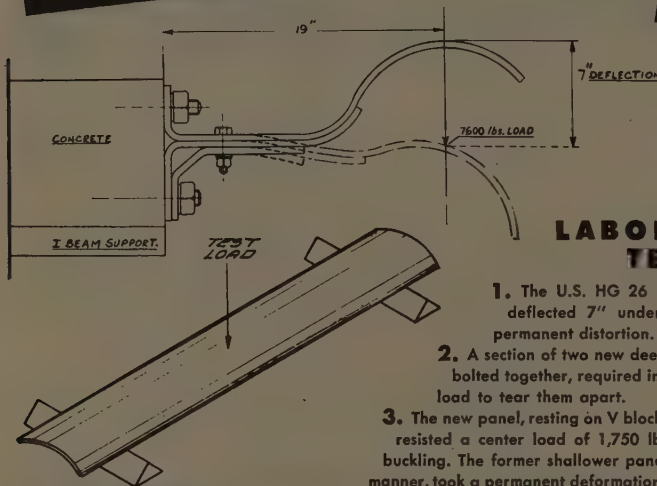
MUCH STRONGER • LONGER LIFE

Insuring Greater Safety

Lower Maintenance Cost

New Guard Rail Panel has twice as much arch as former design ... will stand $2\frac{1}{4}$ times as much load before buckling.

New U.S. HG 26 Supporting Post, made of heat-treated Chrome Vanadium Steel has 3 leaves securely anchored to concrete base. It can absorb more energy from impact because it YIELDS without breaking.



LABORATORY TESTS

1. The U.S. HG 26 Highway Guard Post deflected 7" under 7,600 lbs. without permanent distortion.
2. A section of two new deep arch design panels, bolted together, required in excess of 90,000 lbs. load to tear them apart.
3. The new panel, resting on V blocks spaced 10 ft. apart, resisted a center load of 1,750 lbs. before permanent buckling. The former shallower panel, tested in the same manner, took a permanent deformation at only 795 lbs. load.



Manufactured by

United States Spring & Bumper Co.

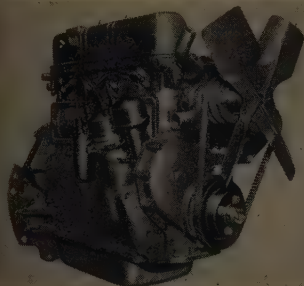
4951 ALCOA, BOX 2475 TERMINAL ANNEX, LOS ANGELES 58, CALIFORNIA

ign permits stacking in a small space and simplifies transportation. On the job, it need not be dismantled in going from one area to another. It is said to have been load tested at better than 100 lb. per sq. ft. Manufacturer is Brainard Steel Div., Sharon Steel Corp.

631

Overhead-valve model added to Ford's heavy-duty engines

The Ford 134 is a four-cylinder, overhead-valve heavy-duty industrial engine. Designed for maximum efficiency, performance and operating

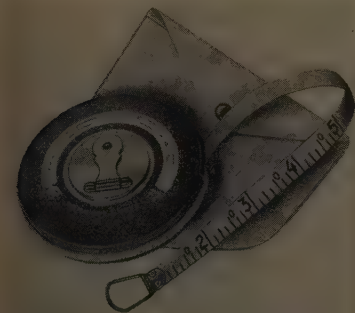


economy, the engine develops 45 brake hp. at 2,400 rpm. and has a 3.4375-in. bore and a 3.6-in. stroke to reduce wear and improve fuel economy. Other features are: cylinders cast in bloc of special high-grade iron; free-turn valves of high chrome nickel alloy, and an oil system with a full-flow filter with renewable element which cleans all engine oil and reduces ring wear. Manufactured by Ford Motor Co.

632

Chrome-plated steel tapes are tough and easy to read

Chrome plating, which creates a blue-white background contrasting strongly with tape marking, greatly



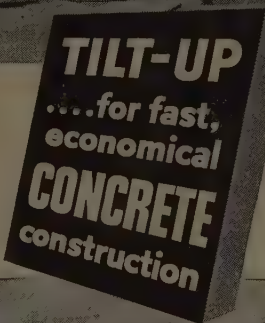
improves the legibility of a new popular-priced line of steel tapes. Moreover, the plating gives the added advantages inherent in a tough surface. Sizes range from 25-, 50-, 75- and 100-ft. in length; feet in inches and eighths or in tenths and hundredths. The tapes come in knurled-band steel cases covered with maroon leatherette



THE fast and economical tilt-up method was used to build the 95 x 188 ft. 3-story concrete warehouse of the Merchants Transfer & Storage Company in Des Moines.

In tilt-up construction, wall panels are cast flat, usually right on the concrete floor using only edge forms—then tilted up into position. This reduces form building to a minimum. Cast-in-place piers and beams tie the panels into one unit.

Tilt-up construction is adaptable to single or multi-story structures of standard or individual design. Such buildings are sturdy, firesafe, decay-proof and attractive. Economical to build, they give years of low-upkeep service. That's low-annual-cost construction. Write for free illustrated technical bulletins, distributed only in the United States and Canada.



Top photo: View on 3rd floor showing 11' x 17'-6" wall panel on platform ready for tilting. Above: Rendering of completed building. Brooks-Borg, architects; The Weitz Company, Inc., contractors.

PORTLAND CEMENT ASSOCIATION

816 W. Fifth Street, Los Angeles 17, Calif.

A national organization to improve and extend the uses of Portland cement and concrete . . . through scientific research and engineering field work.

Lighter . . . TOUGHER

COFFING CHALLENGER SPUR-GEAR HOIST

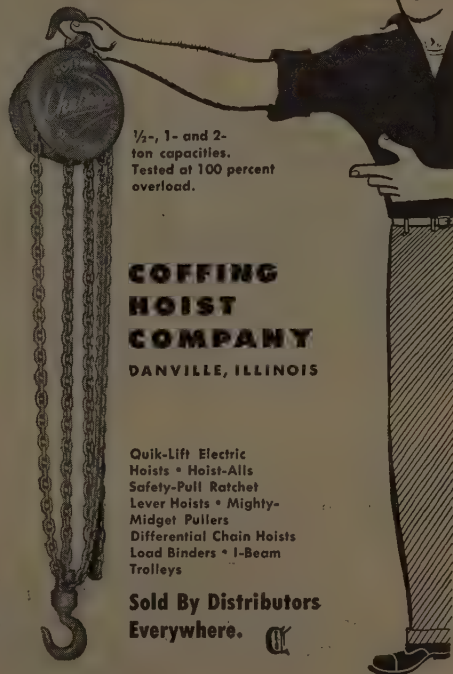
Never before such easy portability and rugged, shock-resisting strength in a spur-gear hoist... never such simplicity of design and ease of servicing.

Light weight—carry it in one hand; set it up anywhere. One-ton model weighs only 39½ lbs.

All Steel—even the housing. Takes shock loads and impact as only steel can.

Easy to Service—may be completely disassembled in minutes with ordinary tools. Simplest spur-gear hoist ever built.

Find out how this better spur-gear hoist can improve operations and save expense for you. Write for bulletin WC6C.



¼-, 1- and 2-ton capacities. Tested at 100 percent overload.

COFFING HOIST COMPANY
DANVILLE, ILLINOIS

Quik-Lift Electric Hoists • Hoist-Alls Safety-Pull Ratchet Lever Hoists • Mighty-Midget Pullers Differential Chain Hoists Load Binders • I-Beam Trolleys

Sold By Distributors Everywhere.

and as such are appropriately called the company's Redhead line. Manufactured by Justus Roe & Sons, Inc.

633

This digging loader is versatile, low cost

Known as the Terraload'r, there is a new machine on the market with numerous versatile features not



usually found in equipment in the lower price range. It is a digging loader. It can load trucks and railroad gondolas, dig trenches and grade as a bulldozer, and can carry loads from one area to another. A powerful hydraulic lift and control valve permits a float position for efficient handling of loose materials when dozing or loading. Its ability to doze efficiently without "roll-under" is said to be of special interest. Available in 3 models: GT-30 (drawbar hp. of 26.3 and ½-yd. bucket); GT-34 (drawbar hp.

of 30 and ¾-yd. bucket), and DT-34 (diesel, drawbar hp. of 29 and ¾-yd. bucket). Manufacturer is American Tractor Corp.

634

Small electric heater guards engines against cold

An electric circulation heater, a completely packaged unit with built-in elements, heating chamber, thermostat, and threaded inlet and outlet, can provide the few kw-hr of electricity necessary to keep diesel engines ready to operate in the coldest weather. On average winter mornings a 150-deg. F. setting is said to be sufficient to heat most engines in half an hour. In colder weather the heaters may be run all night at 90 deg. F. No need to mention the working hours saved by being able to keep outdoor equipment in a condition for immediate use. The Chromalox electric circulation heater is manufactured by Edwin L. Wiegand Co.

635

Lombard launches high quality, low-priced saw

Lombard Model 30 is a high quality chain saw with a low price tag (\$228.50) which should add to its attractiveness. Weighing only 25 lb., its 2-cycle gasoline air-cooled engine is claimed to put forth fast cutting



action which can cut wood within ¼-in. of the ground. Manufacturer is Lombard Governor Corp.

636

Ford's 1953 truck line numbers 190 new models

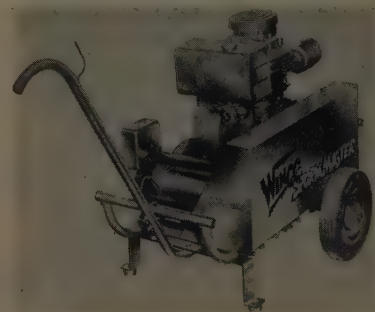
Four distinct lines in 20 new series and in more than 190 models are offered by Ford Division of Ford Motor Co. in the broadest line of trucks in the company's 50-yr. history. Every machine in the 1953 line is redesigned with what is claimed to be a revolutionary new approach to truck engineering—the driver himself, in order to avoid driver fatigue and to ease his burden. All feature new, one-piece curved windshields with swept-back pillar posts and 55% greater visibility. For the first time the new F-100 series of light-duty trucks will be equipped with Fordomatic fully-automatic transmissions or automatic overdrive as optional equipment.

Truck sizes range from 4,000 lb. to 27,000 lb. gv., and up to 55,000 lb. ratings in the new F-900 series, largest truck ever built by the manufacturer. Other factors making the trucks easier to handle are shorter wheelbases, wider front treads and repositioning of springs.

637

Storm Master provides emergency power

Newest addition to the line of Winco engine-driven generators is the Storm Master, Model 3030-X. The



new unit, designed to supply low cost, standby emergency power, is almost 20 lb. lighter than power plants of equivalent capacity, according to

DAVEY Super Chief

... the lightweight champion with the heavy-duty work punch!

Capacity—60 c.f.m.
completely air-cooled
(engine and compressor)



● Here, for the first time, is an economically-priced, lightweight compressor (1250 lbs.) that is designed for constant, heavy-duty service. ● Features include clutch between engine and compressor, full force feed lubrication, built-in unloader system, air receiver integral with frame . . . highest speed chassis and tow bar ever placed on a compressor. ● Like the famous bigger Daveys, the Super Chief has PERMANENT PEAK EFFICIENCY VALVES. These never carbon or foul. They guarantee the utmost in operating satisfaction, low cost operation and long compressor life. ● DAVEY COMPRESSOR CO. ● KENT, OHIO

DAVEY

Pioneers of
Air-Cooled Air

A-5598

Wincharger Corp., the manufacturer. The unit is sold with or without engine. Generator output depends on the size engine used.

638

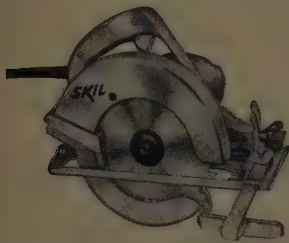
More light from OV-20 luminaire

Pavement illumination values representing an improvement of about 40% over older luminaires are provided by the new OV-20 street lighting luminaire, which directs as much as 56% of the available light from the lamp onto the street itself by means of a compound reflector and a special refractor for lateral control. Lateral distributions for different street widths are also available in the OV-20, ASA Type II distribution for narrow streets and ASA Type III for wider streets. A shield is available as an accessory for use on highways and other places where glassware brightness may be objectionable. Manufactured by Westinghouse Electric Corp.

639

Heavy-duty electric saw weighs only 13¼ lb.

The Skil Homebuilders 7¼-in. saw, Model 687, is designed for carpenters, contractors, homeowners, maintenance men and repairmen. Not only



is it fine for cutting 2-in. lumber, but its high speed of 5,000 rpm. makes it useful for cutting and scoring concrete, cement block, stone, metal, and composition materials. Its features are: a powerful motor, ball and needle roller-bearing construction, overhead-type handle for easy one-hand control, built-in rip fence, and an automatic telescoping blade guard with retracting handle. Adjustable for a cut depth of 1/16 to 2¾ in., and for bevel cutting up to 45 deg. Manufacturer is Skil Corporation.

640

Carver pump will handle 6,000 gal. per hr.

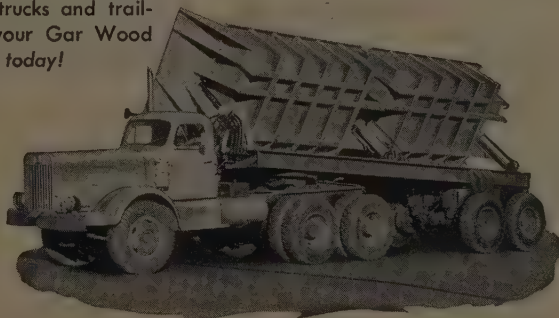
Pumping water at 6,000 gal. per hr. on 17-ft. suction lift (including friction) against a 17-ft. total head, the new Model KN1½L Carver pump can be easily carried by one person. It has a net weight of 55 lb., suction size of 1½ in., suction lift up to 30 ft., engine output 2 hp., overall dimensions of 17 x 15 x 15 in., and is mounted on a spring-steel base. It will prime in less than 30 sec. with the pump 10 ft. above water. Access to the pump is



"LOAD ENGINEERED" TO SOLVE SPECIAL HAULING PROBLEMS

Gar Wood "Load Engineered" Side Dump Bodies and Hoists, designed and built to solve your special hauling problems, assure dependable, on-the-job performance. Where extreme dumping angles are required, Gar Wood double-acting hoist cylinders for high-angle dumping provide hydraulic cushioning at maximum dumping angle to absorb shock loads. Single or dual hoists are supplied as required, with hoist controls mounted in the truck cab for maximum driver convenience. Automatic down-folding sides are available on all Gar Wood Side Dump Bodies as optional equipment.

If you need extra strength and dependability in your hauling operation, investigate the merits of "Load Engineered" Bodies and Hoists designed and built by Gar Wood Industries, Inc.—the world's largest manufacturer of dump bodies and hoists for trucks and trailers. See your Gar Wood Distributor today!



Gar Wood medium-duty side dump bodies, with single or dual hoists, are available for truck mounting in capacities from 4 to 6 cubic yards. Double heavy-duty side dump bodies for trailer mounting are available with capacities from 11 to 25 cubic yards and dumping angles to 70 degrees.



GAR WOOD INDUSTRIES, INC.
RICHMOND DIVISION · RICHMOND, CALIFORNIA

attained by simply removing the suction head. It can be used on construction jobs for dewatering, keeping seepage down, water supply, sluicing, spraying, and pumping out sumps. Manufactured by Carver Pump Co.

641

Adjustable protractor draws accurate angles

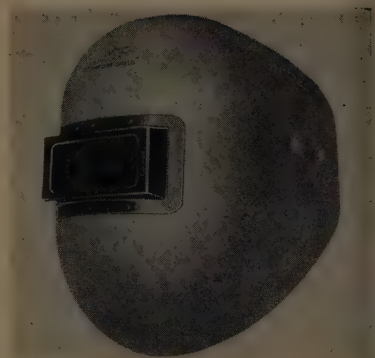
A new adjustable protractor triangle which permits drawing accurate angles from the base line has been introduced by the Alvin Co. Known as the Tru-Angle, the instrument can be set to precise graduations of $\frac{1}{2}$ deg. and is held in place with a knurled

knobbed screw. It has two rows of die-sunk graduations, the outer row running from 0 to 45 deg., and the inner row covering 45 to 90 deg. Made of clear optical plexiglass and available in 6-in., 8-in., and 10-in. sizes, the Tru-Angle eliminates blind spots and forms a shatter-proof, heat-resistant instrument which resists wear, warp, and discoloration.

642

Arc welding head shield designed for comfort

Comfort-Shield is the appropriate name of a new arc-welding head shield, for the manufacturer had the



operator's comfort in mind when he designed this safety device. Its feature is a permanently pliable plastic head band which gives a firm but comfortable fit. Adjustable, it fits both around and over the head and can be put on with one hand. The plastic does not dry out and curl up as does fibre. The shield proper is of one-piece molded fibre construction and permits free air circulation. Manufactured by Lincoln Electric Co.

643

New electrode has many applications

Murex Type R is a heavy-coated electrode designed for welding in any position. Recent innovations in this E-6010 electrode have improved its operating qualities and are said to make it a very easy rod to handle. Its wide applications include structural work and pipe line construction. Manufacturer is Metal & Thermit Corp.

644

Pioneer offers improvement on its asphalt plants

A new type of truck-loading hopper with twin clam gates on the mixer units of both Models 51 and 101 continuous process plants is offered as a new improvement on Pioneer Engineering Works, Inc., Continuo line



of asphalt plants. This new hopper is said to permit discharge of material from the pugmill into trucks with least possible segregation of mix. The gates are steam-cylinder actuated by means of a lever extending up to the operator's platform. Moreover, capac-

speed the job with **CAL-TIE WIRE**
it's Safe!



Concrete reinforcing is another tying job where CAL-TIE steps-up work and brings down costs. It's a sound *safety* measure too, for CAL-TIE wire in a Universal Pacific Reel-Safe leaves no loose pieces underfoot. And the savings in wire will surprise you.

Get complete information on CAL-TIE in the handy pack that hangs on the belt...it keeps CAL-TIE always in reach *yet always out of the way*. Write the office nearest you.

THE CALIFORNIA WIRE CLOTH CORPORATION, OAKLAND
THE COLORADO FUEL AND IRON CORPORATION, DENVER

CAL-TIE WIRE
THE COLORADO FUEL AND IRON CORPORATION **CFI**

ties have been increased so that the hopper on the small mixer now holds over 1 ton of material, whereas that on the larger mixer holds double that amount.

445

Tamping plugs cut stemming time

Quick-Seal Tamping plugs provide a means of cutting stemming time in open pits, quarries, tunnels and mining operations, and according to the manufacturer, the plugs will save powder and provide more effective breakage. The plug is inserted into the borehole against the explosive charge; its wooden wedge is driven into the expanding part of the plug with a tamping stick, and when a ringing sound is heard, the wedge is as tight as necessary to seal the hole, and the shot is ready to fire. The tamping plugs are available in five sizes ranging from 1¼-in. to 2¼-in. diameters. Manufacturer is National Mine Service Co.

446

New type paver is introduced

Tru-Lay is a new machine recently built to lay asphaltic concrete, crusher run and cement-treated or stabilized base in thicknesses of 1 to 6 in. The manufacturer claims that one of the machines plus three men and eight

hours will yield 40,000 sq. ft. of paving. Specifications are as follows: the standard model is 9½ ft. overall width outside and only 5½ ft. front to back. It lays an 8-ft. strip and is mounted on 4 rubber-tired wheels for easy towing or convenient truck carrying. Built of



welded steel, it has a total capacity of 2 tons of working material. Manufacturer is Doug-Lynn Co.

447

Truck-mounted air compressor announced

Said to be the most compact and efficient compressor truck-mounted assembly ever developed, the Air Van has been announced by Davey Compressor Co. Air Vans, offered with a choice of either 105-cfm. or 160-cfm. standard Davey Auto-Air compressors, are driven directly from the truck engine through a power take-off installed in the driveshaft. The

What is your
Most Convenient
Power Source?...



ELECTRICITY



AIR



GASOLINE

Mall

fits 'em all

**CONCRETE
VIBRATORS**



MALL offers a really COMPLETE line of vibrators. You choose the size, style, and power type to fit your exact needs. Write today and see how you can get better concrete for less money.

CHAIN SAWS

Gasoline engine, electric, and pneumatic—there's a MALL chain saw just right for you. More than 20 models to choose from. If you want to get all the facts, mail the handy coupon now.



PORTABLE TOOLS

Look to MALL for the most complete line of electric and pneumatic portable power tools on the market—a size and type of tool for every construction need. Write today.

40 Factory-Owned Service Warehouses, Coast-to-Coast, To Give You Fast, Dependable Service.

Get the Facts NOW

MALL TOOL COMPANY

7706 S. Chicago Ave., Chicago 19, Ill.

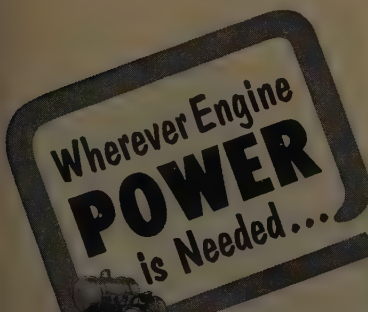
Send me additional information about MALL

☐ Concrete Vibrators ☐ Chain Saws ☐ Portable Tools ☐ Gasoline ☐ Electric ☐ Pneumatic

Name _____

Company _____

Address _____ CU-32



Single cyl.
3 to 9 H.P.

2-cylinder
7 to 14½ H.P.

V-type 4-cyl.
15 to 36 H.P.

WISCONSIN Air-Cooled ENGINES

Fit the Job and the Machine

Because Wisconsin Air-Cooled Engines are supplied in a complete power range, from 3 to 36 H.P., in 4-cycle single cylinder, 2- and 4-cylinder types, there is an ideal size to fit all types of machines and power applications within this range, without wasted power and with maximum power service benefits. Heavy-duty construction, combined with extremely compact design and light weight are added advantages—and dependable AIR-COOLING permits trouble-free service under all climatic conditions.

Specify Wisconsin Heavy-Duty Air-Cooled Engines for the utmost in power satisfaction. Write for descriptive data.

WISCONSIN MOTOR CORPORATION

World's Largest Builders of Heavy-Duty Air-Cooled Engines

MILWAUKEE 46, WISCONSIN



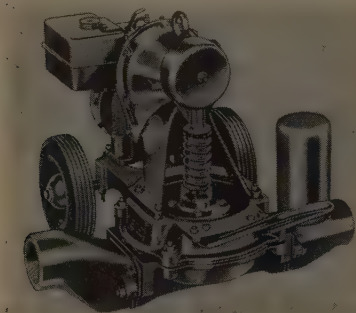
A 7111-¾-R-5

new compressors are recommended for all operations in which a high degree of compressor portability is essential.

648

New type diaphragm pump jumps capacity ratings

A newly designed diaphragm pump is said to have as much as 400% more capacity than that of comparable pumps under similar conditions, its performance becoming more out-



standing the higher the suction lift. For example, at 25 ft. suction lift, the pump delivers 50 gal. of water per min. Moreover, design improvements are claimed to lengthen normal diaphragm life as much as ten times. A

suction accumulator and spring which cushions the downstroke of the diaphragm connecting rod are given credit for the pump's exceptional capacity and longevity. Other features are simple design, overall weight of 153 lb., and use of a 2½-hp. Briggs & Stratton 8 R6 engine. Manufacturer is Gorman-Rupp Co.

649

Dynarc is a revolutionary arc rod process

It's news when an instrument with a flame-like continuous arc, independent of external electrical conductivity, slices through strands of wire like a knife through cord, but when it can pierce stone and concrete, people start talking. In short, the DynaTrode creates its own arc, requires no ground, and does not have to be struck upon metal. The intense heat generated enables it to be pushed into and through the refractory material and molten rock pours from the vicinity of the heat source. According to the manufacturer, its applications are innumerable. For example, it can pierce reinforced concrete, cut sewer pipe, drill holes for blasting, and cut holes for plumbing. All that's needed is any conventional DC arc-welding machine capable of generating 400 amp. or more, and a DynaTrode and its holder (which can be used with

conventional welding electrodes). The operator has complete control at all times and he alone determines when and where the arc will start. No compressors, air lines, oxygen tanks, pneumatic drills, etc., are necessary. Manufactured by ChemoTec Division, Eutectic Welding Alloys Corp.

650

One-man chain saw speeds land-clearing work

Model 4-30, a new one-man chain saw, has ample power to cut rapidly through timber up to 5 ft. in diameter, yet its 30-lb. weight and good balance



make it applicable to a variety of general wood cutting jobs. It comes complete with a 14-in. chrome-plated blade and chain. Blades available

BAXCO THE STAMP OF INTEGRITY ON
CREOSOTED OR UNTREATED
DOUGLAS FIR PILING

POLES • TIMBER • LUMBER • TIES
Other BAXCO Pressure Treated Forest Products include: BAXCO Creosoted Douglas Fir Posts and Ties—BAXCO Creosoted and Salt Treated Lumber and Timbers—Protexol Fire Retardant Treatment.

J.H. Baxter & Co.

200 Bush Street • San Francisco 4, California
3450 Wilshire Blvd. • Los Angeles 5, California

J. H. Baxter & Co. of Oregon
P.O. Box 752, Eugene, Oregon

Baxco Corporation
541 Pittcock Block, Portland 5, Ore.



WHITE ASPHALT PLANTS FOR HOT-MIX PAVING

These reasonably-priced stationary hot plants are complete on one steel frame, for easy moving to a new location. Excellent for medium-size city paving jobs; for street and highway maintenance; and for paving driveways, alleys, sidewalks or industrial plant areas.

Oil-fired rotary dryer, batch mixer, vibrating screen, divided hot bin, dust collector, volumetric or weigh scales, engine or electric power, air controls. Model L-12, 12-15 tons per hour; Model L-25, 25-30 tons per hour. Portable units also available

For FREE circular, write—

Elkhart 24 **White Mfg. Co.** Indiana

ange up to 36 in. in diameter. The manufacturer reports more than 4 brake hp., and an aircraft-type carburetor combined with an all-position fuel system which enables the saw to operate at full power in all positions with no carburetor adjustment required. Other attractive features include: automatic clutch, automatic rewind starter, large fuel capacity, positive chain oiler, high-speed sabertooth chain, and grouped engine controls. Manufacturer is McCulloch Motors Corp.

AE1

Power steering device aids equipment operators

A tractor operator's work was made 25% easier by using the Behlen Manufacturing Co.'s new power steering attachment, an efficiency test showed. Other tests revealed that greater operator efficiency and safety resulted from use of power steering on heavy equipment. The Behlen attachment absorbs shocks in the hydraulic unit. Installation takes about an hour. The power unit, attached to a new section of shaft beneath the steering wheel, consists of a fluid pump driven off the tractor engine with a hydraulic gear motor converting the fluid pressure into mechanical torque.

652

7,100-lb. diesel designed for heavy-duty applications

Expected to fill needs for stationary power plants, Model 38F5¼, a new opposed-piston diesel, has been designed for heavy-duty applications.



However, it is said to be a fraction of the size and weight of conventional heavy-duty engines, the 225-hp. unit weighing 7,100 lb. It has a 5¼-in. bore and 7¼-in. stroke and develops a continuous duty rating of 75 hp. per cylinder at 1,200 rpm. The general design is characterized by a pair of pistons in each cylinder, operating in opposite directions so that the heads of the pistons form a common spherical combustion space. The upper pistons, controlling the scavenging air inlet ports, are connected to an upper crankshaft, and the lower pistons, controlling the exhaust ports, are connected to a lower crankshaft. The upper and lower crankshafts, connected by a vertical splined quill shaft, work together to transmit power to the drive end of the lower crankshaft. The engine is a self-con-

tained unit incorporating all necessary pumps, heat exchangers, filters, and other auxiliaries. It also can be equipped for dual-fuel and spark-ignition gas operation. Introduction of the new unit will permit the manufacturer, Fairbanks-Morse & Co., to offer OP engines from 225 to 2,400 hp.

653

Diminutive line level is convenient mason's tool

This diminutive instrument weighs less than a pencil but serves as an accurate, easy-to-read mason's line level. The light weight of the molded plastic, hexagon-shaped level minimizes the sag in a long line. The body



contains an accurately-set vial of light-absorbing fluid for easy top or side reading. Sturdy, opposed-opening hoods hold the instrument securely on the line. Manufacturer is Empire Level Manufacturing Co.

DAREX AEA

Get all the "on-the-job" PROOF!

**LOW-COST
MORE DURABLE
CONCRETE**

**MORE UNIFORM
MORE WORKABLE**

— at mixer
— at point of
placement

*The only catalyzed
air entraining
agent specifically
formulated for
your concrete job!*

Proof plenty. Look at big concrete jobs with multiple, intricate forms, heavily reinforced. Contractors used low slump concrete and needed workability. Answer—DAREX AEA because of low cost and outstanding uniformity, not only at mixer but at point of placement.

CHARLES R. WATTS & CO.
4121 - 6th Avenue N.W., Seattle 7, Wash.

Darex AEA Distributors for Dewey & Almy Chemical Co. in 11 Western States, Alaska and Hawaiian Islands.

DA

Darex is another Dewey & Almy product doing a better job for less

ASK YOUR NEAREST DEALER ABOUT DAREX:

Pacific Coast Aggregates, San Francisco; Blue Diamond Corporation, Los Angeles; C. E. Mitcham, Salt Lake City; Baker-Thomas Lime & Cement Co., Phoenix; Ray Corson Machinery Co., Denver; Mason's Supply Co., Portland; Miller-Richardson, Helena; Hawaii Builders Supply Co., Honolulu.

CHARLES R. Watts & Co.

4121 Sixth Ave. N.W. • HEmlack 8400
SEATTLE, WASHINGTON

AS ACCURATE AND VERSATILE AS A HANDSAW

10 to 20
Times
as FAST.

Universal teeth;
makes all cuts
in all woods
Reciprocating
long-life
twin blades

Cuts at any angle;
reaches hard-
to-get-at places
No kick,
grab or
bucking

Weights under
15 lbs.—easy to
handle. Operates on
60 ft. compressor.



Heavy-duty light-weight
WRIGHT PRECISION POWER SAW
slices through a stack of timber in seconds!
Cuts on-the-line with only 3/16" kerf.
Chrome-plated blades resharpen and set
like hand saw. Safety-endorsed. Guaranteed.
Write for on-your-job demonstration—
see why no other type of power saw can
equal WRIGHT'S cost-cutting ability.

WRIGHT

**POWER SAW
AND TOOL CORP.**

292 Longbrook Ave., Stratford, Conn.

Service and Sales Offices throughout United States,
Canada, Hawaii and Europe.

NEWS of DISTRIBUTORS AND FACTORY BRANCHES

New Masonite Western mgr.

Harry D. Ashley, manager of dealer sales in Masonite Corp.'s Western Division, has been named division manager. The division office is in San Francisco, and its territory includes Washington, Oregon, California, Idaho, Utah, Arizona, and New Mexico. Lewis C. Kummerow, a dealer salesman, has been promoted to assistant manager in charge of dealer sales for the division.

Federal Electric plant in L. A.

The new Los Angeles plant of Federal Electric Products Co. of Newark, N. J., will soon be ready for production, according to T. M. Cole, president of the company. The new plant, erected by means of the tilt-up wall process, contains 45,000 sq. ft. of floor space and has an additional 80,000 sq. ft. available for parking and future expansion.

King-Knight takes on Nordberg

The King-Knight Co. of San Francisco has been appointed distributor for Nordberg Manufacturing Co. 4FS diesel engines in Central and Northern California.

Universal Form Clamp mgr.

Richard G. Allen, general manager of Universal Form Clamp Co., has been appointed district manager of the company's San Leandro, Calif., branch in place of B. R. Hoerr, who has resigned. He will be responsible for the company's activities in Northern California, Washington, Oregon, Utah, Idaho, Nevada, Alaska, and Hawaii.

Black & Decker changes address

Black & Decker Manufacturing Co. has moved from 1090 Bryant St. to more spacious quarters at 4343 Third St. in San Francisco. Recent personnel changes include Lester C. Kaefer, San Francisco branch manager, transferred to Los Angeles as branch manager there; A. W. Escoffier, Portland branch manager, new San Francisco branch manager, and Paul Pounds, transferred from the San Francisco branch to become sales engineer at the Portland branch.

Carter rep. in Northwest

Sam Patterson of Seattle has been appointed Pacific Northwest factory representative for the Ralph B. Carter Co., manufacturer of various types of pumps.

Four-Wheel Drive moves

The Four-Wheel Drive Pacific Co. has moved from 469 Bryant St. to its new building at 860 Harrison St. in San Francisco. The company is dis-

tributor for such lines as Four-Wheel Drive Auto Co., Byers Machine Co., Eagle Crusher Co., and Rosco Manufacturing Co.

Wooldridge names rep.

Wooldridge Manufacturing Co. has appointed Ralph W. Christofferson



Ralph W. Christofferson,
district manager
and factory rep-
resentative for
Wooldridge Manu-
facturing Co.

as district manager and factory representative for the Pacific Northwest with headquarters at Portland, Ore. He will work with distributors of Terra Cobra heavy earthmoving equipment, the major part of the Wooldridge line.

New Peterson sales mgr.

Thomas A. Hopkins, former Seattle district representative for the Caterpillar Tractor Co., has been picked as industrial sales manager by Peterson Tractor & Equipment Co. of San Leandro, Calif. Overall sales for the firm, which distributes Caterpillar and allied equipment in the San Francisco

Save Time! Cut Costs! USE A BEND-O-SHEAR



For Shearing and Bending Reinforcing Steel Rod

The Ben-O-Shear will quickly and easily bend and shear 3/8", 1/2", and 5/8" reinforcing steel rod at a savings in time and money to you. It is constructed with Torrington bearings, cutting blades are of finest tool steel, and the one blade cuts all size rods up to 5/8". It's portable weighing only 24 lbs., and can be mounted over the end of a bench or plank. For complete information write—

LEE SALES CO.

8439 Gainsford, Downey, Calif.

Day Area, will be directed by Frank Castellucci, general sales manager.

Lippincott moves too

Lippincott Company, Inc., manufacturers representatives headquartered in San Francisco, moved to new and larger quarters at 995 Market St. on May 1. They specialize in sales and service of steel products, hardware, mill supplies, and industrial rubber goods.

Caterpillar sales confabs

Approximately 400 sales representatives from the Western States, British Columbia, and Alaska attended a series of four-day sales conferences at the Caterpillar Tractor Co.'s sales training division at Bakersfield, Calif., during April. Sales discussion meetings and field demonstrations of equipment featured the get-together.

Shav-O-Disc distributor named

Chet Jacobs of the Jacobs Equipment Co., Bakersfield, Calif., has been appointed California distributor for Shav-O-Disc, now being manufactured by T & M Manufacturing Co. of Bakersfield.

Republic takes on plastic pipe

The Republic Supply Co. of California has been appointed distributor for Kraloy Plastic Pipe.

Volz joins Osgood-General

George N. Volz has been named division sales manager for the Northwest states by Osgood-General, makers of excavating and material han-



George N. Volz,
division sales
manager in
Northwest
states for
Osgood-General

dling machinery. He will be assisted by John Bernhardt, newly-appointed division service representative. Frank Johnson, who formerly covered the 11 Western States, will confine his efforts to California, Nevada, and Arizona with headquarters in San Francisco.

Sterling Electric sales mgr.

John R. Howell has been appointed sales manager for the Western part of the United States by Sterling Electric Motors, Inc. His headquarters will be in Los Angeles.

New Remington distributor

Remington stud drivers and fastener studs will be distributed by the Nelson Stud Welding Division of Gregory Industries, Inc., according to the Remington Arms Company, Inc. Verne Bender, Nelson's Western regional manager, reported that this

region will be served from the company's warehouse at Oakland, Calif.

Pearson joins Air Rentals

Robert H. Pearson, associated with Gardner-Denver Co. for 37 yr., retired in May to assume management of Air Rentals, Inc., in Denver, Colo. This newly-formed organization will distribute Gardner-Denver equipment and several allied lines used in construction and mining work.

Burke to handle Bay State line

W. J. Burke & Company, Inc., has been appointed distributor for the Bay State Abrasive Products Co. line

of abrasive products for the construction and building trades. The line will be available at Burke's headquarters in San Francisco as well as at Portland, Seattle, Los Angeles, and Albuquerque branches, according to George O. Gaetke, the general manager.

Farr names reps.

Air Filter Sales & Service Co. of Denver, Colo., and Dust Control, Inc., of Hawthorne and San Diego, Calif., have been named sales representatives by Farr Company of Los Angeles, manufacturers of Far-Air filters and air filtration equipment.



"Spray It
and
Forget It"
with

hunt PROCESS

concrete curing compounds

1

HUNT PROCESS CLEAR

For natural color of the concrete. A carefully proportioned blend of materials in a petroleum solvent which will not permanently discolor the concrete.

2

HUNT PROCESS "TILT-UP"

For curing and bond breaking in "Tilt-Up" or precast construction. Film disintegrates and oxidizes after curing period leaving surfaces in condition for painting.

3

HUNT PROCESS BLACK

For curing and waterproofing. A blend of asphalts with pigment in a petroleum solvent.

4

HUNT PROCESS PIGMENTED—WHITE & GRAY

For temperature control in the concrete. A curing compound containing high quality pigments which give a heat reflecting film.

HUNT PROCESS CURING COMPOUNDS AND AIR ENTRAINING AGENTS ARE NOW AVAILABLE IN ALL MAJOR CITIES THROUGH HUNT PROCESS CO. DISTRIBUTORS

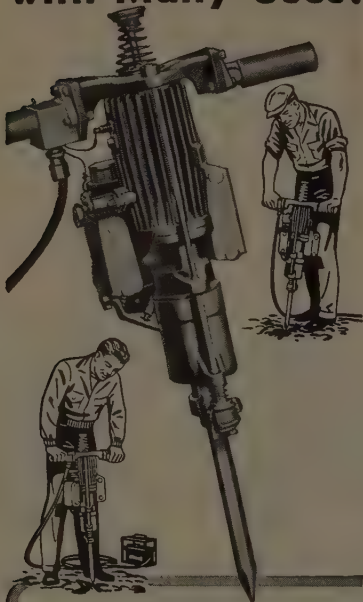
New Illustrated Brochure Available Upon Request

HUNT PROCESS COMPANY, INC.

FACTORY & MAIN OFFICE

7012 STANFORD AVENUE, LOS ANGELES 1, CALIFORNIA

A Profitable Tool with Many Uses!



BARCO *Gasoline* HAMMER

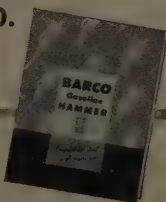
■ **HERE'S** why owners of the improved Barco Gasoline Hammer are enthusiastically acclaiming it as "A Profitable Tool With Many Uses!"

- Versatile! Use it for Pavement Breaking... Cutting... Digging... Rock Drilling... Frost Breaking... Rod Driving. Ideal for general utility, standby, and emergency service.
- One man operation. No compressor needed. Easy to take to any location.
- New ignition system—quick, easy starting.
- Quick disconnect at handle for battery cable. Thumb controlled switch.
- Powerful, rugged; up to 1550 strokes per minute.
- Economical! Low first cost, low operating expense, low maintenance expense. *Quickly pays for itself.*

ASK FOR A DEMONSTRATION—See for yourself—ask for our nearest distributor to give you a demonstration.

BARCO MFG. CO.

543 G Hough St.
Barrington, Illinois
A Chicago Suburb



Ask For
This New
BULLETIN 613

NEWS of MANUFACTURERS

Westinghouse Air Brake buys
LeTourneau, Failing cos.

Westinghouse Air Brake Co. enlarged its entry into the construction field in a big way with the purchase of two major equipment manufacturing firms during April and May. The earth-moving and related business of R. G. LeTourneau, Inc., including all fixed assets and machinery at Peoria, Ill., and Toccoa, Ga., was bought for \$19,500,000. Edward O. Boshell, Westinghouse Air Brake president and chairman of the board of directors, announced on May 8.

And on April 16, announcement was made that Westinghouse Air Brake had purchased the George E. Failing Supply Co. of Enid, Okla., world's largest producers of portable drilling rigs. Last year Westinghouse had acquired ownership of the Le Roi Co. of Milwaukee, Wis., manufacturers of internal combustion engines and air compressors.

No change of personnel is contemplated in either case, Boshell said. The earthmoving business will operate as the LeTourneau-Westinghouse Co., a subsidiary of Westinghouse Air Brake. R. G. LeTourneau will devote part of his time as a consultant on development and research work for the new company. The drilling rig company will be known as the George E. Failing Co., another subsidiary of Westinghouse Air Brake. George E. Failing will serve as president of the new company.

New officers of LeTourneau-Westinghouse Co. are Merle R. Yontz, who



Yontz



Isgren



Schoen



Wemple

started with LeTourneau 18 yr. ago as an accountant, president; Elmer Isgren, who joined LeTourneau in 1930,

USE A CARCO WINCH



FOR AN "ON-THE-GROUND" INSURANCE POLICY

FOR an "on-the-ground" insurance policy equip your tractors with Carco winches. Carco winches reduce "down time" by converting your tractors into mobile general utility tools... by doubling tractor pulling power and increasing tractor "reach." They are instantly available for towing heavy machinery, rescuing mired or ditched equipment, pulling pipe, stumps, rocks, buildings and riggings, setting poles, clearing and cleaning up as well as a multitude of other uses that help keep your jobs moving ahead on schedule. See your nearest Carco dealer for more complete information. PACIFIC CAR AND FOUNDRY COMPANY, Renton, Washington. Branches at Portland, Oregon, and Franklin Park, Illinois.



WINCHES
For All Industrial
Tractors

CARCO

executive vice president; Herbert A. May, vice president; John Schoen, vice president and general sales manager; Warren Wemple, vice president and controller; Ed Greiner, secretary and treasurer; Winston Sumner, assistant controller; Herbert Kastien, assistant secretary; and Roy O. Yearck, assistant secretary and assistant treasurer.

Dwight D. Guilfoil dies

Dwight D. Guilfoil, 66, vice president and general sales manager of Sauerman Bros., Inc., died of a heart attack in his home at Chicago on May 18. He had been with the company since 1913 with the exception of service during World War I with the 108th Engineers in France. He was discharged with the rank of major. He had been active in the affairs of the manufacturers' division of the Associated Equipment Distributors.

Wheeler expands tire recap service

The Wheeler General Tire Co. of Salt Lake City has expanded its tire retreading plant and is now operating on a 24-hr.-day basis, according to Charles T. Wheeler. The naming of Marvin Doepner as traveling superintendent highlights the increased coverage of the 11 Western States made possible by the new facilities. The company specializes in large off-the-road construction job tires and can handle sizes up to and including 2400-29 tires. Doepner or other experts are available to go anywhere in the West.

Horace X. Baxter dies

Horace X. Baxter, 50, president of J. H. Baxter & Co. of San Francisco, died at Belmont, Calif., on April 1 after a short illness. He was widely known in the wood preserving and lumber industries in the West.

Kaiser Steel names four

Appointment and promotion of four men at Kaiser Steel Corp.'s Fontana, Calif., plant was announced early in May. Gerard E. Balsley, former industrial relations director for Chase Aircraft, was named director of industrial relations. Jack W. Walling, a member of the legal and industrial relations department since 1942, was appointed resident counsel at the Fontana plant, where he will be in charge of all legal matters concerning the plant and the company's iron ore and coal mines. Ewald Carlson, general foreman of the electric weld pipe mill, was upped to assistant superintendent of the mill. Carl W. Ludwig, general foreman of the soaking pits and blooming mill, became assistant superintendent of that operation.

New Utility Trailer pres.

John C. Bennett, secretary and assistant manager of the Utility Trailer Manufacturing Co., was elected president at a recent meeting of the company directors.

Two Ways to Steady Low-Cost Drilling

"SUBWAY" Air Hose

Built to assure four characteristics which make it the outstanding hose for rock drilling and other heavy-duty tool service:

- 1—Wear- and weather-resistant red rubber cover.
- 2—Extra strong, durable wrapped duck carcass.
- 3—Long-lasting black oilproof tube.
- 4—Minimum weight and extreme flexibility, for easy handling.

Sizes $\frac{1}{2}$ " to $1\frac{1}{4}$ ", in maximum lengths of 50 feet.



"ALLGOOD CORD" Manifold Hose

For manifold lines on jumbos, wagon drills and drifters, where its super-strength and stamina insure steady power to the drilling tools. Widely used on caissons, too, because its kink-proof construction precludes the risk of failure in the air supply. Sizes $1\frac{1}{2}$ " to 4", in maximum lengths of 50 feet.

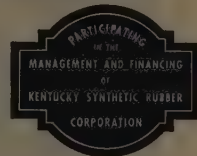


"Subway" and "Allgood Cord" are Goodall "Standard of Quality" products . . . a designation earned through years of service to the Nation's contractors. Contact our nearest branch for complete information on these and other hose . . . belting, boots and clothing . . . comprising the complete Goodall line.



GOODALL RUBBER COMPANY

GENERAL OFFICES, MILLS and EXPORT DIVISION, TRENTON, N. J.
Branches: Philadelphia • New York • Boston • Pittsburgh • Indianapolis • Chicago • Detroit • St. Paul
Los Angeles • San Francisco • Seattle • Spokane • Portland • Salt Lake City • Denver
Houston • Goodall Rubber Company of Canada, Ltd., Toronto • Distributors in Other Principal Cities



Space is sold as advertisers' inches. All advertisements in this section are 1/8 in. short of contracted space to allow for borders and composition.

CLASSIFIED SECTION

Rates are \$8.50 a column inch. Copy should be sent in by the 20th of preceding month if proofs are required by the 23rd if no proofs are required.

For Sale

CONCRETE PLANT

Includes 2 cu. yd. concrete mixer, hopper, weight batcher, cement batcher, blowers, bucket elevator, boiler, air compressor, etc.

Also

GRAVEL PLANT

Includes grizzly, conveyor, bucket line, rock crusher, vibrating screens, air compressor, hoppers, etc.

Write, Wire, Phone

DULIEM STEEL PRODUCTS, Inc.
of Washington
9245 E. Marginal Way - Seattle 5, Wash. - Under 5000

**ONE man with a MAINCO
DISTANCE MEASURING WHEEL**
can beat **TWO** men with a chain
Dept. H—**THE MAINTENANCE CO., INC.**
453 West 42nd St., New York 36, N. Y.

ATTENTION LIMA MODEL #1001 CRANE OWNERS

FOR SALE, complete Lima 2 1/2-yard shovel front with dipper sticks — 2 1/2-yd. Esco bucket
This equipment is new — Price \$6,000.00, FOB. Stockton, California
Fresno, California Contact **J. A. PRICE** 1504 Cortland Street

FOR QUICK SALE

2 U-D8 Angle Dozer, 24-25 winch; 100-hp. Patrol, only 1100 hours; 1/2-yd. Lima 5AH available; 105 C. P. Compressor & misc.; KB 11 International Winch truck; 16-18 yd. Bell dump body; 300-amp. welder and miscellaneous.

WANTED: 1/2-yd. moto crane.
Box 261 **F. H. HOLLAND** Othello, Wash.

LOW BED TRAILERS

12 Wheels

9 Units to Choose From

HALF TRACKS

2 with less than 1,000 miles.

5 — DODGE NAVY AMBULANCES

WRITE PHONE

Ben W. Colburn Co.
520 So. K St. Ph. 6-6533
TULARE, CALIF.

FOR SALE

STEEL SHEET PILING

(No CMP Allotment required)

NEAR BREWSTER, WASHINGTON

Shipped New — Used Only One Job

CARNEGIE	MP-101	MP-102	TEES
Length	Pcs.	Pcs.	Pcs.
72-68 ft.	15	175	3
65-60 ft.	1493	—	39
55-50 ft.	1702	—	38
45-40 ft.	312	—	10

Also quantity 35 ft. and shorter—Quick Shipment.
Regardless of job, location. Write, Wire or Phone
MISSISSIPPI VALLEY EQUIPMENT CO.
511 Locust St., St. Louis 1, Mo., Chestnut 4474

WILLIAMS

"SUPER-HI" TENSILE

CONCRETE FORM HARDWARE
CLAMPS — TIE RODS — COUPLINGS
AND PIGTAIL ANCHORS
Greater Safety — Less Weight to Handle
Investigate Williams Economy

WILLIAMS FORM ENGINEERING CORP.
1501 Madison Ave., Grand Rapids 7, Mich.
Phone 5-9209
Western Branch—Phone TW 6453,
2914 N. Lombard, Portland 17, Ore.

SAVE by using AIRPLANE TIRES



on all types of heavy equipment

Airplane tires are made of real rubber, exceptionally strong for stress and impact; more serviceable because of flotation effectiveness, more rugged construction and LOWER INITIAL COST.

World's Largest Stock

AIRPLANE TIRE CO.

A division of the

Ben W. Colburn Co., Inc.
520 SO. "K" STREET TULARE, CALIF.
Telephone Tulare 6-6533

TIRES, TUBES, WHEELS,
SPINDLES AND AXLES

FOR SALE—500 tons 60-lb. No. 1 Steel Ball with splices, 500 thousand feet of used stringers, 10 x 16—24' and 10 x 16—32' Redwood, and 10 x 18—32' and 8 x 16—32' Douglas Fir. Also two tank cars 12,500 gal. cap. one for fuel oil, other for water. Will sell tanks only.

F. L. BOTSFORD — Railway Supplies
DOuglas 2-8710 — Sharon Bldg. — San Francisco

STOP that WATER

With **FORMULA NO. 640**, a clear liquid which penetrates 1" plus in concrete, brick, stucco, plaster, etc. Seals out water, dirt. Holds 20' head. Use outside and in. Preserves all absorbent materials. Sold 14 years. Quick, economical, sure. \$3 in 55's. Free sample. See Sweet's.

HAYNES PRODUCTS CO., OMAHA 3, NEBR.

Do YOU Want—

- to find a job?
- to get good help?
- to sell or rent good used equipment?
- to buy good used equipment?

Use **WC Classified
Pages for ACTION!**

HELP WANTED

SUPERINTENDENT WANTED

California firm seeks experienced construction superintendent for industrial and refinery projects with specialization in industrial, process and power piping; millwrighting and machinery installation work.

Give full experience record, education, age, availability and salary expected.

Box 31, Western Construction
609 Mission St., San Francisco 5, Calif.

ENGINEERS

Structural, mechanical, and electrical for work on hydro-electric power developments. Write giving full experience record and qualifications.

HARZA ENGINEERING COMPANY

400 West Madison Street
Chicago, Illinois

CONTRACTORS WANTED

Engineering company seeking contractors for large construction projects in foreign countries. For both single and joint ventures, write

BOX 60, WESTERN CONSTRUCTION
609 Mission Street, San Francisco 5, Calif.

ENGINEER

Texas manufacturer needs young sales and design engineer. Also MECHANICAL DRAFTSMEN familiar with crushing, screening, washing and cement machinery. Excellent opportunity in well established company.

WRITE BOX 1369, DALLAS, TEXAS

POSITION WANTED

CIVIL ENGINEER

20 years' experience design irrigation structures, layout open and closed systems. Registered in California

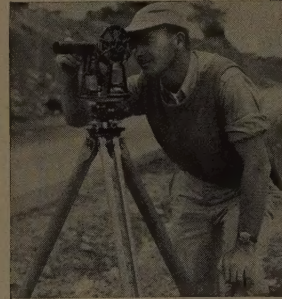
BOX 61, WESTERN CONSTRUCTION
609 Mission Street, San Francisco 5, Calif.

ASSURE ACCURACY--SAVE TIME-- REDUCE COSTS

You can do your field work better by using
WARREN-KNIGHT TRANSITS and LEVELS

Special Features that assure you of the greater value per dollar in investment include the following:

- Sturdier Construction—special re-inforcing
- Extra fine coated Lenses—flat — Brilliant — close focus 4½ feet
- Disappearing Stadia
- Graduations differentiated size and slant
- Right angle peep sight through telescope axle
- Balanced internal focusing telescope
- Non-cramping Leveling head
- Replaceable leveling screws
- Leveling screw threads covered



These Features Assure

Precision
Permanence of Adjustments
Reduced Maintenance and Repair Costs.
Speed and Convenience in Handling.
10 day TRIAL.

No obligation to purchase
Send for Catalog WC-36

WARREN-KNIGHT CO.

Manufacturers of Warren-Knight Transits and Levels

136 N. 12th Street

Philadelphia 7, Pa.

SOLD • RENTED • REPAIRED
Transits • Levels
Steel Tapes • Compasses
PORTLAND INSTRUMENT CO.
334 S.W. 5th St. Stark
PORTLAND 4, ORE., AT 3598

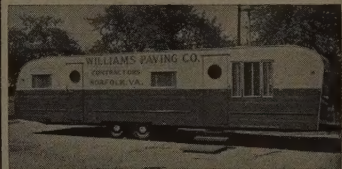


Read and Use Western Construction
Classified Ads for Better Results

Superintendents & Project Managers Training Course

All instruction by mail. Send today for sample lesson and complete details.
GEO. E. DEATHERAGE & SON, DEPT. 103
411 So. 5th Avenue, LAKE WORTH, Florida

Would you use 1925 construction equipment today? No. Why not change over and equip your jobs with modern office trailers and cut costs.



CONTRACTORS' OFFICE TRAILER

Models 24'—28'—35' Price \$2100. to \$3500. Birch finish, drafting table, 2 built-in desks with letter files & drawers, other conveniences. Can offer three year finance plan. Write for pictures and plans.

TRAILER VILLAGE SALES, INC.

8642 Pulaski Highway, Baltimore 21, Md.
Phone: Essex 2233



Picture shows exposed bolts before being covered with live rubber both inside and outside.

Earthmover Tires Repaired by **FORBUSH "Vulca-Bolted" Method** Make Permanent Repairs

"VULCA-BOLTED" SECTIONS are bolted as well as vulcanized. Repairs are guaranteed to hold. Patented. Ship as "junk tires" via cheapest route. We pay freight both ways.

THE FORBUSH COMPANY

110 Grand Avenue • Phone 5100 • Pueblo, Colorado

PETTIBONE-MULLIKEN SPEED LOADER

MODEL 54

SERIAL NO. SL 276. Equipped with Chrysler Industrial Eng. Type 12A310, Serial #26961. 30" Belt. 13:00 x 24 Tires.

This machine in excellent condition. Less than 400 hrs. actual operation. Big price reduction.

WILSON EQUIPMENT & SUPPLY CO.

902 W. 22nd St. Phone 88923
Cheyenne, Wyoming

FOR SALE

1 CATERPILLAR D-7, Serial No. 3T18922 with starter and No. 25DD-PCU and 7-S Dozer, 1 yr. old, 2,000 hrs. \$11,500, f.o.b. Mangum, Okla.

1 CATERPILLAR D-8, Serial No. 1H8081 with No. 25DD-PCU and 8-S Dozer, 1,000 hours since compl. major overhaul. \$8,000, f.o.b. Mangum, Okla.

E. C. SAUNDERS

BOX 243, MANGUM, OKLA. 950J1
or KE. 3-7092, Oakland, Calif.

SACRIFICE

2 GALION CHIEF 10-ton 3-wheel rollers, hydraulic steering; rebuilt.

CAT D7, traxcavator and hystaw attach-ments; new tracks.

TINKLER EQUIPMENT CO

2589 Oakdale, San Francisco Mission 7-7677

FOR RENT OR SALE

250 PARSONS Trenchliner. New September 1952. Used very little.

WELLER BROTHERS

N. 633 Madelia Ke 9341 Spokane, Wash.

FOR SALE OR RENT

One Model 212 Caterpillar Motor Grader. Excellent condition, reasonably priced.

STANDARD MACHINERY CO.

450 Bayshore Blvd. San Francisco, Calif.
Telephones: ATwater 2-2883, 2-8884, 2-8885

D-7 CAT. — 3 T Series

New tracks, angle dozer, 2 drum rear P.C.U. Very good condition. Bargain.

Also some trucks at bargain prices

460 Kifer Road, Santa Clara
AX 6-7712

KOEHRING DUMPTORS

Mdl. WD60 Diesel, w/General Motors 471 engines, 6-8 c.y. bodies, all current mdl. Good rubber. Cleaned, painted, and ready to go. \$4,250, Boise, Idaho. Three available.

WENZEL MACHY. RENTAL & SALES CO.
2136 Jefferson, Kansas City, Mo. Tel: Harrison 0021

D8-2U JBar/8s/25 \$9,500; Forks, Cranes
1-10T; HD10; TD24; 46 \$4,500; D7 \$6,750;
lobes; scrapers; swing crane.
Phone BErkeley 7-6726

AVAILABLE EQUIPMENT CO.

2608 Waring Street Berkeley 4, Calif.

FOR SALE 2 CLIMAX ENGINES

245 HP at 1200 RPM—Model R81.

Complete with radiator and clutch.

Butane operated.

Also 3000 gal. butane tank.

Write, wire or phone

JAMES B. ALLEN

P. O. BOX 212, SAN CARLOS, CALIF.

Phone Lytell 3-0413 or Lytell 3-2889

CLETRAC 80

NEW engine, transmission, clutch and final drive completely overhauled. Winches front and rear; Isaacson's double drums.

TACOMA WHITE TRUCKS, INC.

2719 S. Tacoma Way, Tacoma, Wash., GA 4471

STEEL SHEET PILING LARGEST RENTAL STOCKS IN U.S.

The exact lengths and sections of Steel Sheet Piling to meet all needs—shipped "FASTER From FOSTER." RENT: Corrugated Steel Piling, Pile Hammers & Extractors.

• RAILS • PIPE • WIRE ROPE

L.B. FOSTER co.

Pittsburgh 30, Pa. New York 7, N. Y.
Chicago 4, Illinois Houston 2, Texas

Controversy marks Hells Canyon withdrawal

RAISING A STORM of controversy, Secretary of the Interior Douglas McKay announced on May 5 that he was withdrawing his department's objections to the Idaho Power Co.'s application to build three dams on the Snake River near the Oregon-Idaho border.

The situation has been tense for a number of months. It stems basically from an Interior Department plan to build a huge, multipurpose dam at Hells Canyon (*Western Construction*—February 1953, p. 92) in opposition to the private power company's plan to build power development dams at Oxbow, Brownlee, and Hells Canyon. Either project would drown the site of the other.

What most of those who rushed into print, both for and against the government's construction of Hells Canyon Dam, apparently failed to realize was that McKay's decision actually didn't settle a thing. It is the Federal Power Commission which must make the decision as to whether or not it will grant the Idaho Power Co.'s request to build one low dam at the Oxbow site (the company has announced plans to build at the other two sites but has applied only for Oxbow as yet). The FPC hearings will be held July 7.

T. E. Roach, president of the Idaho Power Co., pointed out that the controversy will be decided on its merits after a full consideration of the facts.

Let WESTERN CONSTRUCTION Help Sell Your Surplus Equipment!

Have you any used or rebuilt equipment for sale or rent? WESTERN CONSTRUCTION offers you many potential outlets, at a good profit and little expense to you.

Announcement of your surplus equipment in the classified columns of WESTERN CONSTRUCTION puts your ad in the greatest concentrated market in the eleven Western states.

Men who read the
classified columns
do so with an eye
to buying.

★

**TURN YOUR SURPLUS
MACHINERY INTO CASH!**

★

Use the
Classified Columns of
WESTERN CONSTRUCTION
regularly.

**WESTERN CONSTRUCTION
Classified Adv. Dept.**

609 Mission Street
San Francisco 5, California

I'm interested. Here's an ad according to
rates at top of page 210.

FIRM.....

CITY..... STATE.....

SIGNED.....

Set 1, 2, 3 Columns, (specify which)
by inches (1-10).

INDEX TO ADVERTISERS IN THIS ISSUE

A	Fruehauf Trailer Company	55	P	Pacific Car & Foundry Co. (Carco)	208
Adams, J. D., Manufacturing Company.....				Panama Lamp & Commercial Co., Inc.....	197
Allis-Chalmers Mfg. Co.....	10, 11			Permanente Cement Company.....	38
American Bitumuls & Asphalt Co.....	16, 17, 18, 19			Pittsburgh-Des Moines Steel Company.....	106
American Hoist & Derrick Co.....	164			Portland Cement Association.....	199
American Rubber Mfg. Co.....	97				
Armco Drainage & Metal Products Co.....	179				
Atlas Powder Company.....	154			Q	
Austin-Western Company.....	54			"Quick-Way" Truck Shovel Co.....	86
	58			R	
B				Raymond Concrete Pile Co.....	4
Baker Manufacturing Company.....	90			Remington Arms Co., Industrial Tools Div.....	153
Barber-Greene Company.....	117			Roebbing's, John, Sons Co.....	41
Barco Manufacturing Co.....	208			Rotes Motors, Inc.....	134
Barnes Manufacturing Co.....	196			Rucker Company, The.....	130
Basalt Rock Company.....	133			S	
Baxter, J. H., & Co.....	204			Schramm Inc.....	36
Blaw-Knox Company.....	165			Seaman Motors, Inc.....	131
Briscoe, E. V., & Son.....	185			Shell Oil Company.....	149
Bros, Wm., Boiler & Mfg. Co.....	98			Silver Booster Manufacturing Co.....	196
Bucyrus-Erie Company.....	14, 15 & 159			Skookum Company, Inc.....	191
By-Chemical Products.....	169			Smith Engineering Works.....	135
C				Smith, S. Morgan, Company.....	125
Caterpillar Tractor Co.....	7, 129, 136 & 157			Sight Feed Generator Co.....	188
Chain Belt Company.....	24			Standard Oil Company of California.....	21
Carver Pump Co.....	161			Standard Steel Corp.....	144
Case, J. I., Company.....	163			Stephens-Adamson Mfg. Co.....	102
Chapman Valve Mfg. Company.....	89			Superior Concrete Accessories, Inc.....	150
Chevrolet Motor Division, General Motors Corporation.....	20			Superior-Lidgerwood-Mundy Corp., Lidgerwood Industries, Inc.....	39
Chicago Bridge & Iron Company.....	56			T	
Chrysler Corporation, Dodge Truck Division.....	32			Texas Company, The.....	Cover 2
Cleveland Trencher Company.....	138			Thompson Tire Company.....	195
Coffing Hoist Company.....	199			Tilden Tool Company.....	151
Colorado Fuel & Iron Corp., Clinton Wire Cloth.....	6			Timken Roller Bearing Company, Rock Bit Division.....	99
Wickwire Rope.....	35			Traylor Engineering & Mfg. Co.....	173
Cal-Tie Wire.....	202			Turner Halsey Co., (Mt. Vernon-Woodberry Mills).....	45
Columbia-Geneva Steel Division, United States Steel Corporation.....	27			U	
Columbia Trailer Company.....	Cover 3			Union Oil Company.....	171
Cook Bros. Equipment Co.....	118			Union Wire Rope Corporation.....	192
Cummins Engine Company, Inc.....	145			United States Spring & Bumper Co.....	198
D				United States Pipe & Foundry Co.....	25
Davey Compressor Co.....	200			United States Steel Corporation, Columbia-Geneva Steel Division, Wire Rope.....	27
Dewey & Almy Chemical Co. (C. R. Watts).....	205			Universal Form Clamp Company.....	181
Dodge Truck Division, Chrysler Corporation.....	32			W	
Doug-Lynn Company.....	46			Warner & Swasey Company, Gradall Division.....	40
Drott Manufacturing Company.....	166			White Manufacturing Company.....	204
Du Pont, E. I., de Nemours & Co., Inc. Remington Arms Co., Industrial Tools Div.....	153			White Motor Company.....	114
E				Watts, C. H., Co. (Dewey & Almy).....	205
Eaton Mfg. Co., Axle Division.....	101			Wellman Engineering Co.....	142
Edwards, E. H., Company.....	143			Wellman, S. K., Company.....	95
Eimco Corporation.....	50			Western Concrete Pipe Association.....	148
Electric Steel Foundry Company.....	147			Wild, Henry, Surveying Instruments of America, Inc.....	200
Euclid Road Machinery Co., The.....	22, 23			Wisconsin Motor Corp.....	203
F				Wood, Gar, Industries, Inc.....	201
Fiske Brothers Refining Co., Lubriplate Division.....	186			Wooldridge Manufacturing Company.....	44
G				Worthington Corporation.....	37
Galion Iron Works & Mfg. Company.....	29			Wright Power Saw & Tool Company.....	206
Gar-Bro Manufacturing Company.....	47				
Gardner-Denver Company.....	42, 43				
General Motors Corporation, Chevrolet Motor Division.....	20				
Detroit Diesel Engine Division.....	167				
General Petroleum Corporation.....	33				
Goodall Rubber Company.....	209				
Goodrich, B. F., Company.....	5				
Goodyear Tire & Rubber Co., Inc. Cover 4 Gradall Division, Warner & Swasey Co.....	40				
H					
H. & L. Tooth Company.....	53				
Harnischfeger Corporation.....	34				
Heil Company, The.....	8, 9				
Homelite Corp.....	127				
Hopkins Volcanic Specialties, Inc.....	168				
Huber Manufacturing Company, The.....	139				
Hunt Process Company.....	207				
Hyster Company.....	121				
I					
Ingersoll-Rand Company.....	51				
Insurance Company of North America.....	28				
International Harvester Company, Industrial Power Division.....	12, 13				
Motor Truck Division.....	48				
J					
Johnston, A. P., Co.....	213				
K					
Keasbey & Mattison Co.....	177				
L					
Lee Sales Co.....	206				
Leschen, A., & Sons Rope Company.....	155				
LeTourneau-Westinghouse Co.....	30, 31				
Lidgerwood Industries, Inc.....	39				
Lincoln Electric Co.....	109				
Link-Belt Speeder Corp.....	52				
Lubriplate Division, Fiske Brothers Refining Co.....	186				
M					
Macwhyte Company.....	105				
Mall Tool Company.....	203				
Marion Power Shovel Company.....	26				
Marlow Pumps.....	140, 141				
Marvel Equipment Corporation.....	189				
Masonite Corporation.....	113				
McCaffrey-Ruddock Tagline Corp.....	190				
McDonald, B. F., Co.....	189				
McKiernan-Terry Corp.....	169				
Minneapolis-Moline.....	160				
Mt. Vernon-Woodberry Mills, (Turner Halsey Co.).....	45				
Murphy Diesel Company.....	93				
N					
Natural Rubber Bureau.....	85				
Noble Company.....	111				
Northwest Engineering Company.....	3				
O					
Onan, D. W., & Sons, Inc.....	120				
Owen Bucket Company.....	175				

Classified Section

210, 211, 212

Johnston Stainless Welding Rods

213

BACKFILL, uncompacted

You might say the business is brisk

We have acknowledged a new surge of Western roadbuilding activity with this issue. One thing about this "new era" ties in with what we recently heard from a Western contractor's engineer.

The increased highway programs will mean more project "starts." And, said this engineer, the repeated opportunities for new starts are just what make contracting the exhilarating game it is. There is a positive value in the ritual that follows every job—closing the books, packing up the files, and sending the whole kit into the home office. With those records go all the mistakes and troubles of the job, and all the red ink as well.

The start of a new job is a fresh start for every man on it. Everyone is bright-eyed and bushy-tailed and has brought with him only the best experience from his former work. We think this fresh approach has a lot to do with the sharp performance of contractors.

It figures

Hats off (hard hats, of course) to B. F. McDonald Co.

Industrial magazine advertisers—and writers, too—are generally supposed to be a sober lot. They confine

their "copy" to factual reasons-why and their illustrations to gadgets large and small. They love intricate diagrams and figures. Which is as it should be usually.

But this is June. Summer weather, shirt sleeves and swim suits. Thoughts of cool lakes, hammocks, and long tall drinks persist in spite of our sternest efforts.

The McDonald people have solved the problem of an eye-catcher by cutting the statistics down to one figure. But what a figure! Who would want more statistics than those shown on page 189 of this issue?

Some motorists see red; others see redwoods

Whether standing up or lying down, redwood trees in California seem to cause trouble. A couple of recent news stories from different parts of the state are good illustrations.

On the Redwood Highway tempers are flaring over the possibility that four-laning U.S. Highway 101 would wipe out many of the ancient trees for which the region is famous. Highway engineers disclaim any immediate plans, but they admit that the day is coming when inadequate alignments will have to be improved on account of the increasing traffic. Local interests say in effect that 70- and 80-

A little more water

FORECASTS of 1953 Western water supplies as of May 1 depart but little from the April 1 forecast published in *Western Construction*.

Snow melt in April was less than average due to temperatures lower than usual throughout most of the Western mountain areas. This aided in conserving the snow-pack at higher levels and will have the effect of slightly increasing streamflow to meet late season irrigation demands. April precipitation was normal or slightly above in most parts of the West. This also has resulted in slight upward revision of the earlier forecasts of April-September runoff.

By and large, the upward revision ranges from zero to 10%. This small improvement in outlook is not sufficient to alter materially the dismal outlook for natural runoff in Arizona, New Mexico, southern Utah, most of Nevada and parts of California, Colorado and Wyoming.

mph. through traffic is not welcome in their part of the country.

Down in the southern Sierra, a giant redwood has fallen across the road in Sequoia-Kings Canyon National Park. Engineers have appraised the situation before making repairs, and they have concluded that it may be cheaper to leave the tree alone and tunnel the road underneath.

Now there is an idea. Maybe it could be applied to the first case: tunnel under the Redwood Highway for the new alignment!

Twenty-five years ago in *Western Construction*

At Pardee Dam, "the concrete mix is under the supervision of L. H. Tuthill, resident concrete technologist for the East Bay Municipal Utility District. An excellent and uniform grade of concrete is being obtained, using an average of 1 bbl. of cement per cubic yard . . . a water cement ratio of 9.5, and a slump of about 6 inches . . . The average of a number of 90-day tests is 2,376 lb. per square inch, using an average of 1.02 bbl. of cement."

* * *

"It is now generally conceded that Herbert Hoover, the engineer, will be our next President."

* * *

"John Carey Regan, civil engineer with the Gow Co. of New York, foundation specialists, affiliated with the Raymond Concrete Pile Co., has come to San

Francisco to open a branch office for the company."

* * *

"Charles E. Putnam, for a number of years assistant engineer, Washington State Highway Department, has resigned to become city engineer of Tacoma."

* * *

Jointly undertaken by the city of Port Townsend, Washington, and the National Paper Products Co., a 30-mi. water supply pipeline was under construction between the Big Quilcene River and Port Townsend. Engineering was being handled by Baar & Cunningham of Portland, with F. S. Zeidlhack as project engineer. James H. Coyne of Port Townsend had the general contract. Both wood stave and arc-welded steel pipe was used, with diameters from 20 to 30 in.

What'll you have?

The map of our Western region returns to the cover of *Western Construction* this month. First time in a long time. And it serves as a quick reminder of some of the things that make engineering and contracting a fancier business in the West.

For instance, here are some of the things that were spotted on an earlier version of the map published several years ago: the wettest spot in the U.S., in Washington, and the driest, in Nevada; the hottest, in Arizona, and the coldest, in Montana; the highest and the lowest, both in California.

We wouldn't go so far as to say that having conditions like these as every-day problems makes the Western engineer or contractor any better than his colleagues elsewhere, but it sure makes him different!

By THE EDITORS