WESTERN CONSTRUCTION NEWS

WITH WHICH IS CONSOLIDATED
WESTERN HIGHWAYS BUILDER

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VOLUME XI, No. 3

MARCH, 1936

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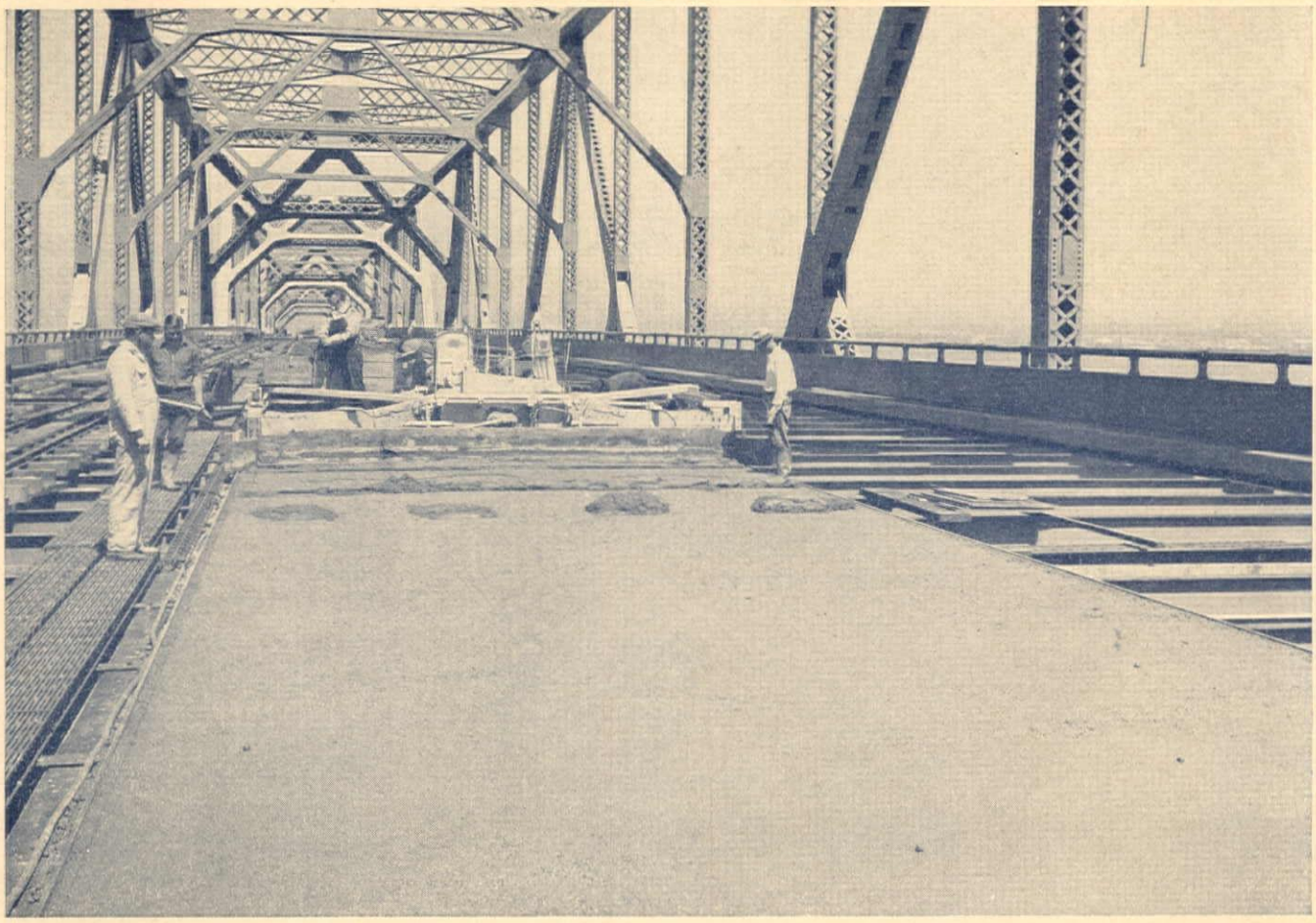
$2.00 PER YEAR

IN THIS ISSUE

A Modern Western Highway — Washington State Route No. 1 in Woodland Park, Seattle, provides six lanes of concrete paving and adequate grade separations. See p. 63.

"ON DECK"



PAVING UPPER DECK SAN FRANCISCO-OAKLAND BAY BRIDGE

Golden Gate Portland Cement Being Used

Modern construction methods demand that materials be quickly available from dependable, adequate sources of supply.

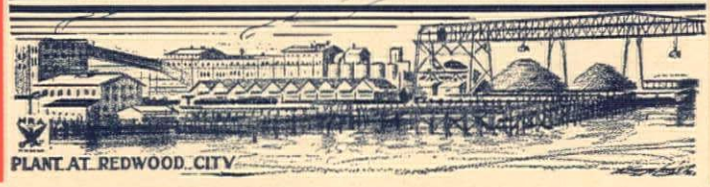
Golden Gate *True* Portland Cement is always "on deck"... when and where you want it... anywhere on the Coast.

Produced on San Francisco Bay, it is always quickly available in bulk or sack ... by rail, steamship, barge or truck.

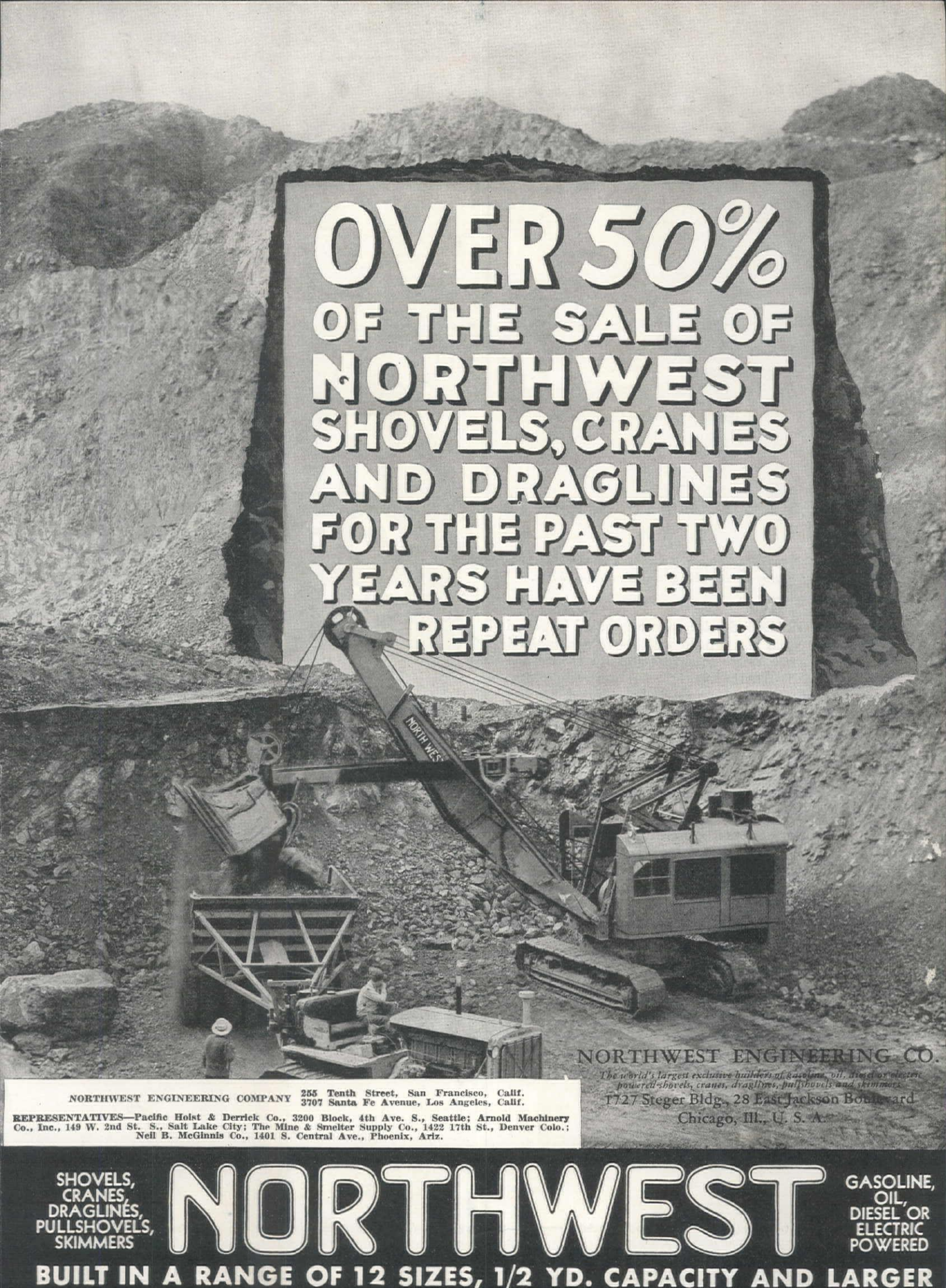
You'll also find the men behind Golden Gate right "on deck"... always ready to serve your needs.

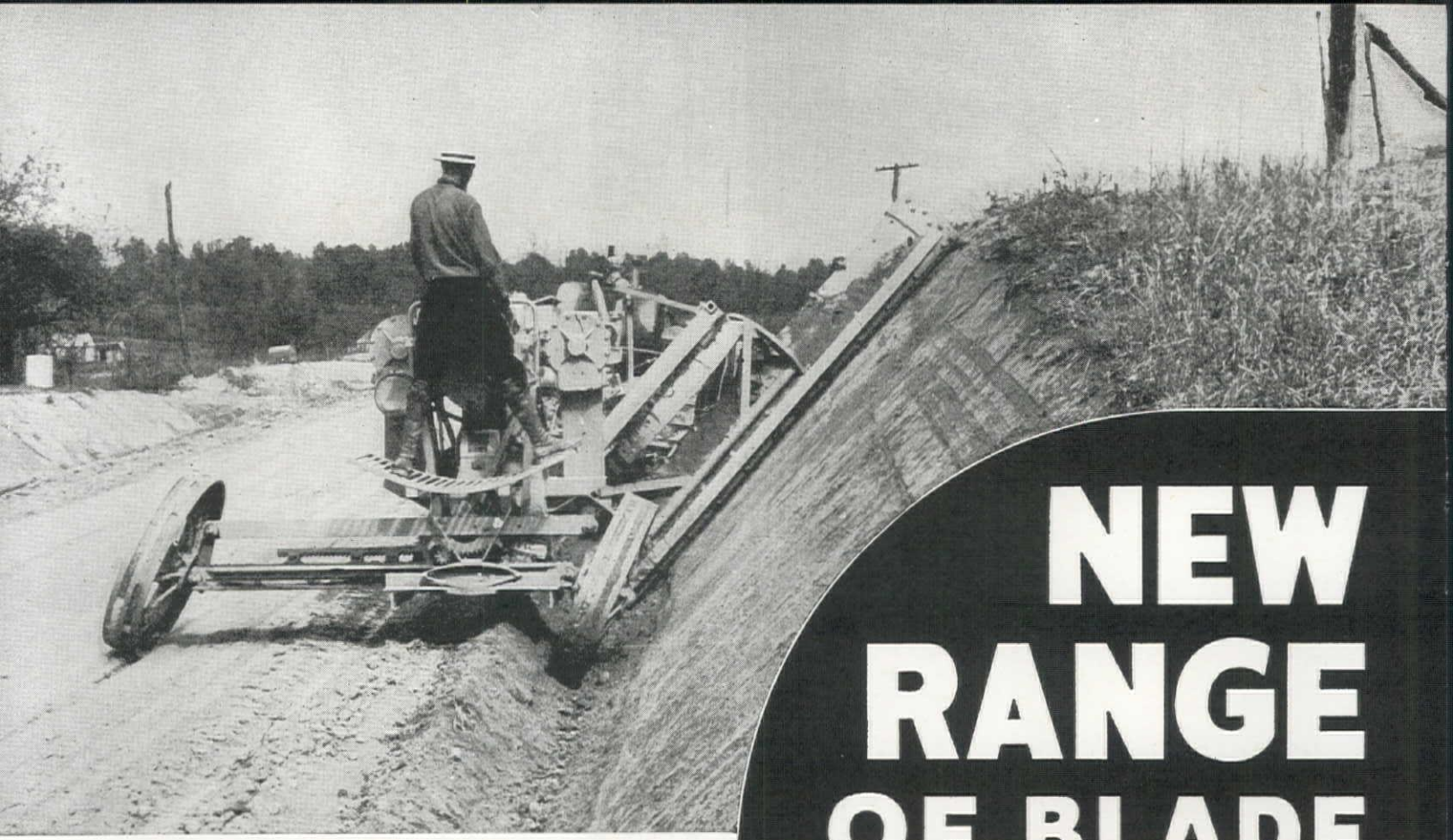
Ask Your Materials Dealer

PACIFIC PORTLAND CEMENT COMPANY
SAN FRANCISCO



GOLDEN GATE PORTLAND CEMENT


OVER 50%
OF THE SALE OF
NORTHWEST
SHOVELS, CRANES
AND DRAGLINES
FOR THE PAST TWO
YEARS HAVE BEEN
REPEAT ORDERS
NORTHWEST ENGINEERING CO.
The world's largest exclusive builders of gasoline, oil, diesel or electric powered shovels, cranes, draglines, pullshovels and skimmers
1727 Steger Bldg., 28 East Jackson Boulevard
Chicago, Ill., U. S. A.
NORTHWEST ENGINEERING COMPANY 255 Tenth Street, San Francisco, Calif. 3707 Santa Fe Avenue, Los Angeles, Calif.
REPRESENTATIVES—Pacific Hoist & Derrick Co., 3200 Block, 4th Ave. S., Seattle; Arnold Machinery Co., Inc., 149 W. 2nd St. S., Salt Lake City; The Mine & Smelter Supply Co., 1422 17th St., Denver Colo.; Neil B. McGinnis Co., 1401 S. Central Ave., Phoenix, Ariz.
SHOVELS, CRANES, DRAGLINES, PULLSHOVELS, SKIMMERS
NORTHWEST
GASOLINE, OIL, DIESEL OR ELECTRIC POWERED
BUILT IN A RANGE OF 12 SIZES, 1/2 YD. CAPACITY AND LARGER



NEW RANGE OF BLADE POSITIONS

This 12-foot blade is cutting a 1 to 1 slope on a bank 8 feet high; it is capable of cutting much higher of course on steeper banks.

A ROAD GRADER'S value to you is based largely, is it not, on what you can do with it—how completely it answers your needs? If you have high banks to cut back, a grader that will cut to the top of them is more valuable to you than one that will not. If you have backsloped, flat-bottom ditches to cut, a grader that will cut them to specifications without the use of a backsloper attachment is more valuable to you than one that requires an attachment. For finishing soft shoulders, a grader that can extend its blade farther beyond the line of wheels is of distinct value.

The new-type Adams Leaning Wheel Graders are worth more to you because you can get more extreme positions of the blade and make cuts that are outside the range of other machines. Their adjustment is so flexible that on 90% of your work you don't even have to change the setting of your lift links or the position of moldboard on the circle—that means much time saved.

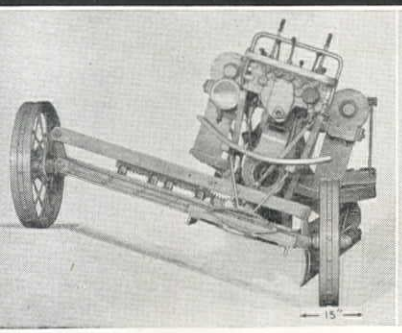
In addition to this, all adjustments throughout the machine are made very quickly and easily. You get a visibility of the blade that is not approached in any other machine. You get all-welded construction which, for strength and rigidity, is unequalled; machine-cut gears and liberal use of anti-friction bearings insure long life.

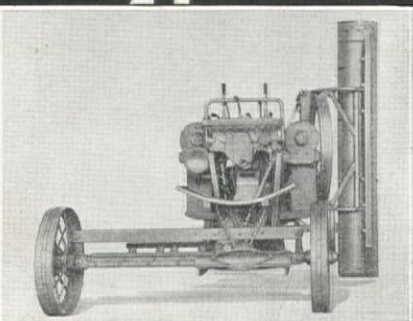
Have our local representative show you one of these remarkable machines or write for complete details. Now available in 12 and 10-ft. blade sizes with hand or power-operated controls.

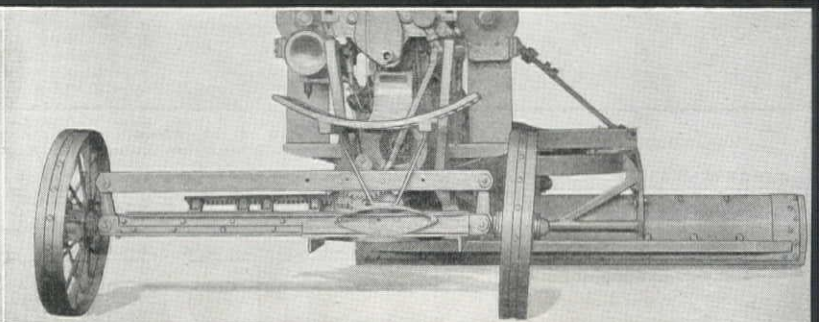
J. D. ADAMS COMPANY
SAN FRANCISCO—LOS ANGELES—BILLINGS

Western Distributors: HOWARD-COOPER CORP., Portland, Seattle, Spokane; LUND MACHINERY CO., Salt Lake City; NIEL B. McGINNIS CO., Phoenix, Ariz.; McKELVY MACHINERY CO., Denver, Colo.; McCHESNEY-RAND EQUIPMENT CO., Santa Fe, N. M.

—the New-Type ADAMS GRADERS







Above illustrations (left to right) show 1—how blade can be set at sharp angle to cut narrow, flat-bottom ditches. Sharp angles also permit cutting low backslopes without interfering with poles and fences. 2—Due to new, narrow-frame design, the blade can actually be swung through an arc of 90 degrees to cut any desired slope. 3—The blade can be extended far outside the line of wheels for shoulder work.

Ten Years Ago

Items from the third month's issue of "Western Construction News," March, 1926

Excavation for the abutments of the Pacoima dam, a unit of the Los Angeles County flood control program was nearing completion. Construction of the 375-ft. constant angle arch dam (the highest attempted up to that time) was under the supervision of J. W. Reagan, chief engineer, Los Angeles County Flood Control District. B. F. Jakobsen was engineer in charge of construction.

•

The Bureau of Reclamation program included construction of three large dams: the McKay dam on the Umatilla project in Oregon, the American Falls dam on the Snake River in Idaho, and the Guernsey dam on the North Platte River in Wyoming.

•

March 11, 1926, Frank C. Towns and his associates, Mark E. Noon and William A. Deuel, filed plans and specifications for the San Mateo vehicular toll bridge across San Francisco Bay.

•

The Donner Summit arch bridge was under construction as part of the re-alignment program on the Donner Pass section of the transcontinental highway over the Sierra Nevada to Reno.

•

A contract was awarded to the J. H. Tillman Co. for reconstruction of the Webster St. swing-bridge across the estuary between Oakland and Alameda, Calif.

•

The Agua Fria Water Conservation District, Maricopa County, Arizona, awarded a contract to Tibbetts and Pleasant of Oklahoma for the construction of the Frog Tanks (Lake Pleasant) dam on the Agua Fria River. The dam, a multiple arch type, 201 ft. in height, was the highest of its type at the time.

•

Bent Bros., contractors of Los Angeles began work on a 126,000,-000-gal. oil storage reservoir for the Southern Pacific Co. at Tracy, Calif.

SUBSCRIPTION RATES

The annual subscription rate is $2 in the United States and foreign countries where extra postage is not required. To Canada and to foreign countries where extra postage is necessary the annual rate is $3. Single copies 25 cents.

WESTERN CONSTRUCTION NEWS

WITH WHICH IS CONSOLIDATED WESTERN HIGHWAYS BUILDER

J. I. BALLARD, Editor

Contents for March, 1936

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New York Office: 509 Fifth Avenue . . . . . Ralph H. Flynn, Manager

Please address correspondence to the executive offices, 114 Sansome Street, San Francisco

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PROFITABLE LOADING

There'll be more yardage for you in 1936 . . . more reason for profitable, up-to-date loading methods. Saving a few cents a yard will mean hundreds of dollars of extra profit.

The Barber-Greene Model 82 Bucket Loader can't be beaten for low cost loading. It's rated at 2 to 3 yards a minute. Clocked at 4.

A one-cent card will bring complete details on the new Synchronized Feeding, Slow Crowding, Knee Action Oscillating Axle, Tank Type Chassis Frame, Welded Buckets, Hard Faced Bucket Lips, Quick Acting-Self Locking Swivel Spout, Floating Boom, Automatic Overload Release, and many other B-G Features.

Phone, write, or wire. There is no obligation.

Barber-Greene Company
425 West Park Ave., Aurora, Illinois

36-1

Standardized Material Handling Machines

BARBER GREENE
AURORA, ILLINOIS

WEST COAST REPRESENTATIVES

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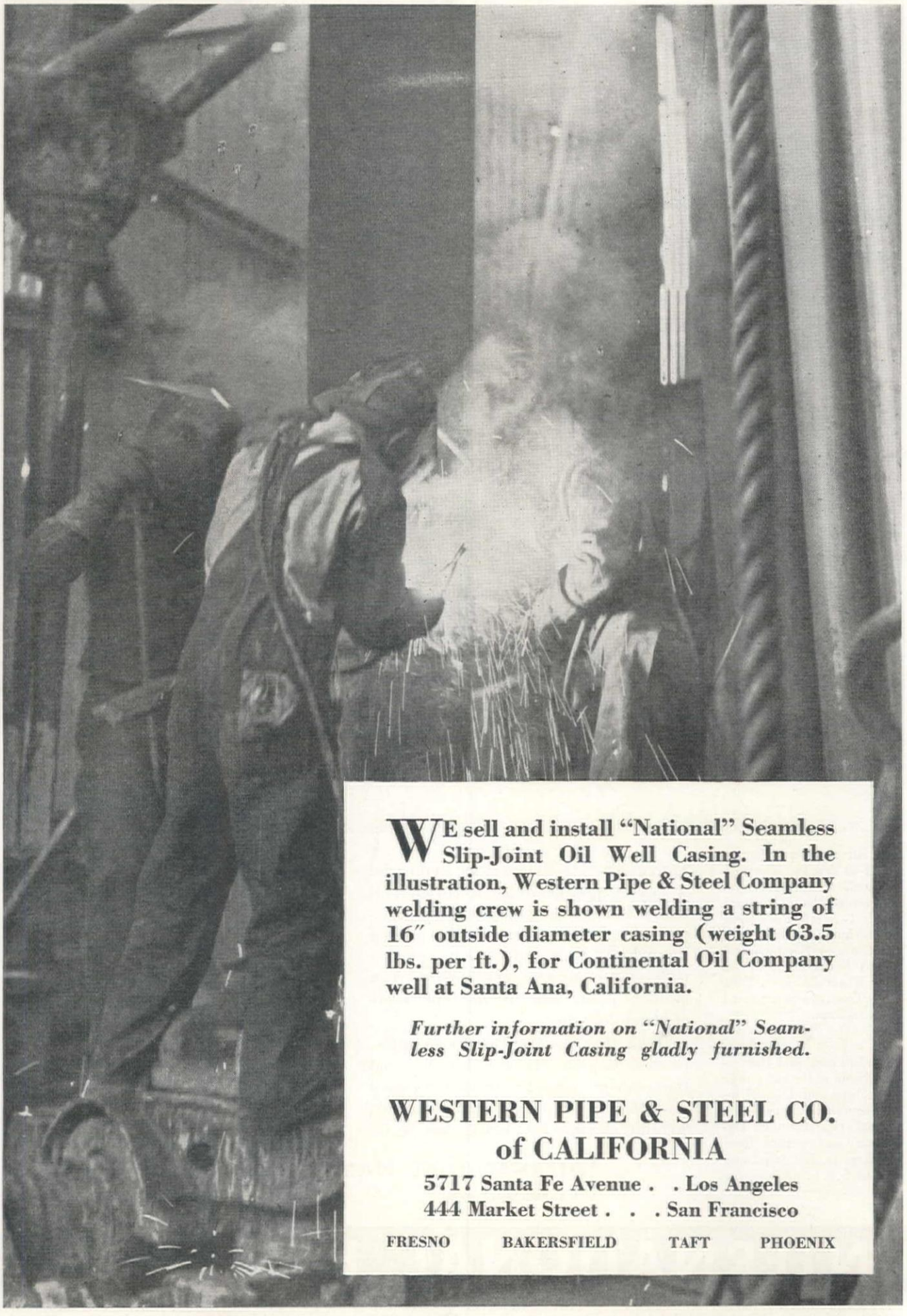


WE sell and install "National" Seamless Slip-Joint Oil Well Casing. In the illustration, Western Pipe & Steel Company welding crew is shown welding a string of 16″ outside diameter casing (weight 63.5 lbs. per ft.), for Continental Oil Company well at Santa Ana, California.

Further information on "National" Seamless Slip-Joint Casing gladly furnished.

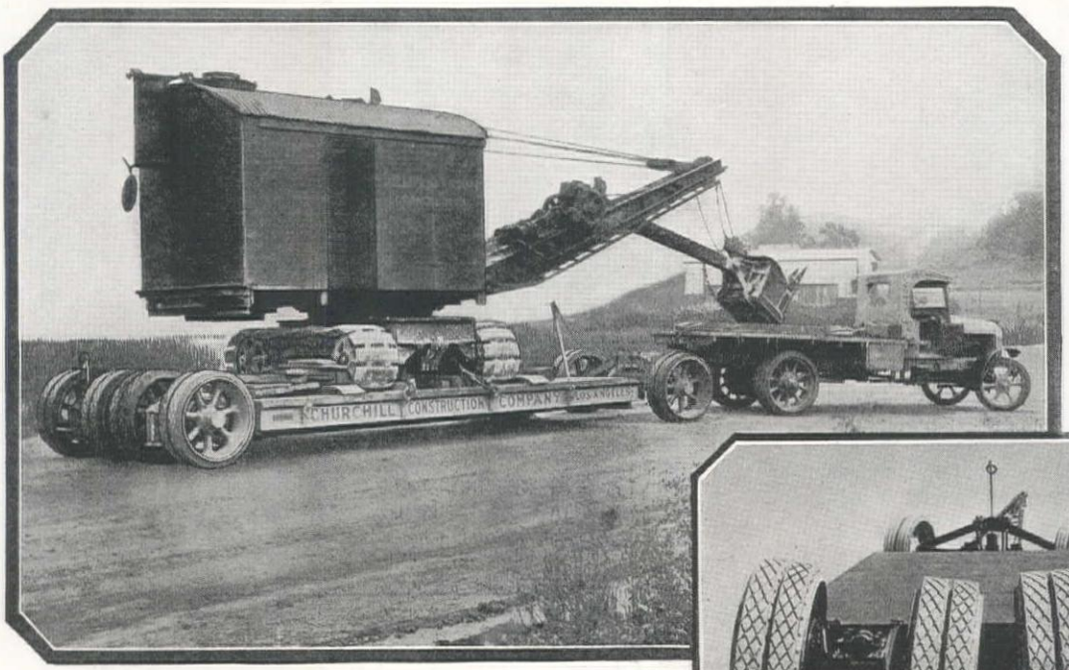
WESTERN PIPE & STEEL CO. of CALIFORNIA

5717 Santa Fe Avenue . . Los Angeles
444 Market Street . . . San Francisco

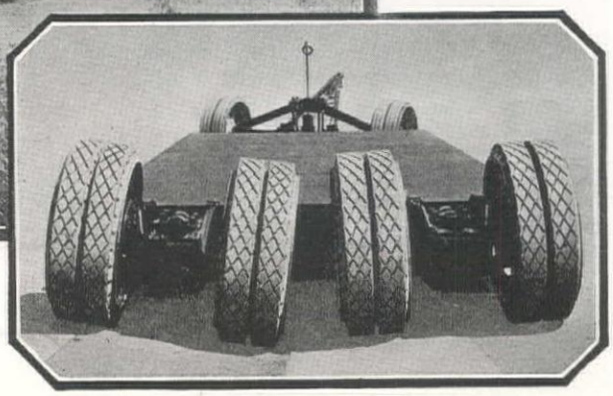
FRESNO BAKERSFIELD TAFT PHOENIX

BULKY AND HEAVY LOADS

Moved Easily with UTILITY Heavy Duty Trailers



The rocking action of all axles allows wheels to follow the contour of the road surface.



25- to 35-ton capacity, with 10′ x 22′ loading platform, 40″ x 8″ dual tires on all six wheels—total 96″ of rubber. If more rubber is necessary, can be furnished with 3 tires per wheel instead of 2, as shown.

UTILITY heavy duty trailers and semi-trailers shown on this page demonstrate the skill acquired in 20 years' experience in producing equipment designed to carry the greatest pay loads with the lightest possible weight.

UTILITY trailers are built in four- and six-wheel types —single or dual tires—five- to fifty-ton capacities—with loading platforms for all purposes, and equipped with effective brakes.

Electric welded I-beam construction provides lightest weight and maximum strength in the frames. All trailer steel castings are produced in our own Electric Steel foundry, where quality is tested at each step in the production process.

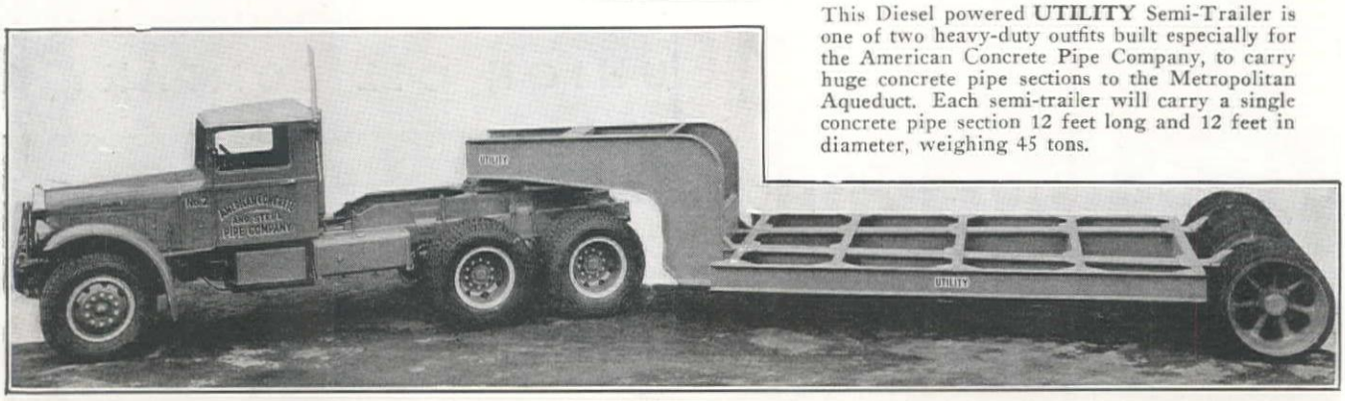
UTILITY equipment can be built to meet the needs of the individual truck operator—and our sales offices in all principal western cities bring **UTILITY** service conveniently near to you. **"UTILITY"** means Economy to you.

UTILITY TRAILER MFG. COMPANY

P. D. Box 1407
ARCADE ANNEX

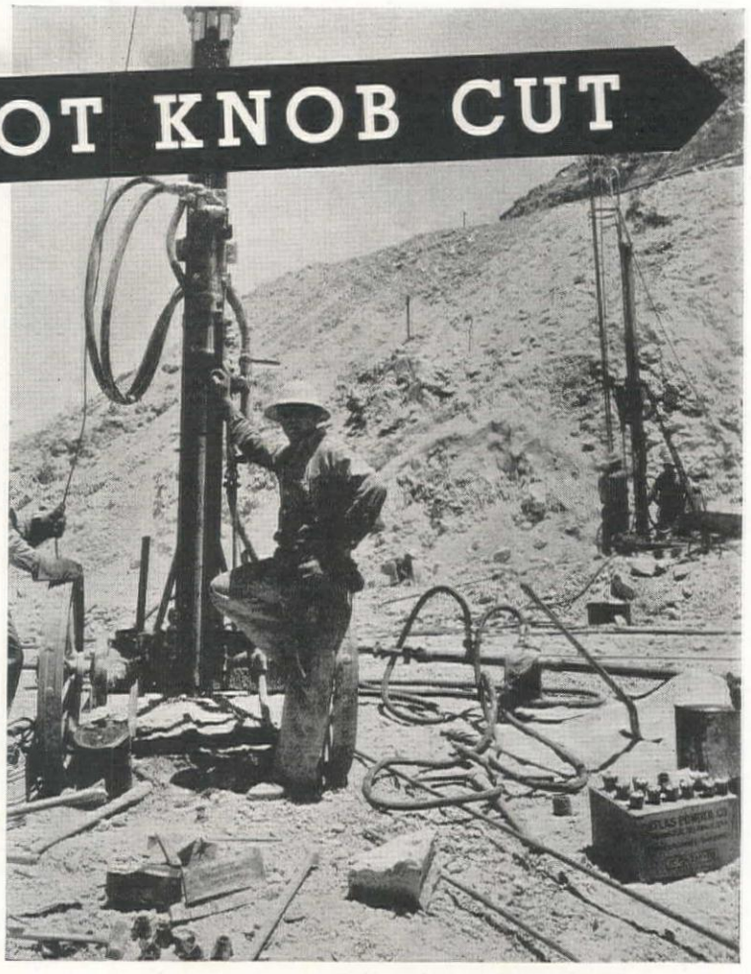
UTILITY TRAILERS

LOS ANGELES, CALIF.
Cable Address "UTILITY"



This Diesel powered **UTILITY** Semi-Trailer is one of two heavy-duty outfits built especially for the American Concrete Pipe Company, to carry huge concrete pipe sections to the Metropolitan Aqueduct. Each semi-trailer will carry a single concrete pipe section 12 feet long and 12 feet in diameter, weighing 45 tons.

IN THE PILOT KNOB CUT



• Two WDA-10 Rigs were used for the primary drilling operation on Griffith's 570,000-yard cut of the All American Canal. In the hard, ravelly ground of the Pilot Knob Cut, the Cleveland Rigs were the only machines that would turn the trick. Some of the hard streaks were so difficult that more than a dozen bits would be required to drill a single foot of hole. Yet the Cleveland Rigs each averaged 150 feet of holes per day. Ordinary wagon drills could not do the work and were soon removed from the job.

• You will want to know how a Cleveland Rig will save money on your own drilling job. Bulletin 109 tells the story.

●

THE CLEVELAND ROCK DRILL CO.

3734 E. 78th STREET CLEVELAND, OHIO

LEADERS IN DRILLING EQUIPMENT

Besides Drill Rigs, or wagon drills, we manufacture:

HAND HAMMER DRILLS
SINKERS, DRIFTERS, STOPERS
PAVING BREAKERS
PNEUMATIC DIGGERS AND TAMPERS
TRIPODS, COLUMNS
HOSE COUPLINGS
AIR VALVES
DRILL STEEL
PAVING BREAKER STEELS
MISCELLANEOUS AIR TOOLS AND ACCESSORIES

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501 Dooly Bldg., Salt Lake City

Western Distributors

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Los Angeles
Edward R. Bacon Company
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Howard Cooper Corporation
Portland Seattle Spokane
Twin Falls
Caird Engineering Works Co.
Helena, Mont.
H. W. Moore Equipment Co.
Denver, Colo.
Wortham Machinery Co.
Cheyenne, Wyo.
Arizona Tractor & Equipment Co.
Phoenix, Ariz.
Connelly Machinery Co.
Billings, Mont.

Did you get a copy of the "Driller's Handbook"? It will be mailed free to bona fide rock drill owners and operators in return for the coupon filled out with the types and sizes of drills you are using.

THE CLEVELAND ROCK DRILL COMPANY,
3734 East 78th Street, Cleveland, Ohio.
Gentlemen: Please send me the "Driller's Handbook."

Name.....

Company.....

Address.....

We are now using the following makes and types of machines:

Hand Hammer Drills.....

Paving Breakers.....

Clay Diggers.....

Back Fill Tampers.....

Wagon Drills.....

When writing to THE CLEVELAND ROCK DRILL COMPANY, *please mention Western Construction News*

WISCONSIN GOES

SNOW-BOUND STATE RELIES ON A-C POWER IN STORM CRISIS

89% OF TRACTORS PURCHASED ARE ALLIS-CHALMERS!...

WHEN the real test came—Wisconsin dug out with Allis-Chalmers tractors. This was one of those "old fashioned" winters—raging blizzards ... heaviest snowfall in a generation ... fierce, shifting winds ... treacherous drifts ... temperatures down to 52 below. Equipment was taxed to the limit—none but the best could stand the test. It was no time for second-best machinery. That is why Wisconsin public officials specified Allis-Chalmers—33 A-C Tractors during those three trying weeks ... compared to four units of other makes.

WHEN DEPENDABILITY COUNTS — When highways are blocked, business stops. Milk, foodstuffs and coal cannot go through. Dependable equipment — to keep the roads open — pays for itself many times over.

POWER — It takes real power to buck big drifts. Where trucks and smaller tractors were helpless — A-C's plowed through.

DURABILITY — Less rugged equipment went to the shop for repairs — caused by the stresses and strains of heavy drifts against the plows. Under tests like this — A-C quality proved itself.

INSTANT STARTING — Only A-C Controlled Ignition Oil Tractors offer this advantage—instant starting on Diesel fuel oil, regardless of weather.

QUICK MANEUVERING — "Light on its feet" as well as powerful — able to turn in its tracks in close quarters. The operators appreciated this feature in A-C's.

TRACTION — There is no substitute for a track-type tractor when the going is toughest. A-C's have what it takes.

BOX SCORE

THREE WEEKS' SALES

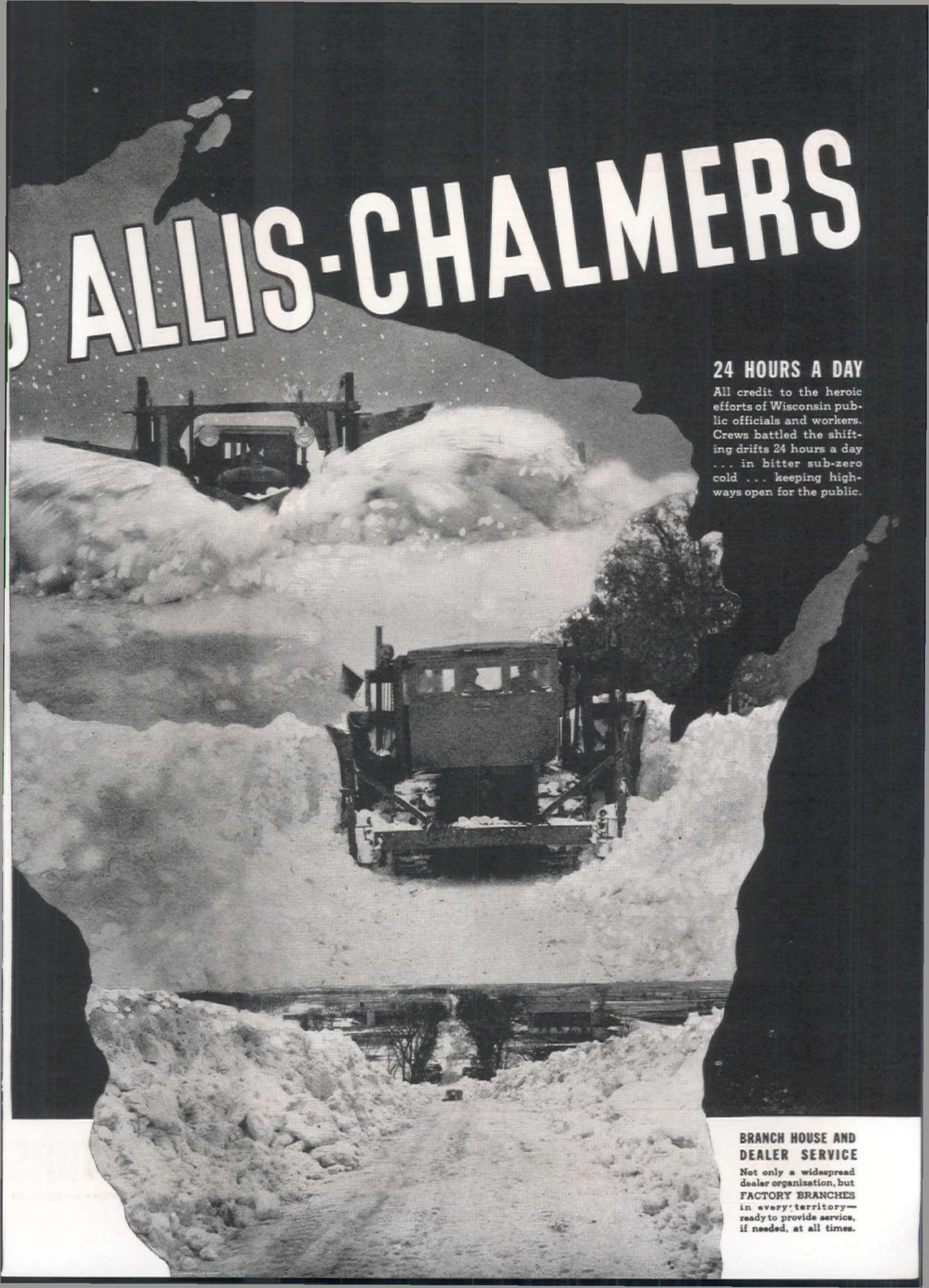
A-C . . . 33 TRACTORS

OTHERS . . 4 TRACTORS

Wisconsin has "gone Allis-Chalmers" in a big way. The same quality features and advantages that make A-C Tractors first choice in Wisconsin . . will enable YOU to handle your job in less time . . at lower cost.

ALLIS-CHALMERS OIL TRACTORS

TRACTOR DIVISION—MILWAUKEE, U. S. A.


S ALLIS-CHALMERS
24 HOURS A DAY
All credit to the heroic efforts of Wisconsin public officials and workers. Crews battled the shifting drifts 24 hours a day . . . in bitter sub-zero cold . . . keeping highways open for the public.
BRANCH HOUSE AND DEALER SERVICE
Not only a widespread dealer organization, but FACTORY BRANCHES in every territory—ready to provide service, if needed, at all times.

today it's LIMA SHOVELS, DRAGLINES and CRANES

GRAND COULEE DAM - FORT PECK DAM - BONNEVILLE DAM - QUIBBIN RESERVOIR DIKE - METROPOLITAN AQUEDUCT - MUSKINGUM VALLEY - HETCH HETCHY PROJECT - THE LEVEE - SKYLINE DRIVE - CASPER ALCOVA PROJECT - PINE VIEW DAM - SAN FRANCISCO-OAKLAND BAY BRIDGE

follow the trend

LIMA is proud to have among its many customers the firms listed below. These pioneer contractors have done much to make possible the great highway and construction development of the West. We salute them for their worthy achievements and their keen judgment in selecting LIMA excavating equipment for their many jobs. LIMA'S modern and efficient earth moving equipment is the standard of those who hold to high production with low operating costs.

American Concrete & Steel Pipe Co., South Gate, Calif.
W. E. Callahan Construction Co. and Gunther & Shirley, Dallas, Texas
Clifton & Applegate, Spokane, Wash.
Colonial Bldg. Co., Spokane, Wash.
James Coyle, Seattle, Wash.
The Diamond Match Co., Chico, Calif.
L. E. Dixon, Los Angeles, Calif.
Goodfellow Bros., Coulee, Wash.
Griffith Company, Los Angeles, Calif.
J. A. Gudgel Sons, Inc., Kalispell, Montana
J. E. Haddock, Ltd., Pasadena, Calif.
Hallett Construction Co., Crosby, Minn.
Frank J. Hass, Grandview, Wash.
Wm. J. Lathers, Jr., Madison, Wis.
Los Angeles Road Dept., Los Angeles, Calif.
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City of Minneapolis, Minneapolis, Minn.
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Martin Wunderlich Company, Jefferson City, Missouri

LIMA LOCOMOTIVE WORKS, Incorporated
SHOVEL and CRANE DIVISION LIMA, OHIO, U. S. A.

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LOS ANGELES—Smith-Booth-Usher Company, 2001 Santa Fe Avenue.

A TYPE AND SIZE FOR EVERY JOB

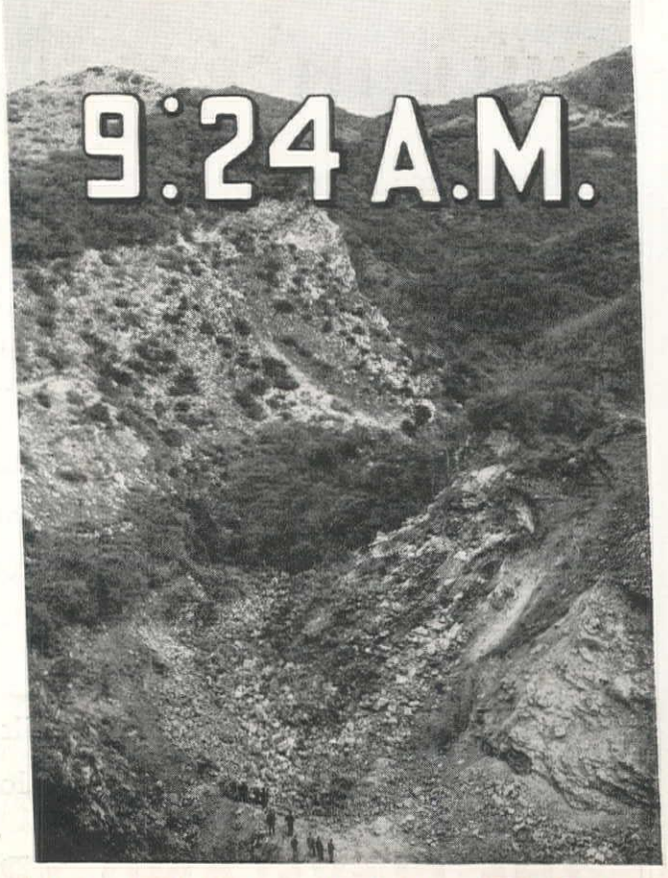
BLASTING AGENT . . .

A 9 MINUTE DEMONSTRATION BY HALAFAX EXPLOSIVES

These are pictures of a "run-of-the-mill" blast, using Halafax free flow powder. There's nothing particularly unusual or unique about them at all. Everything that the explosives engineers expected in yardage moved, the time, manner and low cost of moving it, was eminently satisfactory.

If you were actually present on this job and witnessed this or any other one of these blasts, you too would have placed your approval on Halafax because of its consistently good results. Halafax results are intimately connected to Halafax performance and Halafax economy.

This 9 minute picture demonstration doesn't reveal Halafax economy—but does portray the efficiency and dispatch with which Halafax performs. We invite you to inquire further about Halafax Explosives.



HALAFAX EXPLOSIVES COMPANY

Plant and Magazine: Saugus, California

HALAFAX EXPLOSIVES

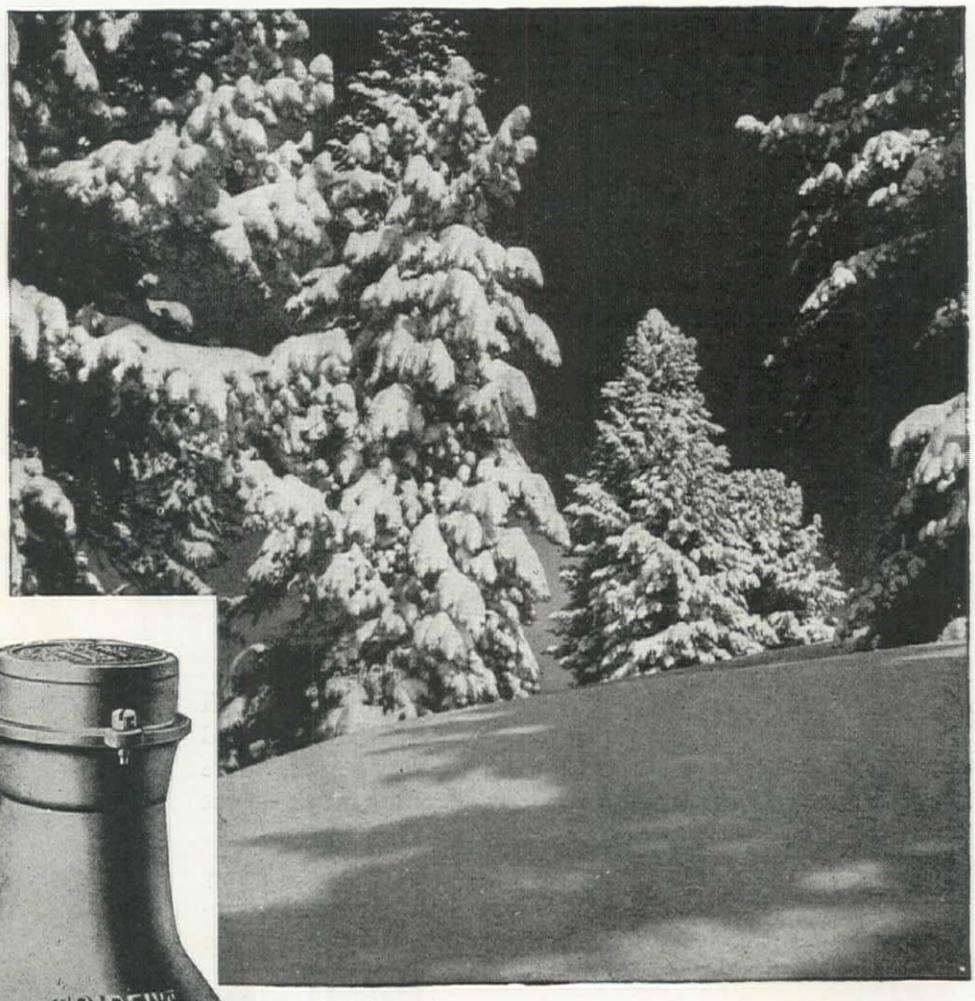
116 New Montgomery St.
SAN FRANCISCO
Phone GArfield 4795

810 South Spring Street
LOS ANGELES
Phone TRinity 8528

HALAFAX FREE FLOW

When writing to HALAFAX EXPLOSIVES COMPANY, *please mention Western Construction News*

Winter snows bring Meter woes



but not when you use Trident frost-proofs . . .

THE FAMOUS TRIDENT FROST-PROOF METER

Its parts are interchangeable. Among other Trident features it embodies the Oil-Enclosed Gear Train, Anti-Friction Disc Thrust Roller, Snap Joint Disc Chamber; special Heat-proofed and Removable Bushings on Gear Train and Register.

The north winds *blew* . . . but freezing weather brought no big repair bills — no loss of revenue — to lines equipped with Trident Frost Proof Meters, with inexpensive breakable bottom that relieves ice-strains. And many winters will pass before you will have to replace these meters—because modern *interchangeable* parts fit perfectly the old as well as the new models, and will continue to fit as long as we manufacture water meters . . . and we've been at it for well over a generation! All types for all purposes. Write Neptune Meter Company (Thomson Meter Corp.), 50 West 50th Street (Rockefeller Center), New York City . . also . . Neptune-National Meters, Ltd., Toronto, Canada.

Quality TRIDENT & Lambert WATER METERS

OVER 6 MILLION MADE AND SOLD THE WORLD OVER

WE make conduits to transport anything that flows by gravity or under pressure. We cast them centrifugally from gray iron in a metal mold without chill, or vertically against sand. The material—cast iron—is universally recognized for native high resistance to corrosion and consequent long life. If super-corrosive properties are required, as in certain industrial processes, we use alloys. Rigid metallurgical control is a daily matter of course. Diameters—up to 84 inches; joints—bell and spigot, mechanical, flexible; also plain end or threaded pipe; fittings—any size.

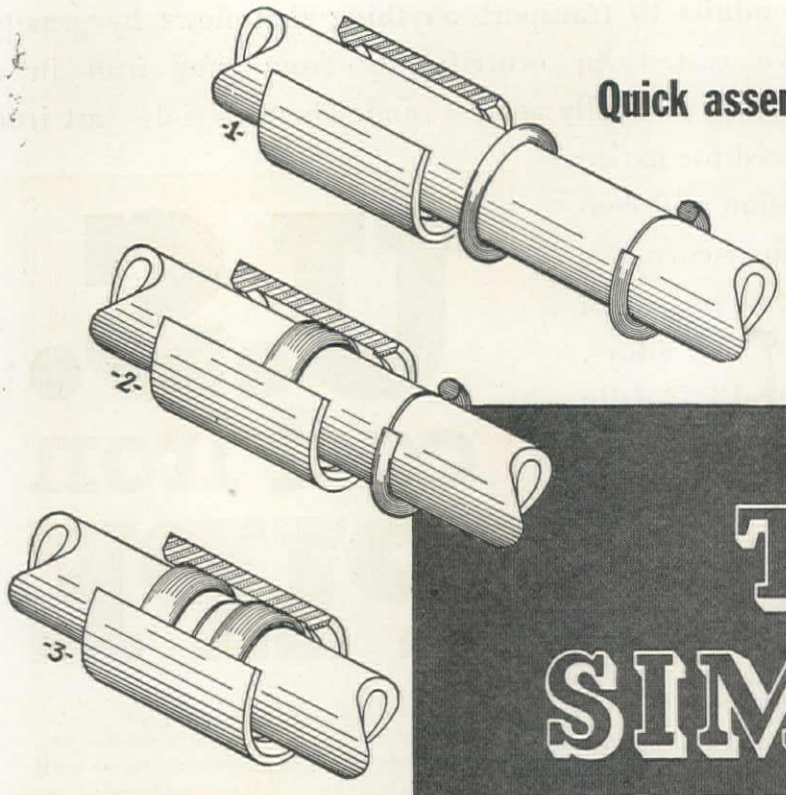
U.S. cast iron PIPE

Cast iron and alloy cast iron pipe centrifugally or pit cast—for water works, gas, sewerage and drainage service as well as industrial uses involving corrosives.

U. S. PIPE & FOUNDRY CO.
BURLINGTON, NEW JERSEY
Foundries and Sales Offices throughout the U. S.

SUPER-DE LAVAUD CENTRIFUGAL CAST IRON PIPE

U. S. Pit Cast Pipe U. S. Threaded Cast Iron Pipe U. S. Mechanical Joint Pipe
U. S. Ni-Resist Cast Iron Pipe U. S. Flexible Joint Pipe U. S. Cast Iron Culverts
Alloy and Gray Iron Castings U. S. Cast Iron Roof Plates



Quick assembly means low installation costs

These diagrams show the trouble-proof simplicity of the Simplex Coupling. Consisting of only a Transite sleeve and two rubber rings, this coupling assures rapid, simple installation: (1) Starting position. (Pipe is marked at factory to show proper position of rubber rings.) (2) Second position, with one rubber ring compressed. (3) Final position, with both rings compressed.

THE SIMPLEX COUPLING

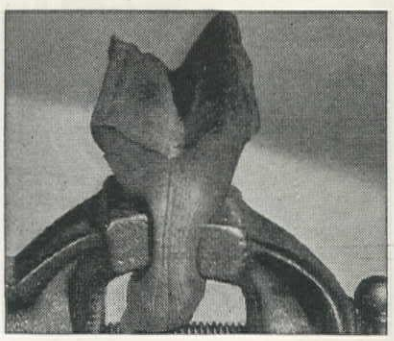
Another reason why Transite Pipe is the Economical Water Carrier

Easily assembled, flexible, bottle-tight, Simplex Couplings lower installation and maintenance expense, help keep pressure high and pumping costs permanently low.

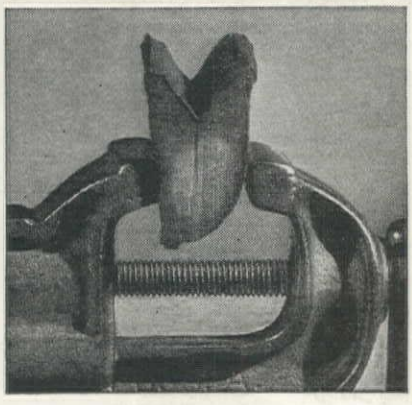
33-Year-old rubber rings outlast pipe line!

Remove rubber from the effects of light, heat and air, and it becomes virtually indestructible, as these photographs show. And these are the ideal conditions under which rubber serves as the sealing medium for pipe joints. Authentic records are available of service extending 60 years and more in America and for even longer periods in Europe.

But permanence is only part of the story. Rubber rings make watertight joints. Their flexibility permits wide sweeps with straight sections of pipe. And this same flexibility allows necessary movement under the static and dynamic loads and the vibration to which pipe lines may be subjected.



THIS 33-YEAR-OLD RUBBER RING was still good for many years of service when the pipe line was replaced. In underground pipe line service 29 years; above ground and exposed to light, heat and air for 4 years. Recovery after compression shown at right.



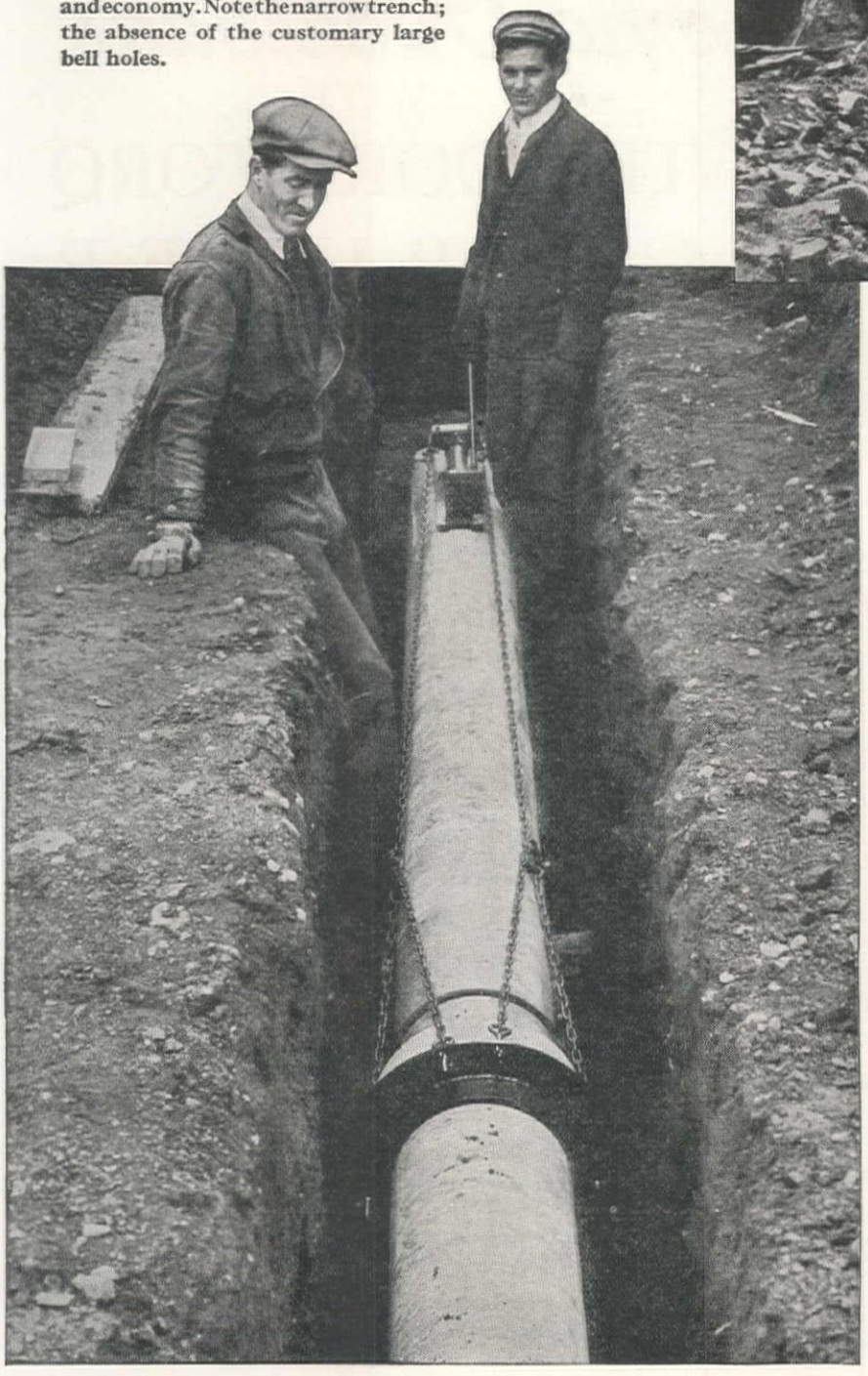
A COUPLING reduce the cost of water transportation? Yes, decidedly!

The Simplex Coupling used on Transite Pipe lines not only saves money *during installation*, but it helps greatly to keep *maintenance* and *pumping expense* permanently low.

No caulking with Simplex Couplings. Hence rapid assembly by unskilled labor. No large bell holes either; trenching costs are less.

Furthermore, Transite's flexible Sim-

UNSKILLED LABOR equipped with a special jack-type puller assembles Simplex Couplings with notable speed and economy. Note the narrow trench; the absence of the customary large bell holes.



GOING AROUND CURVES—is done quickly and economically with Transite's Simplex Couplings. On this job at Lebanon, Virginia, 6" Transite Pipe is used, and an angularity of 10° to 12° is possible at each joint.

plex joints are permanently *bottle-tight*. They prevent the breaks in mains, the heavy maintenance expense, so often caused by leaks washing away supporting soil.

And by also preventing a multitude of lesser leaks, Simplex joints help maintain constant pressure and eliminate the costly pumping of water that, through leakage, never reaches the consumer.

And as for Transite, the pipe . . . It is built for permanence. It is designed to end corrosion troubles, inside, outside, clear through. Transite means lower installation costs, lower maintenance costs, lower pumping costs. In every respect, Transite Pipe is the *economical* water carrier.

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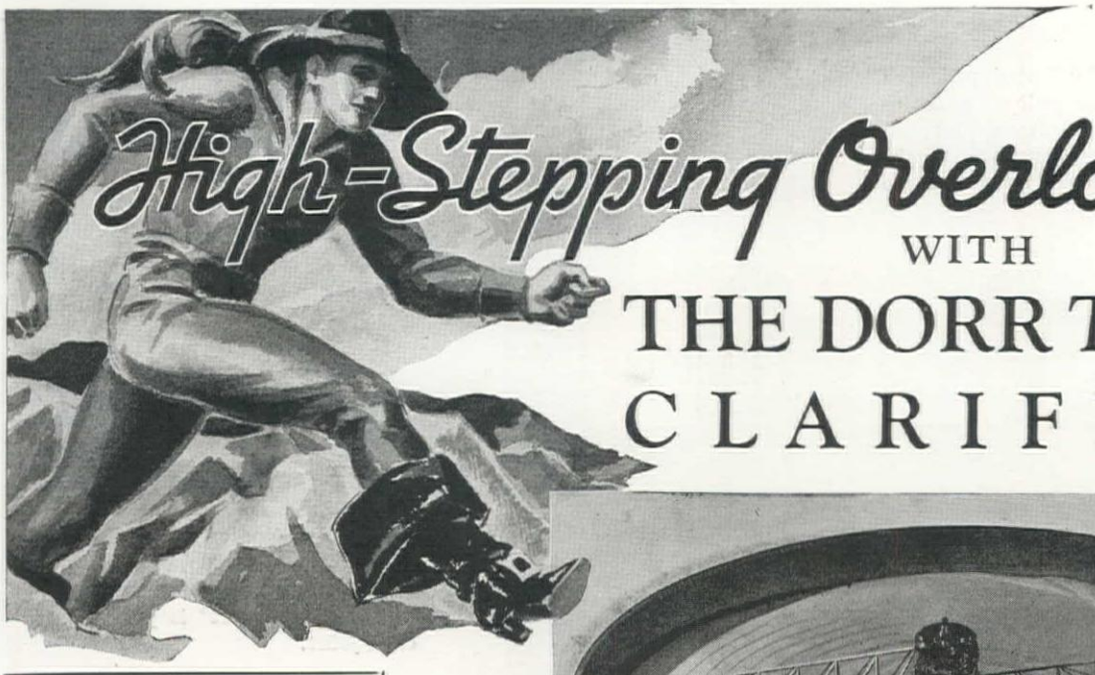
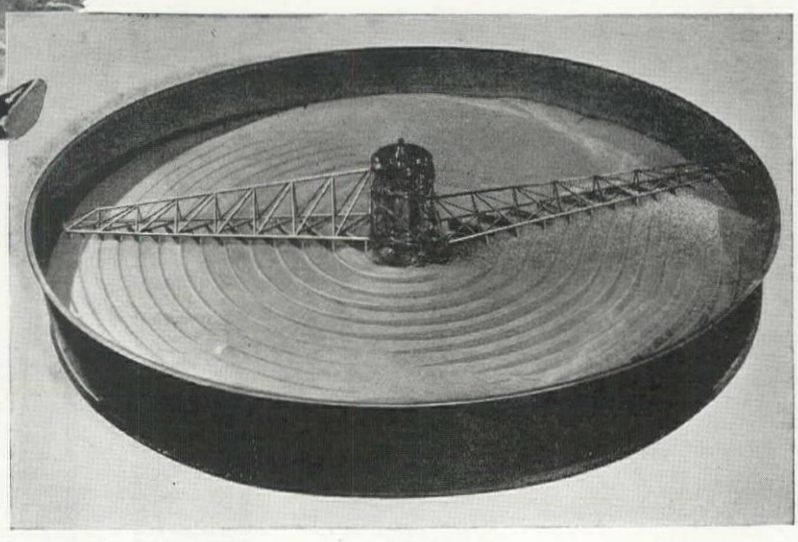


High-Stepping Overloads WITH THE DORR TORQ CLARIFIER



DORR TORQ CLARIFIERS IN OPERATION

Grand Coulee Dam, Washington, 3 - 125-ft. dia.

Golden Queen Mining Company, Mojave, Calif., 4 - 55-ft. dia.

DORR TORQ CLARIFIERS ON ORDER

All-American Canal Desilting Plant, near Yuma, Arizona, 72 - 125-ft. dia.

THE new Dorr Torq Clarifier steps smoothly over overloads—simply, effortlessly, automatically. It doesn't attempt to plough through them—bringing unnecessary strains into play and calling for manual manipulation of the rake lifting device.

The Dorr Torq Clarifier does just what you do when you meet an obstruction in your path—just what a well-sprung, modern car does when it strikes a bumpy road.

But as the arms swing upwards from the center, they continue to rake at full capacity. Thus the overload is raked down further and further at each revolution until the rakes resume their normal operating positions.

The "torque-type" overload relief is obtainable only with Dorr sedimentation units. It protects you against the breakages, due to overloads, which occasionally occur in the best regulated plants.

Plan now to investigate further the Dorr Torq Clarifier by writing to our nearest office for details.

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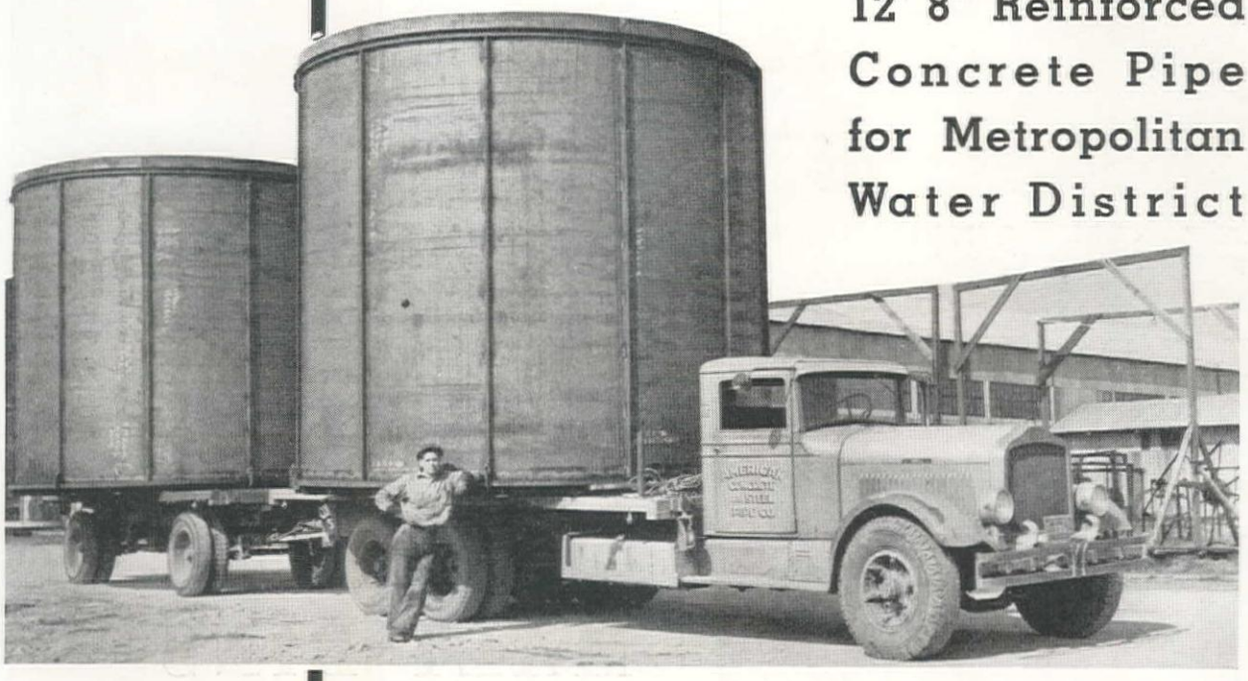
50,000 feet of

12' 8" Reinforced Concrete Pipe for Metropolitan Water District

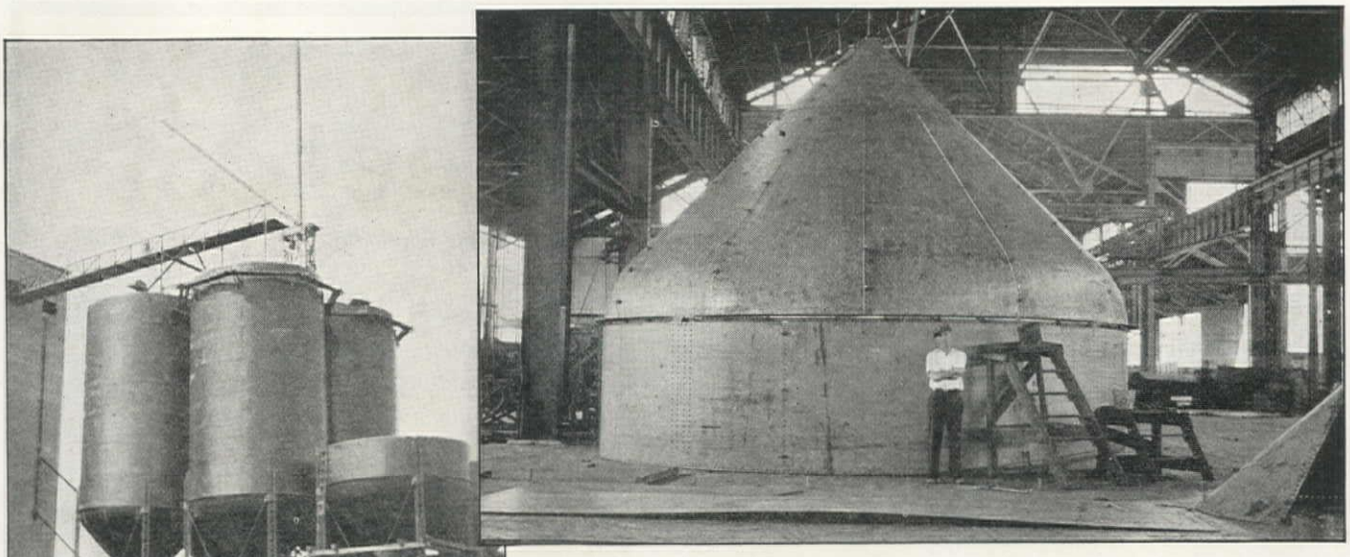


(Below) Low bed semi-trailer (capacity 50 tons) for transporting 152" pipe from the casting yard to the trench. (Pipe weight approximately 43 tons per section). Trailer built by Utility Trailer Manufacturing Company. Sterling Motor Truck with Diesel engine provides the motive power.

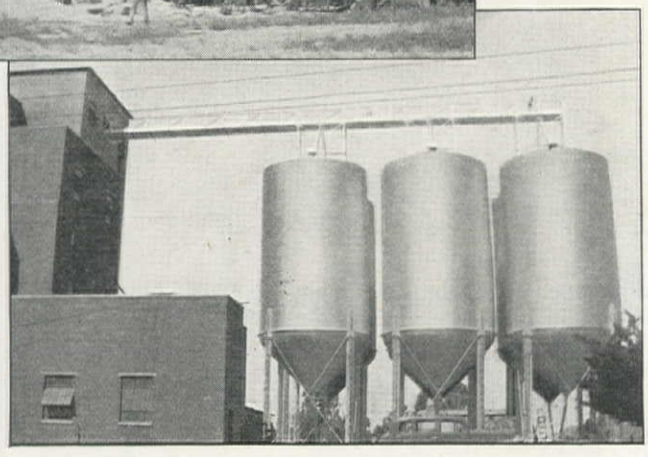
This pipe is being manufactured for Schedules 4 and 5 of the Distribution System for the Metropolitan Water District, located between Fontana and Ontario, California. The forms *(shown above)* for casting 152" Internal Diameter Reinforced Concrete Pipe are 15 feet in external diameter and 12 feet in length. They were fabricated at the Southgate Plant of the American Concrete & Steel Pipe Company, and are shown leaving the plant for the pipe casting yard at Rochester, situated near the line of the work. This pipe is being manufactured and installed for the Metropolitan Water District of Southern California; F. E. Weymouth, Chief Engineer and General Manager.

American Concrete & Steel Pipe Co.

SAN DIEGO LOS ANGELES OAKLAND TACOMA



Above: A bin bottom being fitted up before being shipped from our Birmingham plant. *At left:* The bins during construction. *Below:* The completed installation.



Six New MALT BINS at Mexican Malting Plant

BY installing six conveyor-equipped cone-bottom steel bins of special design, the Mexican Malting Company has recently secured an excellent solution of the problem of storing and handling grain and malt at their Tecate Plant in Lower California. Each bin is 24 ft. in diameter by 40 ft. high, and has a capacity of 16,650 bushels. One-panel towers were used to support the bottoms 14 ft. above the ground.

The company produces malt, malt sprouts and mixed feed. They malt an average of 25,000 lbs. per day and sell about 60% of their malt production to all of the breweries in the Republic of Mexico. They also produce about 800 lbs. of mixed feed, and 1,200 lbs. of malt sprouts per day.

Steel bins are but one of many types of steel platework which we fabricate and erect with our own Pacific Coast crews. Our nearest office will gladly furnish you with estimates for such work, or steel tanks for any municipal, industrial, or institutional use.

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Los Angeles	1414 Wm. Fox Bldg.	Houston	2919 Main Street	New York	165 Broadway Bldg.
Birmingham	1500 North Fiftieth Street	Tulsa	Thompson Bldg.	Philadelphia	1700 Walnut Street Bldg.
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CAST IRON *is the standard material for water mains*

The following tabulation shows the percentage of cast iron pipe used in the water distribution systems of the 15 largest cities in the United States as reported in 1935 by their Water Departments.

CITY	PERCENTAGE
New York	97.2
Chicago	100.0
Philadelphia	98.3
Detroit	98.7
Los Angeles	74.0
Cleveland	98.9
St. Louis	98.7
Baltimore	99.7
Boston	99.8
Pittsburgh	97.9
San Francisco	76.8
Milwaukee	100.0
Buffalo	99.8
Washington D.C.	98.8
Minneapolis	95.8

Our 15 largest cities depend almost exclusively on cast iron pipe for water distribution mains

ONE of the greatest investments in public service made by any community, large or small, is in pipe for water mains, the cost of installing it, and the pavements which cover it. More than 95% of the pipe which distributes water to the 24 million residents of our 15 largest cities is cast iron pipe. The reason is that cast iron pipe can be laid and forgotten for a century. It is not only the most economical measured by length of service but in maintenance cost and street repairs as well.

Cast iron is the standard material for water mains. Its useful life is *more than a century* because of its effective resistance to rust. It is the one ferrous metal pipe for water and gas mains, and for sewer construction, that will not disintegrate from rust. Available in diameters from 1¼ to 84 inches. For further information, address The Cast Iron Pipe Research Association, Thos. F. Wolfe, Research Engineer, 1015 Peoples Gas Building, Chicago, Illinois.

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METHODS OF EVALUATING BIDS NOW IN USE BY ENGINEERS RATE THE USEFUL LIFE OF CAST IRON PIPE AT 100 YEARS

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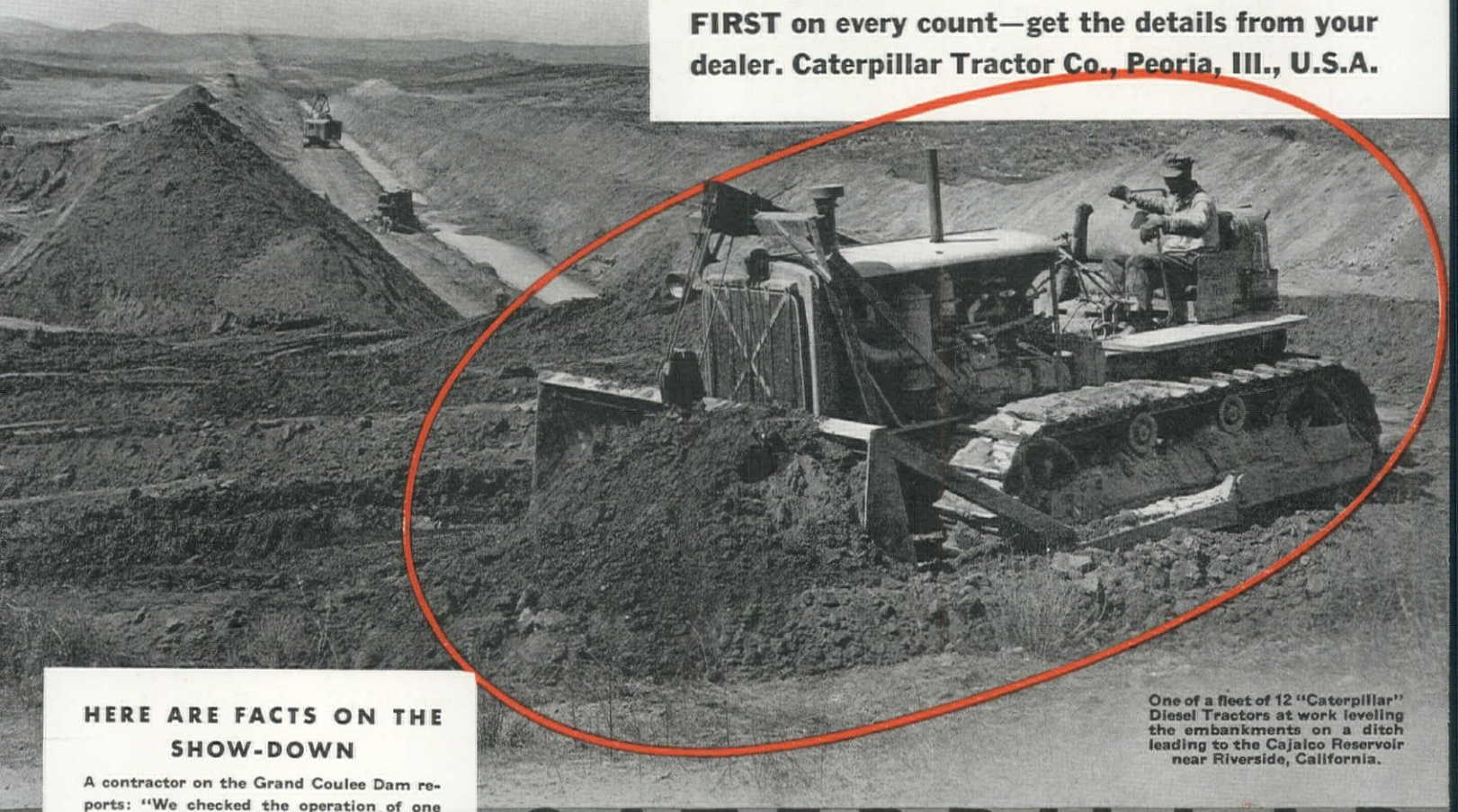

One of a fleet of 12 "Caterpillar" Diesel Tractors at work leveling the embankments on a ditch leading to the Cajalco Reservoir near Riverside, California.

HERE ARE FACTS ON THE SHOW-DOWN

A contractor on the Grand Coulee Dam reports: "We checked the operation of one 'Caterpillar' Diesel. It was hauling 11 to 20 yds. of earth per trip at a fuel cost of about 30 cents per hour." 24 "Caterpillars" were put to work on this contract.

From the dam project near Los Gatos, Calif.: "15c per hour is the fuel cost for the biggest of our five 'Caterpillar' Diesel Tractors that are pushing bulldozers, pulling wagons, scrapers, and sheep-foot tampers."

CATERPILLAR

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WESTERN CONSTRUCTION NEWS
WITH WHICH IS CONSOLIDATED WESTERN HIGHWAYS BUILDER

March, 1936 Vol. 11, No. 3

J. I. BALLARD, Editor
G. E. BJORK, Northwest Editor
H. W. PYERITZ, News Editor

Don't Blame the Engineer For Highway Accidents

THE increasing number of highway accidents has resulted in a logical search for the underlying causes, including a review of modern highway design as one of the factors. Only recently the eminent traffic authority, Dr. Miller McClintock of Harvard University, if press reports are correct, referred to highway design as still in the horse-and-buggy era and suggested that improvements in highway design could reduce accidents by more than 90%. If correct, this is a strong accusation and tends to point a finger of almost criminal negligence at highway designers with a result that immediate restudy should be demanded on the present status of highway engineering. If incorrect, however, it is a charge which should not go unchallenged in the defense of those engineers who have devoted years of theoretical and practical study to the planning and designing of our highways. These studies have always considered the requirements of safety first, followed by those of speed and convenience.

It is true that many of our highways have not yet been improved to modern design standards, because of insufficient time and funds, but it is as illogical to look only at this fact and shout "horse-and-buggy," as it is to measure progress in automobile design by the occasional vehicle of 1920 vintage still to be seen on the highway, or contemplate the few drivers who would still feel more at home behind a horse and remark that all our drivers are antiquated. Progress and adequacy of highway design must be judged from present day standards and practices which are now being incorporated into our roads as fast as funds permit. To be constructive, criticism of highway design should be directed toward the most modern sections of highways, and, further, should suggest improvements which are financially feasible and within the sphere of control of the highway designer.

Seeking to correct certain faults of highway design, Dr. McClintock offers his suggestions. For example, he suggests a center wall to divide the paths of opposing traffic. This design might serve to divide traffic but would introduce a serious mental hazard in forcing drivers to travel continually along a wall (even a curb) which would tend to decrease highway capacity and make driving even more dangerous. Another suggestion of a neutral zone between opposing traffic is far more logical and has been demonstrated of proven merit as used in Washington and described on another page in this issue. Grade crossing elimination and the use of separate lanes for fast and slow traffic, recommended by Dr. McClintock, are well recognized and are being accomplished by engineers as fast as funds are available. In fact, building safety into highways has for years been one of the major considerations of highway departments. On the other hand, if states continue to permit the incapable driver and the inadequate car to use modern high-speed roads, the accidents should not be laid at the door of the designers and builders of the highways. The conclusion that 90% of highway accidents could be eliminated by changing highway design is a gross inaccuracy when most accidents result directly from the fault of the driver and not the highway.

•

Boulder Dam Is Finished

WITH the contract for the construction of Boulder Dam officially terminated this month, this job has been completed in less than five years or more than two years ahead of original schedule. The details of this gigantic and difficult construction accomplishment are well known to engineers and construction men of the West: The rush to put men to work in spite of inadequate preparations, the record-breaking heat of the first summer, the driving of the 50-ft. tunnels at a rate which made progress records appear impossible, cofferdam and excavation work at unprecedented speed and finally concrete placing at rates that surpassed all existing records. All of these features are now history—the history of the best known construction project of modern times. The advantages of low flow in the river and the good tunnel rock do not detract from the vigor and skill with which the contractors attacked and prosecuted the work. There probably will never be a construction project which will catch the public fancy and have the national prominence of Boulder Dam. Therefore, all of those who served on this work will continue to occupy a unique position in the field of construction. There is every reason to congratulate the Six Companies Inc. organization from top to bottom and say, "A great job, well done."

•

Basis for Highway Costs

If it is the accepted policy of state highway departments to base cost estimates on current low bid prices, there results a natural tendency to depress highway costs, when they should have a more stabilized base. This situation is emphasized by the fact that too many contractors use published low bid figures as a guide to bidding, rather than their own demonstrated costs. From the point of view of the state, the summarizing of the low bid (award) prices for a six-month or one-year period as the basis of estimating costs is most logical, as it represents the actual cost of getting this work done. On the other hand, the award figures may be below actual cost, with the result that the contractor or the surety puts up the additional subsidy for the benefit of the public.

A more logical basis for estimating costs would be to take average unit bid prices because they more nearly represent the consensus of contracting opinion as to the cost of the work. Following out this suggested proposal, the award would still be made on the lowest bid, but the recognized and accepted figure for cost among engineers and contractors would be the combined skill of a group, rather than the less-than-cost guesses of the lowest bidders, tending to further depress prices. Highway departments frequently profess the wish that contractors would get a fair price for their work, including a reasonable profit. There is a lack of sincerity in this desire if it is followed by a practice to use the low bids as the gauge for legitimate highway costs.

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8 GREAT FEATURES

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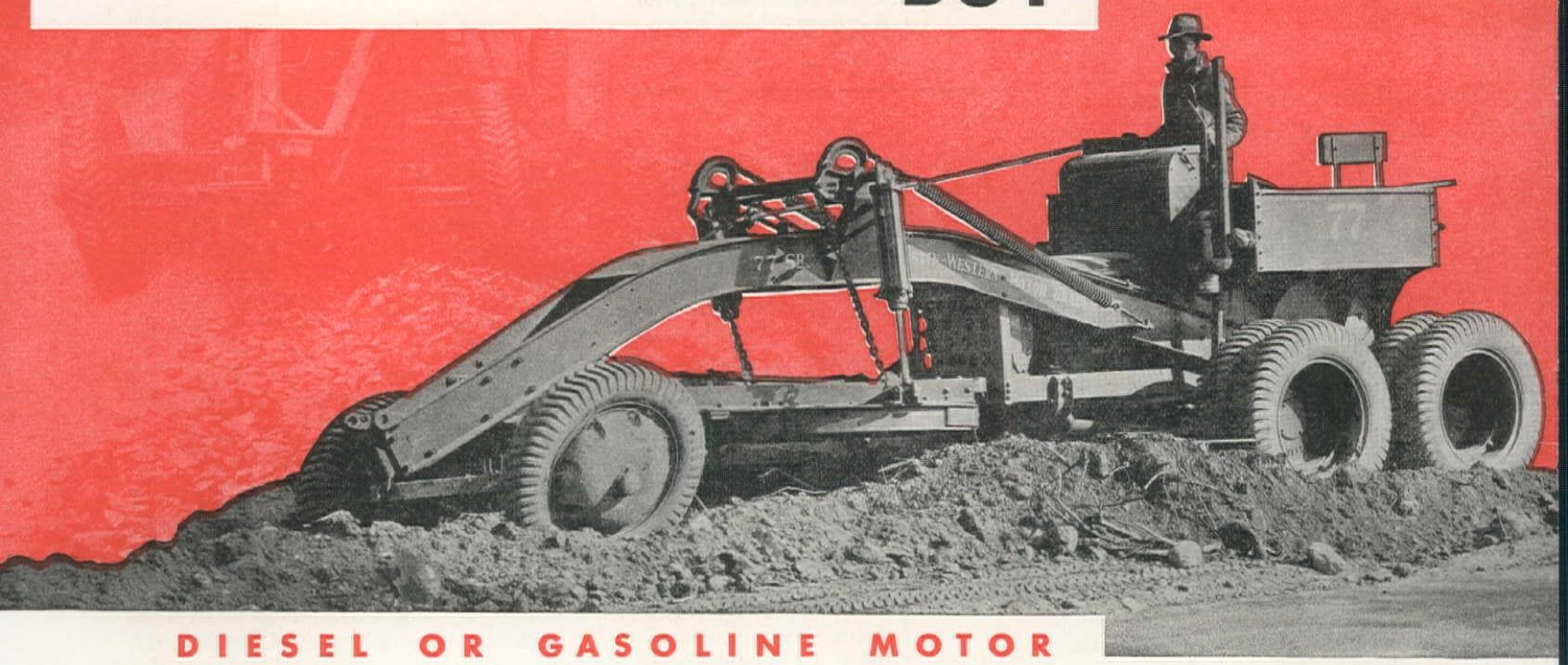

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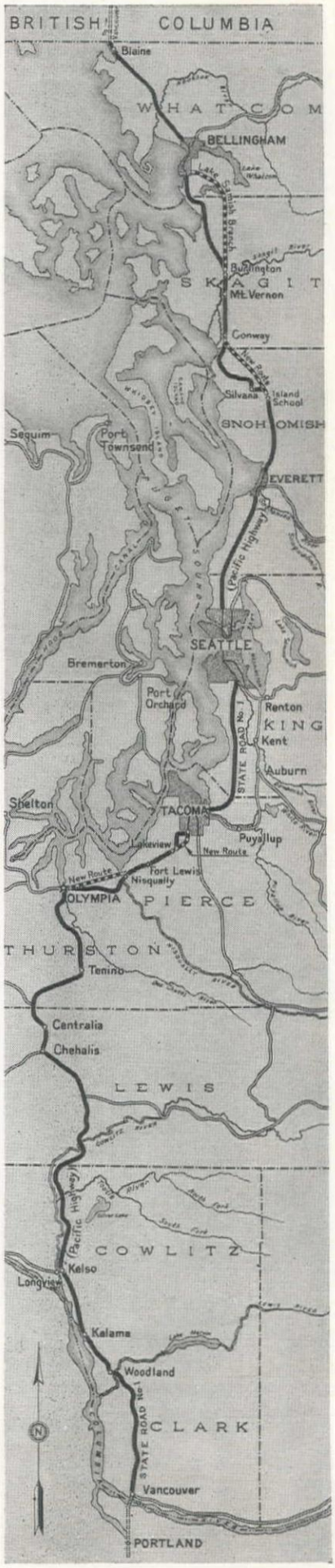
WESTERN CONSTRUCTION NEWS
MARCH, 1936



Washington Modernizes Obsolete Sections of Major Highway

Reconditioning of Tacoma—Olympia link in Pacific Highway features record bridge project on Nisqually cutoff, including 4,000-ft. concrete trestle

By LACEY V. MURROW
Director of Highways
Olympia, Wash.

THE PAST twenty years have witnessed tremendous changes in the highway field. Year by year conditions have altered, problems have altered, problem solutions have altered. When, finally, one compares the end with the beginning of this period the contrast is indeed amazing. There has occurred the vast increase in the number of vehicles, the great increase in their speed, the whole growth of freight transportation—and, most fortunately, a concomitant revolutionary development in excavating and earthmoving machinery which has made it possible for highway construction to keep abreast of highway needs.

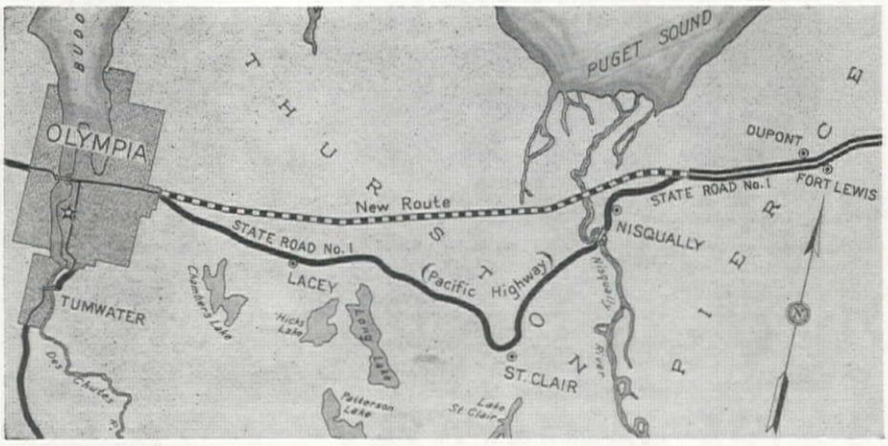
These great changes have rendered obsolete much early work which, when planned and constructed, was suited both to all the reasonable developments then to be foreseen and to the financial capabilities of those times.

This obsolesence is often most pronounced in highways carying the heaviest traffic and connecting the most populous centers for, naturally, it was such roads that were earliest improved. Having once been put in shape they have continued to serve the ever increasing traffic in an increasingly unsatisfactory manner while the less important roads have received the later construction funds and have benefited by the great improvements in breadth of roadbed, alignment, and grade made possible by the revolutionary low cost methods of excavating and earthmoving, which have been developed. Thus it has come about that many miles of comparatively unimportant roads are built to fundamentally higher standards than some roads of primary importance.

To reconstruct obsolete primary highways and to bring them into condition to render the fullest and most satisfactory service to their users is the task confronting many a highway department. Assuredly, it is a task which in Washington we envisage and are moving steadily forward to accomplish. This does not mean the utter abandonment of the old roads. They simply cease to be main roads and become secondaries, serving the local territory through which they pass and furnishing connection to intersecting roads, etc.

It may well be asked whether future years will not render obsolete the present high-standard construction in the same manner past years have dealt with past work. A definite negative answer cannot as well be given to this question. The future is the future and keeps its own counsel.

Nevertheless, it may be said that no future has ever or ever will render obsolete a straight line as the shortest path between two points; no future can ever make a 2-degree curve as awkward to negotiate as a 20-degree curve; no future can render obsolete good visibility once it is attained. In short, we can say confidently that what we are doing now in the reconstruction and reconditioning of our main highways is of a permanent lasting character. This work may be refined in the future. It may be necessary to expand



Nisqually cutoff which will eliminate about 1,000 deg. of curvature and reduce the curves from 20 deg. to 2½ deg.

it in the future. But it conforms with the major topographic features of the country traversed, with traffic needs, and with population centers. Therefore we do not expect obsolesence to deal with it as it has dealt with the work of 20 years ago.

The Pacific Highway

In Washington, our most important road is the Pacific Highway which extends in a generally north and south direction from the City of Vancouver on the Columbia River opposite Portland, Oregon, to the City of Blaine on the international boundary at the extreme north. It constitutes the Washington section of the main traffic artery of the Pacific Coast and it connects all the principal cities of the western part of the state. Naturally, it was given chief attention in the early days of state highway construction and when in 1923 its paving was completed, it was rightly felt that a great work had been completed.

It was recognized at that time however, that in certain portions, where use was made of existing county roads, relocation and reconstruction would be required. Notably was this the case between Tacoma and Seattle and between Seattle and Everett. In the following years these sections were constructed with what has proved to be a most satisfactory type of heavy traffic road: two strips of 10-7-10-in. concrete pavement 20 ft. wide with a 4-ft. sodded neutral zone between them and with 9-ft. shoulders on the outer sides. This requires a roadbed 62 ft. wide on fills and 68 ft. wide in cuts, the additional breadth being due to the side ditches in cuts.

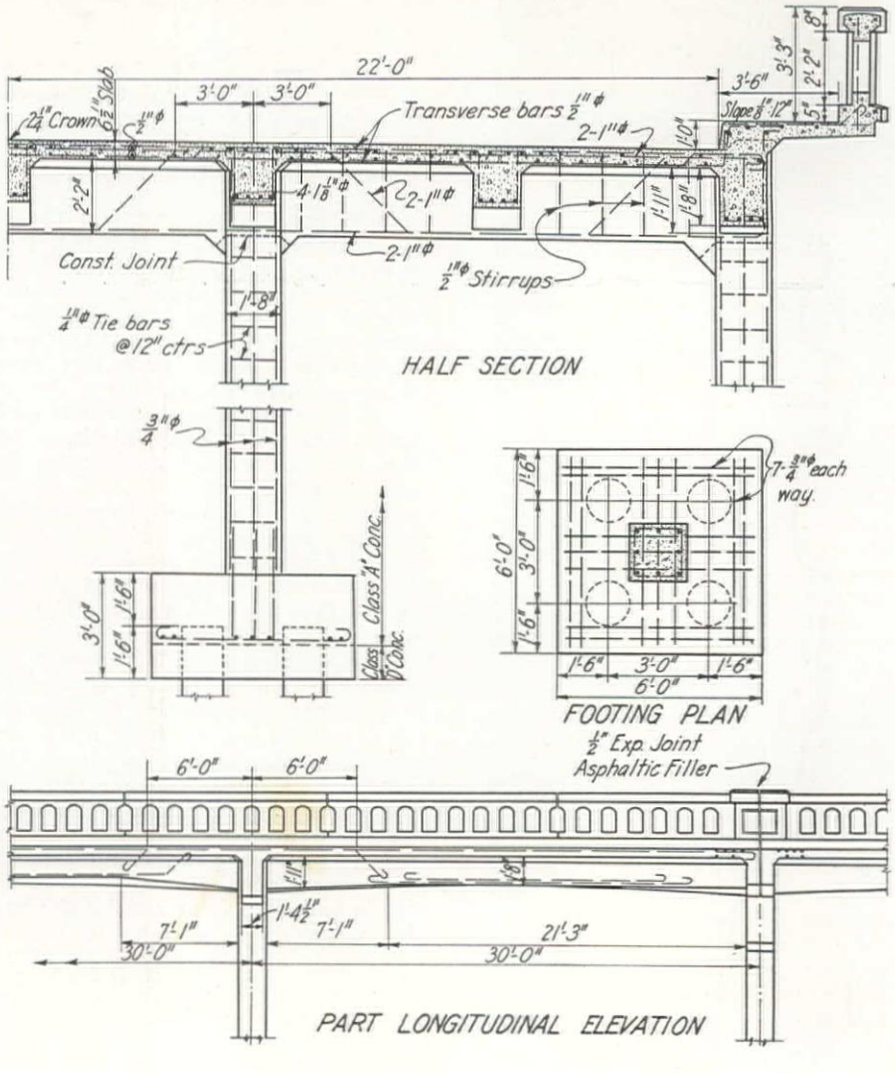
This double-strip pavement construction gives a complete two-lane pavement 20 ft. wide to the traffic moving in each direction and, for normal highway uses, has a practically unlimited capacity. The 4-ft. sodded neutral zone between the two pavements definitely divides the traffic streams and has a great psychological value in giving drivers a feeling of safety and security; oncoming traffic has its own pavement and must, or seemingly must, stay there. The only concern experienced is the slight one of passing vehicles moving in the driver's own direction. This feeling of safety is a very real satisfaction to motorists and further increases the traffic capacity of the road. On the other hand should storm or accident temporarily close one strip of pavement the traffic can at any point be put under control, be taken across the neutral strip and detoured around the blockade.

There is nothing imaginative about the increased safety afforded by the double-strip construction. With it, passing another vehicle is accomplished without entering into the path and right-of-way of oncoming traffic. The temptation to take a chance in getting by a slow moving truck or a whole line of slow moving cars is eliminated by removing all hazard from the act. There has ceased to be any oncoming traffic to cause hazard and danger. Pass on curves if you want to.

Illustrative of this safety is the fact that the records of our department show no instances of head-on collisions having occurred anywhere on the 70 miles of such road that we have built. On the other hand five lives have been lost and about $100,000 property loss has been suffered in recent years in head-on collisions on the 13 miles of single strip pavement still remaining in service east of Olympia.

A major reconstruction project of this double strip type now approaching completion is the Olympia-Nisqually cut-off on the Pacific Highway covering nearly half the distance between Olympia and Tacoma. Previous work has brought wide or double strip pavement from Tacoma to Fort Lewis and 3 miles west thereof. The Olympia-Nisqually cutoff closes the remaining gap and completes the reconstruction to the state's capital city.

Typical design features of the 4,000-ft. reinforced concrete trestle on the Nisqually cutoff which is under construction for a bid price of $1.87 per sq. ft. Foundation consists of untreated timber piles.



The accompanying maps show the general location of this work and contrast the new with the old alignment. The extent of the improvement is briefly summarized in the following tabulation:

	Old Road	New Road
Length	12.92 mi.	10.07 mi.
Curvature	1,060 deg.	47½ deg.
Maximum Curve	20 deg.	2½ deg.
Pavement	1-20 ft. strip	2-20 ft. strips

The savings in distance and time thus to be effected are widespread and far reaching. The 1934 traffic counts

Double-strip design (above) which features the reconditioning of the Pacific Highway. Note the 4-ft. sodded neutral zone between opposing 20-ft. traffic lanes.

Record cut (left) on the Nisqually project, with a length of 2,400 ft., depth of 93 ft., and bottom width of 68 ft.

west of Fort Lewis at the beginning of the cutoff showed a daily average of 4,053 vehicles for a 7-day period in April, and in September, at the Labor Day period, 8,828 vehicles. Assuming 5,000 vehicles as the annual daily average traffic and a speed of 40 mi. per hour, the revision will effect an annual saving of 5,200,000 vehicle miles and 304,000 man hours of motorists' time. Assigning a value of 6 cents per vehicle mile as average of passenger car and truck or bus operating cost the reconstruction produces an annual saving of $312,000. To this add the value of the saving in motorists' time—indeterminate, since it depends upon the use the motorist makes of the saved time—and there results a total which may easily amount to $400,000 per year.

The Nisqually River, near the easterly end of the project is responsible for the heaviest and most costly work. The river is crossed within a mile or two of the point where it empties into Puget Sound. Its valley is flat and low-lying and contains much mucky peaty soil. Ground water is not far below the surface and when floods in the river combine with high tides in the Sound, large areas of the bottom lands become covered with water. On both sides of the valley bluffs rise up steeply 250 ft. or more to the general level of the bench lands here bordering on the Sound.

Getting down to the river bottoms at the west side of the valley required the heaviest single grading operation ever undertaken by the Washington Highway Department. It consisted of a cut 2,400 ft. long, 68 ft. wide at grade, having a maximum center line depth of 93 ft. and a maximum top breadth of 328 ft. and required the removal of 642,000 cu. yd. of glacial sands and gravels. This material was dumped into a long fill in the bottom lands; a fill which, at its westerly end, attains a maximum height of 90 ft. and a widened out base width of 532 ft.

A steel bridge of 322 ft. span, not yet under contract, will take the highway across the Nisqually River.

Long trestle approaches to this main river span and two slough bridges, totaling 3,994 ft. in length, are now under contract. The design calls for typical 30-ft. spans of reinforced concrete, continuous in groups of three, founded on plain untreated wood piles cut off at the level of permanent saturation. This constitutes the largest bridge project of reinforced concrete ever undertaken by the highway department. Contract was awarded to Rumsay & Co., Seattle, on a bid of $376,727.

The roadway is 44 ft. wide. There is one sidewalk 3½ ft. wide and concrete guardrails. The bridge averages 15 ft. in height above ground. Its contract price is $94.32 per lin. ft., or $1.87 per sq. ft. on an overall breadth of 50 ft. 4 in. These figures clearly indicate a very economical design and the benefits of standardization in large scale work.

From the bottom lands, easterly, a mile and a quarter of heavy grading brings the new road up to the bench land levels again and to its connection with earlier reconstructed highway west of Fort Lewis. In this section undercrossings beneath the double-track Point Defiance line of the Northern Pacific Railway and beneath its single track American Lake branch are required.

It is planned to complete the pavement over the entire cutoff by the end of the 1936 season. Each strip will be of Portland cement concrete 20 ft. wide of 10-7-10-in. section.

Total cost of the entire revision, including right-of-way, is estimated at $1,811,000. This is a large expenditure of highway funds but the benefits accruing from it are so great, so widely distributed, and so lasting that the outlay becomes an investment of the wisest character.

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Cajalco Diversion Tunnel Is Holed Through

The holing through of the diversion tunnel on the Cajalco Dam project of the Colorado River Aqueduct, completes an important preliminary on this feature of the Metropolitan Water District program. The tunnel was completed January 26 by crews of Broderick & Gordon, who hold a subcontract from the Griffith Co. for the diversion tunnel.

The 2,000-ft. tunnel will carry the stream flow around the Cajalco Dam site during the construction period. The tunnel was driven in 187 shifts with an average advance of 10.7 ft. per shift and only 172 ft. of the distance required support.

Steel-Faced Dam Built by Colorado Municipality

Fourth structure of this type built in Intermountain section—Design features steel supporting system—Large plates reduce amount of welding

By FRANK O. RAY

City Engineer
Colorado Springs, Colo.

THE fourth steel faced dam to be built in the intermountain region, has recently been completed by the City of Colorado Springs, Colo., to store water for the domestic supply of the city. The Crystal Creek dam is located on the northern slope of Pikes Peak at an elevation of 9,200 ft. above sea level and is connected to the city distribution system by a steel conduit line designed for a head of 1,900 ft. This pipe line may be used, in the future, as connection to a hydroelectric plant, when the demand for power makes this economical.

The dam is of earthfill type built on a foundation of gravel and decomposed granite, resting on granite bed rock. Fill material consists of the disintegrated granite and was placed, sprinkled and rolled in 8-in. layers. The material was available at the site and provided a satisfactory fill with a weight of at least 100 lb. per cu. ft.

At the maximum section the fill is 92 ft. high with a crest width of 20 ft. and a base width of about 380 ft. Both side slopes are 2:1 and the downstream face is covered with a layer of hand-trimmed dump rock from 4 to 18 in. in size. Sand was washed into this rock blanket to fill the voids. The cut off trench, 10 ft. wide and 10 ft. deep is provided under the center of the structure, back filled with selected impervious material sprinkled and rolled to correspond to the main body of the dam. At the downstream toe a drainage trench about 2 ft. deep was excavated and refilled with screened crushed rock. An 8-in. drain pipe extends from this trench to an outlet in stream bed.

On the crest of the dam a reinforced concrete parapet wall, 20-ft. roadway and highway guard fence complete the construction.

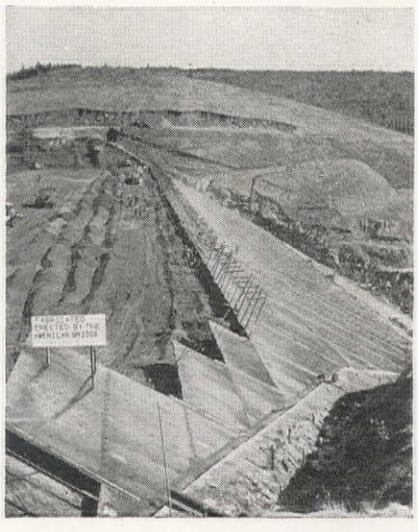
At the upstream toe of the dam a concrete cut-off wall was sunk about 6 ft. into the solid granite, below the decomposed material. Grout holes in this wall were drilled to a depth of 25 and 50 ft. to insure tightness in the rock. These grout holes were filled under a pressure of 100 lb. and took from one to a maximum of 124 sacks of cement per hole.

From the concrete cut-off, a reinforced concrete slab poured continuously from bottom to top, extends up the face to an elevation above the outlet pipe. About this elevation the facing consists of electric welded steel plate.

Steel facing

The facing material consists of ¼-in. copper-bearing steel sheets 8 ft. 4 in. wide and 24 ft. 5 in. long. Vertical expansion joints in this steel facing were provided at 25-ft. intervals to take care of the horizontal expansion. These joints are formed by a V-shaped strip of No. 16 gage copper water stop, which provide an opening of about ¾ in. between the steel plates in their normal position.

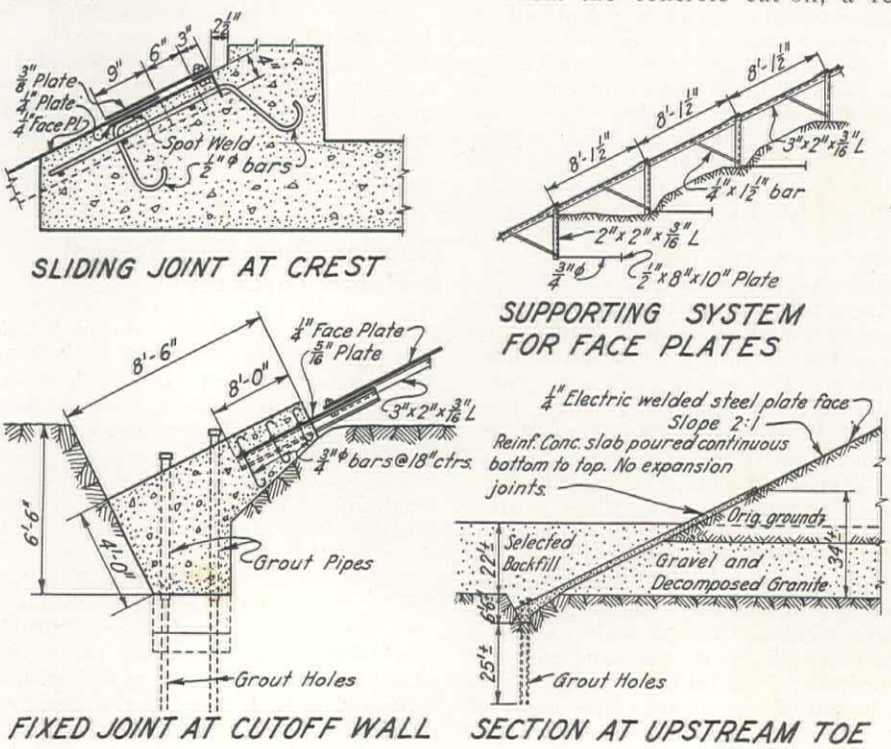
In the other direction, the steel facing is fixed at the bottom to the concrete slab and expansion is provided by a sliding joint installed at the junction of the steel face with the parapet wall. The upper limit of the steel facing is placed one foot above spillway elevation.



Junction of steel face and concrete cutoff along the abutment. Note the method of placing the steel supporting members in a vertical position ready to be dropped into place on the fill.

The steel was supported during erection on steel-angle frames resting on the fill. This method of erection was used to permit the facing to be carried forward simultaneously with the fill and, subsequently, to be painted on the underneath side after the welding had been finished. The steel supports consisted of an assembly of 3x3x3/16-in. angles running up the slope at the proper grade. These angles were spaced at 5-ft. intervals across the dam, and were supported by short columns at intervals of 8 ft. (slope distance). These columns consisted of 2x2x⅜-in. angles resting on metal base plates on the fill. A small ¼x1¼-in. bar was used as a diagonal support between the foot of the column and the center of the 8-ft. span of the stiffener angle. Columns were tied into the fill, at their base, by a ¾-in. round bar extending back to a ½x8x10-in. steel plate embedded in the fill. The general arrangement of this

Design details of the steel facing and supporting system. Both side slopes of the dam are on 2:1.



system of supporting members is shown in the accompanying illustration.

The steel face plates were placed and bolted to the angle supports and all bolts and joints were then carefully electrically welded. The stiffener angles were spot welded to the face plates and a continuous electric weld was made along each lap joint. Because of the size of the plates, the length of weld required per square foot of steel face was relatively small. The expansion joints, at 25-ft. intervals, were fastened to the edges of the steel plate by a continuous weld.

Before erection, the face plates were painted on both sides with red lead and all supporting angles were given a coat of red lead and oil. Following the completion of welding, all paint damaged by the heat of welding, abrasion, or the erection process was replaced. It can be appreciated that the method of supporting the steel plates above the fill permitted this final painting to be done rapidly, with full assurance that the paint protection was complete. It also permitted the anchoring of the face into the fill.

Carrying forward the fill and facing operations at the same time. Decomposed granite was used for the fill, sprinkled and rolled in 8-in. layers. Welders are shown at work on the steel face plates.

Beginning of the steel face above the concrete slab, which extends from cutoff to the elevation of the outlet pipe. Note the size of the steel plates and the supporting system of steel angles.

Following the final painting, the space between the fill and the facing plates, was filled with selected material, sprinkled and tamped. When the steel face had been completed, a coat of aluminum paint was supplied to the outside face.

A steel face was selected for this dam because of the fact that there are no chemicals in either the water or the soil at this location, which seriously affect steel. This is proven by our experience in the use of steel pipe, some of which we have had in use for over thirty years and appears to be in perfect condition.

Previous similar structures

There are three other steel faced dams in this region, where conditions are very similar to those which will be experienced by the Crystal Creek dam.

The Skagway dam, near Victor, Colo., owned by the Southern Colorado Power Co., was built in 1889. This is a rockfill dam with a riveted steel face lying against the rock fill. The face of this dam has no expansion joints and, while the face is buckled, it is perfectly water tight and after 46 years of service the sheets are in good condition.

The Rosemont dam which is located about 21 mi. southwest of Colorado Springs was built in 1932. This dam is a rockfill dam with a steel face anchored to a stone masonry slab. The sheets are welded and expansion joints are provided.

El Vado dam *(Western Construction News*, February, 1935) constructed in northern New Mexico in 1934, also has a steel face with concrete toe wall. The sheets are welded and rest on a gravel fill dam.

Organization

The design of the Crystal Creek dam was prepared in the office of the writer as city engineer for Colorado Springs. O. O. Phillips was designing engineer, and the late D. C. Henny of Portland, Ore., acted as consulting engineer for the project. General contractor for the structure, including foundation preparation and fill, was held by the Ed H. Honnen Construction Co. of Colorado Springs on a bid of $293,235. The American Bridge Co. held a $65,000 contract for the furnishing and erection of the steel plate facing. J. H. Sanford was resident engineer on the project.

Boulder Reservoir Named for Elwood Mead

The reservoir formed by Boulder Dam—the world's largest artificial lake—has been officially named Lake Mead, in honor of the late Dr. Elwood Mead, commissioner of reclamation.

The official designation announced by the Board of Geographical Names follows:

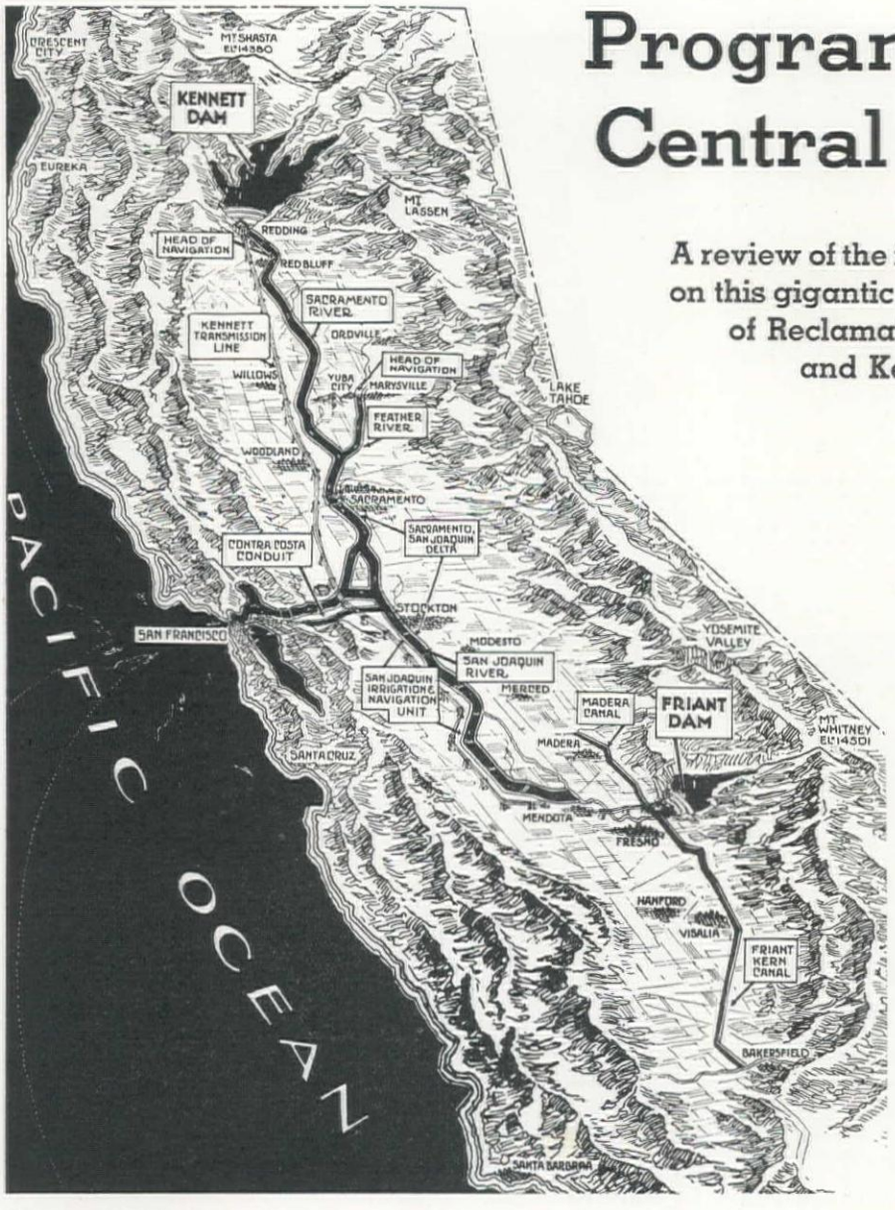
"**Lake Mead**—An artificial lake in Mojave County, Ariz., and Clark County, Nev., formed by damming the Colorado River in upper Black Canyon. Named in honor of Dr. Elwwood Mead (born Jan. 16, 1858, died Jan. 26, 1936), Commissioner, Bureau of Reclamation, 1924-1936, under whose supervision the dam that impounds the lake was built."

Water began to be stored in Lake Mead on Feb. 1, 1935, when the gates of the diversion tunnels on the Boulder Dam project were closed. The spring flood of 1935 of the Colorado River was stored in the lake which, today, contains about 4,000,000 ac. ft. of water. The lake is now 82 mi. long.

At full capacity, Lake Mead will extend 115 mi. up the river from Boulder Dam, into the lower end of the Grand Canyon. It will contain 30,500,000 ac. ft. of water or about 80,000 gal. for every person in the United States. Its area will be 146,500 ac. or 229 sq. mi. This storage capacity is allocated for the following uses: 9,500,000 ac. ft. for flood control; 5,000,000 to 8,000,000 ac. ft. for silt; 12,000,000 to 15,000,000 ac. ft. for active or regulation storage.

Program of the Initial Central Valley Project

A review of the first construction work to be started on this gigantic water development by the Bureau of Reclamation—Data on the Friant Dam and Kennett railroad relocation



THE past few months have seen the design and field organizations of the Bureau of Reclamation actively engaged in making plans for starting construction on several units of the vast Central Valley Project in California. The $15,000,000 allotment made for this work by Secretary of the Interior, Harold L. Ickes, represents only a small fraction of the estimated cost of the complete development, a paramount issue in the continued growth of the northern two-thirds of the state. During the past 50 years California and various federal agencies have been engaged in investigating its water resources, which culminated in the "State Water Plan" reported to the 1931 legislature, by B. B. Meek, director of public works and Edward Hyatt, state engineer.

The Project

The Central Valley project will include extensive construction works on the two largest stream systems wholly within California; viz., the Sacramento River Basin on the north and the San Joaquin River Basin on the south. The Sacramento River rises in the Cascade Range and flows south while the San Joaquin River has its source in the Sierra Nevada Range and after flowing westerly for a hundred miles, proceeds in a northerly direction to a confluence with the Sacramento River just east of Suisun Bay, which receives the flow of both streams discharging it through San Francisco Bay into the ocean. Each river has many tributaries and the area of both basins, known as the Great Central Basin, is 58,000 sq. mi., having an average north and south length of 500 mi. and width of 115 mi. The agricultural land within this area is estimated as 15,000,000 ac., being 63% of such land within the entire state.

The Sacramento Basin

The Sacramento Basin with an agricultural area of 6,500,000 ac. is adaptable to the production of most vegetables, grain, alfalfa, fruits, including citrus varieties and grapes, olives and nuts. Dairying, stocks and poultry raising, lumbering, mining, and the canning of fruits and vegetables are among the most important industries. In the past 55 years the irrigated area has increased from 100,000 to 900,000 ac., representing about 20% of the irrigable area. The State Water Plan contemplates the ultimate construction of ten major storage reservoirs in the Sacramento Basin and one on the Trinity River with diversion to the basin, with a combined storage capacity of over 12,000,000 ac.-ft., which will provide a surplus for use elsewhere in the Central Valley project. At the present time during dry years, there is insufficient water to fill the requirements within the Sacramento Basin. The ultimate development also calls for the construction of twelve power plants.

The San Joaquin Basin

The San Joaquin Basin has an agricultural area of 8,500,000 ac., of which over 2,000,000 are at present under irrigation, being given to the raising of the same crops as those in the Sacramento Valley and, in addition, cotton. The major industries are also much the same, although manufactured products exceed those of the northern basin by 50%. Settlement on irrigable lands and development of industries have been so rapid in the San Joaquin Basin that requirements have greatly exceeded the water supply. This has been particularly serious during the recent cycle of dry years. When surface supplies became insufficient, resort was made to pumping from ground water storage. This resulted in a depletion of such supplies, with the result that uneconomical pumping lifts forced the abandonment of numerous heretofore highly cultivated fertile lands. To remedy this situation as well as provide for flood control, another serious problem during wet years, the State Water Plan proposes ultimately the construction of thirteen storage reservoirs; and, as the total developed water supply within the basin will be insufficient for its needs, the ultimate utilization of the surplus developed within the Sacramento Basin. Four major power plants are also proposed, the energy to be used largely in irrigation pumping. In the ultimate development the total surface storage within the San Joaquin Basin will be over 5,000 ac.-ft.

Work on the in California

Probably nowhere is there a project for the development of water resources which embraces such a variety of uses for its stored water as the Central Valley project. These are for irrigation, flood control, navigation, salinity control, power generation, domestic and municipal supplies, manufacturing, hydraulic mining and in the more thickly populated areas for recreational purposes. While the predominating use in the final development will be, as at present, for irrigation, several of the other purposes will demand large storage space in the various reservoirs; this in spite of the advantage which will be taken in project operation of the unusual opportunity for reuse of water. In the ultimate plan it is proposed to reserve in fifteen of the major reservoirs sufficient space to store 2,600,000 ac.-ft. of water for flood control.

The Sacramento and San Joaquin rivers are at present navigable throughout the entire year as far upstream as Sacramento on the former and Stockton on the latter. Under the State Water Plan, navigation would be improved and extended upstream from these cities with resulting savings in transporting commodities. One of the serious problems in the delta region of the two rivers is the upstream invasion of salinity. This may be controlled to harmless proportions near Antioch by a combined flow in the channels of 3,300 sec.-ft., or annually 2,390,000 ac.-ft. It has been estimated that there are over 1,000,000,000 cu. yd. of gold-bearing gravel in the tributaries of the Sacramento River which may be profitably mined if water supplies are made available.

Initial construction

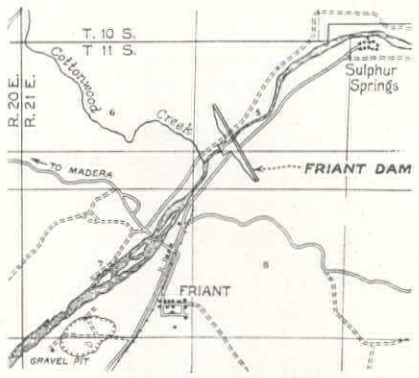
Under the present allotment of $15,000,000, work will be commenced at early dates on various major features of the project as follows:

(1) Friant Dam.
(2) Friant-Kern Canal.
(3) Madera Canal.
(4) Contra Costa Canal.
(5) Kennett Dam foundation excavation.
(6) Relocated railroad past Kennett reservoir.

The above program, which distributes the construction from the Upper San Joaquin River in the south to the northern part of the Sacramento Basin, will provide initial construction on the most urgently needed units of the project, as well as scatter ERA employment.

Friant Dam

The Friant Dam, to be constructed on the Upper San Joaquin where it emerges from the foothills (see accompanying map), will not only store water for the various project uses, but will divert water to two of the principal irrigation canals, the Madera Canal on the north and the Friant-Kern Canal on the south. The dam will be constructed with power penstocks for future use, should there later be a demand for the power which must be

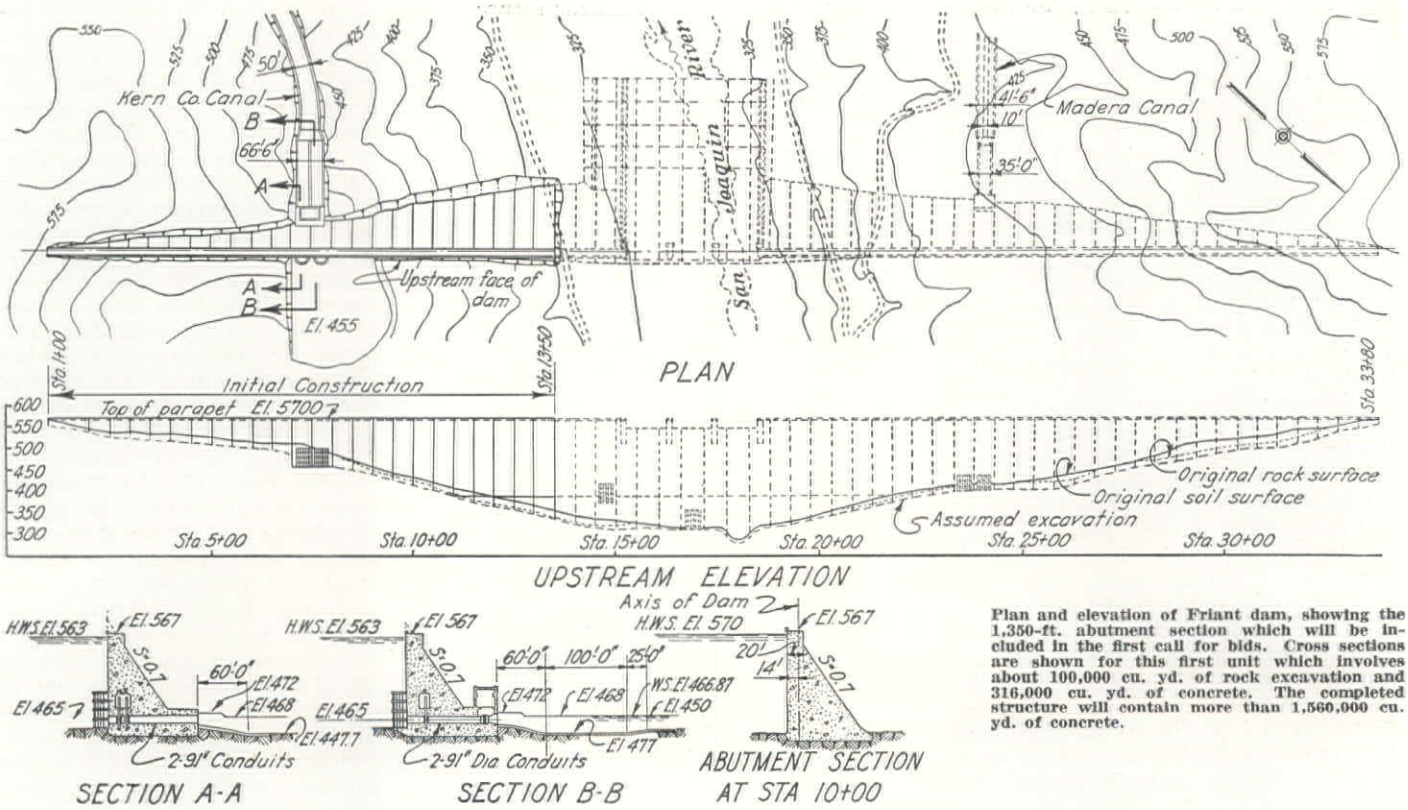


Location sketch map of Friant dam site on the upper San Joaquin River.

largely seasonal. The reservoir will have a capacity of 430,000 ac.-ft., 300,000 of which will be active storage, the remainder being dead storage to provide for diversion into the canals. The reservoir will extend 13 mi. upstream, flooding an area of 4,450 ac.

Dam site

The dam site is located 20 mi. northeast of Fresno and 1 mi. upstream from the town of Friant, from which the dam derives its name. While the river channel section is U-shaped, the abutment slopes are gentle, thus calling for a somewhat greater length of dam than usual for the storage obtained. The foundation has been explored in the past by both drill holes and open pits, and some further investigations are in progress at present. These consist of two exploratory tunnels directed along the axis of the dam into the abutment rock, one on each side of the river, some additional small drill holes and a few 36-in. holes with shot drills, which will give valuable information for



Plan and elevation of Friant dam, showing the 1,350-ft. abutment section which will be included in the first call for bids. Cross sections are shown for this first unit which involves about 100,000 cu. yd. of rock excavation and 316,000 cu. yd. of concrete. The completed structure will contain more than 1,560,000 cu. yd. of concrete.

foundation excavation, grouting and drainage. Some of the early holes show sound rock practically at the ground surface, while others show it to be disintegrated and weak to a depth of over 40 ft. Though the foundation excavation will thus be irregular in depth, sound rock was found in every hole at a reasonable depth.

The foundation is in a single metamorphic formation of schist of a fine close-grained texture. There is petrographic variety in that parts are predominantly quartzose and other parts micaceous, and that granitic materials have been forced into some of the schist. The strike of the formation is practically at right angles to the river course, and the dip is so steep that the bedding is practically on edge. As the rock is sound, insoluble in water and not given to rapid weathering and decay, it is considered highly satisfactory for supporting a high concrete dam.

Design of dam

The dam will be of the massive concrete, straight-gravity type with a maximum height of about 300 ft. and crest length of 3,500 ft. A river-overflow section, about 325 ft. long will occupy the central part of the dam. The crest width of the abutment sections will be 20 ft. The reservoir free-board will be 4 ft. below the top of the dam or 7 ft. below the top of concrete parapet walls running the full length of the abutment section. The toe of the spillway section will be extended downstream to form a bucket, which will reduce the velocity of the overflow and forestall undercutting. These features are shown in the accompanying illustration.

To prevent undesirable cracking of the mass concrete by shrinkage, transverse vertical contraction joints will be spaced generally on 50-ft. centers throughout the length of the dam. These will be so formed that adjacent 50-ft. sections will be interlocked by vertical keyways. A system of metal pipe and fittings, with uniformly distributed outlet boxes into the joints, will be embedded in the concrete for pressure grouting when the joints have opened up by contraction of the concrete.

A grout cut-off curtain will be constructed below the heel of the dam by drilling and pressure grouting a continuous row of holes, the spacing and depth of which will depend largely on the jointing, seams and other characteristics of the foundation rock, as disclosed by the present explorations. From former drilling data it is doubtful if the depth of any holes will need to be greater than 100 ft. After grouting has been completed within minimum distances of 150 ft., drain holes from 25 to 50 ft. in depth, 10 ft. on centers, will be drilled in a single row a few feet downstream from the grout curtain. Drainage outlets will be provided to the downstream face of the dam. The internal drainage system will consist of small diameter porous concrete drain tile embedded vertically near the upstream face of the dam, which will connect with the foundation drainage outlets.

Spillway and outlet works

Spillway overflow will be controlled by three 100-ft. by 18-ft. automatically-operated structural steel drum gates mounted on the ogee-shaped crest of the river section of the dam. Without encroaching on the reservoir freeboard, the spillway capacity with gates down is sufficient to handle twice the recorded maximum mean daily flow of 38,800 sec.-ft. The drainage basin above Friant damsite covers an area of 1,631 sq. mi., three-fourths of which area is over 5,000 ft. in elevation and the flood run-offs are largely the result of melting snows in the spring.

The outlet works will be in three separate units, one for the release of water down the San Joaquin River located at about river level through the center of the spillway section of the dam, another for diversion into the Friant-Kern Canal located about midway through the left abutment section and the third for diversion into the Madera Canal located through the right abutment at about one-third of its length from the river section. Final location of the Madera Canal may result in moving this outlet unit several hundred feet to the right. All outlets will consist of conduits through the dam with suitable regulatory and emergency gates or valves. Reinforced concrete and structural steel trashrack structures will be provided at the inlet ends on the upstream face of the dam. On account of the high heads under which the water will be released for canal diversions, it will be necessary to provide stilling basins for these units immediately downstream from the dam. In addition to the above outlets, the power penstocks for future use will be installed through the right end of the left abutment section of the dam.

Principal quantities as estimated for the several classes of work for the completed dam are: 90,000 cu. yd. of common and 290,000 cu. yd. of rock excavation; 54,000 lin. ft. of grout and drainage holes; 60,000 cu. ft. of pressure grouting; 1,570,000 cu. yd. of plain and 25,000 cu. yd. of reinforced concrete; and 9,600,000 lb. of metal work, consisting of concrete reinforcement bars, pipe, gates and valves and trashrack bars.

First contract

It is expected that specifications covering the first construction will be issued by the Bureau of Reclamation early in April. This will comprise about 1,350 ft. of the left abutment section or all of it except 165 ft. adjacent to the river-overflow section. The maximum height of the portion of the dam first constructed will be about 235 ft. The estimated major quantities of work involved are: 40,000 cu. yd. of common and 100,000 cu. yd. of rock excavation; 20,000 lin. ft. of grout and drainage holes; 19,000 cu. ft. of pressure grouting; 316,000 cu. yd. of plain and 2,200 cu. yd. of reinforced concrete; and 1,800,000 lb. of metal work.

A branch line of the Southern Pacific R. R. runs from Fresno to Friant, and all materials furnished to the contractor will doubtless be delivered at the latter point, from where they may be trucked over an oil-surfaced road to the dam site. Final investigations on concrete aggregate are in progress and it is believed that suitable material will be found within a mile or two of the dam site. It is probable that electrical power for construction purposes can be obtained from a commercial power company having a transmission line within 10 mi. of the dam site.

Canals

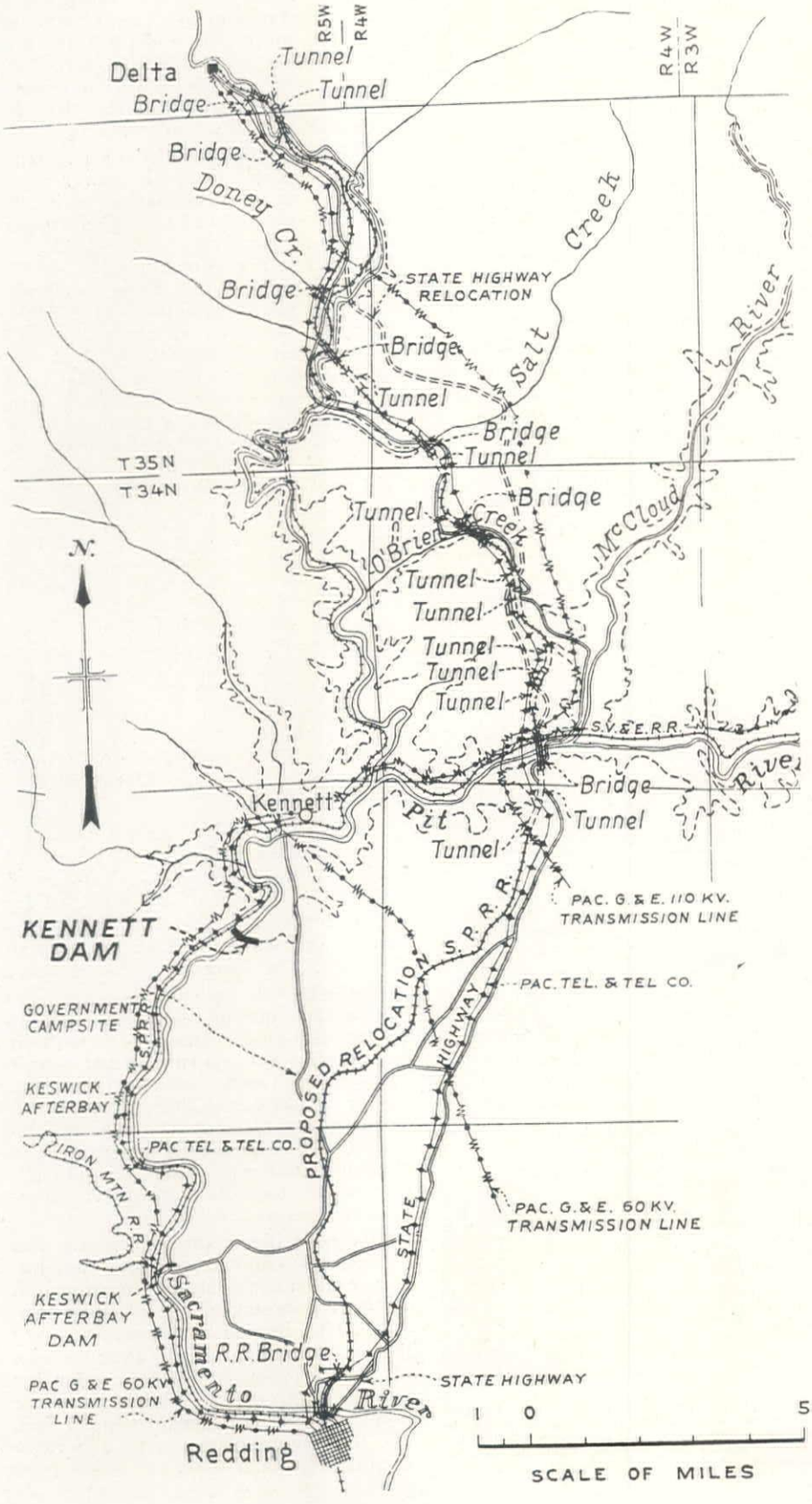
The Friant-Kern Canal will supply irrigation water for use on the eastern slope of the Upper San Joaquin Valley south of the San Joaquin River. Its location extends southward from the headworks at Friant Dam along the base of the foothills for a total length of 165 mi. to a point a few miles south of Bakersfield. Its initial capacity will be about 3,500 sec.-ft. It is probable that specifications for the first work on this canal will be issued early in the spring and will cover the upstream 5½ mi. Although this reach of the canal is in rugged country, present location studies indicate that it can be constructed entirely in open cut, which will be lined with concrete to a reasonable freeboard above the water surface. The upstream 4,000 ft. is entirely in rock, and the remainder of the first contract will involve a large proportion of rock excavation.

The Madera Canal will carry irrigation water for use on the eastern slope of the upper San Joaquin Valley north of the San Joaquin River. It will extend in general northwesterly from the Friant diversion for a total length of over 30 mi. to the Chowchilla River. The original plans were to terminate this canal at the Fresno River, 18 mi. from the headworks. Final determination of the capacity has not been made although it is reasonably assured this will be 1,000 sec.-ft. or somewhat greater. Final location of this canal is progressing and specifications covering a part of it will be issued when sufficient field data are available. The topography for the first several miles is so extremely rough that a number of major canal structures will be required. Open-cut sections will be lined with concrete.

The Contra Costa Canal will furnish a much needed water supply for highly cultivated lands and important industries in the San Francisco Bay region south and east of Suisun Bay. The rich agricultural areas, largely orchards and vineyards, which have been developed under natural conditions are now in need of surface irrigation due to the rapid recession of the underground water levels which were formerly close to the surface. The industries which have depended on fresh water require-

ments from wells and the river are imperiled because the water has become too salty for use during several months of the year. The source of the water supply for the canal will be at the west end of Rock Slough, about 10 mi. southeast of Antioch, from which heading it will extend westerly for a total length of 50 mi. Under the State Water Plan an initial capacity of 120 sec. ft. was proposed, but studies now in progress by the state may result in an increased capacity. The original capacity will be pumped near the headworks some 60 ft., and two or more additional pump lifts will be required for reduced capacities along the length of the canal. The location is through flat or gently sloping country. While, on account of the high state of development of the lands traversed, some of the canal may be in closed conduit, in general the canal will have an open-cut, concrete lined section. Field location of this canal is now under way, but on account of right-of-way and water requirement problems, it will likely be some time before specifications for the first construction can be issued.

About 33 mi. of main-line railroad relocation will be necessitated by the flooding of the reservoir site behind Kennett Dam. This work will include the driving of 6 mi. of tunnel and the construction of seven bridges.



Kennett Dam

Kennett Dam, the largest single construction feature of the Central Valley project, will impound storage water for all of the various project uses heretofore enumerated. The dam site is located on the Sacramento River about 5 mi. downstream from its confluence with the Pit River, and 13 mi. upstream from Redding, at which point the tributary drainage area is 6,650 sq. mi. varying from a riverbed elevation of about 600 ft. at the site to 14,161 ft. at the summit of Mount Shasta. The abutments at the site rise on approximately 3:1 slopes from a streambed width of about 150 ft. Foundation investigations completed in the past consist of three exploratory tunnels and nineteen drill holes. Additional investigations to determine the limits of disintegrated rock are in progress. The single bedrock formation is thoroughly metamorphosed rock of different types, largely andesites and andesitic tuffs. The entire formation, known as "greenstone," has a greenish cast, and unweathered portions are exceptionally hard, tough and durable.

The dam will be of the massive-concrete, gravity type, either straight or slightly curved, dependent on the result of present economic studies. While the height has not been definitely determined, it will probably be about 460 ft. from the lowest foundation elevation. For this height the reservoir capacity would be 4,000,000 ac. ft., and the area 28,700 ac. The volume of mass concrete would exceed 3,500,000 cu. yd. and foundation excavation would approach 2,000,000 cu. yd. Under the present allotment it is proposed to contract foundation excavation only, the date of issuance of specifications being dependent on the progress of present investigations.

Railroad relocation

The Kennett reservoir will flood the portion of the Southern Pacific R. R. located along the Sacramento River from the dam site to within a few miles of the town of Delta. This necessitates the relocation and reconstruction of the railroad from Redding to Delta, a distance of about 33 mi. by the new location, which runs northerly on higher ground on the west side of the river. It requires the construction of 26½ mi. of open track, almost 6 mi. of tunnels and seven bridges, two of which, viz., across the Sacramento River near Redding and across the Pit River in the reservoir area, will be major structures.

The final relocation for the first section from Redding to Mile Post 266, about 7½ mi., is practically completed and expectations are that two separate specifications covering this portion will be issued shortly, one set to cover all construction except the Sacramento River bridge and the other for the bridge only. The approximate principal quantities involved in the former are 1,500,000 cu. yd. of common and 425,000 cu. yd. of rock excavation and 35,000,000 sta. cu. yd. of overhaul. The Sacramento River bridge, located on a 3-deg. curve, with a total length of 2,386 ft., will consist of two deck-truss spans, each 253 ft. long, supported across the river on concrete piers, and of two structural steel viaduct approach sections. It is anticipated that the call for bids on the above work will be followed by the issuance of specifications covering a number of the tunnels.

Organization

Since the recent death of Commissioner Elwood Mead, R. F. Walter, chief engineer, has been Acting Commissioner, with headquarters at Washington, D. C., and S. O. Harper, assistant chief engineer, located at Denver, Colo., has been acting chief engineer. J. L. Savage, also located at Denver, is chief designing engineer, and Walker R. Young with headquarters in Sacramento, Calif., is construction engineer for the Central Valley project.

Boulder Dam Accepted by Government

THE Boulder Dam and power house were accepted on behalf of the United States from Six Companies Inc. on March 1, according to an announcement of Secretary of Interior Harold L. Ickes, terminating the contract and marking the end of actual construction of the project in 11 days less than five years. More than a year ago, Boulder Dam was put to work controlling the floods and conserving the waters of the Colorado River. The gates of the diversion tunnels were closed Feb. 1, 1935.

Preparations are being made to place the first battery of 82,500-k.v.a. generators in operation in May or June. Four of these are being installed at this time. Ultimately, the power house will contain fifteen generators of this size and two of 40,000 k.v.a. capacity. The power house will not be fully equipped for several years.

In construction of Boulder Dam and power house, the Bureau of Reclamation estimated that a total of 604,800 man-months was provided of all classes of employment. The Bureau of Reclamation will take over the plant and equipment of the contractor for use without charge until October 1, for the installation of power house equipment and in putting certain finishing touches on the structures.

Under the contract between the Bureau and Six Companies Inc., which became effective Mar. 11, 1931, the contractor's gross earnings will amount to approximately $54,700,000. The work now being completed originally was expected to require 2,565 days and the contractor had until April 28, 1938 to finish the job. Thus the work will be completed two years, one month and 28 days ahead of schedule. Six Companies Inc., the contractor, and the Bureau of Reclamation entered a final agreement on payments, penalties and settlement of claims prior to fixing the date for termination of the contract.

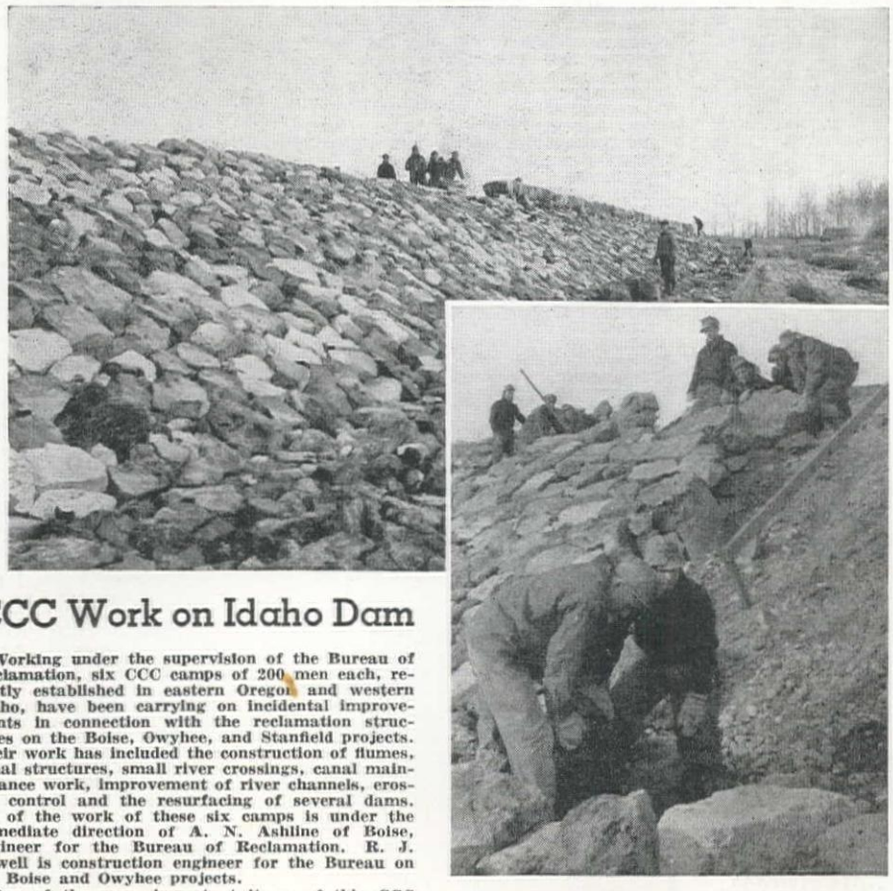
When bids were called on construction of Boulder Dam and power house the Bureau of Reclamation estimated that on the basis of the specifications it had prepared the job would cost $48,866,254. Six Companies Inc., in the successful bid, estimated the cost under the unit prices submitted at $48,890,-995.50. The gross earnings now are estimated at $54,700,000. With deductions made by the Bureau of Reclamation for various services, such as provision of electric power to the contractor and rental at Boulder City, the actual cash payment to the contractor will approximate $51,950,000.

After the contract was let, a change was made in the design of the power house to increase its size. This increased the cost of the power house by more than $2,000,000 over the estimate. This was the most important of several alterations in plans and design. The penstock tunnels, however, were increased from 30 ft. in diameter to a size which would permit the installation in them of steel pipe of 30-ft. diameter. This increased the cost of these tunnels by about $1,000,000 over the estimate.

Up to Jan. 1, 1936, Six Companies had excavated 5,965,972 cu. yd. of all classes of materials on which it earned $27,433,627. It had placed 4,364,903 cu. yd. of concrete in the dam and power house, and earned $19,305,198. These figures will be increased by work done in January and February.

The amount of concrete actually placed in Boulder Dam itself, without considering the appurtenant works such as spillways, intake towers and power house, was 3,240,871 cu. yd., for which the contractor was paid $8,750,-351.70. The most costly single item in the construction program was the drilling of the four 50-ft. diameter diversion tunnels at $12,914,874.

Only one important item in the Six Companies' contract will not be completed when the contract is terminated. It is the plugging of one of these tunnels. The Bureau found it necessary to delay placement of this plug because of the necessity to by-pass water for irrigation through the tunnel until the power house is placed in operation. The Bureau will place the plug by force account at a later date.



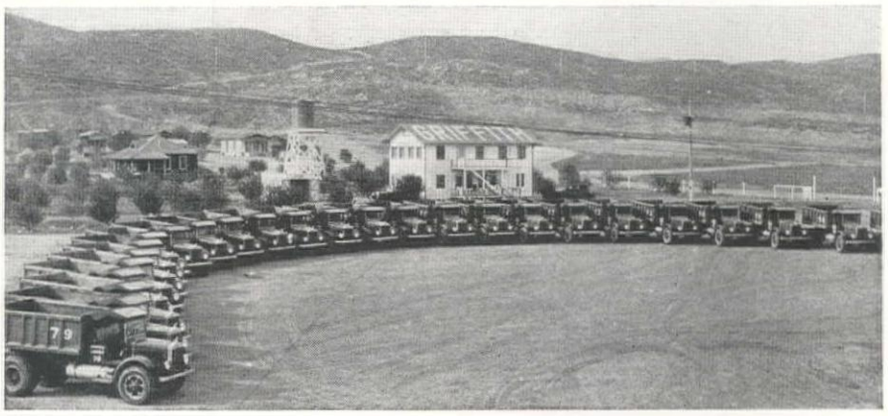
CCC Work on Idaho Dam

Working under the supervision of the Bureau of Reclamation, six CCC camps of 200 men each, recently established in eastern Oregon and western Idaho, have been carrying on incidental improvements in connection with the reclamation structures on the Boise, Owyhee, and Stanfield projects. Their work has included the construction of flumes, canal structures, small river crossings, canal maintenance work, improvement of river channels, erosion control and the resurfacing of several dams. All of the work of these six camps is under the immediate direction of A. N. Ashline of Boise, engineer for the Bureau of Reclamation. R. J. Newell is construction engineer for the Bureau on the Boise and Owyhee projects.

One of the more important items of this CCC program has been the placing of a rock face on the Deer Flat earth fill dam on the Boise River project. This rock veneer on the upstream face has been added to prevent wind and wave erosion. Using rock blasted from nearby quarries, the CCC boys covered the upstream face of the structure with dry rubble masonry as indicated in the illustrations. This work was performed during the low level stage in the reservoir when the face of the dam was exposed.

Servicing Earth Moving Equipment At Cajalco

Definite maintenance schedule followed for servicing trucks, tractors and shovels on a 7,000,000 cu. yd. earthfill dam project—Special equipment devised by contractor reduces greasing time to minimum



To haul the 7,000,000 cu. yd. of earthfill material, this fleet of 30 Mack trucks is used. They have been converted to burn butane gas, and consume 2,500 gal. per 24 hr.

Proper care of expensive construction equipment is not a universal characteristic of contractors. Further, the planning for fueling and servicing equipment is often badly neglected with resulting loss of time and money. Occasionally, a job is carried out by an efficient and well organized construction outfit with the development of servicing facilities which set a worthwhile example for others. This is true of the present operation of the Griffith Company on the Cajalco Dam contract, described in this article. The information should be profitable for any contractor or construction man interested in getting the most out of earth moving equipment.—Editor.

TO HANDLE the 7,000,000 cu. yd. of rolled earthfill to be placed in the Cajalco dam and dike, the Griffith Co., contractor on the project, has massed more than $400,000 worth of new earth moving equipment and has arranged a program for fueling and servicing these units that is particularly notable. The dam is being built by the Metropolitan Water District to provide 100,000 ac. ft. of terminal storage for the Colorado River aqueduct. Design of the dam has already been described in *Western Construction News* (September, 1935) and the construction procedure, control of moisture and compacting of the fill will be covered in a later article when work is further advanced; the present article presents a detailed review of the contractor's program for maintaining the motor equipment.

Briefly, the dam is of usual earthfill design of 6-in. compacted layers with side slopes of 3:1 and an 8-in. reinforced concrete paving on the upstream face. The main dam is 194 ft. high and contains three million cu. yd. of fill. Some distance from the main dam on Cajalco Creek, a dike with a maximum height of 90 ft. and a length of about 7,500 ft. is required across a low section of the reservoir site. This dike is of similar design to the main dam and contains 4,000,000 cu. yd. of rolled earthfill. Excavation stripping on the dam includes 575,000 cu. yd. of earth and 25,000 cu. yd. of rock.

A 48-hr. week is permitted on this project, the schedule arrangement providing for twelve days of three 8-hr. shifts, then a complete shut-down for Saturday and Sunday at the end of the second week. This program necessitates the equipment operating continuously for a twelve-day period.

Fuel requirements and storage

An appreciation of the facilities required for fueling the dozens of heavy hauling units, the shovels, and tractors can be had from noting the quantities of fuel needed during peak operations. The consumption of various fuels in gallons per 24 hr. follows:

500 gal. of gasoline—misc. trucks and cars
1,000 gal. of distillate—power shovels
1,700 gal. of diesel oil—tractors
2,500 gal. of butane gas—truck fleet

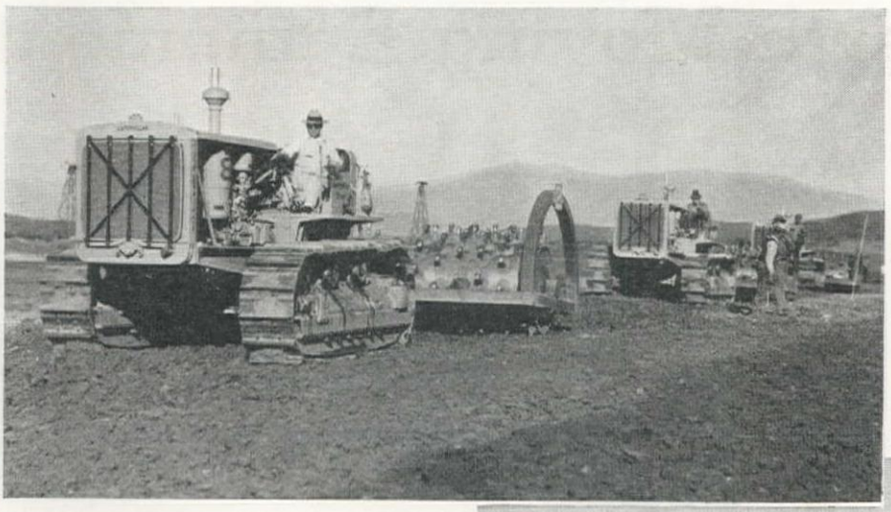
5,700 gal. total fuel requirements for 24 hr.

Storage of these fuels on the job is provided in steel tanks resting on concrete footings on a convenient rise of ground near the shops, allowing gravity discharge. The entire tank area is securely fenced and adequate danger signs are posted. Storage capacities are: butane—8,000 gal.; distillate—6,000 gal.; diesel oil—6,000 gal; gasoline—8,000 gal.

This gasoline storage is disproportionately large, owing to an advantageous purchase of tanks on the part of the contractor, combined with the fact that gasoline consumption was high during the first weeks prior to the conversion of the trucks to burn butane fuel.

All fuels but the butane are delivered by the oil companies to the main storage tanks, and are then dispensed in the field by a tank track of the contractor. Butane is hauled to the job in a 2,700 gal. semi-trailer tank truck built by the contractor. Every precaution was taken in the design and construction of this tank truck to provide safety in operation and the contractor has been complimented on the features of this gas hauling unit. The shell is of ⅜-in. steel and outlets and all valves are inverted or enclosed so that they

Operating safety featured the design of this 2,700-gal. semi-trailer tank truck, built by the contractor to haul butane from the refinery to the job.



Tractors, used principally for hauling sheepsfoot rollers on the fill, are serviced at 12-hr. intervals, and crankcase oil is changed at the end of 50 hr. of work.

would not be broken off in case of accident; pumps and valves are all vented; all wiring is in conduit; air brakes are arranged to set when the pressure is below normal and cannot be released to move the truck until the engine has built up satisfactory pressure. This tank truck hauls from the refinery to the job and the butane is pumped into the 8,000 gal. butane tanks.

Trucks and servicing

The fill material is hauled from borrow pit to the point of placement in the dam (about ½ mi. to the dike and 2 mi. to the dam) in a fleet of thirty Mack trucks with 10-yd. (water level) dump bodies. Loads average about 13 to 13½ cu. yd. or 18 tons.

These units were all purchased new and were converted on the job to burn butane gas by installing two 50-gal. tanks on each truck and making the necessary changes in carburetion. They are refueled once every 24 hr. at the main supply, when they come into the pits for servicing. Pressure of the liquefied butane gas in the truck tanks is maintained above a minimum pressure of about 15 lb. The properties and operating characteristics of butane gas as an internal combustion fuel are not considered an essential part of this article.

Items of Equipment

30 Mack trucks—10 yd.
2 Bulldog trucks (for batched aggregate)
2 Chevrolet trucks (2-ton)—utility
3 Chevrolet trucks sprinkling fill
1 fuel truck
1 welding truck
1 Chevrolet truck trailer (butane hauling)
1 greasing truck
5 Northwest 2½-yd. shovels
1 Bucyrus-Erie 2-yd. (diesel) shovel
1 Northwest 1½-yd. trench hoe
11 Caterpillar diesel tractors—95's
1 Caterpillar diesel tractor—50
2 Caterpillar Patrols
6 Sheepsfoot rollers
4 Byron-Jackson pumps 450 g.p.m.—sprinkling borrow pits
2 Ingersoll-Rand portable compressors (1,000 and 600 ft.)

This "service station on wheels," assembled by the contractor for rapid servicing of tractors in the field, contains an air compressor, grease and guns, and water and oil tanks. Operated by three men, this unit services a tractor in 20 min.

Beginning at the start of the day shift at 8 a. m., the trucks are pulled out of line, one at a time, and ordered to the greasing pits. These are located in a galvanized iron building, situated near the shops and fuel tanks. A crew of four men attend to the trucks (the driver is only required to keep out of the way). This crew services the 68 pressure fittings, eight oil fittings, chain oilers, and also checks the transmission, differential, oil, water, and tires. The time required for oiling each truck averages about 10 min., although this work is occasionally done in less than 5 min. The crew on the day shift completes all of the truck servicing required for the 24 hr. After servicing, the trucks are refueled and returned to continuous operation for another 24 hr. Crankcase oil is drained and reclaimed every 4,000 mi.

Grease drums are stored in an adjacent room, which is maintained at temperature of about 85° by an electric heater, regulated by thermostat. This refinement in grease storage is considered essential to insure rapid and efficient greasing. From the drums, equipped with Lincoln pumps, the greases are forced through pipes, located in troughs under the floor, which are filled with sand kept warm electrically by a resistant wire. This prevents the grease from cooling between the drums and the guns. Pressure on the guns is maintained at about 2,500 lb. per sq. in. A small compressor in the grease pit building supplies air, but the main supply from the shops is also available.

The trucks are being equipped with additional underslung rear springs to accommodate the overload and help reduce the sway of the bodies when in raised position. These springs, and the resulting reduction in sway, are planned to ease the strain on the outside tires. When operating on the slopes of the fill, the loads tend to ride on the lower tires resulting in maximum tire trouble along the edge of the treads or on the side walls of the outside tires.

A complete record of each tire is maintained. When put into service, each tire is branded by the contractor and this number is used, in addition to the manufacturer's serial number. A card record is kept which shows the tire number, make, date of placing in service, truck number, position on the truck, and the odometer reading. Whenever the tire is brought back to the shop this record is carried forward, with additional information as to the trouble. Flats are changed in the field by men from the tire shop. Tires, of 1200 by 24 size are operated on a 110-lb. pressure.

The truck garage is completely equipped for all types of repairs and rebuilding work. The contractor has installed the best type of repair machinery for all operations and carries on this work from stock room to finished job in a well organized and workmanlike procedure.

To service the fleet of Caterpillar

tractors used in pulling the compacting rollers on the fill, and other miscellaneous work, the contractor has built a complete, self-contained, truck mounted greasing unit. On the platform truck are an air compressor and receiver tank, grease drums, hose, grease guns, water tank, oil, and a container for used crank case oil. Operated by a crew of three, this unit is used to service the tractors at 12-hr. intervals wherever they are at work on the project. The tractors are pulled out of line and serviced in about 20 min. At the end of 50 hr. of work, the crank case oil is drained and reclaimed.

In addition to the principal use of pulling the compacting rollers on the fill, the tractors are used for bulldozing on the fill, keeping the borrow pit cleaned up and other miscellaneous work. In stripping the site for the dike the tractors were used with Le Tourneau carts to waste this material. All of the tractors are diesel units and are fueled in the field by the contractor's tank truck.

Shovels and servicing

In the borrow pit the contractor is using four 2½-yd. Northwest shovels with a 2-yd. Bucyrus-Erie as a reserved unit. The Northwest shovels operate on distillate after a preliminary warm-up on gasoline. Pit operations will be described subsequently in an article on dam construction.

At the beginning of every shift the oilers for the four shovels pull one of the units back from the face and function as a servicing crew to complete the oiling and greasing of this shovel in about twenty minutes. Thus, all of the four shovels are serviced once every eight-hour shift. Fuel oil is brought to the pit in the contractor's tank truck.

Miscellaneous

The contractor's shops are located on a flat area within the reservoir site adjacent to the main hauling road between the pits and the dam. In addition to the grease rack and building already mentioned, a large garage and shop building houses all of the equipment for repairing the trucks, tractors, and shovels. In addition to the garage, tire shop, and battery shop, this building contains the stock room, and a large completely equipped machine shop (distinct from the garage) which can handle repairs on all the heavier equipment including the tractors and the shovels. A welding shop with three Lincoln electric welding units, and an auxiliary truck mounted welder for field use complete the shop equipment.

One of the most important features of the welding service is the rebuilding of the tampers for the sheepsfoot rollers. Specifications require that these feet have a bearing area of not more than 6 sq. in. or less than 5 sq. in. Originally, they are cast to a 2x3-in. cross section and when wear reduces this surface to less than 5 sq. in. they are removed and rebuilt using cast iron deposit by electric welding. There are also two Ingersoll-Rand portable compressors (1,000 cu. ft. and 600 cu. ft.) on the project.

Rex B. Sawyer (left), superintendent; Reuel A. Crosiar, master mechanic; and T. E. Dillion, timekeeper, of the contractor's field organization on the Cajalco Dam.

To supply sprinkling water to moisten the borrow pit areas, four Byron-Jackson pumps of 450 g.p.m. capacity are in use. The sprinkling of the borrow pits requires about 1,750,000 gal. per 24 hr.

The Griffith Co. secured the contract for building the Cajalco Dam and dike on a bid of $4,646,857. Unit bids of the six bidders were published in *Western Construction News*, September, 1935. S. M. Griffith is president of the Griffith Co., D. H. Moore is vice-president, in charge of the company's operations on the Colorado River Aqueduct, and Rex B. Sawyer is superintendent on the Cajalco Dam project.

The Cajalco Dam is being built by the Metropolitan Water District. F. E. Weymouth is general manager and chief engineer of the district, J. L. Burkholder is assistant general manager, and Julian Hinds is assistant chief engineer. R. B. Ward is resident engineer on the dam which is under the general supervision of R. B. Diemer, distribution engineer.

Shovels in the borrow pit are serviced at the beginning of each 8-hr. shift by the oilers of the four shovels, acting as a greasing crew. Note the 50-gal. butane fuel tank on the truck at the right.

Salt Lake City to Make Survey of Water Sources

THE consulting firm of Alvord, Burdick & Howson, of Chicago, has been retained by Salt Lake City to prepare a survey of the municipality's water problems. This is a definite step toward the development of a long-time water program by the city. The cost of the survey, at the present time, on a per diem basis, is not expected to exceed $5,000.

The consulting firm will review all of the new sources of water which have been investigated by the city. This study will consider the city and the Metropolitan District, authorized by voters last fall, as identical. Some of the projects to be considered include the Deer Creek development, Green River diversion, the diking of Utah Lake, underground water, storage possibilities, and conservation of the present supply.

Fort Peck Dam Spillway

. . . . A Man Made Channel for Missouri

Excavating more than 13,000,000 cu. yd.—Operating equipment in sub-zero weather—Boring 467 5-ft. diameter holes for concrete piles—Cutting foundation shale with saws

By CAPT. JOHN R. HARDIN
Corps of Engineers
Fort Peck Dam Project

THE FORT PECK DAM project includes the construction of a 245,000-sec. ft. spillway in the rim of the reservoir about 3 mi. east of the dam. Under normal conditions the diversion tunnels, located under the shale hills on the east bank, will carry the flow from the reservoir for navigation and other purposes, but in time of flood a spillway of ample proportions is necessary to protect the hydraulic-fill dam against overtopping. When the reservoir is slightly above normal full stage, the spillway capacity, together with that of the diversion tunnels, is sufficient to carry the maximum computed flood flow. The rather startling proportions of the spillway are in keeping with the size of the project as a whole.

General description

The spillway (Fig. 1) consists essentially of: (1) an unlined approach channel 1,900 ft. long leading to (2) a gate structure mounting 16 steel, vertical-lift gates (each 25x40 ft., set between concrete piers); a concrete-lined channel over 4,700 ft. long, varying in width from 800 to 130 ft., and (3) a deep cut-off structure at the lower end of this paved channel. An unlined outlet channel, which also will act as an elongated stilling basin, extends from the cut-off structure into the flood plain of the Missouri River.

The gate structure is one of the most interesting features of the spillway construction. It is protected for 225 ft. upstream by a concrete approach slab 3 ft. thick which is keyed into the shale by frequent transverse cut-off collars. Piers are built upon a foundation slab 75 ft. wide and 12 ft. thick extending completely across the channel and under the abutments. Concrete piles, each 5 ft. in diameter and from 30 to 40 ft. deep, support the foundation slab. Under the upstream edge of the pier slab, a cut-off wall 10 ft. thick and 30 ft. deep will prevent percolation under the gate structure and abutments. The piers taper off into training walls which extend 187 ft. down the channel to prevent turbulence and the formation of standing waves. These training walls are supported on thick concrete slabs which are in turn keyed into the shale by transverse cut-off collars.

The concrete-lined channel is, for the most part, on a 5.23% grade, and as the velocity of the flow increases, the width varies to provide uniform discharge capacity. At maximum flood, the discharge velocities at the cut-off structure will exceed 60 mi. per hr. Such high velocities necessitate adequate protection against back scour at the end of the paved channel, hence the inclusion of a cut-off structure of cellular construction extending 70 ft. into the shale under the channel lining.

Another unusual and interesting feature of the channel lining is the extensive system of sub-surface drainage shown in Fig. 2. These drains are located under all transverse and longitudinal slab joints. With slab dimensions usually 20x40 ft., the extent of this drainage net can be understood. The transverse collars under the slab perform the dual role of cut-offs and stiffeners against side thrust.

Bear-paw Shale

The necessity for such extensive foundation protection lies in the nature of the material through which the spillway extends. This Bear-paw Shale formation has many peculiar characteristics and offers many construction difficulties. It is a dark, heavy, compact material having a degree of hardness about equal to "soapstone," or, more accurately, its position in the hardness scale for minerals is between 1 and 2.

The natural moisture content is about 15% by weight, and in this fact lies its most troublesome characteristic, as moisture is readily lost in the dry atmosphere of the climate. Loss of moisture results in shrinkage, cracking and spalling of horizontal surfaces, and failure of unsupported faces. When the natural moisture is once lost and the shale is again wetted, disintegration to the state of mud quickly occurs. Construction procedure must, therefore, be such as to prevent the loss of natural moisture before concrete is deposited on foundations, and, to further insure the permanency of the work, every opportunity for cut-off and keying action into the shale has been utilized in the design. If the shale is properly protected during construction, it forms an excellent foundation material. Water has no deleterious effect on shale in its natural state, acting as a preservative instead of being a destructive agent. The nature of this shale is directly responsible for the unusual types of equipment described later in this article.

Heavy Excavation

Spillway operations to date can conveniently be divided into two phases: (1) heavy excavation and (2) gate structure construction. After Government forces had moved 500,000 cu. yd. in preparatory work, the heavy excavation was carried on under two contracts. One contract, for the excavation of the lower part of the channel, amounting to 2,535,000 cu. yd., has been completed by Martin Wunderlich of Jefferson City, Mo. The Massman Construction Co. of Kansas City, Mo., (Spillway Builders, Inc., Agents), under the other contract, have removed 9,750,000 cu. yd. from the entrance and lined channel areas.

The smaller of these two contracts

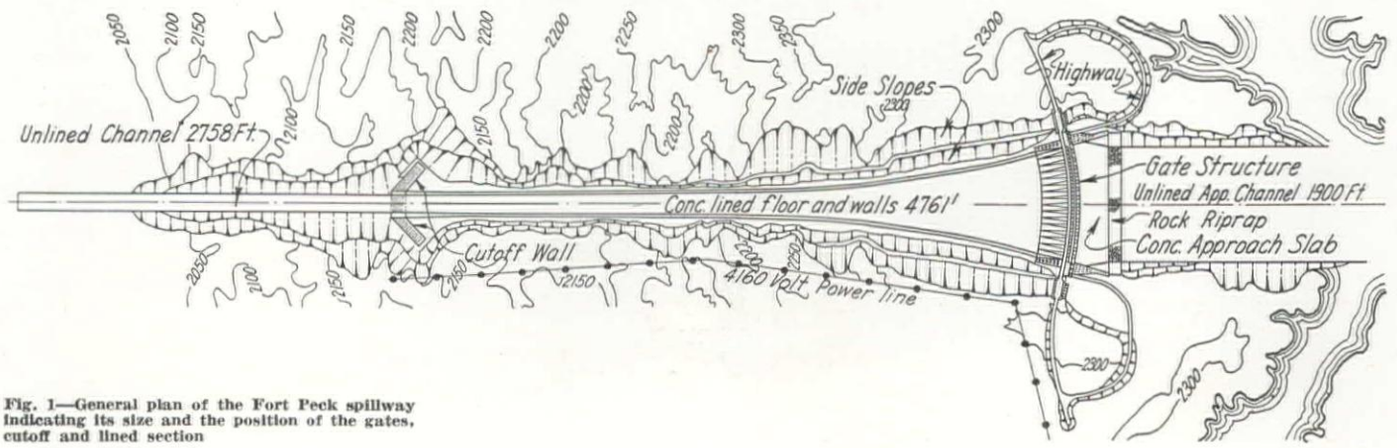


Fig. 1—General plan of the Fort Peck spillway indicating its size and the position of the gates, cutoff and lined section

Construction

River Floods

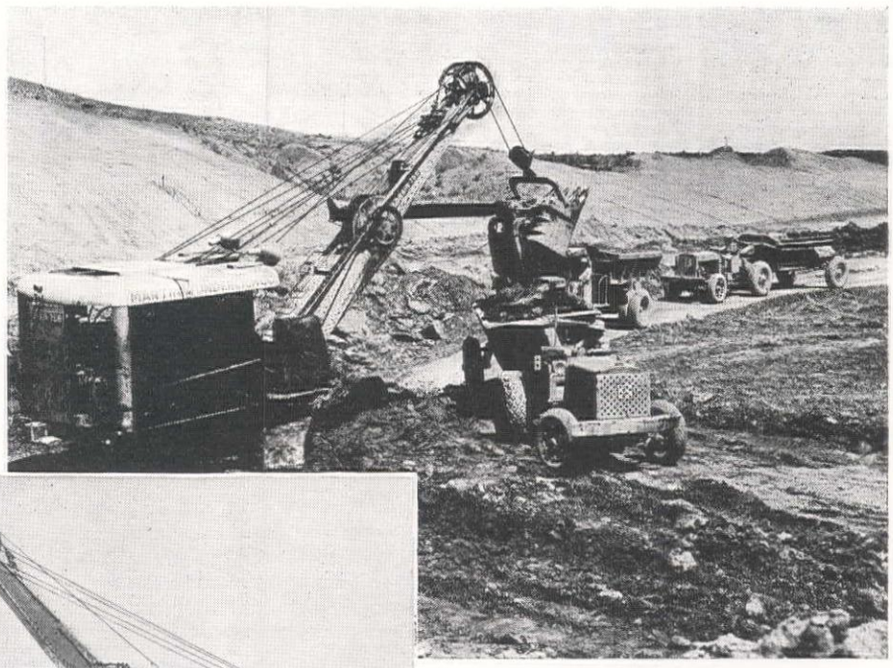


Fig. 3—The 2,535,000-cu. yd. excavation contract of the Martin Wunderlich Co. for the lower portion of the channel was completed in a ten-months period. The general type of equipment used is shown. For winter operations the tires on the drive wheels were encased in a special metal armor enabling the hauling units to work effectively, even on steep grades.

Fig. 4—Typical excavation and hauling operations on the entrance and lined section of the canal, which were remarkable for their efficiency and speed. Work was continuous on a 7-day per week basis and the organization of men and equipment was so well arranged that a record of 46,754 cu. yd. was moved in one day. High speed, 6-yd. trucks shown above, formed the bulk of the hauling equipment on this contract of Spillway Builders, Inc.

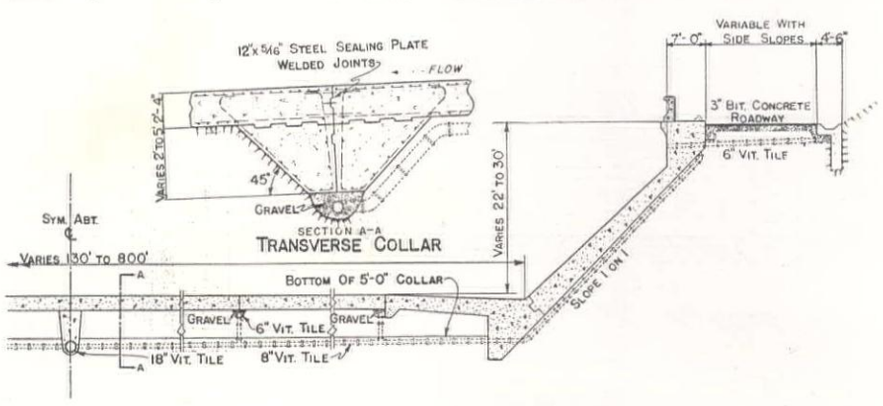
was completed in Sept., 1935, about 10 months after starting and in 3 months less than contract time. The general type of equipment used on this portion of the work is shown in Fig. 3. During the winter season and in muddy weather these hauling units used "grousers" or a close-fitting metal armor equipped with lugs, which completely encased the tires on the drive wheels. These devices enabled the hauling units to operate on the exceedingly steep grades required during the early phases of the operation. Tractor-drawn equipment and tractors equipped with bulldozers were also extensively used. The side slopes were trimmed with power-operated wheel scrapers of large capacity after the shale had disintegrated sufficiently to permit their use. Blasting was necessary for expeditious removal of the shale on this portion of the work. Average employment was 175 men, the work being conducted on the basis of three shifts per day.

On the second and larger excavation operation, the initial objective was reached in exactly one year from the time of commencement on Dec. 5, 1934, with only 14 calendar days lost due to weather conditions. Work was suspended for a period of eight days during January, 1935, when temperatures dropped below —25 deg. Otherwise the work went on three shifts a day, seven days a week. Shovels, trucks and tractors frequently were kept running continuously for days at a time to obviate difficulties encountered in re-starting in very low temperatures. The desire to continue employment and to meet a very heavy production schedule was the motive behind this extraordinary effort which closely resembled wartime activity.

The contractor's equipment consisted of nine 2-yd. diesel-powered shovels, supplemented at times by four 1½-yd. shovels and draglines. High speed dump trucks with 6-yd. bodies formed the bulk of the hauling equipment, (Fig. 4) although some trucks of 8 and 12-yd. capacity were also used. The average haul to the spoil areas was about 1¼ mi. Total number of hauling units actually working varied between 110 and 90, depending upon shovel locations and weather conditions. Three tractor-drawn blade graders, seven tractors with bulldozer attachments, and two highway motorpatrols were used in maintaining the roads in the pits and to the spoil areas. These machines also kept the dumping points in table-like smoothness.

The success of this tremendous hauling operation depended to a large extent upon this matter of pit, road, and dump maintenance. Trucks were able to receive their loads, move to the dumps and return in the minimum time. The main haul roads to the spoil areas were, in fact, boulevards of generous proportions, none less than 60 ft. and several 120 ft. wide, with four traffic lanes. Those used in winter and spring months were gravelled, others

Fig 2.—Half section through the lined channel indicating the drainage system and principal dimensions.



were not surfaced as the clay and gravel in the overburden, or stratum covering the shale formation, makes a very satisfactory road surface in normal weather. Whatever the surface, it was carefully maintained because the speed of trucks was about 30 miles per hour when loaded, and higher when empty.

In view of the necessity for night operations, ample illumination was necessary not only in the shovel pits, but also along the haul roads and spoil areas to avoid collisions. Electric floodlights, arranged to avoid glare, were installed along the roads and at other critical points on ordinary telephone poles, the poles being moved as the operations shifted to another location. In addition, traffic control at intersections was necessary; flagmen in conspicuous positions indicated routes and right-of-ways.

Servicing all equipment was done in a systematic manner. One shovel was generally held out of production at a time, usually for the duration of a shift, sometimes longer, depending upon the amount of work to be done on it. During these routine repair and inspection periods, the machine was carefully checked. Repairs, if needed, were completed before it was returned to duty. With three different operators per day and continuous operation (with the exception of one hour between shifts and one-half hour at lunchtime), rigid inspection and checking were found to be necessary. Between shifts, for the most part, and even during shifts while the shovel was operating, the oiler performed his duties. The shovel crew consisted of two men, the operator and oiler. Trucks were serviced every 24 hr.

This servicing included chassis lubrication, cleaning air and oil filters, and inspection of tires as to condition and air pressure. It is interesting to note that due to proper road maintenance and proper inflation of tires, the average service obtained per tire was in excess of 36,000 mi. Engine oil was changed every 500 mi., the old oil being filtered and processed for re-use. Repairs were made as needed in a completely equipped shop large enough to accommodate 10 trucks. Truck drivers were not allowed to make adjustments or repairs of any nature. The stock of repair parts for trucks, tractors, and shovels, valued at $60,000, was kept in a building adjoining the shop, and few, if any, delays were occasioned by reason of lack of parts.

Organization of forces must necessarily play a large part in a job of this magnitude, particularly in view of the three-shift operation. A general manager was in complete charge. His principal assistant was the general superintendent, who was in responsible charge of operation, equipment and personnel. The heads of the payroll, supply, and engineering sections reported directly to the general manager.

The general superintendent ordinarily took charge of the day shift personally, at other times an assistant was in charge of operations. A master mechanic had charge of all repair work, with assistants to act in his absence. The shop operated 3 shifts a day with the largest force on duty during the day shift. A truck master, with assistants, directed the employment of hauling units, traffic circulation and servicing operations. Each shovel was in charge of a shovel foreman, and as stated previously, the crew consisted of two men. The shovel foreman's duties were to enforce the superintendent's instructions as to the cuts to be made, maintenance of line and grade, and to direct the shovel operators and truck drivers when in the shovel pit. The average weekly employment figure for a period of one year was 600 men, although at times the weekly figure exceeded 750.

In the early months of operation, the daily rate of excavation was about 25,000 cu. yd., bank measure. During the spring and summer of 1935 production schedules were stepped up until over 40,000 cu. yd. were removed daily, and due to a swell of 25 to 30 per cent for truck measurements, this resulted in 8,500 truckloads in 19½ hr. of working time. The peak of production occurred on May 22 when 46,754 cu. yd. of shale were moved over a mile.

Long-time records of the nine 2-yd. shovels indicate that one make averaged 232 cu. yd. (bank measure) an hour, while another make averaged 244 cu. yd., based on actual working time. The same shovels averaged 175 and 188 cu. yd. per hour based on shift time, no credit being given for time lost due to periodic overhauls, individual breakdowns and repairs. Daily totals for individual shovels in 19½ hr. of operation frequently exceeded 5,000 cu. yd.

The very rugged terrain through which the spillway channel extends necessitated careful planning of shovel positions and direction of cuts, particularly in the early stages of the work. The side slopes were generally 1 on 3 in overburden and 1 on 2 in shale down to the channel floor. Bulldozers were used extensively in building roads or ramps for the shovels to use in getting into initial positions on the hill tops, or for sidehill cuts. However, where the going was particularly difficult, the shovels would excavate a roadway in the hillside by casting methods as they worked themselves into position. As the cuts became deeper and the channel began to develop in form, it was the objective to have the shovels work on about the same levels taking long cuts parallel to the centerline. In this way, broad, flat, excavated surfaces were developed which materially facilitated truck movements.

In the beginning of the shift, ample trucks were assigned to each shovel to prevent idle shovel time, with assignment increased or decreased by the truck master as circumstances warranted. At times, shovels were worked in tandem cuts (separated about 200 ft., front to rear) both moving in the same direction. This permitted trucks arriving from the dump to serve either of the shovels, depending on which needed trucks at that moment. Bulldozers and tractor-drawn blade-graders were continuously on duty in the shovel area, visiting each shovel in turn to clear away spilled material from the path of trucks and dressing up the pit immediately behind the shovel. This degree of care not only paid dividends in saving seconds for trucks and shovels, but also resulted in low upkeep.

Normally, the shovels worked against an 8-ft. face, loading into trucks which moved parallel to the shovel facing in the opposite direction.

Very little blasting of shale was necessary in the entrance and the upper portion of the channel. The 2-yd. shovels broke into the joint planes of the shale in those areas quite readily. However, in the lower portion of the channel, a firmer material was encountered and light charges of powder were required to loosen the shale.

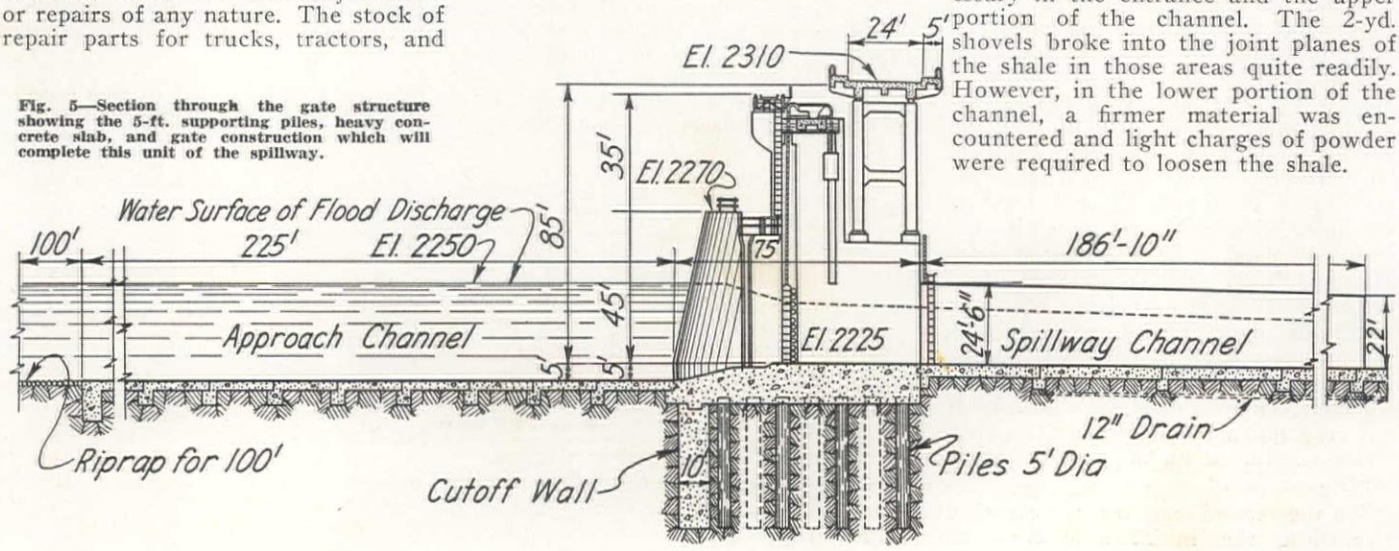


Fig. 5—Section through the gate structure showing the 5-ft. supporting piles, heavy concrete slab, and gate construction which will complete this unit of the spillway.

With cuts reaching a maximum depth of 145 ft., with work continuing almost steadily through a Montana winter, with 24-hr. operation seven days each week, and with nearly 13,000,000 bank yards moved over a mile by trucks in the period of one year, this unprecedented earth-moving job has broken many records.

Future Work in Lined Channel—Beginning in the spring of 1936, Spillway Builders, Inc. will undertake the construction of the lined channel. Approximately 1,000,000 cu. yd. of shale, which has been left in place for protection of the slab and wall surfaces against disintegration during the winter, will have to be removed. Some of the larger contract items yet to be placed are: 259,000 cu. yd. of concrete, 36,000,000 lb. of reinforcing steel, and 25 miles of tile drains. Total amount of the contract is $7,133,000. The Government will furnish cement and concrete aggregates.

Gate Structure

The contract for the gate structure (Fig. 5), and the cut-off at the end of the lined channel, was awarded in May, 1934, to Addison-Miller Inc., and Fielding & Shepley Inc., of St. Paul, Minnesota. The preliminary excavation in the entrance channel, by Spillway Builders, Inc., was completed in June. Operations in the vicinity of the gate structure by the Addison-Miller Co. were started immediately. Excavation of the protective shale cover, left by the preceding contractor, was begun in the approach slab area as the initial operation.

Observation of the previous excavation operations had convinced the contractor for the gate structure, as well as others associated with the work, that the shale demanded special equipment for trimming to finished line and grade. Pneumatic tools could be used but this manner of preparing surfaces against which concrete would be placed was known to be costly. The relatively soft shale invited machine methods. The contract requirements for sealing shale surfaces within 2 hr. after exposure with a spray coat of bituminous paint and for placing concrete thereon within 14 days, demanded speed.

Shale saws

The approach slab blocks included a rectangular cut-off collar 4 ft. deep at each transverse joint, and a modified coal-cutting saw was found well adapted to cut the necessary trenches. It was found that if the kerf made by the saw was promptly backfilled with the saw's cuttings, the trench did not need to be excavated immediately — the trench walls being sufficiently protected against disintegration. A trench was generally excavated by a pull-shovel or a clamshell after the center portion was broken down by air spades.

Trimming horizontal shale surfaces for slabs was facilitated by using a saw, (Fig. 6) which can cut a vertical, inclined or horizontal face by merely rotating the power head. This machine advances under its own power on rails, the blade making sweeping cuts through 180° of arc. The loose material is removed by a pull shovel or by hand permitting the saw to advance on its rails for another semi-circular cut.

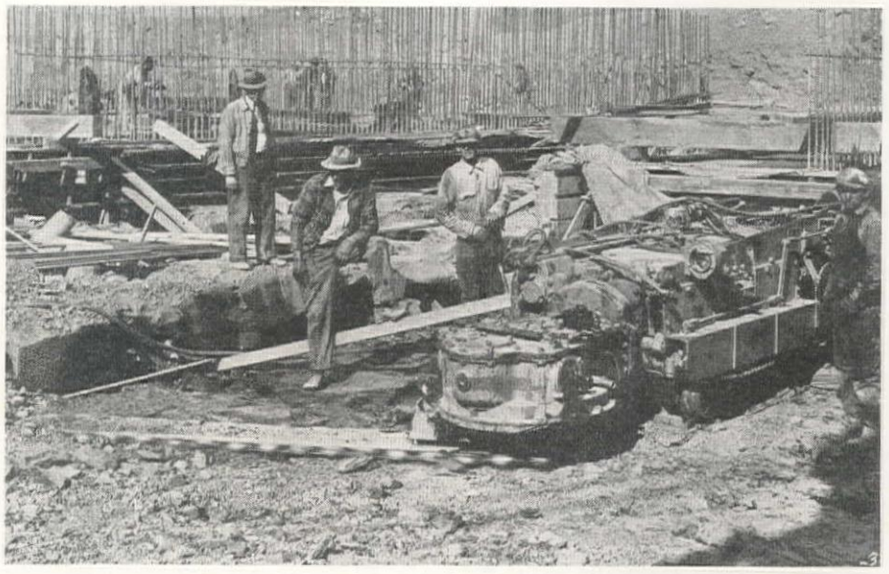


Fig. 6—Modified coal-cutting saw used in digging trenches for the cutoff collars and trimming the horizontal surfaces of the foundation shale for the gate structure. This type of saw, capable of cutting through an arc of 180° was advanced on rails after completing each arc. The loose material was removed by a pull shovel or by hand as the saw advanced.

Foundation piles

Further opportunity for machine work on the shale presented itself in the construction of the foundation piles under the pier slabs. The specifications required these 467 concrete piles, 5 ft. in diameter by 30 or 40 ft. deep, to be poured in place after the hole was excavated by some type of rotary drilling equipment. The contractor favored the use of a simple rig which in effect is a glorified earth auger (Fig 7). It is essentially a motor-driven shaft with a cutting assembly at the lower end, attached by a pin joint which allows the cutter to be dumped.

The cutting assembly consists of two semi-circular plates, slightly dished and warped, with cutting teeth of tungsten carbide welded to the lower radial edges. These plates are welded to the shaft. The shaft extends below the cutting plates about 9 in. and is pointed and studded with small, sharp teeth of tungsten carbide to form a pilot bit. Above the pin joint, the shaft is made of extra heavy pipe "hog-rodded" for resistance to bending. A telescoping pipe arm attached to the drive unit and to the crane's boom resists the torque of rotation.

Although the equipment had proven its ability to operate in stiff clays and other similar materials, several modifications had to be made to adapt it to Bear Paw shale. The gears of a tractor are used as a reduction and drive unit and a 40 h.p. electric motor furnishes the power.

Pile holes are started by cutting to a depth of 1 ft. with air spades. The boring rig is lowered gently to allow the pilot bit to spot its hole, power is turned on, and then the crane's load-line clutch is released sufficiently to put most of the drill's weight on the cutter. Drilling is continued until the cutter pans are full when the rig is raised and swung around to the dumping point. The driller's helper pulls a locking pin from the hinged joint, slips the looped end of the crane's closing line over a cutting tooth and signals for the crane operator to dump the load.

Releasing the closing line allows the cutting assembly to return to its digging position, the loop frees itself from the tooth which it engaged, the driller-helper quickly inserts the locking pin and the rig is swung back to the hole. The cutter is lowered into the hole under guidance of the driller who starts the motor, when the drill is seated, by a push-button switch held in his hand at all times. With the switch in his hand, the driller is able to cut-off the power instantly in case the bit encounters a calcareous concretion which have been found to be quite numerous in the shale. The rig is further protected by an overload switch and by shear bolts just above the hinged joint. The actual operation is very simple. About 5 ft. of hole are drilled per hour. The holes are surprisingly true in alignment even though there is no lateral restraint to the auger. A tolerance from a true vertical line of 1/60 of the depth is permissable for each hole but this variation is rarely noted. The weight of the rig is never entirely released upon the cutter, and, although the drive unit swings slightly during the drilling, this motion is compensating.

When the required depth is reached, the bottom is cleaned, sides blown or brushed free of dust, and the surfaces sealed with a spray coat of bituminous paint. To expedite drying and to relieve the painter from breathing the dense vapor generated by the spray, a draft of fresh air is forced to the bottom of the hole by a portable fan discharging through a canvas duct. Usu-

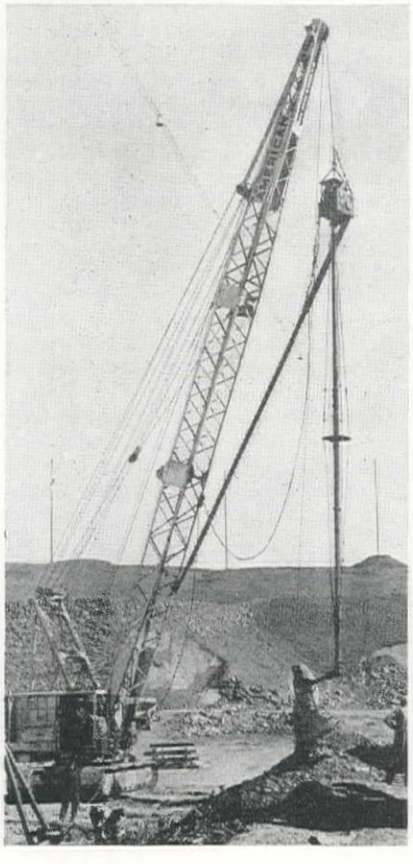
ally, within a day from the time of completing the hole, the reinforcing steel is inserted as a completely fabricated unit (Fig. 8) and the pile poured using 2-yd. buckets dumping into a hopper to which elephant-trunk chutes are attached. The concrete is thoroughly vibrated as the pour progresses.

Cut-off trench

The cut-off wall extending to a depth of 30 ft. under the upstream edge of the pier slab offered an opportunity to use the shale saws. Another disagreeable characteristic of the shale formation is that blocks will occasionally fall out of vertical faces without warning if the joint planes happen to be unfavorably arranged. Bracing of the cut-off trench walls was necessary to insure safety of workers and to resist the heavy pressures frequently encountered. Steel wales and struts were utilized, and, to a large extent, the walls were sheeted with corrugated metal. Grouting behind the sheets was regularly done to prevent any movement of the shale and thereby to insure an undisturbed impervious mass against the upstream face of the cut-off wall.

The shale saws moved under the sets of bracing when making their cuts along the walls of the trench. The material in the center of the trench was blasted lightly and removed by clamshells. Spraying the exposed shale surfaces with the sealing solution followed closely behind the excavation, then came sheeting and bracing, although sheeting was omitted as frequently as the structure of the shale would permit. The trench was filled with concrete, construction joints being sealed with a keyway and a steel sealing strip.

Fig. 7—Novel method of excavation used in boring the holes for the 5-ft. cast in place concrete foundation piles, which support the gate structure. This drill rig, developed on the job, operates like an ordinary post hole auger in the foundation shale. Lifted out of the hole with a load of cuttings, the pin joint is loosened and the material dumped as shown.



Concrete operations

Concrete for the gate structure is mixed in a central plant containing two 2-yd. tilting mixers. Aggregates are furnished the contractor by rail, dumped from a trestle and carried to hoppers in the mixing plant by belt conveyor running in a tunnel under the aggregate piles. Overhead gates in the tunnel permit the selection of aggregates as needed in the plant. Cement is furnished in bulk, pumped into storage silos and re-pumped to the cement hopper in the plant. Cement and aggregates are batched by weight, water content being controlled by automatic volumetric measurements. Moisture content of aggregates is determined at brief intervals and the water-cement ratio accurately controlled. Mixed concrete is transported by trucks from plant to forms in bottom-dump buckets.

Due to the extreme conditions of exposure, the mixes are designed with a high cement content. The water-cement ratio is kept to a minimum consistent with workability, and vibration by internal methods is used in placement. Six bags of cement per yard of concrete is the mix generally used except in heavy formation work of certain classes where a 5-bag concrete is authorized. The cement, furnished by the Government, is specially designed for this project and is highly resistant to alkaline waters.

Precautions are taken that concrete surfaces are effectively cured. The specifications require all concrete surfaces not finished against forms, to be cured with water for 12 days. In the slab work this was accomplished by placing a double thickness of burlap on green concrete surfaces as soon as they had set sufficiently to support the weight of a man, and then by sprinkling with a hose for the period stated. The burlap was continually saturated, but no excess water was used, as run-off from the concrete seriously affected the preparation of adjacent shale surfaces. Upon the termination of the water-curing period the concrete surfaces were thoroughly cleaned and then sprayed with a coat of bituminous waterproofing solution to lengthen the hydration period. Surfaces finished against forms were cured by surface treatment with one or more coats of waterproofing solution applied as soon as the forms were removed. Where it was desired to avoid discoloring the concrete surface, a clear waterproofing solution was applied. All solutions were furnished by the Government.

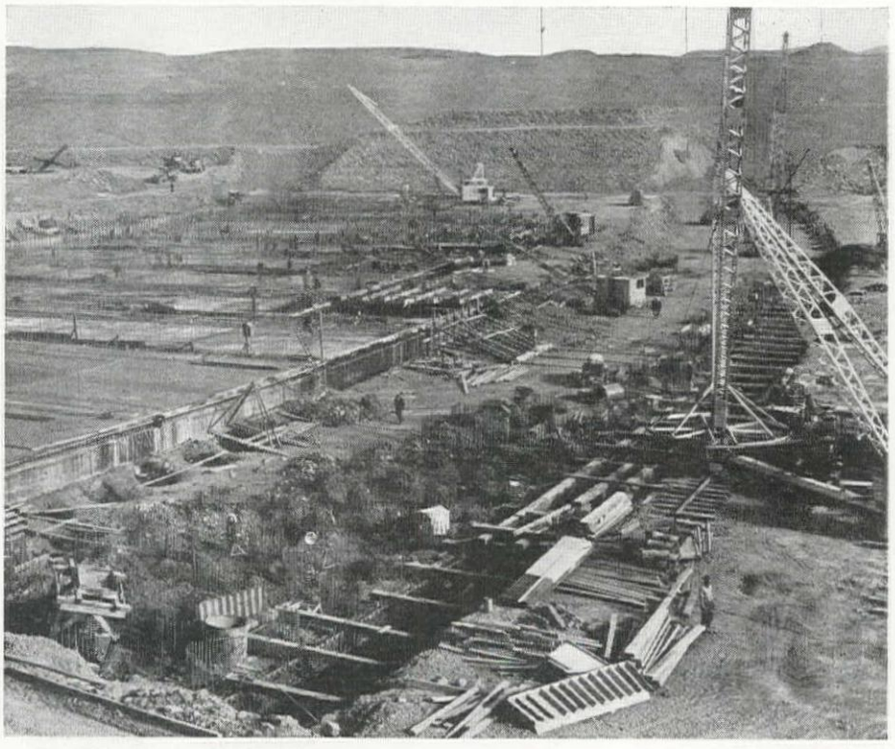


Fig. 9—General view of the excavation and foundation work on the gate structure. Foundation consisted of 467-5-ft. diameter concrete piles placed in bored holes, and a 10-ft. cutoff trench 30 ft. deep. The piles support a reinforced concrete foundation slab 75 ft. wide by 12 ft. thick on which rest the piers for the gates. Concrete placing is under way on the foundation slab in the background and the boring of the holes for the piles is under way at the left.

Cold weather protection

Concrete work in cold weather is limited to emergencies occasioned by sudden temperature drops, to construction procedure, or to the contractor's desire to continue the working season as long as possible. Freezing tempera-

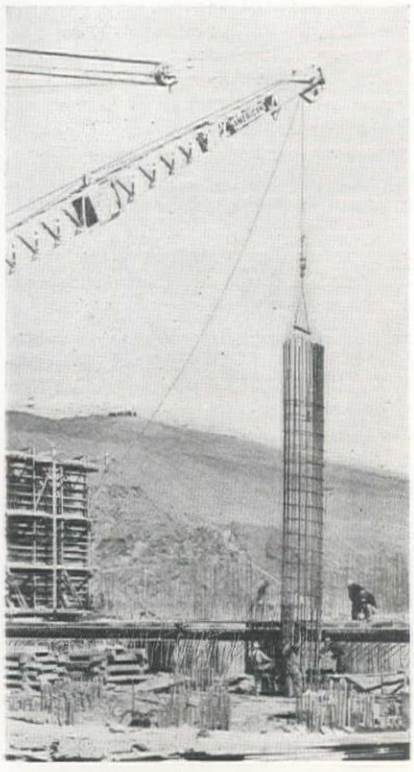


Fig. 8—Lowering a steel reinforcing cage into one of the 5-ft. diameter holes prior to concreting this foundation pile. Note the depth of the spillway cut which is 145 ft. at this point, indicated by the size of the spectators at the top of the slope in the background.

tures are frequently encountered in September, are certain to occur in October, and yet mild weather may exist for extended periods until Christmas.

When the atmospheric temperature was below 35°, or when freezing temperatures were forecast to arrive within 8 hr. after placement of the final concrete in a pour, the temperature of the concrete when deposited was kept between 50° and 100°, generally about 60°. The addition of heat was affected principally by heating the mixing water, although in low temperatures the aggregates were heated by means of coils in the hoppers above the mixers. If, during the first 72 hr. of curing, the ambient atmospheric temperature fell below 40°, the air coming in contact with the concrete was maintained between 50° and 70°.

A large amount of slab work in the training wall area was completed during freezing temperatures. It was found that the heat introduced in the concrete at the plant was sufficient to permit finishing without protection. Immediately thereafter a framework was erected which supported tarpaulins about 3 ft. above the slab surface, the sides of the tarpaulins falling over the sides of the slab form. A steam line was then bled into this improvised tent to keep the air temperature up to the required point. Care was taken to insure that all corners and edges were protected. Curing by the saturated burlap method went on under this tent as usual, but due to the use of steam little attention was needed to keep the mat wet. After the 72-hr. period expired, the only problem was to keep the curing mat from freezing.

If the temperatures were very low, the use of the tent and steam heat was continued, but usually it was sufficient to place covers of insulating paper over the moist burlap and the heat of hydration was ample to keep the surface of the concrete well above freezing. These slabs were 3 and 4 ft. thick and, therefore, generated considerable heat. To facilitate placing and removal of the insulating paper covers and to provide longer life for the material, light wooden frames, about 4 by 8 ft. were made up to hold the insulating paper in the fashion of a window screen. These covers were used principally at night, and a large number could be placed in a very short time when needed.

Pouring and curing the training walls in cold weather was a more difficult problem. The monoliths were 37 ft. long by 24 ft. high by 10 ft. thick. Steel forms were used in their construction. A canvas tent was erected around the steel forms prior to beginning the pour. When the pour was completed, the air in contact with the forms was kept to the required temperature by four large salamanders made from oil drums.

Operations were terminated for the season when it was evident that continuous cold weather had arrived.

Status of the work

During the 1935 working season the greater portion of the slab work (except pier slabs) was completed, about two-thirds of the foundation piles were poured, and the deep cut-off wall under the piers was completed to the abutments. Other miscellaneous excavation, grading and railroad work was performed.

In the 1936 season it is planned to complete the slabs, foundation piles, training walls, abutments, and adjoining walls forming the channel and to pour the lower portion of the gate piers. Work on the cut-off structure at the end of the lined channel, which is included in the contract for the gate structure, will also be started this year.

The gates and other metal work incident thereto are being fabricated in a Detroit plant and will be shipped for installation when required.

The total amount of the contract for the gate structure and the cut-off structure is $3,985,000. Adding this to the amount of the spillway contracts mentioned previously, the total of the contract work is $12,151,000.

Personnel

A. D. Harvey, general manager for Spillway Builders, Inc.

H. E. Daley, general superintendent for Spillway Builders, Inc.

H. C. James, general superintendent for Addison-Miller Inc. and Fielding & Shepley Inc.

L. J. Gavin, assistant general superintendent for Addison-Miller Inc. and Fielding & Shepley Inc.

W. J. Foster, was superintendent for Martin Wunderlich.

Planning and design of all features of the Fort Peck project have been performed in the Missouri River Division office of the Army Engineers at Kansas City, Mo., with Colonel R. C. Moore, Corps of Engineers, as Division Engineer. The responsibility for the field execution of all work is placed on the Fort Peck District with Major T. B. Larkin, Corps of Engineers, as District Engineer. Major Clark Kittrell, Corps of Engineers, is Chief of Operations, and the writer is in direct charge of spillway construction.

Equipment Used on Fort Peck Spillway

TO SUPPLEMENT the description of the design and construction of the Fort Peck spillway, presented in the foregoing article by Captain Hardin, *Western Construction News* secured from the contractors the list of larger equipment used on this work, as a service to our readers who are interested in earth-moving contracts and construction work of this general type.

The equipment used by Spillway Builders, Inc. (Massman Construction Co., Kansas City) follows:

- 45 White trucks, Model 718-D
- 25 Diamond T trucks, Model 512-DR —Special
- 5 Bucyrus Erie shovels, Model 43-B
- 4 Lima shovels, Model 701
- 9 Caterpillar tractors—75's, equipped with bulldozers
- 1 Caterpillar tractor—50
- 3 Tractors equipped with hand controlled graders.
- 14 Automobiles of various makes used in the supervision of the work.

This contractor reports that the gasoline consumed on this work was about 1,390,000 gal. with the diesel oil consumption 320,000 gal.

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Addison Miller, Inc. & Fielding & Shepley, Inc., St. Paul, Minn., report the following major units of construction equipment used on their contract.

- 25 Trucks from 1½ to 5-ton capacity
- 1 Northwest shovel crane, No. 6
- 1 Koehring—301 crane clamshell
- 1 Koehring—301 trench hoe and crane
- 1 American 1-yd. shovel crane
- 1 American 20-ton stiff leg derrick on railway tracks
- 2 American No. 500 cranes—20-ton
- 2 Caterpillar tractors, one with bulldozer
- 2 10-ton tractor trailers
- 2 Sullivan special shale saws
- 1 Sullivan CLU coal cutter
- 2 Hollingsworth drilling augers
- 1 Blaw-Knox batching plant
- 2 Smith 2-yd. concrete mixers
- 8 Blaw-Knox concrete buckets

Blaw-Knox steel forms
Fuller-Kinyon cement unloading and conveying equipment.
Gardner Denver and Ingersoll-Rand compressors.

The shale saws, according to information supplied by the contractor, were manufactured by the Sullivan Machinery Co., two being adaptations of their long-wall cutter used for mining coal and the third was a standard machine. These machines operate on 440-volt built-in motors. The long wall type were arranged for mounting on a track and used for cutting the side walls of the trenches. The CLU type of cutter travels on its own wheels on a track and was used both for trimming the horizontal slabs and also cutting the trench walls.

The augers used for drilling the 5-ft. diameter pile holes were a development of D. M. Hollingsworth of St. Louis. They were larger and required more power than any previous machines of this type and it was necessary, finally, to build the driving heads on the job. These heads were built from gears of Caterpiller tractors mounted in a special welded steel boxes, driven by 40 h.p. General Electric motors. The augers were handled by the American cranes.

Concrete Flume Built on California Power System

New structure replaces 15-yr.-old timber flume on conduit to Hat Creek No. 2 power plant—Annual saving of $5,500 effected

By I. C. STEELE

Chief of the Division of Civil Engineering
Pacific Gas and Electric Company
San Francisco

THE Pacific Gas and Electric Company recently completed and placed in operation 4,167 ft. of reinforced concrete bench flume, replacing all timber flume leading to its Hat Creek No. 2 power house located on Hat Creek in Shasta County, California, at a cost of about $120,000.

The timber flume and power plant were constructed in 1921. The flume was of untreated wood construction 16 ft. wide and 8 ft. deep. During the past few years this structure required considerable maintenance and by the spring of 1935 the timber had deteriorated to such an extent that complete replacement was essential.

An economic study was made to determine: (1) the annual cost of replacing the existing flume with short sections comparable to maintenance, (2) replacing in one operation, and (3) complete replacement with reinforced concrete bench flume similar in design to the company's Tiger Creek conduit (*Western Construction News*, Dec. 10, 1930).

The annual cost of the concrete structure was found to be approximately $2,500 less than the wooden structure without considering the value of power lost through leakage and due to plant outages caused by flume breaks and maintenance. The average annual value of power lost during the past 10 years due to flume outages alone, was estimated as about $3,000. The total annual saving is, therefore, to the order of $5,500.

Design features

A hydrographic study was made of the average flow of Hat Creek over a period of 18 years. This indicated that the flume capacity could be reduced from its original capacity of 800 sec. ft. to 600 sec. ft.

Hydraulic design of the concrete flume was governed, at the head end, by the maximum allowable water surface at the diversion dam and at the lower end, by the normal maximum water level at the existing concrete side-channel spillway located immediately above the header box for the penstock. This established the grade of the new structure at .00065, with the elevation of the bottom of the concrete structure approximately 3 ft. above the top of the old flume bench, necessitating the construction of a compacted fill upon which to place the concrete structure.

The new flume is 18 ft. wide and 7 ft. deep—inside dimensions. The 7-ft. depth of flume was selected to permit the use of the steel forms and construction equipment which were purchased and successfully used in the construction of the Tiger Creek conduit (see *Western Construction News*, Dec. 10, 1930). Special transition sections were required at each end of the flume to form suitable connections to the existing permanent structures.

A normal freeboard of 15 in. was selected. Upon rejection of load at the power house, the freeboard will be reduced to about 6 in. at the lower end of the flume due to back water. The value of n in Kutter's formula was selected at .015 because of known bad conditions of algae growths in the region, during certain seasons of the year. This is a higher value than would be expected to obtain on a smooth concrete surface. The velocity for a flow of 600 sec. ft. is 6 ft. per sec. The inside of the flume was coated with water-gas tar, a by-product of manufactured gas, as an experiment to combat the growth of algae.

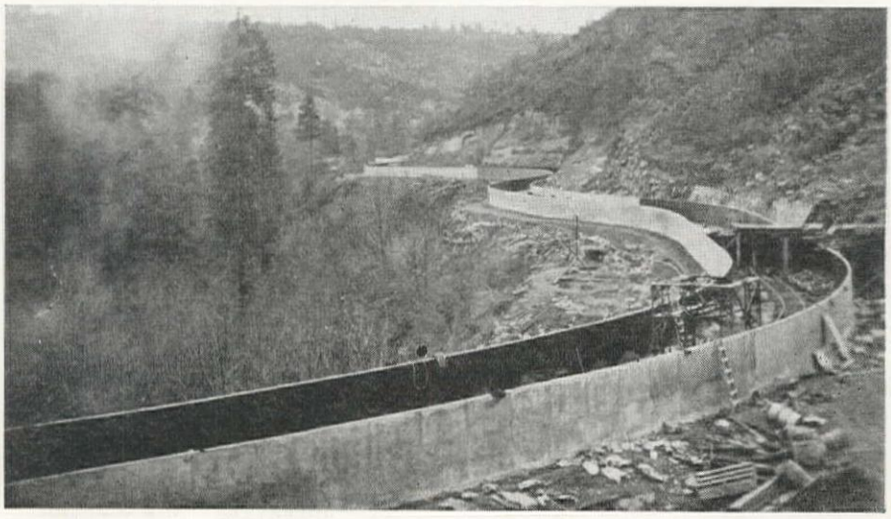
Ground topography permitted a minimum 150-ft. radius center line curvature. The design strength of concrete was 2,500 lb. per sq. in. at 28 days.

Construction features

The old timber flume containing about 1,600 M board feet was removed by burning. The flume was divided into sections, each several hundred feet long, and a simple but effective fire protection system installed to control the rate of burning and to prevent spreading.

Material for the compacted fill, upon which the flume would rest, was procured from several borrow pits along the flume alignment and consisted principally of diatomaceous earth and sandy silt. The fill material was placed in 6-in. layers by a 7-cu. yd. LeTourneau unit, each layer being thoroughly consolidated with a petrolithic roller and a 30-Caterpillar tractor before spreading material for the next layer. Moisture in suitable quantities was added

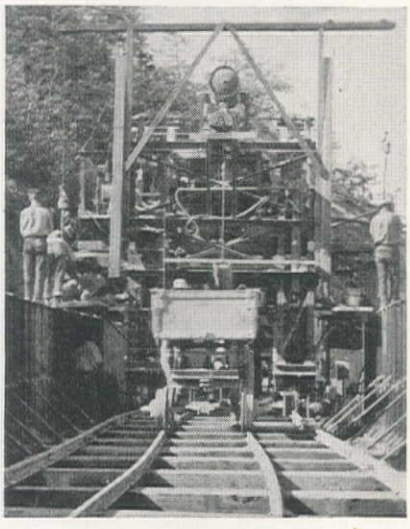
This 4,167 ft. of reinforced concrete bench flume, which replaces fifteen-year-old untreated timber flume, effects an estimated annual saving of about $5,500.



to aid compaction. The completed fill contained 11,072 cu. yd., measured in place.

The alignment of the old flume was straightened somewhat, the concrete flume being 97 ft. shorter. The new flume is 4,167 ft. long, of which 150 ft. consists of an elevated reinforced concrete structure with five 23-ft. spans, one 24-ft. and one 10-ft. span. The maximum height of substructure is 15 ft.

Details of construction were similar to those used in building the Tiger Creek flume for the Mokelumne River development in 1930. This work was described in detail in the previously mentioned article in *Western Construction News*, Dec. 10, 1930. Concrete ties were first cast at 5-ft. intervals along



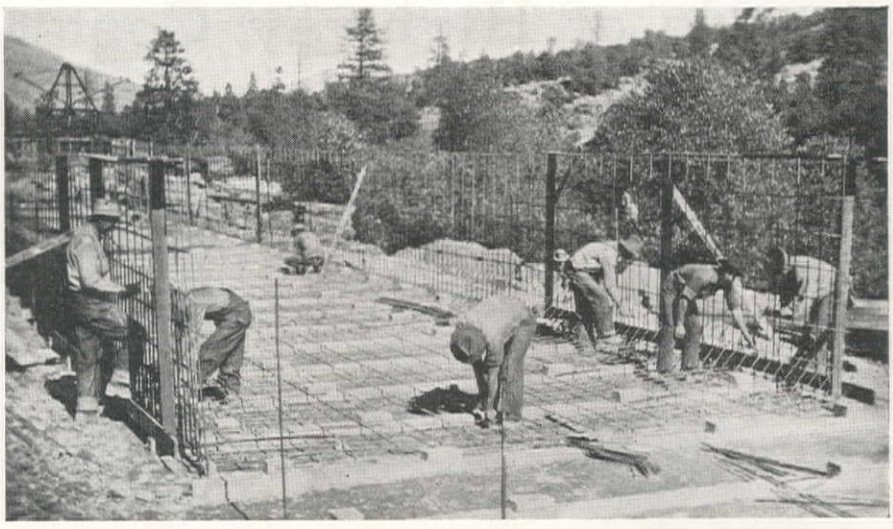
The concreting jumbo operated on the outside tracks. Batched aggregate was hauled in cars pulled by gas locomotive. Using 20-ft. panels, the side-walls and floor of the flume were concreted at a rate of about 100 ft. per day. The timber beam across the top of the jumbo supported the electric, internal vibrators used in placing the side-wall concrete.

the flume bench, for supporting the steel-panel wall forms. The system of tracks for operating the concrete placing equipment and the batch car hauling also rested on these concrete ties.

Setting, stripping and transporting of the steel forms was done with a steel jumbo, operating on the track inside the flume. Another jumbo containing the concrete mixer, was mounted at a height sufficient to permit chuting into the side-wall forms. Cement and batched aggregate were delivered in special batch cars pulled by a 3½-ton gas driven locomotive, operating on the tracks in the flume.

Concrete placing was carried on in 20-ft. sections, pouring the floor and the side walls as the jumbo advanced. About 100 ft. of flume was completed per day. Forms were stripped by the jumbo and moved ahead to be set up around the wall steel which was placed in advance.

Concrete aggregate consisting of ¾-in. rock and fines passing a ¼-in. screen was produced from lava rock by means of a crushing and screening plant set



Placing floor and side-wall steel in advance of form setting. The concrete ties on 5-ft. spacing were cast in a prevous operaton.

up near the lower end of the flume. Suitable pit sand was obtained locally and mixed with the crusher fines in about equal proportions. A slump of 3½ to 4½ in. was adopted. Electric driven vibrators of the internal flexible shaft type were used and produced excellent results.

Curing of the concrete was done on the outside surface of the walls by suspended canvas kept wet through a perforated pipe running along the top of the wall, and on the inside by sealing the surface with silicate of soda immediately after stripping the form panels. The concrete in the standard bench flume section averages 0.7 cu. yd. per foot of flume and in the elevated structure about 1.7 cu. yd. per foot.

Construction work was handled by company forces under the direction of O. W. Peterson, engineer of construction, and H. W. Haberkorn. J. E. Cooney was field superintendent. Contracts were awarded to Claude C. Wood of Stockton for the compacted fill, to J. H. Hein of Napa for rock crushing, and to several local contractors for hauling.

The economic studies and designs were made by Walter Dreyer and T. J. Corwin under the general direction of the writer.

Registrar of Contractors Appointed

EARL S. ANDERSON, well known contractor in Southern California has been named State Registrar of Contractors by Wm. G. Bonelli, Director of the State Department of Professional and Vocational Standards. The appointment was made by the State Contractors' License Board which is a division of this department. Mr. Anderson succeeds Mr. Bonelli who has been acting as Registrar for the Board, in addition to his regular duties as director of the department and member of the Governor's cabinet.

Mr. Anderson was formerly general manager and hydraulic engineer for the Hadden Company, Ltd., of Los Angeles, and during the past twelve months he has served as secretary to Governor Merriam in charge of legislative matters.

"To the contractors of the state," stated Mr. Anderson, "in all humbleness, I wish to express a desire to render the best service which my capabilities will allow. I hope to see the construction industry, which is one of the most important necessities of present civilization, elevated to a higher level as a matter of service to the public, as well as to every contractor and laborer supported by any of its ramifications. I shall overlook no opportunities to carry out the policies of the Contractors' License Board, and hope to build up the closest possible relationship between the 24,000 present licentiates and the Bureau."

Director Bonelli, in announcing the appointment stated, "Mr. Anderson was drafted by the Contractors' License Board after many weeks of careful deliberation. My acquaintance with him has shown him to be well equipped with initiative and resourcefulness. I know that he brings to his new position a sincerity of purpose that will reflect most favorably upon the Contractors' Board and state service as a whole."

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San Diego A. G. C. Elects

At the annual meeting and banquet of the San Diego Chapter, Associated General Contractors, held on Feb. 13, the following officers were elected for the ensuing year: C. B. Grove, president and M. H. Golden, vice-president. V. R. Dennis, the retiring president, reviewed the chapter activities during 1935, and, in closing, predicted an active and profitable period during the next few years.

Trends of Highway Costs and Bid Prices in Wyoming

Accurate data on the trend of highway costs and the analyses of bid figures are of interest to all highway engineers and contractors. The information in this review of cost statistics from Wyoming presents not only a break-down of the total cost figure into grading and drainage items, but also a study of the characteristics of some recent bid figures. The author bases his information and analysis on years of engineering experience with the Wyoming State Highway Department and is qualified to review the subject and address some pertinent remarks to highway contractors.—Editor.

A statistical analysis of 1929 to 1934 costs, with detailed information on some typical bids during 1935—A word about "bidding systems"

By MARK M. KELLEY

THE CONTRACTOR who bases his bid upon facts may be underbid, but displays far better business sense and will be more successful than the contractor who takes the award on a low bid based on guess work. If a contractor feels inclined to bid, without having actual facts on which to base his figures, he must bid relatively higher to insure against his haphazard method of arriving at costs. The following review of highway costs and unit bids on highway work results from an extensive study on highway work in the State of Wyoming extending over several years. This review is presented in the spirit of constructive criticism in an effort to point out certain characteristics of highway bidding and to give information on the cost of highway work in Wyoming.

The contractor who knows his costs is the one who secures the confidence of those who award contracts and also the men in his own organization. He should be as familiar with the cost of every item in the bid proposal and the price he must ask for this item, as the merchant is with the cost and prices of goods on his shelves. He should watch the market fluctuations in prices of materials, the possibility of labor complications, and the rates of transportation. The sources of this material are numerous and include technical publications providing the records from other highway jobs, government circulars, and miscellaneous pamphlets from organizations supplying materials and transportation service. In this connection, the contractor should not forget the constantly changing developments in construction equipment and the possibility of producing costs and changing methods of operations with the installation of new machines.

Of fundamental importance is the visit to the scene of the proposed project through which the contractor must grasp the hundred and one details that cannot otherwise be obtained. On this visit he should insist on being directed by a representative of the agency calling the bids. This visit to the site, of course, should be supplemented by a thorough study and complete understanding of the plans and specifications, including the legal phases.

In some states, the Notice to Contractors is released only ten days before the bids are called and this presents a distinct handicap to some of the prospective bidders.

Bids on recent Wyoming projects

In Table I is shown a review of four grading and drainage projects awarded by the Wyoming State Highway Commission in 1935. The information presented outlines the physical conditions encountered, the three low bids compared to the engineer's estimate and the relation between grade and drainage costs on these jobs. These projects, located in various parts of Wyoming, represent a fair cross section of the costs of grade and drainage work last year. In all four cases the work was awarded to the low bidder. A study of this material would indicate some of the characteristics of these bids. On the first job "A," the prequalifications of bidders was not required as it was on the other three which were let at a later date during the year.

A study of Table I indicates that there were 72.58 mi. of highway to be graded and drained, 26 treated timber bridges to be constructed in addition to one steel bridge and 19 reinforced concrete culverts. All corrugated metal pipe, ordinarily included in grading contracts, has been separated from the grading costs and added to the cost of the bridge bids, to make the proper distinction between the costs of grading and drainage. This separation has been made for the express purpose of comparing the costs in these contracts with the tabulations made by the State Highway Department of Wyoming for

TABLE II—Details of the Bids on Projects "A" and "B" from Table I.

No.	Item	Unit Quan.	(A) Rough Mountainous—7.32 mi. Quan. Per Mi.	Low Bid Unit Price	Low Bid Total Per Mi.	Eng. Estim.	(B) Rolling Prairie—13.3 mi. Quan. Per Mi.	Low Bid Unit Price	Low Bid Total Per Mi.	Eng. Estim.
2	Exc. Unclass.	Cu. yd.	17,900	0.46	8,220	0.50	18,280	0.169	3,080	0.20
8	Overhaul	Sta. yd.	6,830	0.015	100	0.015	7,010	0.015	100	0.015
61	Rt. of Way Fence	Lin. ft.	10,590	0.07	740	0.05	10,200	0.0375	380	0.045
Total cost per mi. for Grading					$9,060				$3,560	
4a	Dry Exc. for Bridges	Cu. yd.	25.3	1.25	30	1.00	2.6	1.00	3	1.75
32b	Tr. Timber	M. B. M.	5.7	110.00	550	115.00	9.4	115.00	1,080	110.00
34a	Class A Concrete	Cu. yd.	5.7	18.00	100	20.00	10.8	23.00	250	22.00
35	Rein. Steel	Lb.					880	0.065	60	0.06
36	Struct. Steel	Lb.								
39c	Cor. Pipe	Lin. ft.	150	1.65	250	2.30	1.9	1.80	30	2.15
50a	Tr. Timber Piling	Lin. ft.	142	1.25	180	1.20	280	1.15	320	1.10
Total cost per mi. for Drainage					$ 1,110				$1,740	
Total cost of one mi. of road—Grading and Drainage					$10,170				$5,300	

TABLE I—Four Representative Grading and Drainage Projects of Wyoming in 1935.

Project	Description	Length Mi.	Three Low Bidders	Bids	Engineers' Estimate	Grading Per Mi.	Bridges Per Mi.	Grading %	Bridges %
A	Grading, drainage and miscellaneous work. Four timber bridges. Rough, nearly mountainous section of Albany Co.	7.325	**Grading**						
		(a)	Low	$73,207					
			Second	86,948	$78,217	$10,000		90	
			Third	119,971					
			Drainage						
		(b)	Low	8,386					
			Second	8,417	8,177		$1,140		10
			Third	9,484					
B	Grading, drainage and miscellaneous work. Eight timber bridges, three concrete culverts. Rolling prairie in Converse Co.	13.352	**Grading**						
		(c)	Low	55,170					
			Second	55,778	66,579	4,100		66	
			Third	58,896					
			Drainage						
		(d)	Low	27,994					
			Second	28,132	26,245		2,100		34
			Third	28,450					
C	Grading, drainage and miscellaneous work. One steel and one timber bridge and six concrete culverts. Broken, choppy hills in Johnson Co.	14.850	**Grading**						
		(e)	Low	128,812					
			Second	152,367	168,836	8,700		64	
			Third	157,993					
			Drainage						
		(f)	Low	72,431					
			Second	81,974	76,065		4,900		36
			Third	82,502					
D	Grading, drainage and miscellaneous structures. Thirteen timber bridges and seven concrete culverts. Rolling broken prairie in Lincoln and Uinta Co.	37.051	**Grading**						
		(g)	Low	115,790					
			Second	163,680	174,560	5,800		79	
			Third	168,129					
			Drainage						
		(h)	Low	41,184					
			Second	44,066	44,449		1,500		21
			Third	47,529					

Notes: (a) 1,994 ft. corrugated metal pipe, $5,595.
(b) 4 treated timber bridges, $8,387.
(c) 2,232 ft. C.M.P., $4,208.
(d) 8 tr. timb. bridges; 3 rein. conc. culverts, $27,994.
(e) 4,474 ft. C.M.P., $7,241.
(f) 1 tr. timb. bridge; 1 steel bridge, 6 rein. conc. culverts, $72,431.
(g) 7,702 C.M.P., $15,918.
(h) 13 tr. timb. bridges; 7 rein. conc. culverts, $41,184.

the years 1927 to 1934 inclusive, later appearing in Table III.

The total expenditure for the eight contracts, according to the bids, was $562,977 with grading representing $412,980 and the bridges $149,996. Subtracting the $32,963, for corrugated metal pipe from the grading costs and adding it to the bridge costs, the total for grading was $380,017, and for drainage, $182,960. The adjusted proportion between these two costs is 67% for grading and 33% for drainage.

The approximate costs per mile are also indicated in Table I which shows the grading costs varying from $10,000 to $4,100 per mi. and the drainage costs (bridges) from $1,140 to $4,900. These figures indicate a wide variation between the grade and drainage costs for any one mile of highway work, being 90% to 10% in one case and 64% and 36% in another. Obviously, the reason for this result directly from the topography of the country but it is important to observe the difficulty in estimating either one or the other independently.

Of special significance to state highway engineers, is the fact that in all but two of the contracts the bids were considerably below the engineer's estimate, with the award, in each case, to the low bidder. The bids ranged from 6% below the engineer's estimate to 24% below. In the latter case, this represented a difference of $40,000 between the engineer's estimate and the low bidder. Naturally such questions arise as, "What does this mean?" "Can the contractor operate on a legitimate profit?" "Were these bidders ignorant of costs and conditions?" The answers must be based on the figures contained in the engineer's estimates. In many cases these are the results of average bids on similar items during previous months. This estimating procedure has a tendency to lower prices for the next estimating period. Furthermore, many contractors use the same system of determining bid prices which tends to further depress the bid figures. It is certain that if engineers and contractors used actual cost data, the bids should correspond more closely with the estimates.

It is the usual case for highway commissions to reject bids when they are considered to be too far above the engineer's estimates. It is a fair question to consider at what per cent below the engineer's estimate bids should be rejected as being too far out of line as to indicate incompetent or incorrect bidding. On this point, of course, there are many factors which enter into the consideration, making the answer difficult to obtain. However, there are many instances on record of contracts which were let to low bidders who were decidedly out of line on their estimates of costs, with the result that the final cost was greater because of some error on the part of the bidder.

In Wyoming, as in many other states, the surety company is held responsible in the case of a contractor failing to complete the work. Surety companies, no doubt, hesitate before issuing a bond when the bids are substantially below the engineer's estimate. The present system of open bidding on highway work is not intended to cause contractors or surety companies to lose money on highway work or force contractors into cut-throat competition. Theoretically, bidding has been

TABLE III.—Trends of Grading, Drainage and Surfacing Costs from 1929 to

No.	Item	Quantity	1929 Price	1929 Amt.	1930 Price	1930 Amt.	1931 Price	1931 Amt.	1932—Jan.-July Price	1932—Jan.-July Amt.
2	Exc. Unclass.	14,287 Cu. yd.	.2089	2,984.55	.213	3,043.13	.1895	2,707.38	.1678	2,397.35
8	Overhaul	6,417 Sta. yd.	.025	160.42	.025	160.42	.025	160.42	.0151	96.89
61	Rt. of Way Fence	10,560 Lin. ft.	.0441	465.69	.0392	413.95	.047	496.32	.0383	404.44
	Total Cost of Grading		26.0%	3,610.66	26.8%	3,617.50	28.6%	3,364.12	31.3%	2,898.68
4a	Dry Exc. for Bridges	82 Cu. yd.	1.055*	86.51	1.055*	86.51	1.055*	86.51	1.055	86.51
32b	Tr. Timber	4.6 M.B.M.	81.51*	374.94	78.57*	361.42	77.30*	355.58	69.49	319.65
34a	Class A Concrete	36.5 Cu. yd.	25.45	928.92	23.37	853.00	23.66	863.59	17.98	656.27
35	Rein. Steel	3.983 Lb.	.0557	221.85	.0563	224.24	.0576	229.42	.0467	186.00
36	Struct. Steel	7.185 Lb.	.0717	515.16	.0698	501.51	.0672	482.83	.0512	367.87
39	Cor. Pipe	255 Lin. ft.	2.403*	612.76	2.403*	612.76	2.403*	612.76	2.403*	612.76
50a	Tr. Timber Piling	198 Lin. ft.	1.314*	260.17	1.251*	247.69	1.112	220.17	.989	195.82
	Total Cost of Drainage		21.6%	3,000.31	21.4%	2,887.13	24.2%	2,850.86	26.2%	2,424.88
20a	Gravel Surfacing	4,113 Ton	.723	2,973.69	.716	2,944.90	.538	2,212.79	.3136	1,289.83
20e	Haul of Surf. Mat.	16,975 Ton mi.	.1524	2,586.99	.1381	2,344.24	.0961	1,631.29	.0598	1,015.10
66	Processing Roadway	12,016 Sq. yd.	.0469*	563.55	.0469*	563.55	.0469*	563.55	.0469	563.55
67	Oil Asphalt	17,117 Gal.	.0595*	1,018.46	.0595*	1,018.46	.0595*	1,018.46	.0551	943.14
72	Seal Coat	1,503 Gal.	.0831*	124.89	.0831*	124.89	.0831*	124.89	.0831	124.89
	Total Cost of Surfacing		52.4%	7,267.58	51.8%	6,996.04	47.2%	5,550.98	42.5%	3,936.51
	Total Cost One Mile Complete Road			13,878.55		13,500.67		11,765.96		9,260.07

* Actual bid prices not available. Price determined from best available data.

proven to be one of the most satisfactory methods of arriving at just and fair prices when large sums are involved. As a result, bidding becomes a process which results in the survival of the fittest, which is another way of saying that those contractors with the best knowledge of costs survive.

Detailed figures from 1935 bids

In Table II are presented the detailed figures for the low bids on two of the projects indicated in Table I. These two (A and B) were selected because they represented two extremes: (A) rough, nearly mountainous country, and (B) rolling prairie.

The items selected for grading and for drainage were chosen to conform with a table of trends of costs (Table III) of a typical mile of Wyoming highway as compiled by the state highway department. Minor, miscellaneous items are purposely omitted from the table for the sake of uniformity. To those familiar with the tabulation of bids, these figures are self-explanatory. The only unusual feature is the grouping of all items relating to drainage and the quoting of only three items in the grading group.

Trends of highway costs

Data presented in Table III, prepared by the state highway department, indicate the trends of the cost of highway work based on 500 mi. of highway construction. It was found that the average grading per mile during the last several years amounted to 13,600 cu. yd. Some of this work was classified, so in order to use the unit price for unclassified material, this figure was raised to 14,287 cu. yd., increasing the quantity rather than the unit price. Also, as there was no unclassified item prior to 1931, the earth price in Table II was used in place of the price of unclassified. These assumptions are not entirely consistent but the errors introduced do not materially affect the results. Adding the cost of overhaul and right of way fences, these three items are considered to constitute the entire grading cost.

The trend in highway costs, taken from Table III, ranges from $2,500 to $3,000 for drainage and from $3,000 to $4,000 for grading on what is assumed to be a typical mile on Wyoming highways. As a result of the higher labor costs during 1935, recent figures would be higher.

Bidding systems

Some bidders pride themselves on their bidding "system." Almost any system is better than no system at all but, obviously, some systems are better than others. If a contractor's system requires a complete overhauling every few months, it could hardly be dignified by that title. On the other hand, if unit prices have been carefully studied and reduced to percentages, it is quite possible to apply the figures to almost any proposal, allowing slight changes for variations in market prices, transportation costs and local labor difficulties. In this connection, a recent bulletin issued by the United States Department of the Interior entitled "An Economic and Statistical Analysis of Highway Construction Expenditures," prepared by the Bureau of Public Roads, presents the following average proportions of cost for three main items of highway construction:

Grading	20%
Structures	16%
Surfacing	64%
	100%

If only grade and structures are to be considered, these percentages become 55% for grading and 45% for structures.

These percentages were based on a nation-wide survey; corresponding figures for Wyoming would be more nearly 60% for grade and 40% for structures.

This government bulletin also indicates the following division of costs:

Labor	24%
Equipment	21%
Materials	49%
Miscellaneous	1%
Other expenditures	5%
Total	100%

In conclusion

If the highway contractor will begin to apply such simple facts as have been pointed out in the foregoing, even on a small scale, to every phase of his bidding, he will not only build up a valuable system for the determination of his cost figures but will also demonstrate to himself the price below which he cannot afford to bid without losing money.

The evolving of any dependable cost system requires accurate accounting of costs on each project. Items may then be grouped together or further subdivided in any way desired. If proposals require bids to be based on the unit of lineal feet, the contractor should know his final costs in terms of this unit. To do this accurately, the contractor should know how much his labor and material cost per lineal foot. With this unit of cost determined, it is then relatively simple to convert it into cost per mile or other similar units.

1934 for a Typical Mile of Wyoming Highway.

1932—Aug.-Dec. Price	1932—Aug.-Dec. Amt.	1933 Price	1933 Amt.	1934—Jan.-Apr. Price	1934—Jan.-Apr. Amt.	1934—May-Dec. Price	1934—May-Dec. Amt.
.2208	3,154.56	.263	3,757.48	.224	3,200.28	.2318	3,311.73
.015	96.25	.015	96.25	.015	96.25	.015	96.25
.0493	520.60	.0465	491.04	.0438	462.52	.0499	526.94
35.4%	3,771.41	34.4%	4,344.77	30.6%	3,759.05	34.7%	3,934.92
1.094	89.70	1.340	109.88	1.13	92.66	1.2009	98.47
66.54	306.08	87.38	401.94	95.57	439.62	94.661	435.44
19.42	708.83	21.37	780.00	20.39	744.23	20.2287	738.35
.0456	181.62	.0540	215.08	.0518	206.31	.0495	197.16
.0552	396.61	.0589	423.19	.0552	396.61	.0537	385.83
2.403*	612.76	2.403	612.76	2.537	646.93	2.3460	598.23
.9717	192.39	1.049	207.70	1.043	206.51	1.0079	199.56
23.4%	2,487.99	21.8%	2,750.55	22.2%	2,732.87	23.4%	2,653.04
.3815	1,569.10	.519	2,134.64	.536	2,204.56	.4047	1,664.53
.0630	1,069.42	.0743	1,261.24	.0814	1,381.76	.0638	1,083.00
.0485	582.77	.0610	732.97	.0669	803.87	.0542	651.27
.0612	1,047.56	.0748	1,280.35	.0712	1,218.73	.0696	1,191.34
.0831*	124.89	.0831	124.89	.122	183.36	.1068	160.41
41.2%	4,393.74	43.8%	5,534.09	47.2%	5,792.28	41.9%	4,750.55
	10,653.14		12,629.41		12,284.20		11,338.51

Factors such as these lend themselves to presentation in the form of graphs or curves which help to give the contractor a picture of what he should bid on future jobs. These working facts, modified by the contractor's experience, and the information which is pertinent to each individual job, should make the difference between profit and loss in highway work.

Field Testing Machine for Bearing Capacity of Soils

Gas actuated jack maintains uniform loads during test period—Cycle of load applications determines settlement characteristics

A MACHINE for field determination of the bearing capacity of soils, as an aid in foundation design, has been developed during the past year by Abbot A. Hanks, Inc., testing engineers, San Francisco and Hyde Forbes, engineer geologist, San Francisco, associated in foundation investigations. The machine has been used on several extensive foundation studies and is briefly described in the following.

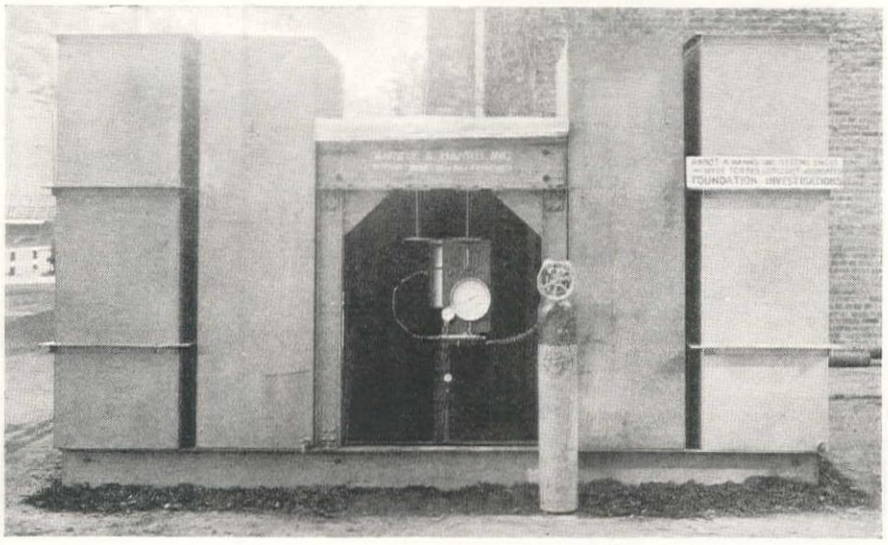
The elements which enter each foundation problem and form the basis for judgment are first, the character of the foundation material, particularly as to homogeneity, density, and stability, second what effect will change in moisture conditions, unbalanced loading, or earthquake shock disturbance have upon the material, and third what resistance to settlement will the material present to unit loads. The first and second elements of the foundation problem are determinable through boring exploration and investigation of the geological conditions. The third element is determined by load test and furnishes values which can be related to the whole. The machine developed for making the soil load tests utilizes a gas activated, calibrated jack, regulated to maintain uniform loads during any designated load application. This machine has been used during the past months in measuring the soil resistance under load relative to the foundation design for school buildings, reservoirs, and large water tanks and other structures in the San Francisco Bay region.

The operation of the machine permits the determination of the effect of various load applications, partial or total load release and recompression effect through a full load cycle to and beyond the failure of the soil. The soil settlements are measured with an Ames Dial having direct readings to 0.001 inch which is connected with the bearing plate set at the location and depth below ground surface prescribed by the preliminary geological study. These plates are of 2 sq. ft. and 4 sq. ft. area dependent upon soil conditions. The machine, shown in the accompanying illustration, consists of a head frame for the jack, with tanks for the counter weight load.

The load-settlement characteristics, namely the stress reaction and deformation under load of the unit soil area tested is determined by measurement of the deflections of the soil in place under load in the field with conditions exactly paralleling actual construction. The observations are plotted graphically to facilitate the analysis of the amount of compression the soil undergoes and the rate at which the compression proceeds as the load is developed. From these results the safe bearing capacity of the foundation material, the amount of settlement of the soil surfaces under the load, the time-settlement relation, and extent of differential settlement are judged upon a basis of a correlation of the physical characteristics of the soil unit tested with those obtaining over the entire soil mat to be loaded, as revealed through the geological investigation and exploratory borings.

Some of the investigations have presented unique problems in ground water influences involving uplift, resistance to lateral movement in landslide under the proposed loading, and in the case of reservoirs, large daily live load variations.

Set up in the field, the machine includes headframe, jack, gas cylinder and tank counter weights.



Intermountain News . . .

Colorado water study

Colorado has been allotted $280,000 for surveys of water resources, with the total cost of the work expected to be about $500,000. The studies will probably be directed by the Reclamation Bureau, possibly aided by other government agencies.

One of the most important allotments included in this sum is $100,000 for the survey of the Blue River diversion project, designed to bring part of that river's flow into the South Platte. It is estimated that the project would yield 218,000 ac. ft. of water, and would involve a tunnel costing an estimated $20,000,000, depending on the site selected, a $6,000,000 compensating reservoir on the western slope, and two storage reservoirs on the eastern slope estimated to cost $5,000,000. A point near Dillon is the site most frequently mentioned for the tunnel.

Another important phase of the study, to cost about $150,000 will cover possible western slope irrigation and power developments. The Bureau of Reclamation is expected to handle this work entirely, as it has that on the Grand Lake diversion project survey, which will be completed soon at a cost of about $150,000. This latter work has been in progress for some time. A $30,000 allocation was made for the Bureau's part in investigations of the Rio Grande Valley water resources problem. The total cost of the Rio Grande surveys which are partly sponsored by the Rio Grande compact committee, will be about $300,000. The Bureau's share of this fund will amount to about $100,000.

Wyoming irrigation projects

Construction has been postponed on one of Wyoming's largest irrigation projects, by the rescission of a PWA allotment of $484,545, made to the Bear River Irrigation District, Uinta County, Wyoming. Rescission was made when the irrigation district was unable, because of suits pending in the courts, to begin work by Dec. 15, 1935, which was the deadline set for projects receiving appropriations from the Emergency Appropriation of 1935. It is reported that in spite of this setback, however, the project has not yet been abandoned.

Considerable preliminary work had been begun, and a drilling rig had been set up at the dam site for the purpose of making tests for bed rock and formations, and preliminary investigation of the diversion canal. T. H. Baldwin of Cheyenne, for several years city engineer of Cheyenne, has been retained as engineer for the project.

The proposed project is located near Evanston, and would provide supplemental water for 33,945 ac. of irrigated lands lying 45 mi. along the Bear River Valley. More than 1,000,000 ac. ft. of water (average yearly flow for the past 35 years) reaches Great Salt Lake from Bear River, and none of it is used for irrigation. A large portion is used for generation of power at the Cutler plant at Wheelon Siding in Utah. The supply canal would include about 2,500 ft. of tunnel.

Two Wyoming irrigation projects are being delayed because of suits brought by objectors to their construction. One is the Greybull Valley Irrigation project, which has a loan and grant allotment from PWA of $1,108,000. Bids for one section of this project were advertised and received in December, but contract letting has been held in abeyance pending the outcome of litigation.

On February 25, the Wyoming Supreme Court handed down a decision reversing the order of the district court in Big Horn County, Wyoming, which had changed assessments previously made against the lands in the district and had authorized the commissioners of the district to enter into a contract with the PWA for funds for construction. The court recommended that future proceedings should include a general reassessment, holding that a reduction in assessments of benefits was irregular and erroneous, and perhaps void for want of jurisdiction. Howard F. Bell of Cody, Wyoming is the consulting engineer for the project.

The other project pending action in the courts is the Washakie Needles Irrigation project in Hot Springs County, near Thermopolis. A PWA loan and grant allotment has been granted amounting to $443,636. This project is to consist of a diversion dam, three-mile canal and storage dam. At present the lands under the project have no storage facilities.

Colorado highway program

Colorado's huge highway program is being held up pending receipt of a $25,000,000 federal loan, expected at any time. Final work on the budget cannot go ahead until the money is actually received. After the state received word that the money had been earmarked for the loan and would be available shortly, complications arose which for a time made it seem that the plan might be blocked. However, Governor Johnson made a personal trip to Washington and apparently overcame the difficulties.

There is a controversy over the route which should be used on one of the year's most important projects, the new Idaho Springs highway. The state advocates a location over the old Floyd Hill route and the Bureau of Public Roads, recommends a new route up Clear Creek Canon, following the present Colorado & Southern railroad grade which the road has offered to donate.

Plans are progressing on a $1,300,000 grade separation program. A schedule, approved by Governor Johnson, calling for expenditure of all but $275,000 of the fund, has been held up by the federal authorities because of failure to provide for a disputed underpass at Colorado Springs. There is a question as to whether Denver or Colorado Springs should get the money.

Miscellaneous

The inspection headquarters for Idaho PWA work has been transferred from Denver to Helena, Mont. Martin E. Kelley is in charge of the Montana office. The Denver office, which at one time had both Montana and Idaho (Montana was made a separate division before Idaho was transferred) retains Colorado, Wyoming and Utah. Mr. Kelley has been in charge of the Montana office since last October.

Bids were expected to be opened sometime in March on a $550,000 water project near Climax, Colo. It will include an earthfill dam 73 ft. high, collection canals, 19,000 ft. of steel pipeline and a 2,500-ft. siphon. The job will be built on Ten Mile Creek. Work is expected to start sometime in the summer. Royce J. Tipton of Denver is engineer.

Several large sewage disposal projects are well under way in Colorado. Machinery for Denver's $3,000,000 plant is already under contract and construction contracts were expected to be let in March. Bids are to be opened in March on plants at both Greeley and Colorado Springs. WPA appropriations have been made for plants at Sterling, Brush and Windsor and all three cities have hired consulting engineers to design plants. PWA appropriations are pending on plants for Fort Lupton, Brighton, La Junta and Glenwood Springs.

Word has been received in Denver from Washington that the $25,000,000 Grand Lake water diversion project which would give northern Colorado an additional 275,000 ac. ft. of water per year may be started this year. Colorado members of Congress are of the opinion that they can persuade the budget bureau to increase the reclamation expenditure for the year to include $3,000,000 for starting the Grand Lake project. The job would require drilling a 13-mi. tunnel under Rocky Mountain National Park at a cost of about $5,000,000.

The Denver water board, early in February, voted to file on a reservoir site on the Williams Fork just above where it joins the Colorado River near Kremmling and on 93,637-ac. ft. of storage, as a step in the city's plan for transmountain diversion of Williams Fork water. A special staff of the city engineer's office is now completing plans for the project to be submitted to Washington with a request for funds for financing. Original surveys started last November. The proposed dam, which would supply water

for municipal use, irrigation, hydro-electric power and sewage plant disposal would be 180 ft. high.

Ralph H. Seaman, secretary-treasurer of the Driscoll Construction Co. of Pueblo, Colo., died in that city. Born in Atlantic, Iowa, Mr. Seaman came to Pueblo when a young boy and was employed by the Stearns-Roger Mfg. Co. there until the firm's plant was destroyed in the 1921 flood, after which he joined the Driscoll firm.

Progress Notes From the Grand Coulee Dam Project

PROGRESS continues at Grand Coulee Dam during the winter months in spite of severe weather conditions. Sub-zero temperatures in February made it necessary to suspend concreting, except for pours that were made in block 40, immediately back of the west cofferdam, which will play an important part in the river diversion. In order that it be completed in time to be coördinated with the river diversion, its construction could not be interrupted. Block 40 is now more than 30% complete. About 65,000 cu. yd. of concrete have been placed in blocks west of block 40, and the base of the dam in this area is now 40% covered.

Cleaning up operations and making the first pours on bed rock naturally slow up the beginning of concreting operations. In some places, weak rock and mud seams have necessitated the removal of considerable extra rock. As soon as bedrock is covered, concrete placing will become a routine work, and production will step up to capacity.

Seventy-eight diamond drill holes and 287 30-ft. jack hammer holes have been drilled and grouted in the west enclosure. About 42,000 sacks of cement were used. Most of the grouting on the west side is now completed, and grouting has been started on the east side of the river.

On the east side of the river, work has centered on cleaning out the crevasse at the foot of the abutment, and on rock work on the abutment and foundation. The crevasse, unlike the condition encountered in the west excavation, extends across the excavation at about 60 deg. to the axis of the dam. It is about 150 ft. wide, narrowing considerable at the bottom, 600 ft. long and ranges in depth from 60 ft. at the north end to about 120 ft. at the south end. Its depth has made excavation difficult.

For the first lifts, shovels, wagons and conveyors were used. When it became impractical to use this equipment, three draglines were put in use. The draglines passed the dirt from one to another, the last one loading it into the feeder of the conveyor. After they had removed all of the dirt they could, the conveyor was removed and a haul road built down into the bottom from the north end. A power shovel was then run down into the hole and the remainder trucked out. About 300,000 cu. yd. were removed from the crevasse.

Approximately 200,000 cu. yd. of rock have been blasted out and removed from the east abutment. Most of this has been taken from benches required for the power house construction. Some rock cuts were as much as 70 ft. There is yet considerable rock to be removed in the keyway and foundation.

The last conveyor on the east side was dismantled the latter part of January. The conveyor trestle across the river has been left, and if it is not destroyed by ice jams, will be used to carry gravel across the river for filling new cells in the west cofferdam. There remains a total of 1,737,000 cu. yd. of common excavation. Of this amount, 582,000 cu. yd. is behind the east cofferdam, 700,000 cu. yd. in the river bed, and 455,000 cu. yd. is behind the west cofferdam. Excavation of the berm behind the west cofferdam was recently started.

Work is now under way on what will be the largest timber crib in the world. This crib is being built in the bucket section of blocks 39 and 40 and will serve as part of the cofferdam when the river is diverted through the west enclosure. About 3,000,000 bd. ft. of lumber will be used in the construction of this crib, and it will be filled with gravel.

A contract has been let by the Government to the Pomeroy Co., contractors who erected the highway bridge, to straighten the east pier of this bridge. Last fall, the pier tilted slightly and is now out of line vertically. To correct this condition, a steel sheet piling enclosure has been driven around the pier. This is being excavated to bedrock. The pier will then be pulled back into line and concerted in place.

Work has begun on the east mixing plant, and as soon as rock work has been completed, work will start on the construction trestles. It is the plan to place as much concrete as possible on the east side, especially in the crevasse, before high water floods the area.

Spring will find the MWAK Co. with most of the common and rock excavation, that can be done now, completed. The one main objective for the summer will be the placing of mass concrete.

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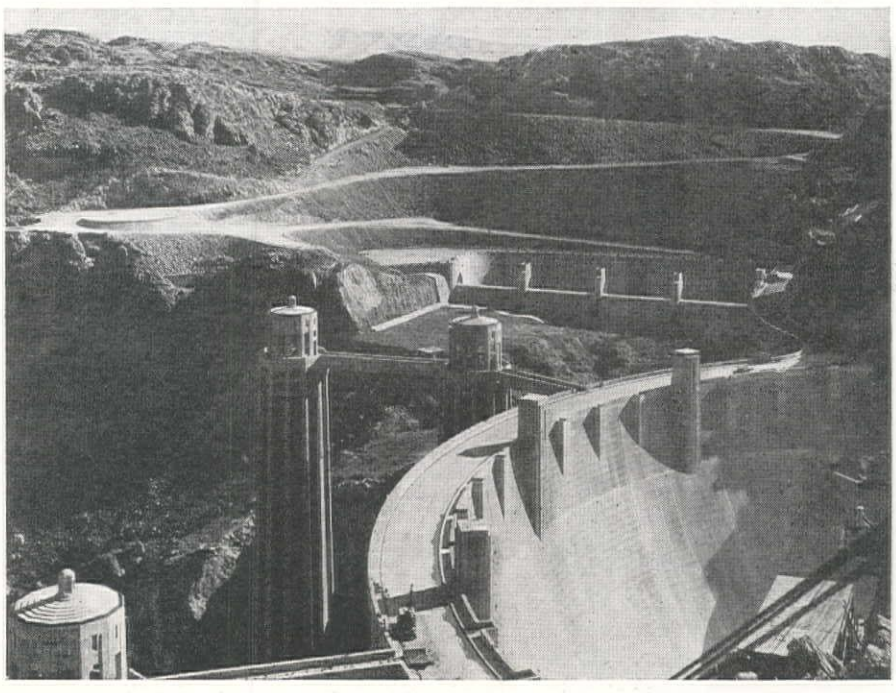
Book on Concrete Pipe Data

The American Concrete and Steel Pipe Co., Los Angeles, has issued a new publication on "Reinforced Concrete Pipe," which contains useful information on the various types of pipe, typical installations and tabular data on the flow of water in concrete pipe. A section of the publication includes hydraulic diagrams and tables and the company states that these diagrams may be obtained separately in larger sizes.

Boulder Dam Officially Complete in Five Years

As Boulder Dam looked when it was accepted from the Six Companies Inc. by the Bureau of Reclamation this month. Across the dam can be seen the Arizona spillway.



Plans for National A.W.W.A. Convention

THE National Convention of the American Water Works Association will be held in Los Angeles, June 8-12. The details of the program to be presented at that time are not yet available, but a general outline of the week's activity has been released to *Western Construction News* by the California section of the A. W. W. A.

This tentative program follows:

June 7—Meeting of the National board of Directors.

June 8—Opening of the convention (11 a.m.) with the address by President Frank A. Barbour. The afternoon will be devoted to technical sessions with meetings of the Plant Management and Operation Division, W. W. Hurlbut, engineer of water works, Bureau of Water Works and Supply, Los Angeles, chairman, and the Water Purification Division, with Albert E. Berry, director of the sanitary division, Ontario Department of Health, Toronto, Canada, chairman. There will be an informal reception that evening.

June 9—**California Day**—the main session will listen to papers by prominent water works engineers of California and there will be a parallel session of the Water Purification Division. That evening there will be the All Divisions dinner.

June 10—Following a meeting with the Breakfast Club, the convention will hold a main session with a parallel session of the Water Purification Division and the Finance and Accounting Division during the morning. The afternoon will be devoted to golf with a business meeting of the California Section. In the evening there will be a smoker.

June 11—During the morning there will be technical sessions for several of the divisions. In the afternoon will be the Round Table session of the Plant Management and Operation Division and the superintendents. That evening there will be an informal dinner dance.

June 12—The day will be devoted to a sightseeing trip to reservoirs of the Los Angeles Water Department with a barbecue luncheon served at the Chatsworth reservoir.

A program of entertainment will be provided for the ladies during the entire week of the convention.

H. A. Van Norman is president of the California Section, A. W. W. A., R. F. Brown, vice-president, and J. E. Phillips (P. O. Box 240, Arcade Annex, Los Angeles), secretary-treasurer.

The headquarters of the convention will be at the Biltmore Hotel.

San Diego Asks About Colorado Aqueduct

THE City of San Diego has addressed an official inquiry to the directors of the Metropolitan Water District of Southern California regarding the possibility of that city participating in the Colorado River aqueduct project. Previously, informal discussions have taken place on this subject but the present inquiry is the first official notice of the interest of San Diego in joining the district to secure supplemental water from the Colorado River.

The communication, signed by the city manager of San Diego, requested "information regarding the possibility and cost of bringing the City of San Diego's 155 sec. ft. of Colorado River water through the Colorado River Aqueduct now under construction by the Metropolitan Water District of Southern California" for the purpose of "determining the most practical and economical route for the city to use in bringing its water to the city."

At the present time, the plans for the All-American Canal include 155 sec. ft. of capacity which is designed to carry the San Diego allocation to the end of the Imperial Valley canal system. From this point it would be necessary for the city to construct its own aqueduct to convey this water over the mountains to San Diego. One of the studies of this aqueduct route involved a 28-mi. tunnel.

The present official inquiry of San Diego requests detailed information regarding engineering details, cost, and the legal aspects of three alternative plans for participation in the present Colorado River Aqueduct project. They are: (1) joining the district as a member city, (2) securing a permanent right to bring San Diego water through the aqueduct, and (3) securing a temporary right to bring Colorado River water through the aqueduct pending the full requirement of capacity by the Metropolitan Water District or the earlier completion of an independent aqueduct by San Diego.

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Contract for Tunnels On Shoshone Project

Contract for the construction of three tunnels on the Shoshone Canyon conduit, which will serve the Heart Mountain division of the Shoshone, Bureau of Reclamation project in Wyoming, has been awarded to the Utah Construction Co. of Ogden, Utah, on a bid of $614,509.50. The Utah Construction Co. bid was the lowest of six received and opened December 5, at the Bureau of Reclamation office at Cody, Wyoming.

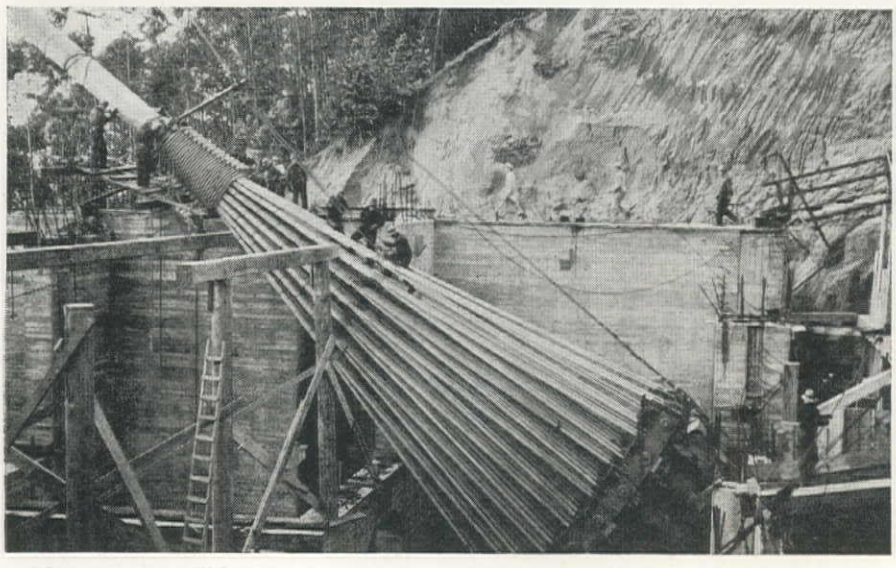
The Shoshone Canyon conduit begins at the Shoshone Dam and follows a gravity line down the river about two miles where it is diverted across the river in a northerly direction and opens into a canal. The three tunnels will be horseshoe shaped with a diameter of 12 ft.; number 1 will be 3,550 ft. long; number 2 will be 7,190 ft. long and tunnel number 3 will be 610 ft. long.

The conduit will serve the new Heart Mountain division of the Riverton project, for which water already has been stored in Shoshone Dam reservoir.

Work will begin within 30 days and must be completed in 750 calendar days.

Bridge Cable Anchored to Yerba Buena Island

At the Yerba Buena Island anchorage of the east suspension span for the San Francisco-Oakland Bay Bridge where the strands of the 29-in. diameter cable splay out and loop around the strand shoes. The splay casting, which marks the point of transition to circular shape, is being placed in position.



Construction Design Chart

VI. . . . Shear in Concrete Forms

By JAMES R. GRIFFITH
Professor of Structural Engineering
Oregon State College

IN the last chart (February issue W.C.N.) three factors were mentioned as controlling the spacing of sheathing supports for concrete forms. The accompanying chart gives the maximum clear span between supports when shear, the second factor, is considered.

As noted, the chart has been constructed for an allowable unit shearing stress of 72 lb. per sq. in. While this value may be considered to be low by some individuals, it was made on the assumption that the best grade of lumber used would be No. 1 common. Then, in addition, the re-use of form lumber still further justifies a reasonable limit. Some authorities recommend the use of values as high as 200 lb. per sq. in. for shear in form lumber, justifying such values by the short time loading to which it will be subjected. On the other hand, we find the weakening of otherwise adequate sections by the installation of clean-out doors, conduits, pipe sleeves, and hangers.

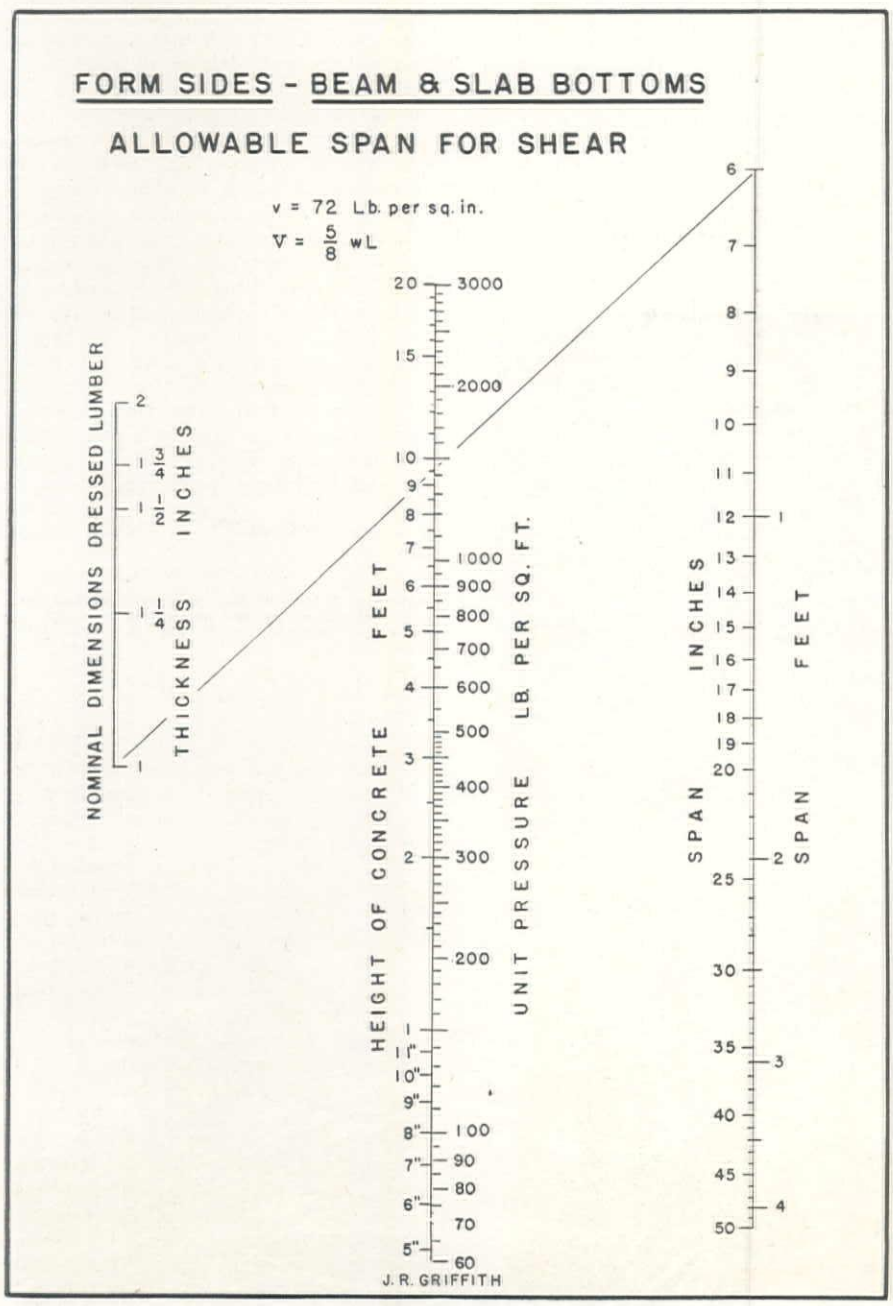
Form sheathing is usually continuous over a number of supports. Without knowing the actual number and spacing of supports, it is impossible to anticipate the magnitude of the total shear in any one span with a high degree of accuracy. For conservative reasons then, the maximum total shear has been taken as

$$V = \frac{5}{8}\, w L$$

which is to be found at the center support of a continuous beam of two equal spans with a uniformly distributed load. As the number of supports increase this maximum value for the total shear will tend to decrease.

As with the chart on flexure, in the February issue, the pressure from the concrete was taken from an equivalent fluid weighing 150 lb. per cu. ft.

In Example 1 of the February issue, the allowable clear span between column yokes was found to be 11.1 in. for an average height of concrete of 9.5 ft. with flexure controlling. In the accompanying chart a solution line has been drawn through 1 in. lumber and a 9.5 ft. height of concrete. On the right hand scale will be seen that the maximum clear span is 6 in. for a unit shearing stress of 72 lb. per sq. in. Thus for shear, the spacing of the yokes would necessarily be about 8 in. center to center.



Check solution

Total shear,

$$V = \frac{5\,w\,L}{8} = \frac{5 \times 9.5 \times 150 \times 6}{8} = 445 \text{ lb.}$$

$$\text{Unit shear} = \frac{3V}{2bh} = \frac{3 \times 445}{2 \times 12 \times (25/32)}$$

$$= 71.2 \text{ lb. per sq. in.}$$

In Example 2 of the February issue it was found necessary to maintain a clear spacing of not more than 30.8 in. between joists suporting 1 in. sheathing for a 9 in. floor slab and a 75 lb. live load. A line, not shown, on the accompanying shear chart from 1 in. lumber through a unit load of 187 lb. per sq. in. gives maximum clear spacing of 46 in. between supports.

Thus it will be seen that in Example 1 shear is the controlling factor as compared to flexure, while in Example 2 the reverse is true. However, we still have the question of deflection to consider and this will be taken up for discussion in the next issue.

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Utah Engineers Elect

At the annual meeting of the Utah Section, American Soc. C. E., the following officers were elected for 1936: K. C. Wright, chief engineer, Utah State Road Commission, president; O. C. Lockhart, bridge engineer, Bureau of Public Roads, vice-president; R. A. Hart, acting State PWA Administrator, vice-president; F. H. Richardson, consulting engineer, Salt Lake City, secretary-treasurer. The secretary's address is 22 East First South Street, Salt Lake City.

Concreting Block 40 at Grand Coulee Dam

Difficult work on the section directly behind the west sheet-pile cofferdam —Large timber truss supports used

PREPARATIONS for placing concrete in the area immediately behind the river side of the west cofferdam at the Grand Coulee Dam involved some of the most interesting and difficult operations carried out by MWAK Co. during the late fall and early winter. This section of the dam, officially designated Block 40, is the most easterly unit that can be placed behind the existing steel sheet-pile cofferdam, and, when the west cofferdam has served its purpose, will be used as a tie between the west ends of the two cross-river cofferdams.

Block 40 is located about 100 ft. inside of the river wall of the west cofferdam. Its nearness to the cofferdam made it impossible to excavate to bedrock without first taking precautions to prevent the cofferdam from moving. The natural ground in this area was at El. 960. Starting 200 ft. behind, and running the length of the front of the cofferdam, a 3:1 slope was left, as excavation in the west pit was carried down to bedrock. Next, 120 ft. behind the cofferdam, a row of piling was driven connecting the cell clusters at the corners of the cofferdam. This row of piling, known as Section F was driven to bedrock. The area directly behind the cofferdam was then excavated to El. 935.

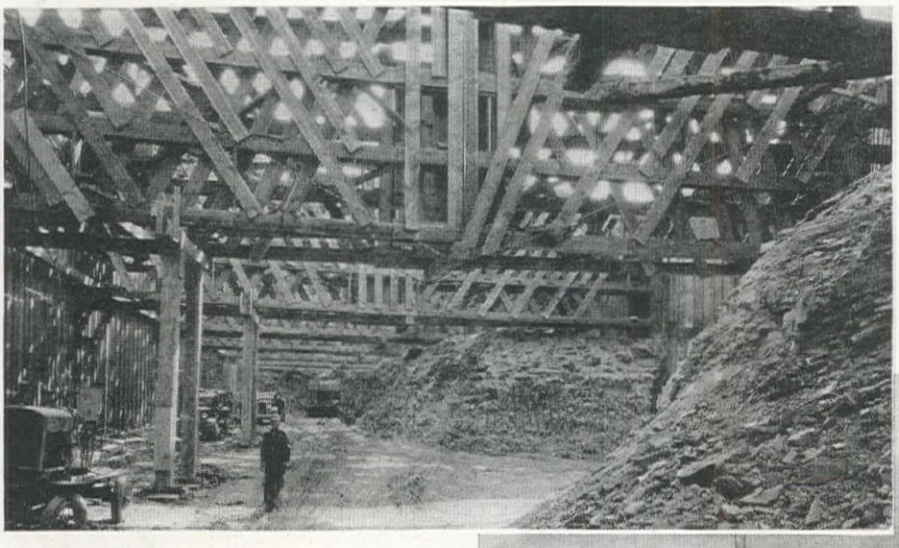
As the piling in Section F was exposed, it was burned off at El. 935. A 30-ft. section in the middle of F section was then pulled, and two rows of sheet steel piling were connected to, and driven at right angles to Section F. These two rows were continued until they intersected the original 3:1 slope, and made it possible to dig in a ramp.

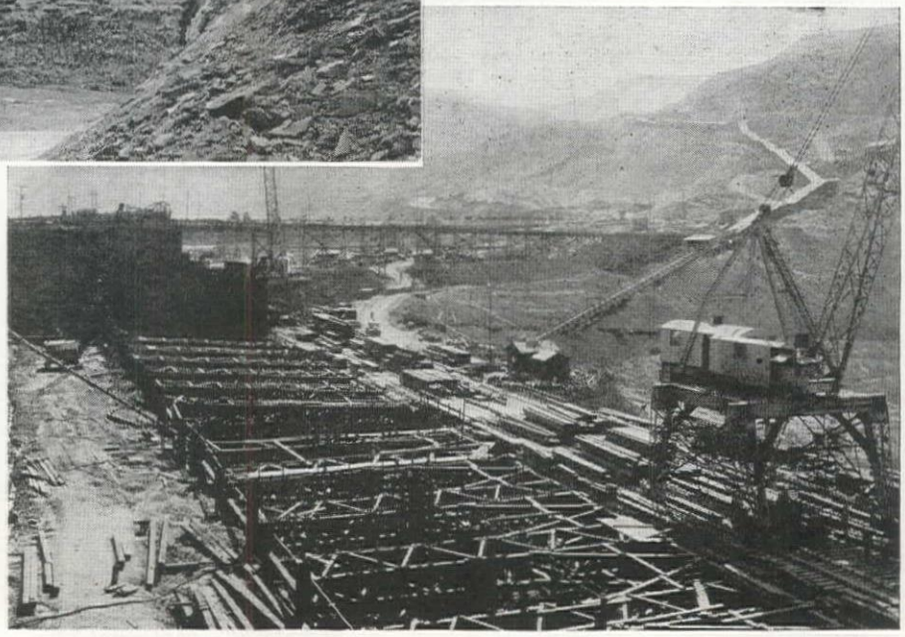
Preparations were next made for the construction of a piling wall 80 ft. west of Section F, 200 ft. back from the river side of the cofferdam, known as Section F-2. Tracks were laid just west of Section F, and two Clyde Wiley whirleys were assembled. A number of heavy steel box beams were fabricated at the MWAK machine shop and driven to Section F-2 at alternate intervals of 27½ ft. and 12½ ft. and connecting them with sheet piling, driven in slight arcs. Most of the box beams were driven to rock, but the connecting piling was not. Sections F and F-2 were then connected to the cofferdam on each end by circular sheet steel piling cells. Several diesel cranes, an electric crane and two whirleys were used for this pile driving. In order to drive the box beams, it was necessary to drill guide holes in the clay. All piling was driven through heavy clay.

When Section F-2 had been completed, excavation was again begun. Two 1½-yd. shovels equipped with short booms and loading into small trucks, dug in between the two rows of piling connecting F section with the 3:1 slope, and excavated the area between F and F-2 to El. 920. Bracing between F and F-2 was then begun. Timbers, 12x12 in., were spaced 5 ft. vertically, resting on the box beams at one end and on whalers along F section at the other end. In the horizontal plane, these timbers were braced across the 12½-ft. span between the box beams with 4x8's bolted to the top and bottom of each 12x12. This prevented any rolling action of the 12x12's. In the vertical plane, three 12x12's were trussed with inclined 3x8's. Before the truss connections were made, the 12x12's were pre-stressed with a load of 30 tons. As the fourth 12x12 was added in the vertical plane, this same system of trussing was used to truss the second, third and fourth 12x12.

When all braces were in place down to El. 920, another shovel cut at El. 900 was made across the area under the timber trusses and the bracing continued down. At El. 900 a course of sheet piling was driven to rock 5 ft. inside of F-2 and a concrete cap was poured between this course and F-2. The object was to seal off a water-bearing sand seam at El. 894, and to decrease excavation to a minimum.

Below El. 900, excavation was done with clamshell buckets and skips, operated by the whirleys. Trimming the clay banks and filling the skips were all hand work, which made excavation slow. Due to the increasing weight and the importance of preventing even the slightest movement of the cofferdam, the number of trusses was doubled, which made a seemingly almost solid mass of timber. This system of excavation and bracing was carried down to bedrock. In the preparation of Block 40, about 2,000,000 b. ft. of structural





Extensive timber bracing was used to hold the area excavated for the placing of concrete in Block 40 immediately behind the cofferdam wall.

fir were used, with about 350,000 bolts and 35,000 lag screws. The satisfactory construction of the west cofferdam was revealed by the fact that during the work on Block 40, only about 20 g.p.m. of seepage had to be pumped out. No movement of the cofferdam was observed during the work.

Average bedrock under Block 40 is at El. 876, although, on the south end is a pocket in the granite, some 15 ft. lower. Under the dam section proper, about 3 ft. will be blasted off the surface of the bedrock, but under the bucket section, it will be necessary to remove between 20 and 25 ft. of rock. Concrete placing is now under way on Block 40, using the mixing and handling procedure described in the article on page 31 of the February issue.

Design for this work was done by the MWAK Co. cofferdam engineers under the direction of C. D. Riddle, job engineer, and R. L. Telford, cofferdam superintendent. Construction was under the supervision of Harvey Slocum, general superintendent, and R. L. Telford.

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Principles of Snow Surveying

A reprint of an article on "Principles of Snow Surveying as applied to Forecasting Stream Flow" taken from the Journal of Agricultural Research, July 15, 1935, is now available. The article was written by J. E. Church of the Nevada Agricultural Experiment Station and a recognized authority on the subject. Copies of this publication may be obtained from the Superintendent of Documents, Government Printing Office, Washington, D. C. The price is 5 cents per copy.

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Wyoming Engineers Hold Annual Convention

Marked by an extensive technical program and an unusual exhibit of construction equipment, the 17th Annual Convention of the Wyoming Engineering Society was held February 7-8, at the University of Wyoming, Laramie. R. D. Goodrich, dean of the college of engineering, University of Wyoming, was elected president of the society for the coming year. James B. True, state highway superintendent and John D. Quinn, deputy state engineer, were elected vice-president and secretary-treasurer, respectively. Among the papers presented at the sessions of the convention was one on the Casper-Alcova project by H. E. Robinson, resident engineer of the Bureau of Reclamation, another on the Bear River irrigation development by T. H. Baldwin, Laramie County engineer and a discussion of the petroleum and natural gas industry in Wyoming by H. P. Rue, supervising engineer of the Laramie petroleum experiment station of the Bureau of Mines.

A discussion of an employment service for the engineers of the society resulted in the appointment of a committee to investigate the proposed plan and report at the next convention.

The exhibit of equipment, which was open to the public, was unusual in the variety of machinery displayed, which included large transformers, tractors, and trucks, made available by twenty manufacturers.

The convention was concluded with the annual banquet presided over by W. B. Schilling of Casper, the retiring president.

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A New Publication on Irrigation Water Rights

A new book is available on the subject of "Water Rights for Irrigation," written by S. T. Harding, professor of irrigation, University of California, based on the author's twenty-five years of teaching and engineering practice.

The book deals with the elements of law, engineering, and public policy in relation to water resources. Although much of the discussion contained in the book is based on court decisions, legal technicalities have been avoided as far as possible, thus presenting a subject, previously available only in legal texts, in a more readable and condensed form. Chapters are included on the history of water rights, appropriation and riparian rights and the conflicts between the two, laws of rights, legislation and other similar topics.

The book of about 180 pages is published by the Stanford University Press, Stanford University, Calif. The price is $2.25.

William Schoeb

Golden Gate Bridge Cables Against the Sky

Cable spinning on the Golden Gate bridge has advanced at a rapid rate during the winter months, in spite of fog and wind. John A. Roebling's Sons Co., on March 9, had completed placing about 50% of the 80,000 mi. of 0.2-in. wire weighing 22,000 tons.

The picture shows the foot walks for the 4,200-ft. span, with the far tower showing in the extreme lower right corner. The extensive system of storm cables is required to prevent sway during winds. The trusses between cables are for cross walks.

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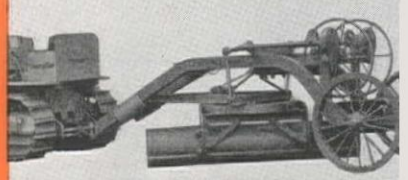
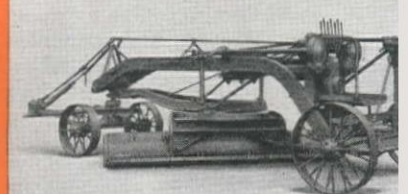
"Caterpillar" Diesel Auto Patrol

"Caterpillar" Trailer Patrol

"Caterpillar" Elevating Grader



"Caterpillar" Terracer



"Caterpillar" Blade Grader

IN ROAD MAINTENANCE AND CONSTRUCTION

"Caterpillar" Road Machinery is setting the pace today! It's built for heavy-duty work. It's tough—built to stay on the job day after day, month after month. It's economical—to do maintenance work or new construction at the least possible cost per mile. That's why it is first choice on the roads today. Ask your "Caterpillar" dealer for a SHOW-DOWN. Caterpillar Tractor Co., Peoria, Illinois, U. S. A.

CATERPILLAR

Personally Speaking . . . . .

N. H. Kearns is the new city engineer for Sparks, Nev.

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Hubbell Carpenter, junior engineer in the testing laboratory of the Metropolitan Water District at the Banning field headquarters, has been transferred to transmission line construction work.

•

H. R. Adams has been elected president of the Las Vegas (Nevada) General Contractors. This is a new organization which held its initial meeting February 26.

•

O. Laurgaard, formerly city engineer of Portland for many years and more recently with the Denver headquarters of the Bureau of Reclamation, is now serving as office engineer on the TVA project at Knoxville, Tenn.

•

H. A. Schirmer, resident engineer for the McClintic-Marshall Corp. during the erection of the East Bay crossing of the San Francisco-Oakland Bay bridge has recently been appointed works engineer in charge of engineering for the fabricating works of the Bethlehem Steel Co. in Alameda, Calif.

•

J. J. Byer has been appointed head of the bridge division of the Idaho Department of Highways. He succeeds the late Charles A. Kyle. Mr. Byer has been with the bridge department for eight years, having previously served as assistant bridge engineer for the Utah Highway Department.

•

Henry Mills, resident engineer for the Cottonwood and Mecca Pass tunnels on the Colorado River aqueduct, has been transferred by the Metropolitan Water District to the Pasadena tunnel on the distribution system where he will supervise the placing of concrete lining.

•

W. J. O'Connell, Jr., field and sales engineer for the Wallace & Tiernan Co. with headquarters in the Newark home office for the past six years, has recently been transferred to the West Coast as a technical specialist for the company in both the industrial and sanitary engineering fields. Mr. O'Connell is a graduate of the University of California in sanitary engineering and later took work at Rutgers University (New Jersey Sewage Research Station) under Prof. Rudolfs. He will make his headquarters in the San Francisco office of the Wallace & Tiernan Co.

•

William Holcomb, office engineer of the Nevada Highway Department, will be in charge of the highway and traffic survey in that state, which will be carried on with a Federal appropriation of $4,000. F. Edgar Mineer will be assistant in charge of traffic surveys. Morris D. Anderson, in charge of the highway testing laboratory, will compile the statistics of the survey. W. S. Smith, engineer of the Bureau of Public Roads from Washington, will be stationed in Nevada as the federal representative and consultant on this work.

•

Clark Eldridge, who has been bridge engineer for the City of Seattle for the past eight years has been named Washington state bridge engineer, by Lacey V. Murrow, director of highways. Mr. Eldridge's resignation from the municipal position became effective March 9. He entered the Seattle city engineer's office in 1919 following service in the engineer corps during the war. Following work in several departments he was appointed city bridge engineer in 1928. Among the major projects designed and built under his direction are: Second Spokane Street bridge, West Garfield Street bridge, reconstruction of the University Avenue bridge and the recent Railroad Avenue seawall. The position of state bridge engineer has been vacant for several months since the death of O. R. Elwell.

•

Start Transmission Line For Aqueduct Pumping

Construction work has started on the transmission line of the Metropolitan Water District from the Boulder Dam power plant to the pumping plants along the Colorado River Aqueduct. The line will be about 240 mi. long and operate on 230,000 volts. Ultimately, when the aqueduct is operating at full capacity, this line will absorb 36% of the firm power generated at Boulder Dam. From Boulder Dam the line extends with two main branches, the first to the pumping plants at the intake end of the aqueduct and the other to the plants further along the line.

The first work was started on the floor of Danby Dry Lake, about 250 mi. north of Los Angeles near the Iron Mountain tunnel of the aqueduct.

. . . . . Superintendents

R. A. Kennan is superintendent on the Seminoe Dam in Wyoming for the Morrison-Utah-Winston-Lawler group.

•

R. E. Malsor, superintendent, and E. R. Hays, foreman, are in charge of the $142,133 contract for highway work in the City of Bozeman, Montana, which is held by the Standard Construction Co. of Bozeman.

•

C. A. Langford is the superintendent on the $109,968 contract recently awarded to Dan J. Cavanagh, Twin Falls, Idaho, for bridge and highway work in that state. Hyrum Judkins will be foreman and Albert Keefer, timekeeper.

•

Wm. Saremal, of Orino Birkemeier & Saremal, Cascade Locks, Ore., will direct the work on the $166,904 contract for a grade separation near Portland, which has been awarded to this organization. Otto Achord will be general superintendent.

•

Edward Hanson and **W. R. Hanson** are superintendent and assistant superintendent, respectively, on C. M. Smith's $42,834 contract for the construction of several highway bridges in Wyoming. The contractor's head office is in Thermopolis, Wyo.

•

P. B. (Slim) Woodburn is superintendent on the Lorenzo bridge job across the South Fork of the Snake River in Idaho. C. B. Beiderbecke is in charge of the office and R. C. Smith is the contractor's engineer. Contract for this $191,714 bridge is held by Warren Northwest, Inc., Portland, Ore.

•

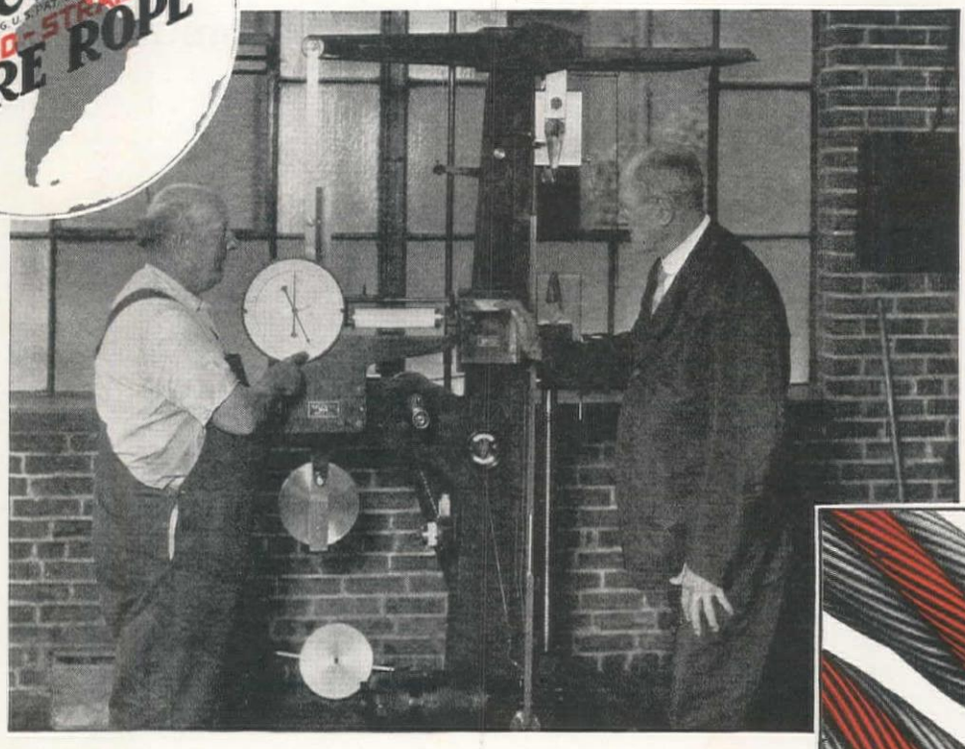
K. J. Kennedy, superintendent of excavation for concrete and C. M. Elliott, superintendent of concrete pipe, are in charge of the $1,315,000 Crystal Springs pipe line No. 2 project at San Francisco, being built by the Youdall Construction Co., San Francisco, for the San Francisco Water Department.

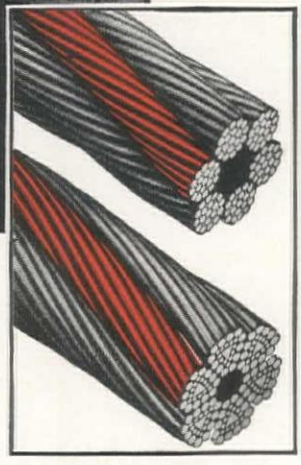
•

E. A. Mullen will be the superintendent in charge of construction on the Alamagordo Dam in New Mexico. The $1,132,547 contract is held by the Hallett Construction Co. of Crosby, Minn. This earth and rockfill dam is being built by the Bureau of Reclamation on the Pecos River for the Carlsbad project. S. T. Harrison will be the contractor's engineer on this project.

•

A. F. Weesner is general superintendent on the $719,355 contract (Schedules 1 and 2) awarded to Wood & Bevanda of Stockton, Calif., for the Iron Mountain pumping plant on the Colorado River aqueduct. Assisting Mr. Weesner will be: L. R. Zimmerman, master mechanic; L. L. Green, excavation foreman; Dan Tonn, reinforcing steel foreman; V. S. Price, concrete foreman; G. W. Gawlett, carpenter foreman. Clyde W. Wood will also spend considerable time directing work on the project.





The man at the left has been with our company for 60 years, and he is still active. On the right is a man who was in our active service for 49 years, and on our retired list for over 17 years. The long and practical experience of these and similar craftsmen in our organization has been a big factor in developing and maintaining Leschen Quality.

Modern Equipment— Experienced Workmen—

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SPOKANE
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This is another vital combination in the manufacture of Leschen Wire Rope. While we set a high value on experienced workmen, we do not underestimate the importance of modern methods and equipment.

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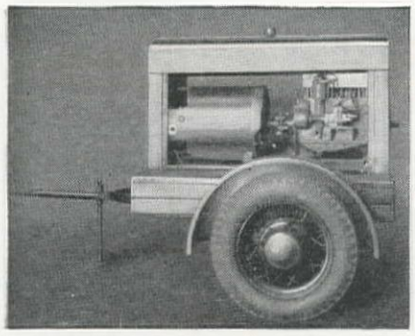


New General Utility Welder

An entnrely new P&H-Hansen arc welder of 150-ampere capacity, announced by the Harnischfeger Corporation of Milwaukee, U.S.A., presents high electrical efficiency developed with the small air cooled gasoline engine which powers it. Welding is simplified through single current control accomplished by shifting brush holders for current settings over the entire welding range.

New Type Trailer Unit.—For field service, the standard unit can be mounted on a two-wheel highway trailer to travel safely behind an automobile or truck at average motor car speeds. The engine and generator protected from road shocks by automotive-type cantilever springs and balloon tires. Large tool boxes are mounted on each side of the welder for convenience in carrying equipment and accessories.

•

Self-Priming Centrifugal Pump

A new line of self-priming centrifugal pumps is announced by the Novo Engine Company, Lansing, Michigan. These pumps will be known as the Model V Self Primers, with the pump and engine as unit assembly. The pump case is bolted directly to the engine block, which results in a very compact design.

The engines are of ample horsepower on the various sizes so that the rated capacity will be delivered under all conditions. A new design of accurately balanced impellers has secured faster priming time.

The Model V Pumps will be built in five sizes: 2 in. with 3 H. P. single cylinder engine, 10,000 G. P. H.; 3 in. with 5 H. P.

UNIT BID SUMMARY . . .

Note: These Unit Bids Are Extracted from Our Daily Construction News Service

Irrigation and Reclamation . .

Yuma, Ariz.—Government—Earthwork and Tunnels, Gila Valley Project

Bids received as follows by Bureau of Reclamation, Yuma, Arizona, for construction of earthwork and tunnels, Sta. 30 to Sta. 931, Gravity Main Canal, Gila Valley Project, Ariz., under Spec. No. 657. Work is located near Yuma, Arizona. Bids received on:

SCHEDULE No. 1—Earthwork, Gravity Main Canal, Sta. 30 to Sta. 285-30. Bids from:

(1) Boyce & Igo, Baton Rouge (low).....$73,200
(2) J. A. Terteling & Sons, Boise..... 73,540
(3) Mittry Bros., Los Angeles..... 76,700
(4) Morrison-Knudsen Co., L. A..... 90,510
(5) W. E. Callahan & Shirley, L. A..... 90,600
(6) David H. Ryan, San Diego..... 91,200
(7) George J. Bock, Los Angeles.....$ 94,625
(8) Jahn & Bressi, Los Angeles..... 121,450
(9) Griffith Co., Los Angeles..... 131,850
(10) Macco Corp., Clearwater..... 140,650
(11) Lewis Construction Co., Los Angeles 237,850

(A) 790,000 cu. yd. excav. for canal, common
(B) 15,000 cu. yd. exc. for canal, rock
(C) 50,000 cu. yd. exc. drain channel &2 dikes

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
(A)	$.08	$.076	$.08	$.099	$.09	$.099	$.0925	$.13	$.14	$.16	$.27
(B)	.40	.50	.50	.49	1.00	.60	.77	.75	.75	.55	.57
(C)	.08	.12	.12	.099	.09	.08	.20	.15	.20	.12	.12

SCHEDULE No. 2—Earthwork and Tunnel No. 1 Gravity Main Canal, Sta. 285-30 to Sta. 330. Bids from:

(1) Mittry Bros., Los Angeles (low).....$210,830
(2) V. R. Dennis, San Diego..... 239,285
(3) J. F. Shea Co., L. A..... 243,535
(4) W. E. Callahan & Shirley, L. A..... 247,840
(5) West Const. Co., Monrovia..... 256,105
(6) Jahn & Bressi, Los Angeles..... 261,130
(7) Briffith Co., Los Angeles.....$264,260
(8) Walsh Construction Co., L. A..... 267,074
(9) Utah Construction Co., S. F..... 297,860
(10) Winston Bros., Los Angeles..... 304,617
(11) L. E. Dixon, Bent Bros. & Johnson, Inc., Los Angeles..... 333,160

(A) 16,000 cu. yd. exc. for canal, common
(B) 87,000 cu. yd. exc. for canal, rock
(C) 27,500 cu. yd. exc. for tunnel, all classes
(D) 130,000 lb. furn. & inst. perm. steel tunnel supports
(E) 42 M ft. BM perm. timb. in tunnel
(F) 290 cu. yd. concr. in portal struc. and transitions
(G) 5,700 cu. yd. concrete in tunnel lining
(H) 32,000 lb. pl. reinforcement bars

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
(A)	$.18	$.45	$.20	$.36	$.35	$.30	$.14	$.27	$.38	$.46	$.25
(B)	.40	.60	.65	.60	.83	.75	.75	.61	.70	.78	.70
(C)	4.75	5.00	4.80	5.30	4.85	5.00	5.50	5.80	6.50	5.55	8.00
(D)	.08	.06	.07	.07	.07	.055	.06	.053	.08	.08	.075
(E)	90.00	60.00	70.00	70.00	80.00	70.00	80.00	72.00	85.00	108.00	90.00
(F)	12.00	15.00	12.00	20.00	12.00	20.00	18.00	10.00	12.00	18.40	13.50
(G)	4.25	4.75	6.25	4.50	5.00	6.50	5.00	6.50	6.00	9.80	5.35
(H)	.02	.02	.02	.02	.015	.02	.02	.01	.015	.02	.01

SCHEDULE No. 3—Earthwork and Tunnel No. 2, Gravity Main Canal, Sta. 330 to Sta. 408. Bids from:

(1) Mittry Bros., Los Angeles (low).....$470,745
(2) V. R. Dennis, San Diego..... 503,205
(3) J. F. Shea Co., Los Angeles..... 505,075
(4) W. E. Callahan & Shirley..... 541,170
(5) Griffith Co., Los Angeles..... 542,560
(6) West Const. Co., Monrovia..... 545,270
(7) Walsh Construction Co., L. A.....$556,374
(8) Jahn & Bressi, Los Angeles..... 556,480
(9) Utah Construction Co..... 667,945
(10) Winston Bros., Los Angeles..... 679,670
(11) L. E. Dixon and Bent Bros. & Johnson, Inc., Los Angeles..... 681,500

Bids received on:

(A) 170,000 cu. yd. exc. for canal, common
(B) 70,000 cu. yd. exc. for canal, rock
(C) 20,000 cu. yd. exc. for drain, channels
(D) 65,000 cu. yd. exc. in tunn. all classes
(E) 356,000 lb. furn. & inst. per. stl. tunn. sup.
(F) 113 M ft. BM perm. timb. in tunnel
(G) 290 cu. yd. concr. in portal struc.
(H) 13,700 cu. yd. conc. in tunnel lining
(I) 32,000 lb. pl. reinforcement bars

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
(A)	$.18	$.20	$.20	$.30	$.14	$.35	$.22	$.30	$.38	$.46	$.25
(B)	.40	.60	.65	.60	.75	.83	.54	.75	.70	.78	.70
(C)	.12	.20	.20	.30	.20	.30	.22	.25	.38	.26	.25
(D)	4.75	5.00	4.60	5.25	5.50	4.85	5.50	5.00	6.50	5.55	7.25
(E)	.08	.06	.07	.07	.06	.07	.053	.055	.08	.08	.075
(F)	90.00	60.00	70.00	70.00	80.00	80.00	72.00	70.00	85.00	108.00	90.00
(G)	12.00	15.00	12.00	20.00	18.00	12.00	10.00	20.00	12.00	18.40	13.50
(H)	4.25	4.75	6.25	4.50	5.00	5.00	6.50	6.50	6.00	9.80	5.35
(I)	.02	.02	.02	.02	.02	.015	.01	.02	.015	.02	.01

SCHEDULE No. 4—Earthwork, Gravity Main Canal, Sta. 408 to Sta. 391, except Gila River Siphon. Bids received from:

(1) Boyce & Igo, Baton Rouge (low).....$200,400
(2) Mittry Bros., Los Angeles..... 236,225
(3) Morrison-Knudsen Co., L. A..... 247,795
(4) W. E. Callahan & Shirley, L. A..... 270,500
(5) Mark C. Walker, Omaha..... 345,595
(6) Macco Corp., Clearwater..... 354,975
(7) Griffith Co., Los Angeles.....$355,700
(8) Jahn & Bressi, Los Angeles..... 420,850
(9) J. A. Terteling & Sons, Boise..... 425,645
(10) D. McDonald, Sacramento..... 539,825
(11) Isbell Construction Co..... 665,400

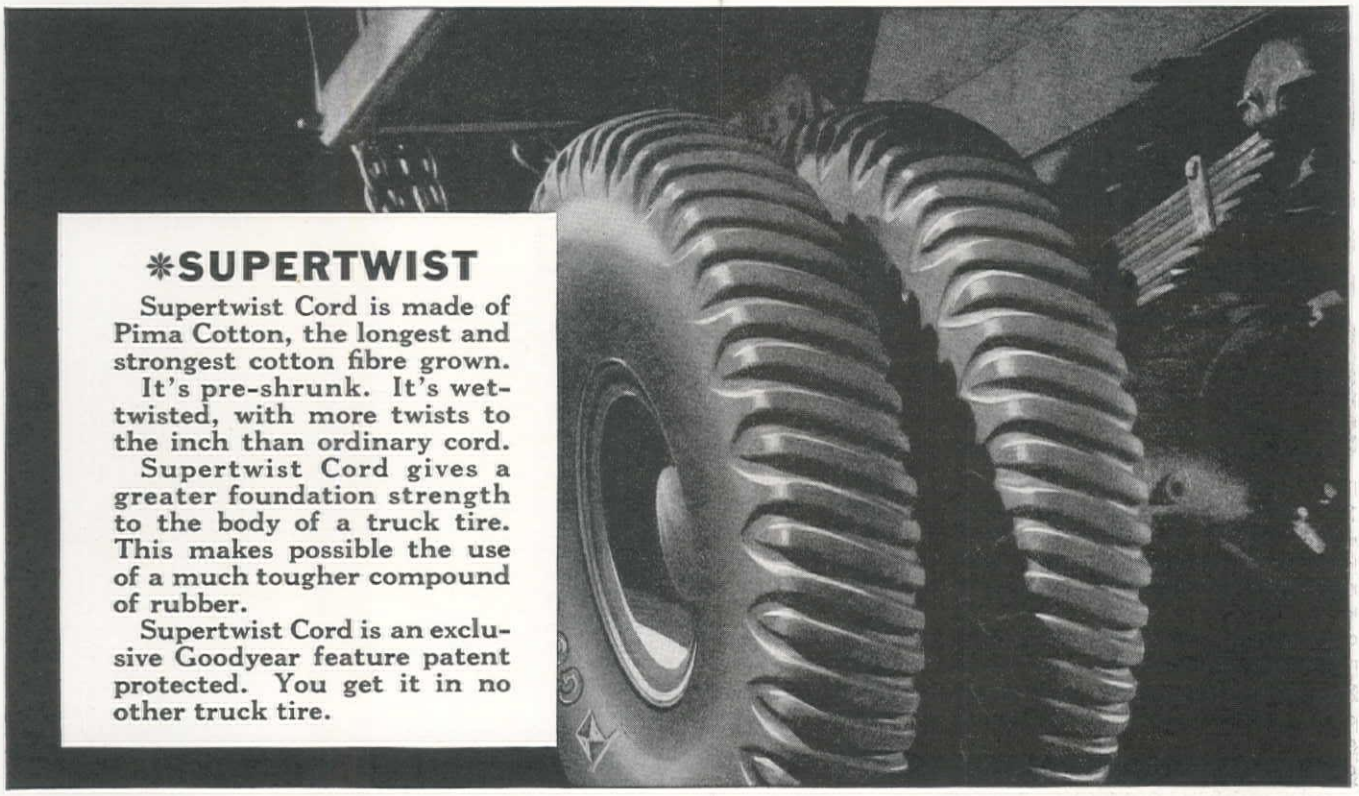
Bids received on:

(A) 2,225,000 cu. yd. exc. for canal, common
(B) 40,000 cu. yd. excav. for canal, rock
(C) 50,000 cu. yd. exc. for drain, channels, etc.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
(A)	$.08	$.095	$.099	$.10	$.139	$.145	$.14	$.17	$.179	$.215	$.28
(B)	.40	.40	.29	1.00	.63	.55	.75	.75	.40	.75	.60
(C)	.08	.12	.099	.10	.139	.12	.20	.15	.12	.50	.20

STIPULATIONS—West Construction Co. will accept Scheds. 2 and 3, Sched. 3 alone, not Sched. 2 alone; L. E. Dixon, Bent Bros. & Johnson, Inc., will accept Scheds. 2 and 3. Mittry Bros. will not accept Sched. 1 alone; V. R. Dennis, Scheds. 2 and 3 or none; W. E. Callahan and Shirley will accept Scheds. 1 and 4, deduct $.02 on Items 1 and 3, and will accept Scheds. 2 and 3 together. Macco Corp. will not accept Sched. 1 alone; Boyce & Igo, Scheds. 1 and 4 together; Winston Bros., Scheds. 2 and 3 together; J. A. Terteling & Sons, Scheds. 1 and 4, all or none. Morrison-Knudsen Co., Scheds. 1 and 4, all or none; Utah Construction Co., Scheds. 2 and 3, all or none; Jahn & Bressi, Scheds. 2 and 3, all or none; Walsh Construction Co., Scheds. 2 and 3, all or none; J. F. Shea Co., Scheds. 2 and 3, all or none; Griffith Co., all or none.

WHAT DOES SUPERTWIST* MEAN Under a Dump Truck?



***SUPERTWIST**

Supertwist Cord is made of Pima Cotton, the longest and strongest cotton fibre grown.

It's pre-shrunk. It's wet-twisted, with more twists to the inch than ordinary cord.

Supertwist Cord gives a greater foundation strength to the body of a truck tire. This makes possible the use of a much tougher compound of rubber.

Supertwist Cord is an exclusive Goodyear feature patent protected. You get it in no other truck tire.

DUMP TRUCK OPERATORS are enthusiastic about this new Goodyear Lug Type Balloon Tire. They like the way those heavy, diagonal tread bars grip, bite down and pull in rough, broken ground—in ruts—in sand—wherever their trucks go.

They like, too, that tough, durable body of Supertwist Cord. It gives them long tire life, dependable performance, more miles . . . lower cost per ton-mile hauling.

Try this New Goodyear on your dump trucks. You'll agree—it's a MONEY SAVER.

These are the reasons why you'll save money with your dump trucks on Goodyear Lug Type Balloons—

- **MAXIMUM TRACTION**—because of those heavy, self-cleaning lugs that bite down and hold.
- **EXTRA-STRONG BEAD CONSTRUCTION**—for heavy, swaying loads.
- **HIGH PROFILE TREAD SHAPE**—more rubber on ground, more pulling power.
- **GREATER BODY STRENGTH**—because of Supertwist cord.
- **HEAT-RESISTING RUBBER**—blow-out protection, longer wear.
- **PIMA COTTON**—longest cotton fibre grown.

Ask for more information about this new Goodyear Truck Tire that's built for the kind of work your trucks do.

THE GOODYEAR TIRE & RUBBER COMPANY, INC., AKRON, OHIO

GOODYEAR

LUG TYPE BALLOON

single cylinder engine, 18,000 G. P. H.; 3 in. with 7 H. P. 2 cylinder engine, 24,000 G. P. H.; 4 in. 9 H. P. 2 cylinder engine, 30,000 G. P. H.; 4 in. 15 H. P. 4 cylinder engine, 36,000 G. P. H. All of the above ratings are taken at a 10 ft. total head.

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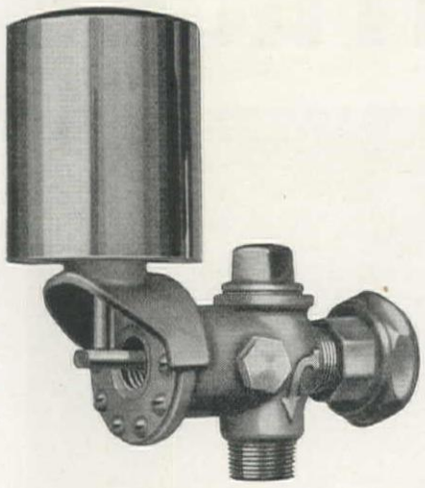

Lammert Control Valves

The Control or Automatic Shut-off Valve, illustrated, embodies a number of new features and refinements. They can be adapted to automatic operation, to remote control, or to automatic operation plus an interlock with a manual-reset device.

The valve has but two moving parts and is held firmly in position, when closed, by a spring. The valve needle and seat are of stainless steel, insuring perfect seating, quick action, trouble-free service and long life. All other parts are also of non-corrosive metals. Any part of the valve can be removed in a few seconds, without detaching the valve from the line, as the whole valve assembly can be taken out after removing a single screw plug, and same is true of piston, spring or other parts.

Lammert Liquid-Control or Automatic Shut-Off Valves are made by Lammert & Mann Co., 283 North Wood St., Chicago, Ill. They are made in standard sizes from ⅜ in. up.

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New Air Hose

The Mechanical Goods Division of U. S. Rubber Products, Inc., has announced a new type of hose for pneumatic tool and air drill service, the U. S. Super Royal Cord.

The outstanding feature of the new hose is its "tire-like" cords laid in tough rubber cushions isolated from adjacent plies to prevent rubbing or shearing. The manufacturer claims that this hose can withstand any amount of pulsation, sudden expansion under pressure and constant flexing in use.

Also, that it shows remarkable resistance to external blows, bruises and abrasions. This durability is due to the specially compounded brown rubber cover which will stand unusual abuse and will not peel when cut or gouged.

Water Supply Systems. . . . .

San Francisco, Calif.—City—Crystal Springs Pipeline No. 2

Contract awarded to Youdall Const. Co., 215 Market St., S. F., $846,159, Sec. "A" and $469,182, Sec. "B," by Public Utilities Comm., S. F., for const. the Crystal Springs Pipeline No. 2 from Millbrae to University Mound Reservoir, W. D. C. No. 79. Bids from:

		Sec. "A"	Sec. "B"	Secs. A & B
(1)	Youdall Const. Co., San Francisco	$846,159	$469,182	.....
(2)	Consolidated Steel Corp., Los Angeles	853,177	.....	.....
(3)	American Concrete & Steel Pipe Co., L. A.	.....	542,848	.....
(4)	United Concrete Pipe Corp., Los Angeles	.....	577,826	.....
(5)	MacDonald & Kahn Co., Ltd., San Francisco	927,119	593,754	$1,517,129
(6)	Uhlen Contracting Corp., Chicago	.....	582,263	.....

SECTION "A"	(1)	(2)	(5)
32,700 lin. ft. furn. & lay 60" x ⅜" weld. steel pipe	13.85	15.00	15.03
2,350 lin. ft. furn. & lay 60" x ⅜" weld. steel pipe (trestle or piers)	13.35	15.55	15.03
35,800 lb. furn. & inst. steel pipe specials	.15	.13	.15
610 ea. furn. & inst. beveled courses for curved sections	30.00	27.00	30.00
1,110,000 sq. ft. apply bitum. enamel protec. coating & lining	.08	.085	.08
497,000 sq. ft. felt wrapping on steel pipe	.04	.04	.05
51,000 sq. ft. ¾" mortar covering on steel pipe	.24	.22	.30
5 ea. furn. & inst. flexible couplings	77.00	80.00	77.00
1 ea. furn. & inst. expansion joints	$1,000	863.00	$1,000
27 ea. furn. & inst. manholes on pipe	108.00	121.00	108.00
6,500 lb. furn. & inst. saddle nozzles	.40	.39	.40
4,000 lb. furn. & inst. companion flanges	.22	.23	.22
5,000 lb. furn. & inst. miscell. steel work	.26	.25	.26
74,200 lb. furn. & inst. miscell. steel work not attach. to pipe	.14	.15	.14
20 ea. furn. & inst. 4" gate valves, 150# pressure	19.50	20.00	19.50
8 ea. furn. & inst. 4" gate valves, 150# press. bev. gears	35.50	34.00	35.50
36 ea. furn. & inst. 6" gate valves, 150# pressure	37.00	33.75	37.00
25 ea. furn. & inst. 6" gate valves, 150# press. bev. gears	52.00	46.00	52.00
12 ea. furn. & inst. 8" gate valves, 150# pressure	54.00	53.20	54.50
5 ea. furn. & inst. 8" gate valves, 150# press. bev. gears	69.50	66.50	70.00
2 ea. furn. & inst. 12" low pressure gate valves	89.50	84.30	90.00
3 ea. furn. & inst. 16" low pressure gate valves	156.00	147.50	156.00
10 ea. furn. & inst. 4" vacuum valves	112.50	118.00	112.50
25 ea. furn. & inst. 6" vacuum valves	165.00	170.00	165.00
5 ea. furn. & inst. 8" vacuum valves	245.50	240.00	246.00
26 ea. furn. & inst. air release valves	38.50	34.60	38.50
22,500 lb. furn. & inst. cast ir. pipe, gate valves covers & fitgs.	.15	.13	.15
3,500 lb. furn. & inst. corr. metal pipe culverts	.15	.14	.14
3,400 lb. furn. & inst. steel castings	.35	.32	.35
600 lb. furn. & inst. bolts, nuts and washers	.30	.20	.30
1,000 lb. install fittings furn. by City	.14	.12	.14
25,000 lb. install large gate valv. & Venturi meter (City furn.)	.06	.05	.06
2,000 lb. install misc. metalwork (City furnished)	.06	.07	.06
21,300 cu. yd. Class 1, earth excav., pipe trenches to 9'	2.50	.70	2.30
1,150 cu. yd. Class 1, earth excav., pipe trenches, below 9'	3.00	1.00	3.00
55,000 cu. yd. Class 2, earth excav. for pipe trenches	.70	.66	1.30
600 cu. yd. earch excav. for footings and struc.	2.00	1.20	1.50
6,600 cu. yd. additional for rock excavation	1.00	1.70	1.00
800 cu. yd. const. earth embankments	.60	.70	.60
13,000 cu. yd. sand backfill	1.00	1.00	1.20
100 each remove, repair and/or replace sewer laterals	20.00	25.00	10.00
500 lin. ft. furn. & install 6" main sewer	.35	.40	.50
240 cu. yd. Class "A" concrete	25.00	20.00	16.00
20 cu. yd. Class "B" concrete	23.00	20.00	16.00
20 bbls. extra cement	3.00	2.60	2.50
27,500 lb. reinforcing steel	.07	.06	.04
18,600 lin. ft. furn. untr. piles	.30	.27	.25
2,500 lin. ft. furn. treated piles	.80	.90	.75
450 ea. driving piles	22.00	27.00	26.00
120 MFBM furn. & install Redwood timber	100.00	118.00	90.00
20 MFBM furn. & install Douglas Fir timber	70.00	90.00	90.00
7,000 lb. furn. & install struc. steel	.05	.07	.06
4,000 sq. yd. paint misc. struc.	.30	.25	.30
18,000 sq. ft. repavement in S. F.	.23	.26	.24
60,000 sq. ft. repavement, San Mateo County	.22	.20	.26
L. S. const. 1 Venturi-meter building	$1,500	$1,900	$1,600

SECTION "B"	(1)	(3)	(4)	(5)	(6)
50 ft. furn. & lay 60" x ⅜" weld. stl. pipe (trench)	14.00	17.90	16.20	16.00	18.50
150 ft. furn. & lay same on trestle or piers	14.00	17.90	16.40	16.00	18.50
7,400 lb. furn. & inst. steel pipe specials	.13	.21	.15	.16	.18
12 ea. furn. & inst. bev. courses for curved sec.	30.00	45.00	40.00	36.00	45.00
5,300 sq. ft. apply bit. enamel protec. coating & lining	.08	.11	.15	.10	.14
200 sq. ft. feltwrapping on steel pipe	.04	.14	.10	.09	.08
1,100 sq. ft. ¾" mortar covering on steel pipe	.24	.11	.10	.25	.18
11 furn. & inst. manholes on pipe	180.00	$145	$150	$115	$135
4,900 lb. furn. & inst. saddle nozzles	.30	.28	.25	.35	.24
800 lb. furn. & inst. companion flanges	.27	.22	.18	.22	.25
200 lb. furn. & inst. misc. steel work	.25	.20	.20	.26	.25
37,800 lb. furn. & inst. same not attached to pipe	.20	.20	.15	.14	.14
8 ea. furn. & inst. 4" gate valves, 150# pressure	25.00	21.50	21.00	20.00	25.00
2 ea. furn. & inst. same with beveled gears	37.00	33.00	31.50	30.00	35.00
29 ea. furn. & inst. 6" gate valves, 150# pressure	36.00	36.00	34.80	32.00	40.00
17 ea. furn. & inst. same with beveled gears	49.00	48.50	49.20	42.00	50.00
2 ea. furn. & inst. 8" gate valves, 150# pressure	51.00	53.00	56.00	45.00	58.00
1 ea. furn. & inst. same with beveled gears	68.00	65.00	70.00	55.00	68.00
17 ea. furn. & inst. 6" vacuum valves	$150	$190	$210	$185	$195½
19 ea. furn. & inst. air release valves	39.00	42.50	38.00	42.00	35.00
7,500 lb. furn. & inst. cast iron pipe, gate valves, etc.	.12	.16	.15	.15	.13
500 lb. furn. & inst. corr. met. pipe culverts	.16	.14	.10	.15	.12
1,600 lb. furn. & inst. steel castings	.20	.24	.21	.35	.25
400 lb. furn. & inst. bolts, nuts & washers	.20	.13	.14	.30	.10
3,000 lb. install City furnished fittings	.10	.05	.04	.14	.10
8,200 lb. install City furn. valves & Venturi meter	.04	.05	.03	.06	.04
2,000 lb. install City furn. miscell. metalwork	.05	.06	.07	.06	.05
12,200 cu. yd. Cl. 1, earth exc. pipe trenches to 9'	1.90	.95	.96	2.20	1.10
4,900 cu. yd. Cl. 1, earth exc. pipe trenches, below 9'	.60	1.05	1.08	3.00	1.15
47,900 cu. yd. Cl. 2, earth exc. pipe trenches	.70	.70	.54	1.30	.95
200 cu. yd. earth excav., footings and struc.	2.00	3.85	2.00	1.50	1.50
720 cu. yd. addtl. for rock excaavtion	1.90	3.85	3.50	.75	3.00
200 cu. yd. const. earth embankments	.60	.80	1.00	.60	1.25

NOON, IT IS. The Bantam-Weight spent the morning on one job and will clean up another before night. That's the kind of speed you can get with this fast-digging, fast-moving ½-yd. (or ⅜-yd.) machine. • Ten minutes will see it loaded on its trailer and off across the map at truck speed. Another ten minutes and it's into the dirt, scooping it out with a cycle that's almost as rapid as a man can swing a hand shovel. • New light weight, high tensile steels, new welded construction, new Ford V-8 power, new design make such speed possible. Take a look at one of these Bantam-Weights in action—we shall be glad to tell you where the nearest one is working.

HARNISCHFEGER CORPORATION

4490 W. NATIONAL AVE. *Established 1884* MILWAUKEE, WIS.

Warehouses and Service Stations: HARNISCHFEGER CORPORATION, 82 Beale St., San Francisco; R. M. Taylor
WOODBURY & COMPANY, 133 S. W. Second Avenue, Portland, Oregon
WESTERN LOGGERS MACHINERY CO., 302 S. W. Fourth Ave., Portland, Oregon

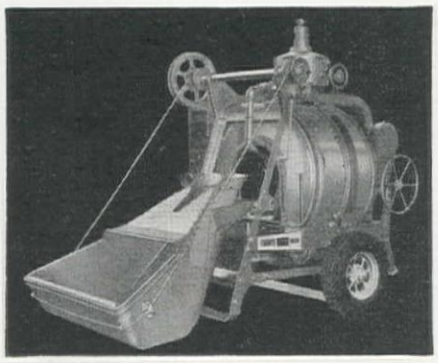
SEATTLE DALLAS LOS ANGELES SAN FRANCISCO

P&H BANTAM WEIGHT

FIRST TO THE JOB — AND FIRST THRU

ONE OF THE 22 P&H PACEMAKERS FOR 1936

When writing to HARNISCHFEGER CORPORATION, *please mention Western Construction News*



Mixers for Hi-Speed Trailing

To meet the demand for a one and two-bag mixer that can be towed behind a truck at passenger car speed, Construction Machinery Company, Waterloo, Iowa, has announced a well balanced two-wheel 7S and 10S non-tilt which is available on balloon pneumatic tired wheels. Springs absorb road shocks and the wheels turn on Twin Timken Bearings.

The new machines are of the End Discharge type. Use of Special Abrasion Resisting Steel and other alloys effect weight reduction without loss of durability. Optional with the pneumatic tired wheels are dual-solids or wide tread steel tired wheels —both roller bearing. New two-wheelers are compact and easy to move on the job.

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Bethlehem Steel Paving Plates

Bethlehem Steel Company, Bethlehem, Pa., has just placed on the market a new type of permanent and protective surfacing for concrete floors and paving, designated Bethlehem Steel Paving Plates which are designed for installation on the surface of concrete slabs to which they are anchored and with which they become an integral part.

When these plates are laid the fresh concrete fills slots to the top of the plate, providing additional bond between concrete and plate, and at the same time increasing its non-skid surface.

The floor-type Bethlehem Steel Paving Plate has a smooth surface, the long-shank anchorage studs, with flat heads, fastening through countersunk holes, make them flush with the top surface of the plate.

The anti-skid or road-type plate is applicable to thoroughfares, such as tunnels and bridges, that carry extremely heavy, continuous traffic.

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Brown-Bevis Open Arizona Branch

The Brown-Bevis Equipment Co. of Los Angeles announce the opening of a branch at 825 East Madison Street, Phoenix, Arizona. Fred A. Saheinzel will be in charge. The same lines will be represented in this office as that available in Los Angeles. Ralph P. Lane of the Austin-Western Road Machinery Co. will also make his headquarters in this new Phoenix office.

9,000	cu. yd. sand backfill	1.00	2.00	2.25	1.25	2.00
170	ea. remov., repair, or replace sewer laterals	12.00	15.60	14.20	10.00	10.00
4,000	ft. furn. & inst. 6" main sewer	.25	2.10	2.75	.48	2.15
60	cu. yd. "A" concrete	28.00	34.50	27.50	18.00	25.00
20	cu. yd. "B" concrete	26.00	34.50	25.00	18.00	25.00
10	bbl. extra cement	3.00	2.50	2.50	2.50	2.25
7,700	lb. reinforcing steel	.07	.05	.05	.04	.05
5	MFBM furn. & install Redwood timber	$100	$100	$100	$100	95.00
5	MFBM furn. & install Douglas Fir timber	90.00	85.00	90.00	90.00	80.00
1,000	lb. furn. & install struc. steel	.10	.16	.20	.05	.12
500	sq. yd. paint misc. structures	.60	2.25	2.50	.30	1.90
34,500	sq. ft. repavement in San Mateo County	.24	.25	.30	.21	.20
860	ft. furn. & lay 60" stl. cyl. reinf. conc. pipe 300' hd.	18.50	21.20	22.75	22.60	22.20
5,240	ft. furn. & lay 60" same, 275' head	17.17	20.45	22.75	21.80	21.90
9,690	ft. furn. & lay 60" same, 250' head	17.35	19.60	21.75	21.30	21.35
4,550	ft. furn. & lay 60" same, 225' head	17.00	19.30	21.25	20.60	21.00
150	ea. tension joints in concrete pipe	10.00	26.00	15.00	20.00	25.00
185	ea. furn. & inst. bevel courses for elbows	20.00	59.50	75.00	20.00	65.00

San Francisco, Calif.—City—Steel Crosstown Pipeline

Contract awarded to MacDonald & Kahn Co., Ltd., Financial Center Bldg., San Francisco, $193,994, by Public Utilities Comm., S. F., for laying the crosstown pipeline in San Francisco, under W. D. Contract No. 80. Bids from:

(1) MacDonald & Kahn Co., Ltd.....$193,994
(2) M. J. Lynch, San Francisco..... 198,760
(3) Sibley Grading & Teaming Co..... 199,109
(4) Barrett & Hilp, S. F.....$199,843
(5) Eaton & Smith, S. F..... 201,648
(6) Charles L. Harney, S. F..... 218,916

		(1)	(2)	(3)	(4)	(5)	(6)
11,150	ft. rem. from Newark & del. S. F., 36" stl. pipe	1.00	1.00	1.05	.84	.80	1.50
11,150	ft. rem. lining & coating from 36" stl. pipe	.60	.60	.64	.73	.60	1.00
75	ft. welding (repair holes in 36" pipe)	1.10	3.00	1.10	2.80	1.33	5.00
11,100	ft. reline & recoat 36" steel pipe	1.47	2.00	1.50	1.80	2.00	1.75
900	ft. fabr. line & coat 36" steel pipe	6.60	6.00	7.14	7.30	7.75	6.54
5,500	ft. fabr. line & coat 44" steel pipe	9.80	8.80	11.09	11.00	11.65	9.71
50	roundabout seams, fabr. bends, 36" stl. pipe	23.00	16.00	26.50	23.00	13.80	25.00
40	roundabout seams, fabr. bends, 44" stl. pipe	28.00	23.00	31.50	30.00	16.00	30.00
12,300	ft. excav. & backf. trench to 6', 36" pipe	2.50	2.50	2.705	2.40	2.40	2.50
5,500	ft. excav. & backf. trench to 6', 44" pipe	3.00	3.00	2.875	3.30	3.00	3.00
1,500	cu. yd. addtl. exc. & backf. trench to 8'	2.50	3.00	1.50	2.00	1.00	4.00
1,500	cu. yd. addtl. exc. & backf. trench over 8'	4.00	4.00	1.50	3.00	4.90	4.00
125	cu. yd. excav. & backf. for drains	3.00	2.00	1.50	5.00	2.40	2.00
150	cu. yd. excav. & backf. for blow-off	3.00	2.00	1.50	5.00	2.40	2.00
1,500	sq. ft. addtl. pavem. remove & replace	.40	.30	.35	.36	.30	.33
225	ft. install drains	1.00	1.00	.75	1.70	.75	1.00
12,300	lin. ft. install 36" pipe (steel)	1.00	1.00	1.30	1.00	1.00	1.60
5,500	lin. ft. install 44" pipe (steel)	1.99	1.50	1.37	1.12	1.20	2.40
350	lin. ft. make joints B & S	1.00	1.00	.75	1.00	.60	2.00
70,000	lb. install fittings	.04	.03	.04	.015	.01	.03
70,000	sq. ft. repavement	.18	.30	.175	.22	.22	.19

Street and Road Work. . . . . .

Sacramento, Calif.—State—Grading & Conc. Paving—Santa Barbara County

Contract awarded to Granfield, Farrar & Carlin, 67 Hoff Ave., San Francisco, $202,819, by Calif. Div. of Highways, Sacramento, for 3.1 mi. grad. & concr. paving between Tajiguas Creek and Arroyo Hondo in SANTA BARBARA CO. Bids from:

(1) Granfield, Farrar & Carlin.....$202,819
(2) J. E. Haddock, Ltd., Pasadena..... 208,839
(3) Geo. R. Curtis Paving Co..... 211,321
(4) Oswald Bros., L. A.....$214,735
(5) S. Pearson & Mundo Engrg Co..... 218,697

		(1)	(2)	(3)	(4)	(5)
30	sta. clearing and grubbing	20.00	50.00	10.00	65.00	200.00
1,500	M gallons water	1.00	2.00	2.50	3.30	1.30
130,500	cu. yd. roadway excavation	.30	.34	.375	.36	.31
690,000	sta. yd. overhaul	.005	.005	.005	.004	.007
21,050	cu. yd. imported borrow	1.20	.75	.50	1.20	1.60
2,900	cu. yd. struc. excaavtion	1.50	1.50	1.00	1.25	1.50
650	cu. yd. ditch & channel excavation	.50	1.50	.75	1.25	.80
6,900	cu. yd. intercept. ditch & dike excav.	.50	.50	1.00	.75	.50
36,700	sq. yd. subgrade for pavement	.90	.11	.10	.10	.10
166	sta. finish roadway	15.00	10.00	6.25	4.00	5.00
127	tons asph. cement Grade E (membrane seal)	19.00	19.00	20.04	19.00	25.00
40	tons liq. asph. SC-2 (prime coat)	12.00	10.00	11.00	10.50	15.00
450	tons liq. asph. SC-2 (rdmix surf. tr.)	11.00	9.40	9.90	9.50	12.00
59,000	sq. yd. prep., mix & shape shoulders & detours	.06	.07	.05	.055	.06
7,340	cu. yd. "A" concrete (pavement)	9.50	10.20	9.86	9.00	8.55
375	cu. yd. "A" concrete (structures)	20.00	20.00	26.00	24.50	20.00
58,300	lb. reinforcing steel (pav. & struc.)	.05	.06	.0625	.06	.05
9,910	ea. pavement dowels	.12	.12	.125	.11	.15
16	ea. pavement crossing devices	30.00	40.00	75.00	200.00	120.00
292	lin. ft. 8" corr. metal pipe	1.05	.90	.93	1.15	1.20
936	lin. ft. 18" corr. metal pipe	1.80	1.70	1.66	1.85	1.75
454	lin. ft. 24" corr. metal pipe	2.70	2.45	2.56	2.70	2.80
226	lin. ft. 30" corr. metal pipe	3.25	3.10	3.10	3.30	3.30
222	lin. ft. 36" corr. metal pipe	4.80	3.50	5.11	5.00	4.00
30	lin. ft. half-cir. 24" corr. metal culvert	4.25	3.00	1.88	3.00	1.70
1,308	lin. ft. remov., clean & salv. corr. meet. pipe	.75	1.00	.75	.75	.50
23	ea. spillway assemblies	15.00	18.00	15.00	15.00	15.00
4	ea. cast steel frames & covers	30.00	35.00	37.50	37.00	40.00
2,500	sq. yd. paved gutters & inlet aprons	1.25	1.50	2.25	1.00	1.00
3,300	cu. yd. remove concrete	1.50	2.50	2.20	1.60	2.00
2,300	cu. yd. salvage detour material	1.50	.50	.75	1.00	2.30
3.8	mi. new fence, Type "A"	450.00	600.00	625.00	550.00	600.00
0.3	mi. new fence, Type "B"	500.00	700.00	687.50	600.00	600.00
20	each drive gates	15.00	15.00	15.00	19.00	25.00
2,570	lin. ft. laminated guard rail	.95	.80	1.25	1.00	1.20
5,000	lin. ft. move and reset guardrailing	.50	.50	.63	.60	.50
53	ea. guideposts	2.50	2.00	2.20	2.00	3.50
52	ea. culvert markers	2.50	2.50	2.50	2.25	3.50
88	ea. monuments	3.00	3.00	3.00	3.00	3.00

Seattle Dealers Elect Officers

The Associated Equipment Distributors of Seattle have elected the following officers to serve during the ensuing year: W. H. Booth, president; H. C. Raymer, vice-president, and Elmer R. Schoen, secretary-treasurer.

The executive board during the year will be composed of H. C. Raymer, George H. Jamison, H. B. Fay, Elmer R. Schoen and W. H. Booth.

●

Allis-Chalmers Appoints Rocky Mountain Distributor

The H. W. Moore Equipment Co. of Denver has become distributor in Colorado, Wyoming and western Nebraska for Allis-Chalmers crawler tractors. Three new men have been added to the staff to handle the line. Dan C. Straight is in charge of northwestern Colorado, A. O. Bundy of western Nebraska and O. A. Sylte of a branch office at Cheyenne, covering the Wyoming territory.

●

Link-Belt Appoints Feenaughty

Announcement is made by Link-Belt Company, Chicago, that the Feenaughty Machinery Company has been appointed distributor for Link-Belt Shovels, Cranes, Draglines in Pacific Northwest territory. Feenaughty headquarters are in Portland, Oregon, with branches located in Seattle and Spokane, Washington and Boise, Idaho. The organization is headed by W. O. Feenaughty, president; J. I. Overman, vice-president; D. J. Feenaughty, secretary; and F. A. Kingston, sales manager.

●

Byers Appoints Western

The Byers Machine Company of Ravenna, Ohio, announces the appointment of Western Road Machinery Company, Edward L. Kropp, 83 S. E. Belmont, Portland, Oregon, as exclusive distributor for the State of Oregon for the entire line of Byers Shovels, Cranes, Draglines, Skimmers.

●

Perkins Named Crusca Manager

A. E. Perkins has been appointed Western Division Manager for the Crucible Steel Company of America. In this capacity, Perkins will have jurisdiction over all western branches, including Denver, Los Angeles, San Francisco, Portland and Seattle. P. F. Harris, formerly District Representative of Crucible Steel Co. and the Halcomb Steel Co. in the Crusca Los Angeles branch, now becomes manager of the Los Angeles branch.

●

Outlet for Mall Tools

The Mall Tool Company, Chicago, Illinois, manufacturers of gasoline engine and electric motor driven concrete vibrators and rubbing machines, announces the opening of a new store and office in Los Angeles, at 2828 South Santa Fe Avenue.

Sacramento, Calif.—State—Grade & Surface—Santa Cruz County

Contract awarded to Peninsula Paving Co., 9 Main St., S. F., $202,613, ALT. "A," and $206,260, ALT. "B," by Calif. Div. of Highways, Sacramento, for 3.9 mi. grad.. & Cr. run base surf. & natural rock asph. surf. OR cr. run base & pl. Mix surf. betw. Scotts Valley & 1 mi. North of Santa Cruz, in SANTA CRUZ CO., Calif. Bids from:

		Alt A	Alt. B
(A)	Peninsula Pav. Co.	$202,613	$206,260
(B)	David H. Ryan, San D.	203,470	.....
(C)	Young & Son Co., Berk.	204,450	207,450
(D)	R. R. Carlson, Stock.	206,055	206,433
(E)	Poulos & McEwen, Sac.	211,097	.....
(F)	Mittry Bros., L. A.	218,082	220,711
(G)	Union Paving Co., S. F.	.....	219,479

(1)	208	sta. clearing and grubbing
(3)	1,800	M gallons water
(3)	255,000	cu. yd. roadway excavation
(4)	5,600	cu. yd. struc. excavation
(5)	900,000	sta. yd. overhaul
(6)	208	sta. finish roadway
(7)	130	cu. yd. "A" concr. (struc.)
(8)	8,000	lb. reinf. steel (struc.)
(9)	950	ft. 8" corr. metal pipe
(10)	180	ft. 12" corr. metal pipe
(11)	1,200	ft. 18" corr. metal pipe
(12)	292	ft. 24" corr. metal pipe
(13)	174	ft. 30" corr. metal pipe
(14)	270	ft. 60" corr. metal pipe, 8 gauge
(15)	110	ft. 72" corr. metal pipe, 10 gauge
(16)	190	ft. 72" corr. metal pipe, 8 gauge
(17)	34	ea. spillway assemblies
(18)	9,000	ft. 8" perf. met. pipe underdr.
(19)	1,620	cu. yd. rockfilling material
(20)	478	ft. rem. clean & relay pipe culv.
(21)	427	ft. rem. clean & salv. pipe culv.
(22)	70	ft. 8" vitr. pipe
(23)	1,100	ft. laminated guardrail

		Alt. A	Alt B
(H)	A. J. Raisch, San Jose.	$224,201	$224,027
(I)	Gibbons & Reed, Burbk.	234,313	238,763
(J)	A. Teichert & Son, Sac.	240,926	235,803
(K)	Hanrahan Co., S. F.	252,053	.....
(L)	Woods & Bevanda Stock.	268,364	294,872
(M)	V. R. Dennis Const. Co.	282,252	280,710

(24)	1,140	ft. remov & stockp. guardrailing
(25)	54	ea. culvert markers
(26)	1,000	ea. guideposts
(27)	5.0	mi. new property frence
(28)	23	ea. 14-ft. drive gates
(29)	7	ea.12-ft. drive gates
(30)	1,700	cu. yd. remove concrete
(31)	113	ea. monuments
(32)	100	tons(liq. asph. SC1A (shoulders)
(33)	70	tons liq. asph. SC-2 (shoulders)
(34)	440	tons screenings (shoulders)
		ALTERNATE "A"—Natural Rock Asph.
(35)	34,250	tons crusher run base
(36)	6,600	tons Natural rock asphalt
(37)	90	tons emul. asph. 95 plus
(38)	215	tons screen. (prime coat)
		ALTERNATE "B"—Plant Mix
(39)	32,360	tons cr. run base
(40)	74	tons liq. asph. MC2 (prime ct.)
(41)	9,250	tons min. aggreg. (pl. mix surf.)
(42)	450	tons liq. asph. MC 40R5 pl. mix
(43)	50	tons liq. asph. (MC3 (seal coat)
(44)	430	tons screenings (seal coat)

	(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)
(1)	40.00	36.00	24.00	25.00	47.00	25.00	50.00	20.00	33.00	37.00	60.00	11.50	$100
(2)	1.25	1.20	1.60	1.25	1.00	.50	.50	1.50	2.40	2.00	1.50	2.30	2.50
(3)	.24	.22	.22	.24	.22	.245	.24	.25	.286	.26	.33	.345	.35
(4)	1.00	1.00	.90	1.00	1.25	1.00	1.00	1.50	1.05	1.25	1.00	.92	1.00
(5)	.005	.0025	.006	.005	.005	.005	.005	.005	.0045	.005	.005	.005	.0075
(6)	5.00	5.00	5.00	10.00	5.00	8.00	5.00	3.50	4.40	10.00	8.00	11.50	5.00
(7)	25.00	21.60	22.00	28.00	20.00	25.00	20.00	16.00	25.00	27.50	23.00	20.70	22.00
(8)	.06	.05	.06	.06	.05	.05	.06	.05	.06	.06	.06	.06	.10
(9)	.90	.95	.90	1.25	1.00	1.00	1.10	1.00	1.00	1.10	1.00	1.15	1.10
(10)	1.10	1.25	1.15	1.75	1.25	1.25	1.50	1.25	1.30	1.40	1.20	1.45	1.75
(11)	1.50	1.70	1.75	2.00	1.80	1.75	2.00	1.75	1.80	2.00	1.70	2.02	2.00
(12)	2.50	2.65	2.50	3.00	2.70	2.75	3.00	2.75	2.70	2.80	2.70	2.88	3.00
(13)	3.00	3.30	3.00	5.00	3.45	3.20	3.75	3.25	3.40	3.50	3.40	3.45	4.00
(14)	14.00	12.80	12.00	12.00	14.50	12.00	16.00	12.25	14.30	14.80	14.00	14.38	17.00
(15)	15.00	13.60	12.80	17.00	14.25	13.50	15.00	12.80	14.25	15.60	15.00	14.38	18.00
(16)	17.00	15.55	15.00	18.00	16.00	17.50	18.00	15.30	16.40	18.00	18.00	16.10	20.00
(17)	15.00	12.70	14.00	15.00	12.00	20.00	15.00	15.00	15.00	16.00	15.00	13.80	15.00
(18)	.90	.95	.88	1.00	.90	1.00	1.00	1.25	1.00	1.10	1.00	1.15	1.10
(19)	2.75	2.45	2.85	2.00	2.00	4.00	4.00	2.50	3.80	4.00	2.90	3.45	3.75
(20)	.50	1.50	1.00	1.50	2.50	1.50	.75	1.00	1.00	1.00	.50	1.45	1.00
(21)	.50	1.00	.75	.50	2.00	1.50	.50	.60	.75	.75	.40	1.45	.75
(22)	1.00	1.20	.75	1.25	1.00	1.25	1.00	.90	.60	.80	.75	1.15	1.00
(23)	1.00	1.10	1.10	1.00	1.25	2.50	1.00	1.10	1.00	1.00	1.00	1.04	1.00
(24)	.10	.30	.10	.25	.50	.50	.25	.40	.10	.40	2.25	.58	.50
(25)	2.00	1.50	2.00	2.00	1.00	2.00	2.00	2.50	1.65	2.50	2.00	3.30	2.00
(26)	1.75	1.50	2.00	1.50	1.00	2.00	2.00	2.00	1.65	2.50	1.70	2.30	2.00
(27)	$750	$650	$800	$400	$630	$650	$500	$750	$555	$780	$840	$460	$700
(28)	25.00	20.00	18.00	20.00	20.00	18.00	16.00	20.00	13.00	16.00	24.00	13.80	15.00
(29)	20.00	18.00	14.00	20.00	20.00	16.00	15.00	17.50	12.00	5.00	22.00	16.10	15.00
(30)	1.25	1.10	2.50	1.50	1.00	2.50	2.00	2.00	2.20	2.50	1.40	2.30	3.00
(31)	3.00	1.50	2.75	3.00	3.00	3.00	2.50	3.00	2.75	3.00	3.00	2.30	3.00
(32)	12.00	15.60	12.50	14.00	14.00	12.00	14.00	12.00	11.40	16.00	15.50	10.35	15.00
(33)	12.50	16.80	13.70	15.50	15.00	13.50	15.00	13.00	12.50	16.00	15.00	11.50	16.00
(34)	3.00	2.40	2.90	3.50	3.00	2.80	3.00	3.00	3.15	3.20	3.30	3.45	4.00
(35)	1.40	1.65	1.60	1.40	1.70	1.65	.....	1.73	1.70	1.82	1.86	2.30	1.80
(36)	3.90	4.10	4.00	4.50	3.40	4.20	.....	4.75	4.75	4.66	4.22	4.89	5.35
(37)	21.00	23.00	23.00	25.00	20.00	20.00	.....	20.00	21.50	27.00	25.00	9.20	25.00
(38)	3.00	2.70	2.90	3.50	3.00	2.80	.....	3.00	3.15	4.00	3.30	3.45	4.00
(39)	1.40	.....	1.60	1.40	.....	1.65	1.45	1.74	1.72	1.82	.....	2.30	1.80
(40)	20.00	.....	20.25	15.00	.....	18.00	22.00	20.00	19.40	32.50	.....	11.50	22.00
(41)	2.45	.....	2.55	2.50	.....	2.80	3.00	2.38	3.15	2.00	.....	5.75	3.00
(42)	18.00	.....	17.00	20.00	.....	14.50	20.00	24.00	18.00	20.00	.....	18.40	18.00
(43)	21.00	.....	23.00	20.00	.....	18.50	20.00	20.00	19.35	22.00	.....	18.40	22.00
(44)	3.00	.....	2.90	3.50	.....	2.80	3.00	3.00	3.15	3.20	.....	3.45	4.00

Los Angeles, Calif.—State—Grading & Surfacing—San Diego County

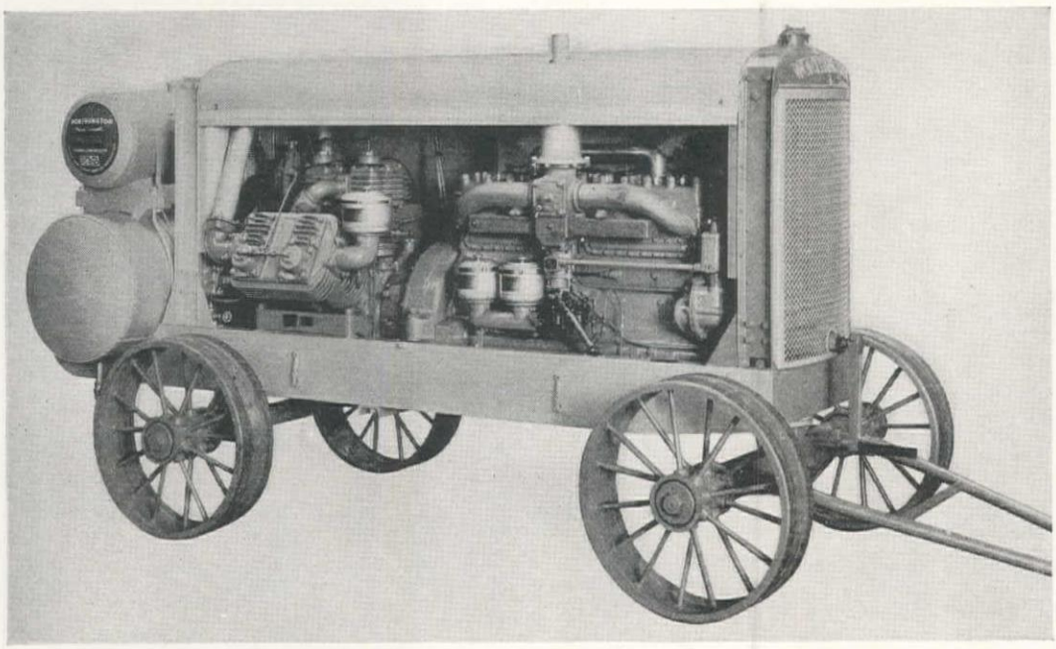
Contract awarded to Basich Bros., 20550 N. Normandie Ave., Torrance, $297,396, by Calif. Division of Highways, Los Angeles, for 3.3 mi. grading on Palomar Mt. Road between Iron Springs Creek and the Observatory site, SAN DIEGO COUNTY. Bids from:

(1)	Basich Bros., Torrance	$297,396	(5)	J. E. Haddock, Ltd., Pasadena. $323,601
(2)	C. W. Caletti & Co., San Rafael	298,233	(6)	Granfield, Farrar & Carlin 324,898
(3)	Daley Corp., San Diego	313,133	(7)	Oswald Bros. 325,745
(4)	Shofner & Gordon	316,116	(8)	V. R. Dennis, San Diego 363,555

Bids received on:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
173 sta. clearing & grubbing	$250	$250	$290	$500	$340	$800	$300	$250
500 M gallons water	3.00	4.00	3.00	3.00	3.00	2.50	2.90	4.00
138,500 cu. yd. roadw. excav.	1.46	1.50	1.50	1.40	1.55	1.00	1.65	1.85
132,500 sta. yd. overhaul	.01	.02	.02	.01	.02	.01	.08	.02
1,650 cu. yd. struc. excav.	2.20	2.50	4.00	2.50	3.00	2.50	3.00	4.00
10,000 cu. yd. imp. sel. matl.	2.20	2.00	2.25	.50	2.10	2.00	2.00	2.00
173 sta. finish roadway	$15	$20	$5	$20	$20	$15	5.00	$40
1,486 lin. ft. 18" corr. met. pipe	2.60	3.00	3.00	3.00	3.00	2.50	2.80	3.00
512 lin. ft. 24" corr. met. pipe	4.50	3.00	5.00	4.00	3.00	4.00	4.00	5.00
116 lin. ft. 30" corr. met. pipe	5.50	6.00	7.00	5.00	4.00	5.00	5.00	8.00
370 lin. ft. 36" corr. met. pipe	7.90	6.00	9.00	6.00	5.00	8.00	7.00	$12
128 lin. ft. 48" corr. met. pipe	11.60	9.00	$13	8.00	8.00	$12	$10	$15
68 ft. 8" perf. met. pipe underdr.	1.85	2.00	3.00	2.00	2.50	1.75	2.75	3.00
120 ft. 75" multi-plate C. M. P.	$28	$20	$30	$30	$20	$30	$26	$50
60 cu. yd. rubble masonry	$15	$20	$30	$50	$24	$15	$21	$35
0.3 mi. remove fences	$125	$500	$150	$300	$400	$150	$300	$500
1,050 ea. border stones	5.00	1.00	2.50	3.00	4.00	3.00	1.60	3.00

WORTHINGTON CONTRACTORS EQUIPMENT

. . . keeps the job moving



No. 36 Rock Hammer

No. 10 Pavement Breaker

No. 9 Clay Digger

No. 8 Backfill Tamper

THE job moves on! No thought about an interrupted air flow . . . no fear of the air supply failing when Worthington Portable Compressors are at work. These compressor units will stay on the job until the last hole has been drilled . . . until the last shoulder has been tamped.

That is why their steady, even performance is such a powerful argument in favor of Worthington Portables.

And when the air tools on the job are Worthingtons . . . the stick-to-it factor is 100%.

● *Literature on request*

A. C. HAAG & COMPANY, Portland
STAR MACHINERY COMPANY, Seattle
GENERAL MACHINERY COMPANY, Spokane
WESTMONT TRACTOR & EQUIPMENT CO., Missoula
GARFIELD & COMPANY, San Francisco
COLLIER TRACTOR & EQUIPMENT COMPANY, Reno
GARLINGHOUSE BROTHERS, Los Angeles
CONTRACTORS EQUPT. & MACHY. CO., San Diego
VANDERCOOK COMPANY, Sacramento
BURTON BROTHERS, Rosamond
ARIZONA MACHINERY COMPANY, Prescott

THE WORTHINGTON COMPANY, Incorporated
SEATTLE SAN FRANCISCO LOS ANGELES

WORTHINGTON

A-36225

Literature

Sullivan Machinery Company, Hammer Drill Division, Claremont, N. H., announces the publication of its new bulletin entitled "Going Places." This bulletin describes Sullivan's New L-2 45-lb. rock drill and advantages. A copy will be sent upon request to the company.

●

Bethlehem Steel Paving Plates.—A four page illustrated folder, No. 354, describes two new types of paving plates, designed for use on roadways, plant floors, loading platforms and docks. Suitable sketches provide instruction details for installation. Copies of this folder may be had upon request.

●

"Cost Finding Record Book for Conveyor Belts" is the title of a new book recently issued by the B. F. Goodrich Company, Mechanical Goods Div., Akron, Ohio, and is available to anyone who is interested in maintaining a running record of conveyor performance as a means of determining belt cost.

The book contains eleven belt and conveyor record sheets; based upon the experience of the manufacturer and users throughout the United States. It can be maintained at slight expense.

OFFICIAL BIDS

UNITED STATES DEPARTMENT OF THE INTERIOR

Bureau of Reclamation

Arnold Dam and Power Plant

Washington, D. C., February 29, 1936.

Sealed bids (Specifications No. 673) will be received at the office of the U. S. Bureau of Reclamation, Austin, Texas, until 10 a. m., March 31, 1936, and will at that hour be opened for furnishing labor and materials and performing all work for the construction of the Arnold dam and power plant, and the processing of sand and crushed rock for the Arnold and Hamilton dams, Colorado River project, Texas. The work is located west of Austin and near Burnet and Kingsland, Texas. The specifications provide for alternative bids on two different types of construction, one a concrete gravity dam and the other concrete slab and buttress dam. The contractor under either schedule shall construct and maintain at his own expense a road between the end of the railroad at the Hamilton Dam and the Arnold Dam. The principal items of work and the advance estimated quantities involved in the two alternative types, which are covered by Schedules Nos. 1 and 2 of the specifications, are as follows: Schedule No. 1 (concrete gravity dam), 20,000 cu. yds. of common excavation in open cut; 25,000 cu. yds. of rock excavation in open cut; 136,000 cu. yds. of concrete in dam and spillway bucket; 7,200 cu. yds. of concrete in appurtenances to dam and in power house; 11,000 cu. ft. of pressure grouting; drilling 15,000 linear feet of grout and drainage holes; placing 500,000 pounds of reinforcement bars; installing 135,000 pounds of standard steel, brass, and cast iron pipe, fittings, and valves; erecting 285,000 pounds of structural steel in power house and switchyards; installing 415,000 pounds of gates, gate hoists, control mechanism, power penstock, cranes, and crane rails, metal pier noses, hand railing, trash rack and other metalwork. Schedule No. 2 (reinforced concrete slab and buttress dam), 26,000 cu. yds. of common excavation in open cut; 15,000 cu. yds. of rock excavation in open cut; 34,800 cu. yds. of concrete in buttresses and face slabs; 8,600 cu. yds. of concrete in footings and spillway bucket; 13,000 cu. yds. in mass sections of dam; 7,200 cu. yds. in appurtenances to dam and in power house; 7,700 cu. ft. of pressure grouting; drilling 7,700 linear feet of grout holes; placing 3,800,000 pounds of reinforcement bars; installing 60,000 pounds of standard steel, brass and cast iron pipe, fittings, and valves; erecting 285,000 pounds of structural steel in power house and switchyard; and installing 485,000 pounds of gates, gate hoists, control mechanism, power penstocks,

(Continued on Page 46)

Sacramento, Calif.—State—Grad. & Conc. Paving & Bridge—Monterey County

Contract awarded to Peninsula Paving Co., 9 Main St., S. F., $316,342, by Calif. Div. of Highways, Sacramento, for 6.8 mi. grad. & concr. paving & const. a reinf. concr. bridge betw. Bradley and 6 mi. S. of San Ardo in MONTEREY COUNTY, Calif. Bids from:

(A)	Peninsula Paving Co., S. F.	$316,342	
(B)	David H. Ryan, San Diego	327,008	
(C)	Wood & Bevanda, Stockton	346,774	
(D)	N. M. Ball and Bodenhamer Const.	348,998	
(E)	Union Paving Co., S. F.	349,149	
(F)	A. Teichert & Sons, Inc.	354,791	
(1)	362	sta. clearing & grubbing	
(2)	2,540	M gallons water	
(3)	241,000	cu. yd. roadway excavation	
(4)	2,940,000	Sta. yd. overhaul	
(5)	4,850	cu. yd. ditch & chann.exc.	
(6)	6,785	cu. yd. struc. excavation	
(7)	1,510	cu. yd. remove concrete	
(8)	11,000	cu. yd. imported borrow	
(9)	225	tons asph. cement, Grade E	
(10)	80,300	sq. yd. prep. subgr. for pav.	
(11)	362	sta. finish roadway	
(12)	75,000	sq. yd. prep. mix & shape shldrs.	
(13)	770	tons liq. asph. SC-2 (rdmix. surf.)	
(14)	2,550	cu. yd. salv. detour surf.	
(15)	15,770	cu. yd. A concr. (pavement)	
(16)	254,500	lb. reinforcing steel (pav. & str.)	
(17)	32,460	ea. pavement dowels	
(18)	10	ea. pavem. cross. device A-20	
(19)	1,180	cu. yd. A concr. (struc.)	
(20)	66	cu. yd. A concr. (foot blocks)	

(G)	Heafey Moore Co., Oakland	$358,867	
(H)	Oswald Bros., Los Angeles	365,673	
(I)	V. R. Dennis Const. Co.	375,900	
(J)	J. E. Braddock, Ltd., Pasadena	387,815	
(K)	Mittry Bros. Const. Co.	390,815	
(L)	Hanrahan Co., S. F.	393,711	
(21)	252	ft. timber railing	
(22)	260	cu. yd. dry rubble	
(23)	518	lin. ft. 8" corr. metal pipe	
(24)	1,434	lin. ft. 18" corr. metal pipe	
(25)	502	lin. ft. 24" corr. metal pipe	
(26)	264	lin. ft. 30" corr. metal pipe	
(27)	198	lin. ft. 36" corr. metal pipe	
(28)	62	lin. ft. 54", 12 ga. corr. metal pipe	
(29)	124	lin. ft. 54", 8 ga. corr. metal pipe	
(30)	280	lin. ft. 8" perf. metal pipe undr.	
(31)	75	cu. yd. rockfilling material	
(32)	45	ea. spillway assemblies	
(33)	1,790	sq. yd. pav. gutters & inlet apr.	
(34)	980	ft. lam. guardrailing	
(35)	63	ea. culvert markers	
(36)	349	ea. guide posts	
(37)	10	mi. new fence, Type A	
(38)	3.8	mi. new fence, Type B	
(39)	36	ea. drive gates	
(40)	120	ea. monuments	

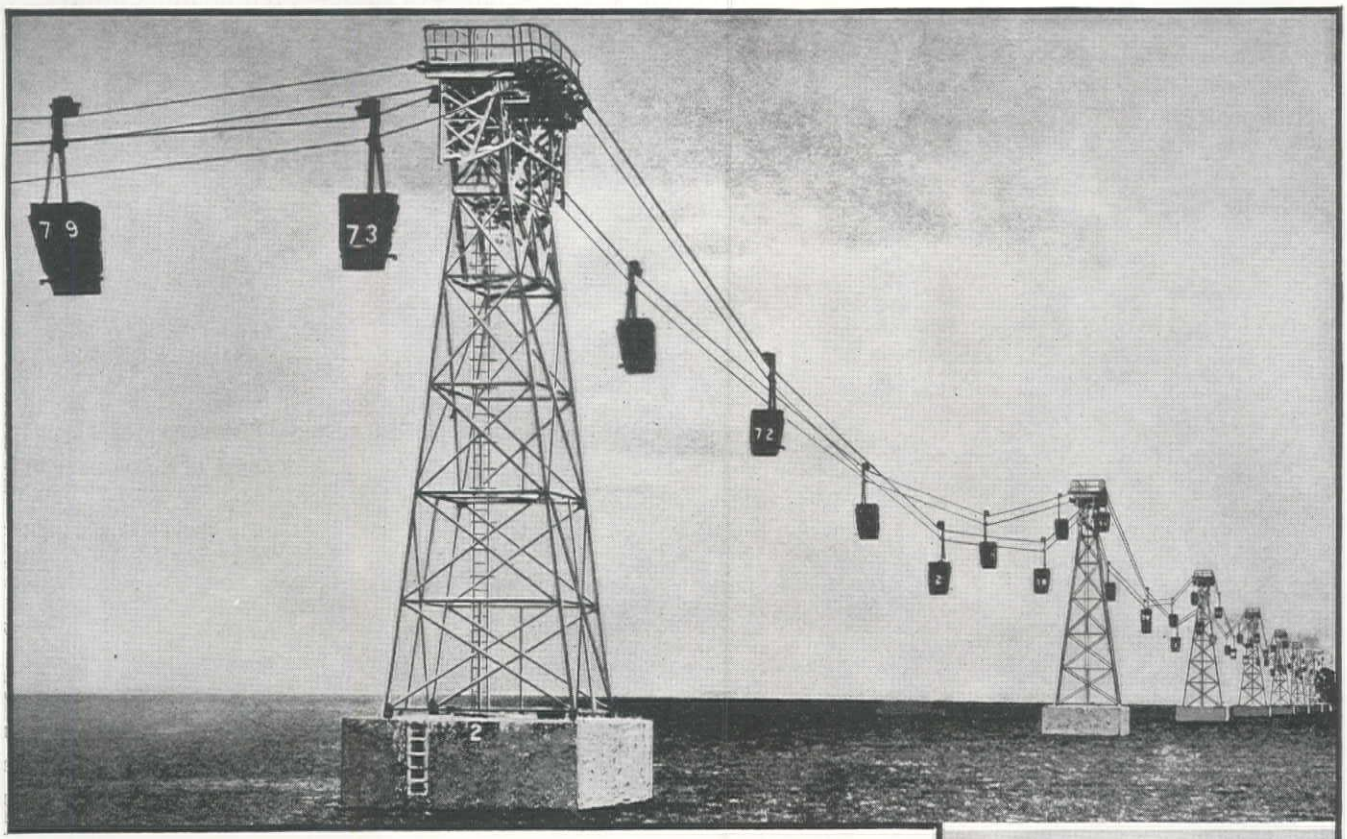
	(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)
(1)	10,00	9.60	10.00	15.00	15.00	15.00	10.00	4.25	20.00	10.00	10.00	10.00
(2)	1.10	1.00	2.00	1.25	.50	1.00	.50	2.60	2.00	2.00	3.00	.31
(3)	.20	.27	.25	.27	.24	.25	.24	.28	.26	.31	.32	.28
(4)	.005	.0025	.005	.005	.003	.004	.003	.003	.004	.005	.005	.0025
(5)	.50	1.00	.50	.90	.40	.60	1.00	.85	.75	1.00	.60	.50
(6)	.80	.75	.75	1.00	1.00	1.00	1.00	1.40	.50	1.50	1.50	1.40
(7)	1.30	1.00	1.50	2.00	2.50	2.00	1.50	1.50	2.00	2.50	3.00	1.00
(8)	.55	.70	.75	.60	1.00	.57	.65	.54	.75	.60	.50	.75
(9)	25.00	20.00	25.00	20.00	20.00	20.00	19.50	26.00	25.00	22.00	32.00	24.00
(10)	.07	.10	.10	.09	.08	.10	.09	.09	.12	.11	.10	.10
(11)	5.00	5.00	10-00	6.00	5.00	5.00	10.00	3.25	10.00	10.00	10.00	10.00
(12)	.05	.05	.06	.05	.07	.05	.07	.055	.06	.07	.12	.06
(13)	13.50	17.00	12.00	11.00	13.00	11.00	12.00	11.00	12.00	12.50	13.00	19.00
(14)	.80	.50	1.00	1.00	.50	.90	1.40	1.00	1.50	.50	1.00	1.20
(15)	8.90	8.40	9.50	9.50	10.00	10.00	9.98	9.80	10.00	10.00	9.50	10.65
(16)	.05	.05	.05	.05	.05	.05	.06	.055	.06	.06	.055	.07
(17)	.16	.15	.15	.14	.16	.15	.12	.14	.16	.15	.15	.25
(18)	75.00	$100	$100	75.00	70.00	75.00	70.00	$120	$100	40.00	$200	90.00
(19)	18.00	20.00	17.50	17.50	18.00	21.75	25.00	26.00	24.00	22.00	19.00	27.00
(20)	14.00	25.00	15.00	15.00	16.00	20.75	23.00	40.00	24.00	22.00	10.00	22.00
(21)	1.00	1.50	1.50	2.00	1.20	1.25	.80	1.20	1.00	1.00	2.75	1.70
(22)	2.00	5.00	2.50	5.00	8.00	7.50	2.00	6.00	6.00	5.00	9.00	6.00
(23)	.75	1.00	.90	1.00	1.00	1.00	1.00	1.00	1.00	.90	1.10	1.20
(24)	1.40	1.70	1.80	1.75	2.00	1.75	2.00	1.75	2.00	1.60	2.10	1.80
(25)	2.25	2.60	2.75	2.25	3.00	2.75	2.75	2.65	3.00	2.45	3.20	2.70
(26)	2.75	3.30	3.25	3.00	4.00	3.25	3.72	3.40	4.00	3.10	3.75	3.50
(27)	4.25	5.20	5.00	4.50	5.00	5.00	5.33	5.00	6.00	4.80	5.80	5.50
(28)	7.50	8.20	7.00	9.00	19.00	8.20	9.37	8.50	9.00	7.60	10.00	10.00
(29)	10.50	11.40	10.50	12.00	14.00	11.50	12.44	12.00	13.00	11.00	15.00	14.00
(30)	.80	1.00	.90	1.20	1.00	1.00	1.00	1.00	1.00	.90	1.10	1.00
(31)	3.25	2.50	3.50	3.50	3.00	5.00	3.50	4.00	3.00	5.00	4.50	1.40
(32)	15.00	13.00	14.00	15.00	15.00	15.00	13.00	15.00	15.00	15.00	20.00	15.00
(33)	1.05	.50	1.25	.30	1.25	1.25	1.50	1.00	1.50	1.50	1.50	1.40
(34)	1.00	1.50	1.00	1.00	1.00	1.00	1.25	1.00	1.00	1.00	3.00	1.00
(35)	1.75	1.50	2.50	2.00	2.00	2.50	2.00	2.00	2.00	2.50	2.00	2.00
(36)	1.50	1.50	2.50	2.00	2.00	2.50	2.00	1.60	2.00	2.00	2.50	1.70
(37)	$500	$400	$425	$500	$450	$450	$550	$435	$500	$600	$550	$550
(38)	$600	$500	$500	$650	$500	$600	$750	$600	$700	$850	$650	$700
(39)	23.00	20.00	15.00	16.00	15.00	20.00	15.00	16.00	15.00	15.00	28.00	21.00
(40)	3.00	2.00	3.00	3.00	3.00	3.00	2.50	3.00	3.00	3.00	4.00	3.00

Phoenix, Ariz.—State—Grading, Paving, etc.

Packard Contracting Co., 402 Title & Trust Bldg., Phoenix, $192,740, low, to State Highway Commission, Phoenix, Arizona, for grading, draining and placing aggregate base course about 17 mi. east of Showlow and extends easterly for a distance of 10 mi. on the Showlow-Springerville Highway WPH 105-B, AFE 6022. Bids received from:

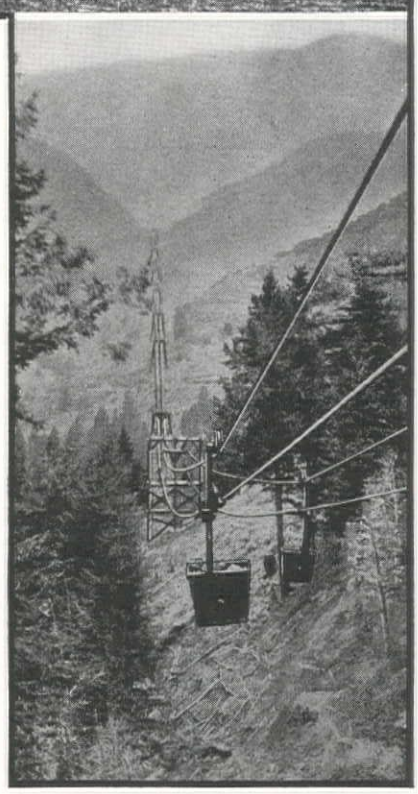
(1)	Packard Contracting Co.	$192,740	
(2)	O. F. Fisher Const. Co., Phoenix	205,989	
(2)	Ken Hodgman, Pasadena	217,835	
(4)	Lee Moor Contr. Co., El Paso	$230,050	
(5)	R. C. Tanner Co., Phoenix	244,167	

		(1)	(2)	(3)	(4)	(5)
44,383	cu. yd. roadway excav.	.45	.65	.62	1.00	.77
1,953	cu. yd. drainage excav.	.37	.69	.30	.77	.80
1,391	cu. yd. struc. excav.	2.00	.69	1.35	2.25	3.00
39,341	sta. yd. overhaul	.05	.02	.05	.03	.06
2,339	cu. yd. mile haul	.45	.48	.40	.43	.45
2,647	cu. yd. rock fill	1.17	1.37	1.00	1.35	2.00
156,669	cu. yd. imported borrow	.195	.22	.28	.325	.30
150,800	cu. yd. imported borrow haul	.20	.29	.23	.20	.23
28,368	tons aggr. base course	1.00	.99	.80	.94	.80
1,299	cu. yd. class "A" concrete	26.00	22.00	30.00	30.00	30.00
126,939	lbs. reinf. steel bars	.05	.055	.07	.045	.08
126	lin. ft. 18" corr. metal pipe	2.34	1.76	3.00	2.25	3.00
824	lin. ft. 24" corr. metal pipe	3.42	2.68	4.00	3.25	4.00
718	lin. ft. 36" corr. metal pipe	6.53	5.08	7.00	5.80	6.00
84	lin. ft. 42" corr. metal pipe	7,26	5.95	9.00	6.75	7.00
105,970	lin. ft. std. line fence	.073	.07	.08	.075	.07
3,400	lin. ft. grader ditches	.03	.03	.04	.10	.07
4,500	lin. ft. crown ditches	.04	.03	.05	.10	.10
56	ea. right of way markers	2.75	2.60	2.50	3.75	2.00
239	ea. guide posts	3.20	1.81	2.50	3.20	2.00
8	ea. std. wire gates	5.00	2.62	10.00	3.50	10.00
2,112	lin. ft. road guard	1.24	.87	1.10	1.00	1.20
3,000	cu. yd. stripping pits	.28	.19	.38	.28	.25
3,119	M gals. sprinkling	3.65	2.30	2.00	3.00	3.00
780	hours rolling	2.20	3.90	4.00	4.25	4.00



NO TRAFFIC DELAYS

in these Systems!



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In general, it is found that aerial tramway operation costs between 1¢ and 6¢ per ton-mile, this cost including power, operating labor, maintenance repair labor and material, lubrication and depreciation of cables and wire ropes and other items.

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United States Steel Corporation Subsidiary

UNITED STATES STEEL

OFFICIAL BIDS

(Continued from Page 44)

cranes and crane rails, metal pier noses, hand railing, trash rack and other metal work. Schedules Nos. 3 to 6, inclusive, of the specifications provide for alternative bids on producing sand and crushed rock, including washing, if necessary, for concrete aggregates for the completion of the Hamilton Dam and for the construction of the Arnold Dam and power plant. Certain equipment used in the initial construction of the Hamilton Dam may be used by the contractor, without charge, in the production of crushed rock. This equipment will be listed in the specifications and may be examined at the site. This invitation for bids does not cover the purchase of materials which are to be furnished by the Government. Materials to be furnished by the contractor and those furnished by the Government are described in the specifications which will be part of the contract. Bid security in an amount not less than 10 per cent of the amount of the bid and performance bond not less than 50 per cent of the estimated aggregate payments to be made under the contract will be required. Where the total amount payable by the terms of the contract is not more than $1,000,000, a payment bond will be required in the sum of one-half of the total amount payable by the terms of the contract. Where the total amount payable by the terms of the contract is more than $1,000,000 and not more than $5,000,000, the payment bond shall be in the sum of 40 per cent of the total amount payable by the terms of the contract. The work contemplated in Schedules Nos. 1 and 2 shall be commenced within thirty (30) calendar days after date of receipt of notice to proceed and shall be completed within six hundred (600) calendar days from the date of receipt of such notice. Liquidated damages for delay will be two hundred dollars ($200) per day. No charge to prospective bidders for copies of the specifications and drawings; to others $5.00, not returnable. For particulars, address the Bureau of Reclamation, Austin, Texas; Denver, Colorado; or Washington, D. C.

JOHN C. PAGE,
Acting Commissioner.

UNITED STATES DEPARTMENT OF THE INTERIOR

Bureau of Reclamation

Bartlett Dam

Washington, D. C., March 2, 1936.

Sealed bids (Specifications No. 674) will be received at the office of the U. S. Bureau of Reclamation, Producer Building, Phoenix, Arizona, until 10 a. m., Mountain Standard Time, April 7, 1936, and will at that hour be opened for furnishing labor and materials and performing all work for the construction of the Bartlett Dam, Salt River project, Arizona. The work is located near Phoenix, Arizona. The dam will be of the concrete multiple-arch type. The principal items of work and the advance estimated quantities involved are as follows: 135,000 cubic yards of common excavation in open cut; 185,00 cubic yards of rock excavation in open cut; 1,000 cubic yards of backfill; 1,000 cubic yards of rockfill; 8,000 cubic yards of concrete in buttress footings and arch cut-offs; 120,500 cubic yards of concrete in buttresses and arches in dam; 12,400 cubic yards of mass concrete in dam; 13,700 cubic yards of concrete in spillway structure; 5,410 cubic yards of concrete in other parts of dam; 45,000 cubic feet of pressure grouting; drilling 29,000 linear feet of grout holes; placing 5,500,000 pounds of reinforcement bars; placing 3,000 linear feet of drain pipe; and installing 3,191,300 pounds of gates, valves, and other metal work. This invitation for bids does not cover the purchase of materials which are to be furnished by the Government. Materials to be furnished by the contractor and those furnished by the Government are described in the specifications which will be part of the contract. Guarantee will be required with each bid in an amount not less than 10 per cent of the amount of the bid. Performance bond will be required in an amount not less than 50 per cent of the estimated aggregate payments to be made under the contract. Where the total amount payable by the terms of the contract is not more than $1,000,000.00, a payment bond will be required in the sum of one-half of the total amount payable by the terms of the contract. Where the total amount payable by the terms of the contract is more than $1,000,000.00 and not more than $5,000,000.00, the payment bond shall be in the sum of 40 per cent of the total amount payable by the terms of the contract. The work shall be commenced within thirty (30) calendar days after date of receipt of notice to proceed and shall be completed within eight hundred (800) calendar days from the date of receipt of such notice. Liquidated damages for delay will be two hundred and fifty dollars ($250) per day. No charge to prospective bidders for copies of the specifications and drawings; to others $2.50, not returnable. For particulars, address the Bureau of Reclamation, Phoenix, Arizona; Denver, Colorado; or Washington, D. C.

JOHN C. PAGE,
Acting Commissioner.

Sacramento, Calif.—State—Grading—Mendocino County

Contract awarded to Hemstreet & Bell, 501 11th St., Marysville, $341,232, by Calif. Div. of Highways, Sacramento for 14.5 mi. grad. betw. Longvale & Dos Rios in MENDOCINO CO., Calif. Bids from:

(1) Hemstreet & Bell, Marysville.....$341,232
(2) Union Paving Co., S. F..... 345,762
(3) Granfield, Farrar & Carlin.....$347,420
(4) George Pollock Co., Sacramento..... 354,985

		(1)	(2)	(3)	(4)
70	acres clearing and grubbing	100.00	400.00	725.00	400.00
325,000	cu. yd. roadway excavation	.90	.84	.73	.85
480,000	sta. yd. overhaul	.03	.015	.02	.03
2,650	cu. yd. structure excavation	1.50	1.75	2.50	2.00
765	sta. finish roadway	5.00	5.00	15.00	5.00
3,000	lin. ft. round timber	.50	1.25	2.50	1.50
14	MFBM Redwood timber (select)	80.00	150.00	100.00	80.00
5,580	lin. ft. 18" corr. metal pipe	1.55	2.50	1.76	2.00
980	lin. ft. 24" corr. metal pipe	2.90	3.00	3.50	3.00
310	lin. ft. 30" corr. metal pipe	3.15	3.50	4.50	4.00
600	lin. ft. 36" corr. metal pipe	4.70	5.00	5.50	5.00
3,259	lin. ft. timber surface culverts	.50	.70	1.50	1.00

Los Angeles, Calif.—State—Grading, Etc.—Los Angeles County

Contract awarded to Griffith Co., L. A. Railway Bldg., L. A., $464,533, by Calif. Div. of Highways, L. A., for 3.7 mi. grading betw. San Fernando Road & Brand Blvd. on Sepulveda Blvd., LOS ANGELES COUNTY, Calif. Bids from:

(1) Griffith Co., Los Angeles.....$464,533
(2) J. E. Haddock, Ltd., Pasadena..... 471,956
(3) Oswald Bros., L. A..... 476,807
(4) Mundo Engr. and Sander Pearson.. 481,459
(5) Gibson & Reed, Burbank.....$482,881
(6) P. J. Akmadzich, Los Angeles..... 485,486
(7) Guy F. Atkinson Co., S. F..... 490,862
(8) Granfield, Farrar & Carlin, S. F..... 603,813

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
194	sta. clearing & grubbing	25.00	20.00	14.00	$100	20.00	44.80	15.00	50.00
6,300	M gallons water	1.70	1.00	1.00	.60	.70	1.10	1.00	.60
348,500	cu. yd. roadway excav.	1.01	1.09	1.11	1.08	1.12	1.12	1.175	1.36
3,800	cu. yd. struc. excavation	3.00	1.75	1.50	2.00	1.00	1.90	1.50	1.50
3,800	cu. yd. ditch & chan. excav.	2.00	1.10	1.50	1.00	1.00	1.90	1.50	1.50
6,000,000	sta. yd. overhaul	.005	.005	.005	.004	.004	.003	.003	.003
194	sta. finish roadway	10.00	10.00	4.50	5.00	10.00	6.90	20.00	10.00
210	tons min. aggr. pl. mix	4.00	3.00	5.60	5.00	2.00	4.65	5.00	4.00
11	tons liq. asph. MC 5	20.00	20.00	17.50	30.00	20.00	19.00	20.00	20.00
20	tons asph. conc. A surf.	5.00	6.00	6.30	5.00	4.00	6.00	8.00	7.00
40	cu. yd. "A" concr. (struc.)	40.00	23.00	21.00	30.00	30.00	24.00	20.00	25.00
220	cu. yd "B" concr. (struc.)	40.00	23.00	19.00	20.00	28.00	24.00	18.00	22.00
3,200	lb. reinforcing steel	.10	.06	.05	.06	.06	.08	.07	.05
18	MFBM tr. Doug. Fir timber	$100	95.00	$100	$100	90.00	99.00	$100	75.00
0.3	MFBM untr. Doug. Fir timber	$100	95.00	$100	30.00	90.00	80.00	80.00	70.00
1,800	lb. struc. steel & metal	.15	.11	.12	.20	.15	.12	.12	.08
27	spillway assemblies	20.00	13.50	17.50	15.00	15.00	21.00	16.00	15.00
740	ft. 8" corr. metal pipe	1.00	.90	1.10	1.00	1.00	1.50	1.00	.90
130	ft. 18" corr. metal pipe	2.00	1.70	2.00	2.00	2.00	2.10	1.70	1.70
70	ft. 21" corr. metal pipe	3.00	1.90	2.20	2.00	2.50	2.90	2.00	1.90
970	ft. 24" corr. metal pipe	4.00	2.55	2.80	3.00	3.00	3.45	2.50	2.60
122	ft. 36" corr. metal pipe	5.00	4.75	5.20	5.00	5.00	5.95	5.00	4.67
100	ft. 60" corr. metal pipe	10.00	11.00	11.40	10.00	15.00	12.00	11.00	10.50
200	ft. 78" corr. metal pipe	20.00	17.50	18.50	20.00	20.00	20.30	18.00	17.50
385	ft. 150" mult. pl. C. M. P.	50.00	50.00	48.00	60.00	70.00	57.70	50.00	60.00
450	ft. 18" C. M. P. siphon	2.50	2.20	2.50	5.00	5.00	3.35	3.00	3.50
110	ft. 24" C. M. P. siphon	3.00	3.10	3.50	5.00	6.00	5.25	4.00	4.50
41	ea. culvert markers	3.00	2.50	2.00	3.00	2.00	3.85	3.00	2.00

Sewer Construction . . . . . .

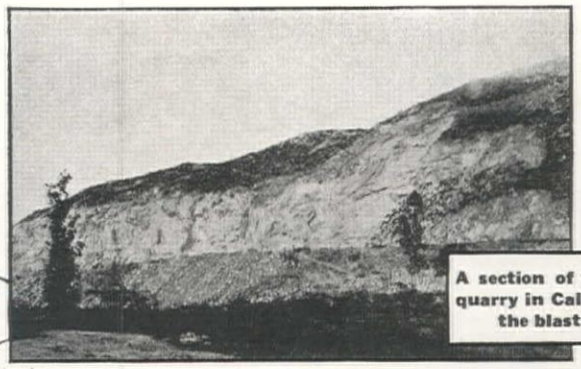
Monterey Park, Calif.—City—Vitr. Pipe Sewer

Award recommended (subject to P. W. A. approval) to A & B Construction Co., 912 Atlantic Blvd., Hynes, $235,568, by City Clerk, Monterey Park, for construction of a sewer system. Bids from:

(A) A & B Construction Co., Hynes....$235,568
(B) J. C. Hickey, Alhambra..... 256,018
(C) V. C. K. Construction Co..... 257,098
(D) Leo Vuksich & Joe Vukoja, L. A... 262,331
(E) J. L. Kruly and Gogo & Rados.... 263,969
(F) Nick Chutuk, Los Angeles.....$276,314
(G) Mike Radich and C. T. Brown and Sutalo & Ralmjak..... 277,461
(H) E. L. Fleming and B. Zaich, Glendale 298,417

		(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)
40,792	ft. 6" vitr. pipe	$.65	$.80	$.73	$.74	$.70	$.46	$.81	$.65
115,845	ft. 8" vitr. pipe	.75	.88	.81	.84	.85	.51	1.00	.90
8,711	ft. 8" same, extra strength	.82	.95	.95	.90	1.20	.58	1.05	1.10
4,396	ft. 10" same, stand. strength	.95	1.00	.99	1.05	1.00	1.84	1.08	1.10
895	ft. 10" same, extra strength	1.05	1.10	1.09	1.15	1.30	1.94	1.25	1.25
994	ft. 12" same, stand. strength	1.20	1.20	1.11	1.29	1.10	2.77	1.30	1.25
2,111	ft. 12" same, extra strength	1.40	1.33	1.34	1.42	1.40	2.89	1.40	1.60
6,023	ft. 15" same, stand. strength	1.65	1.55	1.50	1.84	1.55	5.26	1.90	1.90
12,729	ft. 15" same, extra strength	1.90	1.75	2.38	2.06	1.95	5.47	2.10	2.20
97	each 6" x 6" wye branches	.30	1.00	.25	.45	.55	1.25	.55	.60
3,442	each 8" x 6" wye branches	.50	1.00	.45	.70	.60	.45	.65	.95
104	each 10" x 6" wye branches	.70	1.00	1.00	.60	.80	.60	1.00	1.25
26	each 12" x 6" wye branches	.80	2.00	.76	1.50	1.05	.75	1.25	1.75
265	each 15" x 6" wye branches	1.70	3.00	1.63	3.00	2.00	1.90	2.00	3.50
36	each 8" x 6" tees	.80	1.00	.55	.70	.60	.45	.65	1.00
23	each 10" x 6" tees	.90	1.00	.60	1.00	.90	.60	1.00	1.25
31	each 12" x 6" tees	1.05	2.00	.76	1.50	1.10	.75	1.25	1.75
50	each 15" x 6" tees	2.00	3.00	1.63	3.00	2.00	1.90	2.00	3.50
1,386	ft. standard chimney pipe	2.00	1.50	1.50	2.00	2.00	.60	1.50	1.20
418	each manholes	60.00	70.00	64.00	65.00	71.00	63.51	65.00	$110
110	each flushing manholes	85.00	$100	$101½	90.00	94.00	$101	$100	$130
6	double flushing manholes	$110	$125	$126½	$110	$119	$121	$126½	$175
24	each drop manholes	75.00	$100	90.00	90.00	82.00	78.51	77.00	$190
4,315	ft. concrete cradle	.50	.40	.50	1.00	.75	.50	.50	.65
2,766	ft. ¾" galv. iron pipe	.30	.50	.14	.92	.25	.65	.30	.65
36,563	lin. ft. No. 2 macadam	.175	.10	.24	.17	.12	.16	.12	.20
91,743	lin. ft. No. 3 macadam	.135	.08	.135	.14	.15	.12	.13	.15
26,838	lin. ft. 3" decomp. granite base and 3" asph. concrete surface	.2625	.25	.265	.25	.25	.30	.20	.45
2,111	lin. ft. 4" asph. concrete	.325	.25	.24	.23	.25	.36	.20	.80
300	lin. ft. 6" asph. concrete	.625	.50	.60	.60	25	1.58	.30	1.80

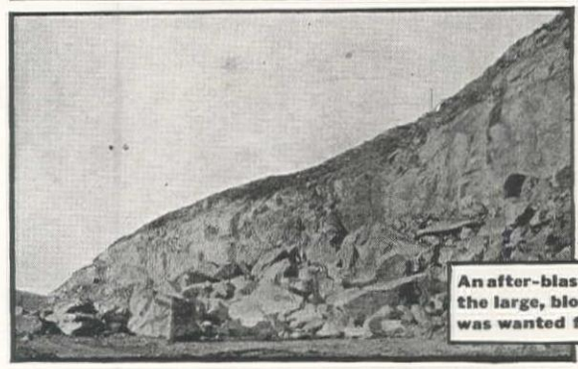
Not a Spectacular "Movie Shot" but... It Delivered the Goods!



A section of the face of a quarry in California before the blast was fired

View of blast. *Note the lack of escaping gases* although the entire burden is in motion

View of blast after dust and smoke had partially covered the quarry face



An after-blast view showing the large, blocky stone that was wanted for breakwater

STUDY this tribute to Atlas explosives and Atlas service *through the eyes of the camera*. Examine this photographic evidence of explosives operating without waste—of confined gases exerting *all* their force on the rock burden!

Large, blocky jetty-stone was wanted for breakwater use by the Rohl-Connolly Co., operators of the Riverside Quarries. "Seventy percent of the rock," they said, "must weigh ten tons or more!" Atlas gave them 225,000 tons of *what they wanted*—proving again the economy and effectiveness of controlled explosives' force.

Let the Atlas representative give you the full facts about Atlas explosives and Atlas service. Atlas will provide high tonnage per pound of explosives to get the fragmentation *you* want!

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ATLAS EXPLOSIVES

CHEMICALS ATLAS EXPLOSIVES

CONSTRUCTION

. . . . . a news summary

Note: For additional information regarding projects in this summary refer to Daily Construction News Service, date appearing at end of each item.

Large Western Projects . . . . .

WORK CONTEMPLATED

14½ mi. 24" pipeline for Twin Falls, Idaho, Bond election in 90 days.
Terminal and bridge railroad for San Francisco-Oakland Bay Bridge. Bids to be called as soon as financing has been arranged. Est. cost, $14,500,000.

CALLS FOR BIDS

736,700 cu. yd. dredging in Wilmington district for L. A. Harbor Comm. Bids to Mar. 18.
Building & electric equipment at Pearl Harbor for Bur. of Yards & Docks, Washington, D. C. Bids to March 25. Est. cost $145,000.
Quay wall etc. at Pearl Harbor for Bureau of Yards & Docks, Washington, D. C. Bids to Mar. 25. East. cost $200,000.

BIDS RECEIVED

R. R. electric interlocking plant for L. A. Harbor Comm., Bennett & Taylor, L. A., $212,600 low.
Clearing for Hamilton Reservoir site for Bur. of Reclamation, Austin, Texas, Brown & Root, Austin, $323,300 low.
10 mi. grading and place aggregate base course on Showlow-Springerville Highway for Arizona Highway Commission, Packard Contr. Co., Phoenix, $192,740 low.
13.1 mi. grading, etc., on Showlow-Concho Highway for Arizona Highway Comm., R. C. Tanner Co., Phoenix, $155,757 low.
Earthwork and tunnels, Gila Valley Project for Bureau of Reclamation, low bids: Sched. 1—Boyce & Igo, Yuma, $73,200; Sched. 2—Mittry Bros., Los Angeles, $210,830; Sched. 3—Mittry Bros., $470,745; Sched. 4—Boyce & Igo, $200,400.
Concrete wharf and steel frame transit shed from Los Angeles Harbor Comm., Wm. P. Neil Co., Ltd., Los Angeles, $347,000 low.

CONTRACTS AWARDED

Additional excavation & concrete for Grand Coulee Dam by Bur. of Reclamation to Mason, Walsh, Atkinson, Kier Const. Co., $6,700,000.
El Capitan-Lakeside pipeline for San Diego to Consolidated Steel Corp., L. A., $412,259.
12.835 mi. grading, etc., on Lander-Muddy Gap Rd. for Wyoming Highway Dept. to Northwest Engr. Co., Rapid City, South Dakota, $169,163.
0.62 mi. grading and Arch Cape tunnel for Oregon Highway Comm. to Orino, Berkemeier & Saramel, Cascade Locks, Ore., $166,904.
Crystal Springs pipeline No. 2 for San Francisco to Youdall Const. Co., San Francisco, $1,315,280.
Two overhead storage tanks for Sacramento, Calif., to Campbell Const. Co., Sacramento, $315,347.
Copper cable for Pioche Power Dist., Pioche, Nev., to Anaconda Copper Co. and General Cable Co., $233,000.
6.8 mi. grading and conc. paving and bridge for Calif. Div. of Highways to Peninsula Paving Co., San Francisco, $316,342.
3.9 mi. grading and surfacing for Calif. Div. of Highways to Peninsula Paving Co., San Francisco, $202,613.
Underpass and 2 mi. approaches between Pueblo and Ordway for Colorado Highway Dept. to Larson Const. Co., and Kranz Const. Co., Denver, $152,698.
6 mi. gravel surf. between Salida and Canyon City for Colorado Highway Dept. to Driscoll Const. Co., Denver, $197,205.
3.1 mi. grading and conc. paving between Tajiguas Creek and Arroyo Hondo for Calif. Div. of Highways to Granfield, Farrar & Carlin, San Francisco, $202,819.
Filtration plant for Santa Barbara, Calif., to Daly Corp., San Diego, $134,694.
Sewer system for Monterey Park, Calif., to A. & B. Const. Co., Hynes, $235,555.
3.3 mi. grading on Palamor Mt. Rd. for Calif. Div. of Highways to Basich Bros., Torrance, $297,396.
3.7 mi. grading on Sepulveda Blvd. for Calif. Div. of Highways to Griffith Co., Los Angeles, $464,533.
Laying crosstown pipeline for San Francisco to MacDonald & Kahn Co., Ltd., San Francisco, $193,994.

Street and Road Work. . . . . .

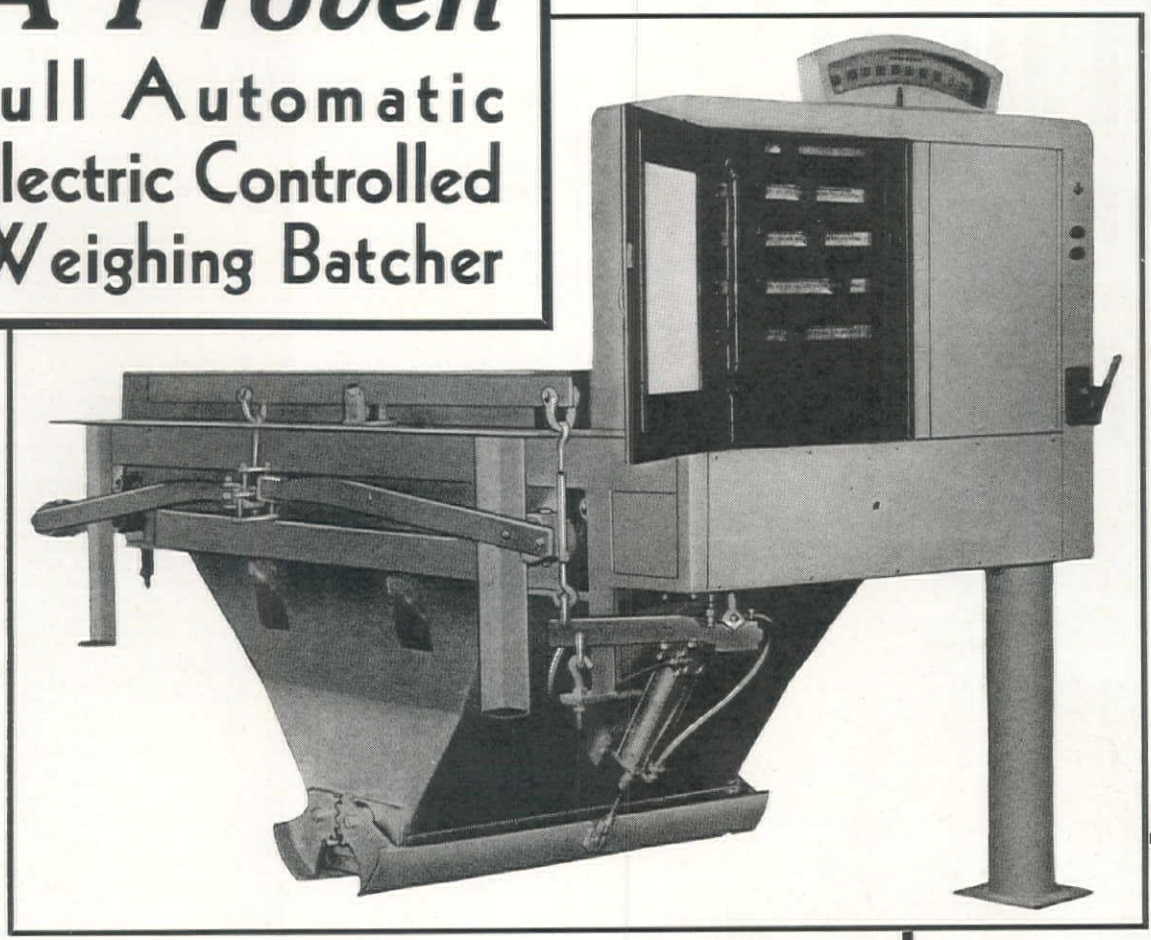
CALLS FOR BIDS

ALAMEDA, CALIF.—Bids to 8 p. m., March 16 by City Clerk, Alameda, for improving Maitland Drive from 3,450 ft. south of Bay Farm Island Bridge, southeasterly, 5,455 ft. to city limit line. Work involves: 2,117 tons asph. concr. leveling course; 1,650 tons asph. concr. top course, Type "D"; 3,081 tons cr. run base and shoulders; 8,000 sq. ft. rock gutter; 18,000 sq. ft. ditch grading; 37,160 sq. ft. armor coat (shoulders); 130 lin. ft. 8" cor. met. pipe culvert; 80 lin. ft. 12" cor. met. pipe culvert; 3 cu. yd. "A" concr. (headwalls). 2-26

TORRANCE, CALIF.—Bids to 8 p. m., March 17 by City Clerk, Torrance, for 1.5 mi. grading and paving in Hawthorne Ave., between Sepulveda Blvd., and Walnut Street, involving: 10,000 cu. yd. grading; 77,000 sq. ft. 6" asph. concr. pave.; 56 lin. ft. 18" corr. metal pipe. 3-2

DENVER, COLO.—Bids to 10 a. m., March 16 by Bureau of Public Roads, Denver, Colo., for 11.414 mi. surfacing the Grand Loop Highway, located within Yellowstone National Park, Project RTEC Part 1-F1, F2, in the State of Wyoming. Work involves in the main: 14,000 cu. yd. unclass. excavation; 20,850 cu. yd. subgrade reinforcement; 30,000 tons cr. run surf. Grade "A"; 8,900 tons cr. run surf. Grade "B"; 5,255 lin. ft. wood guardrail; 115,000 gal. L. A. R. M. Type MC-1. 3-2

A Proven Full Automatic Electric Controlled Weighing Batcher



The WEIGHMASTER

The engineer's specifications for concrete mix can be carried out to the letter . . . more accurately, faster, and easier than ever before with the new WEIGHMASTER. Substitution of one size aggregate for another; overweighing or underweighing is impossible.

The process and operation is extremely simple. Set the required weights on the beams—push the operator's lever to start the filling cycle—and *automatically*, each supply gate is opened in proper sequence. Twenty-five seconds completes a filling, weighing, and dumping cycle of a 5,000 lb. batch . . . to the accuracy specified by the Bureau of Standards.

Scale beams are foolproof for they are locked in the well-built case containing a glass door for visibility. The indicator has a graduated dial of large range. Each batch registers for 2 full seconds on the indicator; thus the weight of each aggregate can be easily read.

As all contacts with the scale are made with photo-electric relays, there is positively no drag on the scale. In fact, each part of the WEIGHMASTER is engineered with this same precision, using only the latest devices the industry has to offer. The standard electrical parts have been proved for faultless performance on elevators and other industrial installations.

Put this most modern of batch-weighing devices to work in your plant. It will save time, effort, and money in the long run. Best of all, the WEIGHMASTER can be adapted to your present plant.

1. Simplicity of Design and Operation.
2. Only 2 Electric Conduits Required.
3. Graduated Dial Easy to Read.
4. Photo Release—No Scale Drag on Scale Beam.
5. Scale Beam Easily Set and Locked.
6. Quick Acting, Adjustable Air Cylinder.
7. Assembled, Mounted and Shipped as a Unit from the Factory.
8. Large, Quick Discharge Roller Gates.
9. Low Head Room Required.

STANDARD STEEL WORKS

5001 Boyle Avenue **Los Angeles, California**

When writing to STANDARD STEEL WORKS, *please mention Western Construction News*

GOLDENDALE, WASH.—Bids to 10 a. m., March 20 by County Clerk, Goldendale, Wash., for 2.597 mi. grading, draining, and surfacing roadway and moving of 150' steel span bridge with piers and wood approaches. 3-2

BIDS RECEIVED

PHOENIX, ARIZ.—Jack Casson, 319 Warren St., Hayward, $92,359 low to Bureau of Public Roads, Phoenix, Ariz., for 9.141 mi. (exclusive of Service roads and Parking areas, which have an area of approx. 67,205 sq. yd.), placing cr. rock base course on all of Route 8, Hermit Rest and the Headquarters Service Roads and Parking Areas, Grand Canyon National Park, COCONINO COUNTY, Ariz. 2-25

PHOENIX, ARIZ.—R. C. Tanner Co., Phoenix, Ariz., $155,757 low to State Highway Comm., Phoenix, Ariz., for 13.1 mi. grading, draining two separate sections of roadway located between Ortega Lake and Concho on the Showlow-Concho Highway, GILA COUNTY, Proj. WPSO 105-A, AFE 609. 2-26

PHOENIX, ARIZ.—Packard Contracting Co., 737 W. Latham St., Phoenix, Ariz., $192,740 low to State Highway Comm., Phoenix, Ariz., for 10 mi. grading, draining and placing aggregate base course about 17 mi. east of Showlow and extending easterly on the Showlow-Springerville Highway, in GILA COUNTY, Proj. WPH 105-B, AFE 6022. 2-25

PHOENIX, ARIZ.—N. G. Hill & Co., Phoenix, $123,818 low to State Highway Comm., Phoenix, for oil processing by rd. mix method, using cutback asph. 30 mi. N. W. of Kingman and extends N. W. about 19 mi. on the Kingman-Boulder Dam Highway, WPSS 102-A, B & C, MOHAVE COUNTY. 2-26

LOS ANGELES, CALIF.—George R. Curtis Paving Co., 2440 E. 26th St., Los Angeles, $31,593, low to Board of Supervisors, Los Angeles, for 0.77 mi. grading and paving on Cedar Avenue from North line of Tract 9901, to 190th Street in Torrance, under Cash Contract No. 483. 2-11

LOS ANGELES, CALIF.—Clyde W. Wood, P. O. Box 49, Stockton, $20,308, low to Calif. Div. of Highways, Los Angeles, for 14.4 mi. grading shoulders and treating with liquid asphalt between Ontario and Riverside in SAN BERNARDINO and RIVERSIDE COUNTIES. 2-27

SACRAMENTO, CALIF.—Claude C. Wood, P. O. Box 1714, Stockton, $19,302, low to California Division of Highways, Sacramento, for 3.8 mi. of crusher run base and armor coat surfacing between Laguna Creek and Dublin in ALAMEDA COUNTY, Calif. 2-27

SACRAMENTO, CALIF.—Young & Son Co., Ltd., 599 Colusa Ave., Berkeley, $20,915, low to Calif. Div. of Highways, Sacramento, for 1.1 mi. grading, selected surface material and treating with liquid asphalt between Lewis Creek and Priest Valley in MONTEREY COUNTY, Calif. 2-26

PORTLAND, ORE.—Bids received as follows by Oregon State Highway Comm., Portland, Ore., for: (1) KLAMATH CO. (State Proj.)—Dunn & Baker, Box 431, Klamath Falls, Ore., $33,783, for 6.74 mi. regrading and resurf. on Dairy-Bonanza Highway. (2) LANE CO. (NRS 234-C)—Consolidated Highway Co., Inc., Portland, Ore., $16,141, low for 0.765 mi. grad., surf., etc., on Doty Ranch, Danebo Road Sec. of Eugene-Veneta Highway. (3) LANE CO. (WPSO 234-B)—Consolidated Highway Co., Inc., Portland, $30,442, low for 1.41 mi. grad., surf., etc., on Oak Hill-Doty Ranch Sec. of Eugene-Veneta Highway. (4) UMATILLA CO. (St. Proj.)—H. C. Rogers & Sons, P. O. Box 181, Dayton, Wash., $51,872, low for 6.34 mi. regrade and surf. and 7.34 mi. oil mat surf. on Cold Springs Bridge-Holdman Sec. of Pendleton-Cold Springs Highway. 2-8

OLYMPIA, WASH.—All bids submitted to the Director of Highways, Olympia, Wash., for 0.4 mi. concr. and asph. concr. paving on St. Rd. No. 21, 6th St., in City of Bremerton, in KITSAP CO. (WPMH 175-D), Wash., have been rejected. 2-27

OLYMPIA, WASH.—All bids submitted to Director of Highways, Olympia, Wash., for 1.9 mi. concr. and asph. conc. paving and const. asph. conc. sidewalks and shoulders on St. Rd. No. 9, City Streets in Hoquiam and City Streets in Aberdeen, GRAYS HARBOR CO. (WPMH 54 & G & WPMH 54-B), have been rejected. 2-27

CONTRACTS AWARDED

PHOENIX, ARIZ.—Award recomm. to Lee Moor Contr. Co., El Paso, Texas, $85,241 by Bureau of Public Roads, Phoenix, for 12.696 mi. base crse. surf. on Sec. G & H, Rt. 7, the Oak Cr. National Forest Highway, Coconino National Forest, COCONINO CO. Ariz. 2-27

PHOENIX, ARIZ.—To Phoenix-Tempe Stone Co., P. O. Box 1645, Phoenix, $64,643, by Arizona State Highway Comm., Phoenix, for grading and draining 0.8 mi. roadway, furn. and placing road mix and seal coat, on the Phoenix-Prescott Highway, located at both ends of the new bridge at Wickenburg, MARICOPA COUNTY, Ariz. 2-19

PHOENIX, ARIZ.—To Ken Hodgman, 714 Plymouth Road, Pasadena, $106,871, by Arizona State Highway Comm., Phoenix, for 7.7 mi. grading and draining roadway and applying SC-2 road oil dust palliative to begin at a point about 14.7 mi. N.E. of Flagstaff, on the Flagstaff-Fredonia Highway, WPH 95-J, COCONINO COUNTY, Ariz. 2-19

BISHOP, CALIF.—To C. W. Wood, Box 49, Stockton, $8,435 by District Engineer, Calif. Div. of Highways, Bishop, for 7.3 mi. roadmix surface treatment to be applied between Death Valley Junction and easterly boundary in INYO COUNTY, Calif. 2-24

LOS ANGELES, CALIF.—Awards as follow by Calif. Div. of Highways, L. A., for: (1) SAN DIEGO COUNTY—To Basich Bros., 20550 N. Normandie Ave., Torrance, $297,396 for 3.3 mi. grad. on Palomar Mt. Road betw. Iron Springs Creek and the Observatory site. Refer issue of Jan. 31 for units. (2) LOS ANGELES COUNTY—To Griffith Co., L. A. Railway Bldg., $464,533 for 3.7 mi. grad. betw. San Fernando Road and Brand Blvd. on Sepulveda Blvd. (See unit bid summary). 2-18

LOS ANGELES, CALIF.—To Southwest Paving Co., Lankershim Bldg., Los Angeles, $35,811 by Calif. Div. of Highways, Los Angeles, for 0.6 mi. grading and asphalt concrete paving through Sunland betw. Fenwick Street and Scovil Avenue in LOS ANGELES COUNTY, Calif. 2-12

LOS ANGELES, CALIF.—To Sully Miller Constr. Co., 1500 W. 7th St., Long Beach, $38,567 by Calif. Div. of Highways, Los Angeles, for 3.7 mi. widen and asph. concr. surf. betw. Traffic Circle and Los Angeles Street in LOS ANGELES COUNTY, Calif. 2-12

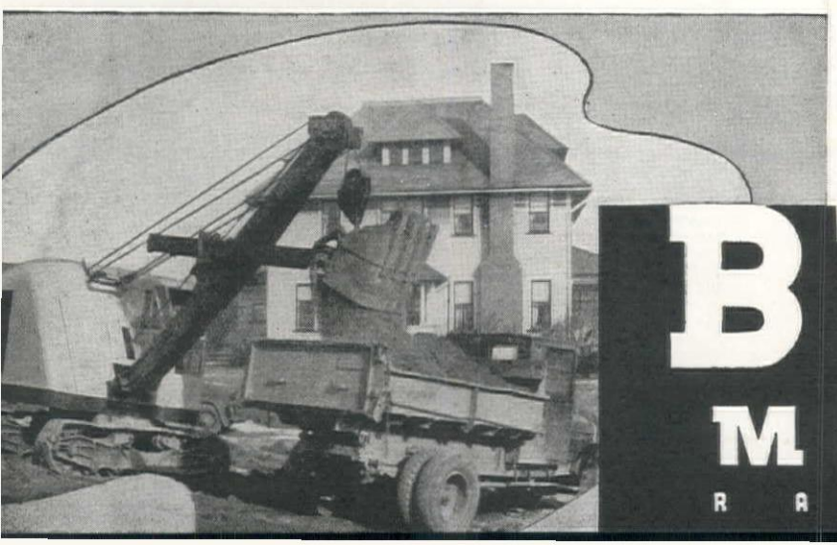
SACRAMENTO, CALIF.—To Bodenhamer Const. Co., 1101 75th Ave., Oakland, $171,869 by Calif. Div. of Highways, Sacramento, for 0.25 mi. grad. and rdmix. surf. and const. bridge over Potato Slough at Terminus, SAN JOAQUIN COUNTY, Calif. 2-7

SACRAMENTO, CALIF.—To Basich Bros., 20550 Normandie Ave., Torrance, $109,721 by California Div. of Highways, Sacramento, for 7.3 mi. grad. and roadmix. surf. betw. Big Pine and Keough Hot Springs in INYO COUNTY, Calif. 2-4

SACRAMENTO, CALIF.—To Heafey Moore Co., 344 High St., Oakland, $66,552 by Calif. Div. of Highways, Sacramento, for 2.4 mi. grading and asphalt concr. paving between Richfield Tower and Santa Maria River in SANTA BARBARA and SAN LUIS OBISPO COUNTIES, Calif. 2-24

ROLLER BEARINGS IN BYERS MODEL "62" SAVE TIME AND MONEY

Thirty-two Timken tapered roller bearings used to mount the crowd, travel and swing clutches and main deck shafts of the Byers "62" brings new shovel profits. Gone are worn-out bushings with their expensive replacement delays. Gone, too, are grabbing, chattering clutches. Power is increased 10 to 15% where it's needed —in the clutch, which speeds up swing, crowd and travel operations, thus insuring greater yardage. ● The new fully enclosed, roomy, steel cab on Byers "62" is designed to save operator's time and speed up his work. The independent cable or chain crowd —power trip—moulded friction clutch linings—and two speed travel are features that make the Byers "62" a real money maker. . . . Send today for the descriptive literature and prices.



REPRESENTATIVES IN WESTERN STATES

Edw. R. Bacon Co., San Francisco, Cal. ● Smith, Booth, Usher, Los Angeles, Cal. ● Service Equipment Co., Inc., Seattle, Wash. ● Arnold Machinery Company, Inc., Salt Lake City, Utah ● Sprott Tractor & Equipment Company, Grand Junction, Colorado ● Rocky Mountain Equipment Co., Denver, Colorado ● Sheehan & Co., El Paso, Texas

BYERS MACHINE CO.

RAVENNA, OHIO

SACRAMENTO, CALIF.—To Granfield, Farrar & Carlin, 67 Hoff Ave., San Francisco, $202,819 by Calif. Div. of Highways, Sacramento, for 3.1 mi. grading and concrete paving between Tajiguas Creek and Arroyo Hondo in SANTA BARBARA COUNTY, Calif. (See Unit Bid Summary.) 2-24

SACRAMENTO, CALIF.—Award to Hemstreet & Bell, 501 11th St., Marysville, $341,232 by Calif. Div. of Highways, Sacramento, for 14.5 mi. grading between Longvale and Los Rios in MENDOCINO COUNTY, Calif. (See Unit Bid Summary.) 2-27

SACRAMENTO, CALIF.—To Blake Bros. Co., Balboa Bldg., San Francisco, $20,862 by Calif. Div. of Highways, Sacramento, for 0.6 mi. constructing riprap slope protection between Isleton and Walnut Grove in SACRAMENTO COUNTY, Calif. 2-25

SACRAMENTO, CALIF.—To Peninsula Paving Co., 9 Main St., San Francisco, $202,613 (ALT. "A") by Calif. Div. of Highways, Sacramento, for 3.9 mi. grading and crusher run base surf. and Natural rock asph. surf. between Scotts Valley and 1 mile north of Santa Cruz, in SANTA CRUZ COUNTY, Calif. (See Unit Bid Summary.) 2-25

SACRAMENTO, CALIF.—To Peninsula Paving Co., 9 Main St., San Francisco, $316,342 by Calif. Div. of Highways, Sacramento, for 6.8 mi. grading and concr. paving and const. a reinforced concrete bridge between Bradley and 6 mi. South of San Ardo in MONTEREY COUNTY, Calif. (See Unit Bid Summary.) 2-25

SAN JOSE, CALIF.—To A. J. Raisch Co., 358 Lincoln Ave., San Jose, $11,440 by County Clerk, San Jose, for improvement of Moffatt Blvd., betw. the City limits of Mountain View and the Bayshore Blvd. in Superv. District No. 5. 2-10

SAN LUIS OBISPO, CALIF.—To Bradley Truck Co., Santa Maria, Calif., $6,678 by Dist. Engineer, Calif. Div. of Highways, San Luis Obispo, for approximately 200 roadside miles applying Diesel oil to roadside vegetation at various locations in SAN BENITO, MONTEREY, SAN LUIS OBISPO, and SANTA BARBARA COUNTIES, Calif. 2-25

STOCKTON, CALIF.—Awards as follow by Dist. Engr., Calif. Div. of Highways, Stockton, for: (1) STANISLAUS, MERCED and MARICOPA COUNTIES—To Sheldon Oil Co., Suisun, $2,425 for 141.4 mi. roadside mi. applying diesel oil to roadside vegetation at various locations. (2) SOLANO and SAN JOAQUIN COUNTIES—To Sheldon Oil Co., Suisun, $2,208 for 128.1 mi. applying diesel oil to roadside vegetation at var. valley locations on westerly side of San Joaquin Valley. (3) SAN JOAQUIN, STANISLAUS, CALAVERAS, AMADOR, TUOLUMNE and MARIPOSA COUNTIES—To Sheldon Oil Co., $2,811 for 156.7 mi. applying diesel oil to roadside vegetation at var. valley locations on east side of San Joaquin Valley. (4) AMADOR, CALAVERAS, TUOLUMNE and STANISLAUS COUNTIES—To Sheldon Oil Co., $3,037 for 185.1 mi. roadside mi. apply oil to roadside vegetation at various foothill and mother lode locations. 2-18

DENVER, COLO.—Awards as follows by Colorado State Highway Dept., Denver, Colo.: (1) BOULDER CO. (WPSS 401-B)—To W. A. Colt & Son, Lyons, Colo., $104,035 for 2.4 mi. grad. between Lyons and Estes Park. (2) BOULDER CO. (WPMS 417)—To M. E. Carlson, 4483 Newton St., Denver, Colo., $20,867 for 1½ mi. gravel surf. between Boulder and Lyons. 2-24

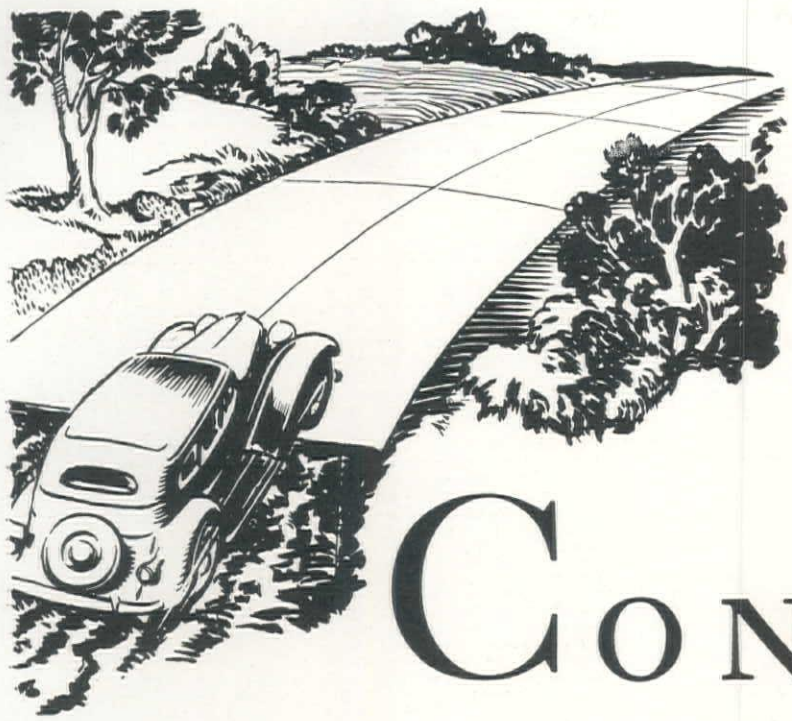
DENVER, COLO.—To Driscoll Const. Co., Box 733, Pueblo, Colo., $197,205 by Colorado State Highway Dept., Denver, Colo., for const. 6 mi. gravel surface between Salida and Canon City, in FREMONT COUNTY, Colo. (comb. project FAP 113E & FLHP 26). 2-24

DENVER, COLO.—To Monaghan & Kenney, 357 S. Down St., Denver, $40,361 by Colorado State Highway Dept., Denver, for 1½ mi. grav. surf. between Brush and Hillrose, in MORGAN COUNTY, FAP 88 AR3, in Colorado. 2-28

BOISE, IDAHO—Awards as follow by Comm. of Public Works, Boise, Idaho, for: (1) SHOSHONE COUNTY (WPSS 215-A)—To Triangle Const. Co., 1220 Ide St., Spokane, $53,640 (resiliflex) for 3.150 mi. const. roadbed, dr. struc. and cr. rk. surf. on Elk River Highw. betw. Emerald Creek & Clarkia. (2) LATAH COUNTY (WPSO 166-B)—To J. F. Konen, 326 Main St., Lewiston, Ida., $31,735 for 2.723 mi. const. roadbed struc., etc., on Lenville-Cornwall Road, Lenville, north. (3) SHOSHONE COUNTY (NRH&M 73-F1)—To Tony Marrazzo, E. 618 Dalton St., Spokane, $60,098 for 1.367 mi. const. roadbed cr. grav. surf., etc., on Coeur d'Alene-Yellowstone Trail from Mullan-east. 2-3

MISSOULA, MONT.—Awards as follow by Montana State Highway Comm., Missoula, Mont., for: (1) LEWIS AND CLARK CO. (FAP 77A & 214)—To Nolan Bros., 18 N. 2nd St., Minneapolis, Minn., $86,391 for 4.435 mi. regrad., surf. with gravel subbase matl., etc., on 11th Ave., in City of Helena and Sec. A of Helena-Three Forks Road. (2) CARBON CO. (FAP 106-B)—To Nolan Bros., 18 N. 2nd St., Minneapolis, $20,090 for 19.780 mi. bitum. surf. tr. of exist. top course of cr. grav. on Secs. B & C of the Red Lodge-Rockvale Road. (3) RAVALLI CO. (FAP 139-D, Unit 1)—To Lawler Corp., Lewisohn Bldg., Butte, Mont., $142,436 for 7.020 mi. grad., etc., on Sec. D of the Bitterroot Road South of Hamilton in town of Darby. (4) MADISON CO. (FAP 171-B)—To Nolan Bros., 18 N. 2nd St., Minneapolis, $17,940 for 5.183 mi. roadmix oil tr. of exist. grav. surf. on Sec. "B" of the Ennis-Sappington Road, etc. (5) GARFIELD CO. (FAP 247-B)—To Martin Wunderlich Co., 219 E. High St., Jefferson City, Mo., $112,129 for 7.632 mi. grad., surf., etc., on Sec. B of Jordan-Circle Road. (6) SHERIDAN CO. (FAP 251-C)—To Lobnitz Bros., Libby, Mont., $132,819 for 11.471 mi. grad., etc., on Sec. "C" of the Scobey-Plentywood Road. (7) PROJ. FLH-4, Unit 2—To Frank Haas, Great Falls, Mont., $10,576 for 0.298 mi. regrading and surf., on Sec. of Kennedy Creek-Waterton Lakes Road. (8) BLAINE CO. (FLH 5-B)—To Inland Construction Co., 3867 Leavenworth St., Omaha, Neb., who bid $111,460 for 6.413 mi. regrading, surf., etc., on the Harlem-Dodson Road. (9) GALLATIN CO. (WPMH 12-B)—To Basil Hunt, Butte, Mont., who bid $19,581 for 0.493 mi. grading, surf., etc., on Section B of the Three Forks-Helena Road. Also included in this contract is const. of similar improv. on 0.147 mi. of U. S. Highway No. 10, North City limits. 3-2

MISSOULA, MONT.—Awards as follows by the Montana State Highway Comm., Court House, Missoula, Mont., for: (1) POWDER RIVER and CARTER CO. (FAP 262-B, Unit 3)—To McNutt Bros., 351½ E. Broadway, Eugene, Ore., $182,819 for 16.049 mi. grad., surf., etc., on Sec. B of Broadus-Wyoming Line Road. (2) To Kirkpatrick Bros., Kalispell, Mont., $37,376 for 0.969 mi. grad., surf., etc., in City of Eureka, LINCOLN COUNTY, WPMH 263-C. (3) MUSSELSHELL CO. (FAP 268D, Unit 1)—To S. J. Groves & Sons, Wesley Temple Bldg., Minneapolis, $192,721 for 12,298 mi. grad., surf., etc., on Sec. D of the Ryegate-Roundup Road. (4) MADISON, SILVER BOW and JEFFERSON CO. (FAP 281A & 281B)—To Woodward Const. Co., Billings, Mont., $41,510 for 15.463 mi. roadmix bitum. tr. exist. cr. grav. surf. course on Secs. A & B of the Vigilante Trail Road. (5) WIBAUX CO. (WPMS 314, Unit 2)—To Nolan Bros., 18 N. 2nd St., Minneapolis, $4,824 for 0.371 mi. roadmix oil treatment of exist. cr. grav. surf. course on 1st Ave., So. and Wibaux St. in town of Wibaux. (6) SILVERBOW CO. (WPMS 378 & 381)—To J. C. Maguire, Lewisohn Bldg., Butte, Mont., $134,186 for improving various streets in Butte, Mont. (7) FLATHEAD CO. (FAP 58-G, Unit 1)—To McNutt



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Concrete is the most *adaptable* of highway materials. The designer can vary the slab thickness to suit traffic loads. Thus, the secondary highway can, with fullest confidence of long life, be of lighter and more economical cross-section than the main-traveled primary highway.

PORTLAND CEMENT ASSOCIATION

Dept. I3-3, 816 W. Fifth St., Los Angeles, Calif.
Dept. N3-2, 564 Market St., San Francisco, Calif.

Bros. 351½ E. Broadway, Eugene, Ore., $178,667 for 9.977 mi. grading, surf., etc., on Sec. "G" of the Kalispell-Libby Road. (8) SILVERBOW CO. (WPMH 70C & 207A)—To J. C. Maguire, Lewisohn Bldg., Butte, $40,928 for 0.093 mi. widen. exist. concr. pavement on Excelsior Ave. between Platinum and Porphry streets, etc., and 0.503 mi. with concr. between Front St. and Jossette Ave. 3-2

CARSON CITY, NEV.—To U. B. Lee, 1059 Carpenter Ave., San Leandro, $48,732 by Nev. State Highway Comm., Carson City, Nev., for 5.39 mi. cr. grav. surf. from E. foot of Connors Pass to 5 mi. E., Rt. 14, Sec. A1, in WHITE PINE COUNTY, Nev. 2-29

SANTA FE, NEW MEXICO—Awards as follow by the State Highway Engineer, Santa Fe, New Mexico, for: (1) VALENCIA COUNTY (FLHP 2-C)—To L. R. Allison, Albuquerque, N. M., $103,525 for 6.344 mi. grad., surf., minor drain. struc. 4 multiple span concr. box culverts each over 20 ft. clear span and misc. const. betw. Suwanee and Grants on U. S. Highway Rt. 66. (2) BERNALILLO and VALENCIA COUNTIES (FAP 4 Reo. and 178-C)—To L. R. Allison, Albuquerque, N. M., $144,931 for 16.493 mi. prepare base course, etc., on U. S. Highway Rt. 66 and St. Highw. Rt. 6. (3) VALENCIA COUNTY (FAP 74 reop.)—To E. W. Everly, Albuquerque, N. M., $98,551 for 2.787 mi. grad., dr. struc., 1 multiple span concr. box culvert, etc., on U. S. Highw. Rt. 66, betw. Gallup & Los Lunas. (4) EDDY COUNTY (NRH 131-A)—To F. O. McDaniel, Santa Fe, N. M., $11,622 for 2.012 mi. grad., misc. landscaping, etc., on U. S. Highway Rt. 285, betw. Carlsbad and Malaga. (5) LINCOLN COUNTY (WPMS 222-E)—To Hayner & Burn, Las Cruces, N. M., $87,839 for 5.492 mi. grad., etc., on U. S. Highw. Rt. 54 betw. Carrizozo and Corona. 2-24

PORTLAND, ORE.—To Theo. Arenz, 10509 N.E. Sandy Blvd., Portland, $38,443 by Oregon State Highway Comm., Portland., Ore., for 0.456 mi. grading and paving and 0.402 mi. grading and widening on Rainier Sec. of Columbia River Highway in COLUMBIA COUNTY, Ore. 2-24

PORTLAND, ORE.—Awards as follow by Oregon State Highway Comm., Portland: (1) COOS COUNTY (FAP 141-C)—To S. S. Montague, 1308 S.W. Front St., Portland, $50,034 for 0.53 mi. grad., surf. and bitum. macad. surf. North approach to Coos Bay Bridge on Oregon Coast Highway. (2) COOS COUNTY (FAP 141-E)—To S. S. Montague, Portland, $52,604 for 0.41 mi. grad. and pave. south appr. to Coos Bay Bridge, Oregon Coast Highway. (1) KLAMATH COUNTY (WPSO 282)—To Harold Blake, 400 N. Thompson St., Portland, $95,245 for 2.5 mi. grade, surf. and oil mat surf. tr. and 2.86 mi. surf. and oil mat surf. tr. on Merrill-Calif. line sec. of Merrill-Hatfield Co. Rd. and Malin-Calif. Line Sec. of The Dalles-Calif. Highway. (2) MARION COUNTY (FAP 176-C)—To R. L. Houck, Independence, Ore., $95,931 for 4.6 mi. grade and const. 4 tr. timber box culverts and an 83 ft. tr. timber trestle with concr. superstructure on Pringle Creek-Taylor Creek Sec. of Pacific Highway. (3) MULTNOMAH COUNTY (WPSO 255-B)—To Jacobsen-Jensen Co., 517 N.E. Stanton St., Portland, $42,639 for 3.19 mi. asph. concr. paving on Glisan St.-Foster Road Sec. of 122nd Ave. (4) WASHINGTON and YAMHILL COUNTIES (FAP 73)—To Homer G. Johnson, 3030-54 S.E. Portland, $189,010 for 2.12 mi. grading, paving and move buildings on Rex Hill Sec. of West Side Pacific Highway. 2-10

PORTLAND, ORE.—Awards as follow by the Oregon State Highway Comm., Portland, for: (1) TILLAMOOK COUNTY (WPSO 283-A)—To J. C. Compton, McMinnville, $11,411 for 3.42 mi. oil mat surf. treatment on Manzanita-Wheeler Sec. of Nehalem County Road. (2) MULTNOMAH COUNTY (WPSO 285)—To Warren Northwest, Inc., P. O. Box 5072, Portland, Ore., $41,935 for 2.01 mi. grad. and pave. and 95 ft. tr. pile trestle with concr. deck on Columbia Blvd.-Levee Road Sec. of N.E. 47th Ave. 2-8

PORTLAND, ORE.—To Brookfield Co., Astoria, Ore., $30,580 by Ore. State Highway Comm., Portland, for 0.33 mi. conc. paving, 20th-28th St. Sec. of Commercial St. and Franklin Ave. in Astoria. Next low: (CLATSOP CO.) 2-8

SALT LAKE CITY, UTAH—To L. A. Young, Richfield, Utah, $9,188 by Utah State Road Comm., Salt Lake City, for 0.588 mi. gravel surf. road on U. S. Highway 189, near Fountain Green, FAP Nos. 47-A-B-C-D in SANPETE COUNTY, Utah. 2-28

SALT LAKE CITY, UTAH—To W. W. Clyde & Co., Springville, Utah, $73,870 by Utah State Road Comm., Salt Lake City, for 9.251 mi. gravel surfacing road between Ft. Duchesne and Half Way Hollow on U. S. 40, FAP 10-C-D-E, in UINTAH COUNTY, Utah. 2-28

SALT LAKE CITY, UTAH—To J. W. Whiting, Springville, Utah, $110,498 by Utah State Road Comm., Salt Lake City, for const. a rock asphalt road betw. Nephi and Levan and Curve Revision West of Levan in JUAB COUNTY, Utah, FAP 70-A-B and 17-C, a distance of 10.341 miles. 2-20

OLYMPIA, WN.—Awards as follow by Director of Highways, Olympia, Wn., for: (1) SNOHOMISH COUNTY—To E. J. Templeton & Co., 902 Hoyt Ave., Everett, Wn., $16,722 for paving of Broadway from 37th St. to So. city limits, Everett. (2) WALLA WALLA COUNTY—To Diesel Oil Sales Corp., 2155 Northlake Ave., Seattle, Wn., $12,909 for const. bit. surf. on 3.5 mi. of County road, Walla Walla, north. (3) PIERCE COUNTY—To Joseph Warter, Sr., 631 N. Fife St., Tacoma, $74,689 for 3.2 mi. paving county road, Gig Harbor to Point Fosdick. (4) SPOKANE COUNTY—To Goodfellow Bros., Inc., Box 1332, Wenatchee, Wn., $34,482 for .5 mi. grading, surf. and const. overcrossing to S. P. & S. Railroad on County Road, Cheney Plaza Road, overcrossing south of Cheney. (5) WAHKIAKUM COUNTY—To Makela Const. Co., Astoria, Ore., $7,106 for const. trestle on Co. Rd., Crooked Creek Bridge. (6) YAKIMA COUNTY—All bids rejected for 4.2 mi. grad., surf. and const. bitum. mac. on county road, Cowiche to Tieton. 2-20

OLYMPIA, WN.—Awards as follow by Director of Highways, Olympia, Wn., for: (1) YAKIMA COUNTY—To Macri Bros., 511 21st Ave., N., Seattle, $23,889 for .6 mi. paving on State Road No. 3, 1st St. in City of Yakima. (2) YAKIMA COUNTY—To Bjork Pierson, & Strom, 2437 W. 63rd St., Seattle, Wn., $105,287 for .5 mi. clearing and grading on State Road, 5, Tieton Dam vicinity. (3) CIALIAM COUNTY—To J. H. Collins & Co., Box 678, Walla Walla, Wn., $42,496 for .6 mi. paving of St. Rd. No. 9, 1st St. betw. Race and Lincoln in Port Angeles. (4) FRANKLIN COUNTY—To H. C. Rogers & Sons, P. O. Box 181, Dayton, Wn., $11,940 for .4 mi. clearing, grad., const. bitum. surf. and overcrossing on Northern Pacific tracks on St. Rd. 11, Pasco north, Airport vicinity. (5) ADAMS COUNTY—To Fred G. Redmon, 303 S. 5th Ave., Yakima, $67,317 for producing and stockpiling 36.1 mi. State Road 11, Ritzville to the Adams-Franklin County Line. 2-20

OLYMPIA, WN.—Awards as follow by the Director of Highways, Olympia, Wn., for: (1) THURSTON COUNTY (WPMH 200-A)—To Warren Northwest, Inc., P. O. Box 5072, Portland, $37,522 for 1.4 mi. concr. (asph.) paving on St. Rd. No. 1, Capitol Way in Olympia. (2) KITTITAS COUNTY (WPH 148-E)—To C. E. O'Neal, Stevenson, Wn., $114,550 for 5.3 mi. grading and ballasting on State Road No. 7, High-Line Canal to Summit. (3) KLICKITAT COUNTY (WPSO 240-A)—To J. C. Papin, Carson, Wn., $42,250 for 2.2 miles grading and surf. county road, Goodnoe Hills Vicinity. (4) COWLITZ COUNTY (WPSO

235-A)—To Hendricks & Co., Chehalis, Wn., $17,926 for 1.9 mi. clearing, grading, surf. and const. a light bitum. surf. tr. on county road Hillside Acres Road. 2-27

SEATTLE, WN.—To Northwest Const. Co., 3950 6th, N. M., Seattle, Wn., $21,450 by Board of Public Works, Seattle, Wn., for paving and const. ducts for lighting on Railroad Ave., from Blanchard St., to University St., under Ordinances Nos. 62123 and 64218, Local Improv. Dist. 5339 (Unit 2). 2-24

CHEYENNE, WYO.—Awards as follow by the State Highway Comm., Capitol Bldg., Cheyenne, Wyo.: (1) FREMONT, CARBON and NATRONA COUNTIES (WPH 162-E)—To Northwest Engineering Co., Rapid City, South Dakota, $169,163 for 12.835 mi. grading, draining, etc., on the Lander-Muddy Gap road. (2) NATRONA COUNTY (WPMH 168-A & 110-A)—To Northwest Engineering Co., Rapid City, South Dakota, $100,381 for 10.880 mi. grading, draining, const. reinf. concr. culverts, etc., on the Casper-Shoshoni road. (3) LINCOLN COUNTY (WPMH 184-A & B)—To Northwest Engr. Co., Rapid City, South Dakota, $50,203 for 19.999 mi. grading, drain, etc., on the Star Valley Road. (4) CARBON COUNTY (WPSO 283)—To H. J. Woodman, Cheyenne, Wyo., $121,090 for 10.832 mi. grading, draining, const. timber bridges, etc., on the Hanna-Elk Mt. Road. (5) BIG HORN COUNTY (WPSO 284)—To Northwest Engrg. Co., Rapid City, So. Dakota, $50,928 for 6.212 mi. grad., drain. base course surf. and misc. work on the Basin-Burlington road. 2-6

Bridges and Culverts . . . . . .

WORK CONTEMPLATED

SAN FRANCISCO, CALIF.—Plans and specifications have been completed and call for bids will be issued as soon as financing has been arranged with the R.F.C. by the S. F.-Oakland Bay Bridge, 500 Sansome St., San Francisco, for construction of the following in connection with the interurban rail system on the S. F.-Oakland Bay Bridge: S. F. Terminal and Approaches, $6,300,000; Track work on main bridge, $640,000; East Bay Storage yard, $860,000; S. P. Co. connections, $600.000; Electrical distribut. system, $720,000; Signals and interlocking, $1,320,000; Alterations to Key System equipment, $2,470,000; Altera. to Southern Pacific eqp., $1,536,000; Altera. to Sacramento Northern equipment, $54,000. 2-6

YUBA CITY, CALIF.—Engineer Ed Von Geldern has been authorized to make survey and submit recommendations to the County Supervisors, Court House, Yuba City, for the reconstruction of the Nicolaus bridge across the Feather River at Nicolaus. Two new spans of 200 and 267 ft. with new approaches will be constructed. Estimated cost of work is $145,510. This will be a WPA project. 2-6

BIDS RECEIVED

CARSON CITY, NEVADA—All bids submitted to Nevada State Highw. Comm., Carson City, Nev. for a reinf. concr. bridge and 0.02 mi. approaches, 1 mi. S. of Gardnerville, DOUGLAS COUNTY, Nev., Proj. WPSO 137, have been rejected. 2-29

CONTRACTS AWARDED

MERCED, CALIF.—To C. B. Cameron & Son, P. O. Box 244, Merced, $1,499 for bridge No. 254 and to Roy Kruger, Gustine, $902 for Bridge No. 256 by County Clerk, Merced, for constructing timber bridges in Superv. District No. 4. 2-19

VENTURA, CALIF.—Award recommended, subject to PWA approval, to V. R. Dennis Construction Co., 3911 5th Ave., San Diego, $121,950, by County Clerk, Ventura, for construction of a steel and timber bridge, resting on pile bent foundations with necessary abutments, across the mouth of the Santa Clara River south of Pierpont Bay, VENTURA COUNTY. 2-8

YUBA CITY, CALIF.—To M. A. Jenkins, 3560 "Y" Street, Sacramento, $2,921, by County Clerk, Yuba City, for const. repairs to the Verona Bridge on the Garden Highway. Work consists of repairing supporting truss, new flooring and surfacing of bridge. 2-10

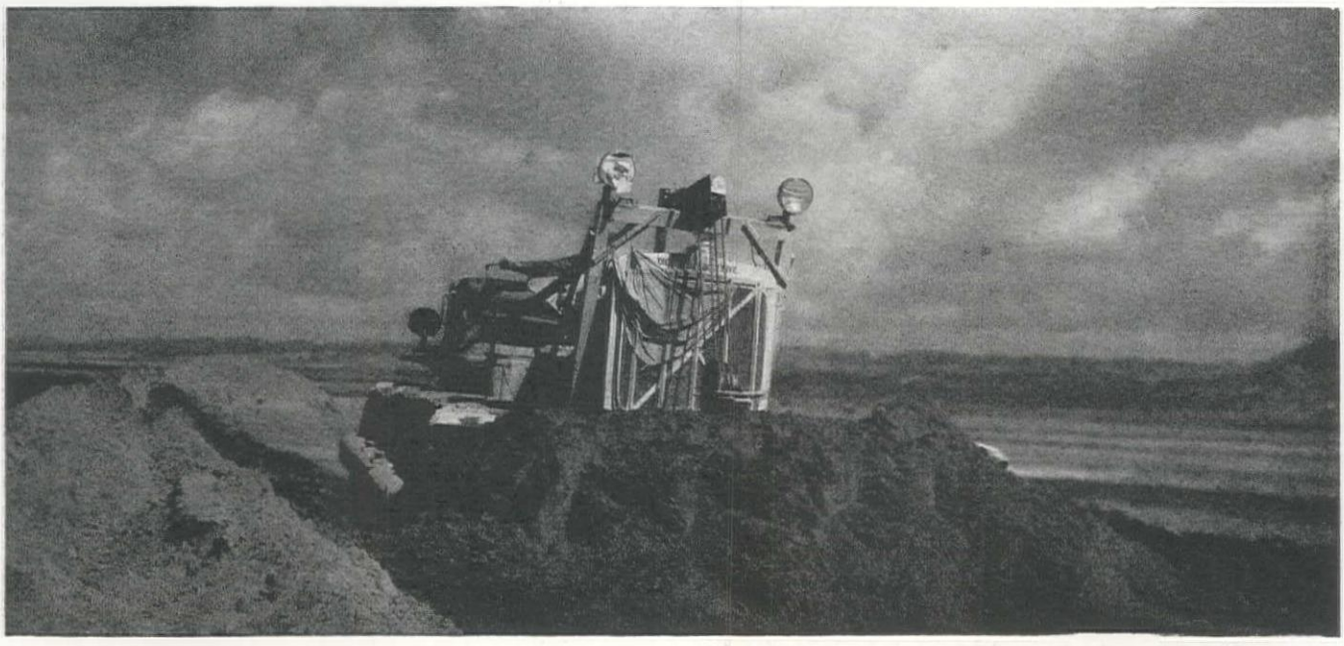
DENVER, COLO.—To De Remer & Atchison, 1429 Pearl St., Denver, $38,624 by Colorado State Highway Dept., Denver, for const. a bridge and approaches betw. Strasburg and Anton in ADAMS & ARAPAHOE COUNTIES, Proj. FAP 351F and ERP 12, combined, Colo. 2-28

DENVER, COLO.—To Larson Const. Co., & Kranz Const. Co., 1902 Blake, Denver, Colo., $152,698 by Colorado State Highway Dept., Denver, Colo., for const. an underpass and 2 miles approaches between Pueblo and Ordway in PUEBLO COUNTY, Colo. (comb. Project WPMS 414 A&WPGS 414B). 2-24

BOISE, IDAHO—Awards as follow by Comm. of Public Works, Boise, Idaho, for: (1) SHOSHONE COUNTY (NRH & NRM 73 F1)—To Triangle Const. Co., 1220 Ide St., Spokane, Wn., $59,446 for 3 conc. bridges and 1 conc. culvert on 0.032 mi. of Coeur d'Alene-Yellowstone Trail from Mullan, east. (2) POWER COUNTY (WPGM 180-B)—To Nic Burggraf & J. W. Brennan, Idaho Falls, Ida., $46,769 (Resiliflex) for const. concr. and steel overhead struc. and grad. and surf. appr. on 0.390 mi. of Roosevelt Highway at American Falls. 2-17

BOISE, IDAHO—Awards as follow by the Comm. of Public Works, Boise, Ida., for: (1) CLARK COUNTY (WPGH 199)—To Max J. Kuney Co., 124 E. Augusta Ave., Spokane, Wn., $90,321 for const. a 295.7 ft. concr. overhead struc. over the Oregon Short Line RR and grad. and surf. appr. on 0.488 mi. of Idaho-Montana Highway at Monida. (2) BINGHAM COUNTY (FAP 84-C-Reop. E)—To Dan J. Cavanagh, Box 1083, Twin Falls, Ida., $109,968 for a 483 ft. steel and concr. bridge and grad. and surf. the roadway approaches with screened gravel on 0.467 mi. of the Lost River Highway at Blackfoot. 2-3

MISSOULA, MONTANA—Awards as follow by the Montana State Highway Comm., Court House, Missoula, Mont., for: (1) RAVALLI COUNTY (FAP 139 D)—To Joseph Iten, Hamilton, Mont., $17,775 for 4 tr. timber pile trestles, 1 tr. timb. stockpass and 1 corr. metal flume, 103 ft. long on Sec. D of the Bitter Root Road south of Hamilton betw. Conner and Darby. (2) MUSSELSHELL COUNTY (FAP 268-D)—To Inland Const. Co., 3867 Leavenworth St., Omaha, Nebr., $19,703 for const. 5 tr. timber pile bridges and 1 tr. timber stock pass on Sec. D of the Ryegate-Roundup Road. (3) LEWIS and CLARK COUNTIES and TETON COUNTY (FAP 257-C)—To S. Birch & Sons Const. Co., Great Falls, Mont., $76,065 for 1 steel and concr. bridge, 1 tr. timber pile trestle, and grad. and surf., also const. small dr. struc. on 0.785 mi. of Sec. C of the Augusta-Choteau Road. (4) HILL COUNTY (WPGM 301-C)—To Jerome C. Boespflug, Miles City, Mont., who bid $85,484 for const. a 5-span 369-ft. concrete and steel viaduct over the tracks of the Great Northern Railway on the extension of 7th Avenue at the City of Havre, Mont., together with tr. timb. pile trestle approaches, etc. (5) MISSOULA COUNTY (WPGM 374A)—To Thos. Staunton, Great Falls, Mont., who bid $113,557 for const. reinf. concrete overpass crossing of C. M. & St. P. R. R. Co.'s tracks on Orange St. By-Pass Road in Missoula. 3-2



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PORTLAND, ORE.—Awards as follow by Oregon State Highway Comm., Public Serv. Bldg., Portland: (1) CLACKAMAS COUNTY (WPMS 264)—To Mt. States Const. Co., Eugene, $83,903 for concr. bridge over Clackamas River and 0.7 mi. grade and oil mat surf. tr. on Woodburn-Sandy Highway at Estacada. (2) LAKE COUNTY (FAP 100-B)—To J. F. Johnson, 800 Sheridan St., Newberg, Oregon, $14,973 for composite frame trestle bridge over Chewaucan River on Fremont Highway 10 mi. S. of Paisley. 2-8

PORTLAND, ORE.—Awards as follow by Oregon State Highway Comm., Portland, Oregon: (1) KLAMATH COUNTY (WPSO 282)—To Dunn & Baker, Box 431, Klamath Falls, Ore., $11,606 for composite pile trestle bridge over USRS Canal "J," untr. pile trestle bridge over a drain. ditch and a lam. tr. culvert on the Merrill-Hatfield County Road, 4 mi. S. of Merrill. (2) MULTNOMAH COUNTY (WPGH 173-A)—To Portland Sand & Gravel Co., Sec. Line Road, Portland, $42,500 for a 116 ft. thru plate girder span and 2 23 ft. I-beam spans to carry the United Ry. track over Columbia River Highw. 1.8 mi. north from the north city limits of Portland. 2-10

SALT LAKE CITY, UTAH—To W. W. Clyde & Co., Springville, Utah, $13,204 by State Road Commission of Utah, Salt Lake City, for a 50-ft. span concrete bridge in PIUTE COUNTY, FAP 19-C betw. Circleville and Junction. 2-20

SEATTLE, WN.—To A. S. Peterson, 4311 Whitman Ave., Seattle, Wn., $10,897 by Board of Public Works, Seattle, Wn., for constructing a reinf. concrete overhead pedestrian viaduct across Aurora Ave. at North 41st St., under Ord. No. 65528. 2-24

MT. VERNON, WN.—To Manson Const. & Engr. Co., 129 Canadian Natl. Pier, Seattle, Wn., $117,783 by Skagit County Commissioners, Mt. Vernon, Wn., for const. a struc. steel, concrete and timber bridge known as Swinomish Slough Bridge No. 231, on portion of Cascade Highway, Secondary Road No. 32 and PWC Docket No. 5898. 2-1

OLYMPIA, WN.—To L. C. Fountain, Clarkston, Wn., $6,927 by Director of Highways, Olympia, Wn., for constructing a treated pile and timber bridge 104.5 ft. long on County Road, Asotin Creek Bridge, Project WPSO 229-A, in ASOTIN COUNTY, Wn. 2-27

CHEYENNE, WYO.—To C. M. Smith, Thermopolis, Wyo., $42,834 by State Highway Comm., Cheyenne, Wyo., for constructing 2 treated timber bridges, 1 structural steel bridge and 3 reinforced concrete culverts on the Basin-Burlington Road in BIG HORN COUNTY, Wyo., Proj. WPSO 284. 2-6

CHEYENNE, WYO.—Awards as follow by the State Highway Comm., Capitol Bldg., Cheyenne, Wyo., for: (1) FREMONT COUNTY (WPH 159-G)—To Swenson Lumber Co., Laramie, Wyo., $146,006 for const. 7 struc. steel bridges on the Dubois-Riverton road. (2) GOSHEN COUNTY (WPSO 282)—To Northwest Engr. Co., Rapid City, South Dakota, $9,904 for const. 2 tr. timber bridges, 4 reinf. concrete culverts, 2 siphon wells, 1 headgate and 2 wing end walls and misc. work on 12.488 mi. of the Torrington-Cherry Creek road. 2-6

Water Supply Systems . . . . .

WORK CONTEMPLATED

TWIN FALLS, IDAHO—Bond election will probably be held within the next 90 days by Twin Falls, Idaho, to vote on a $300,000 bond issue to finance construction of 14½ miles of 24 in. pipeline to develop a new supply of water for the city. 2-28

CALLS FOR BIDS

MARE ISLAND, CALIF.—Bids to 11 a. m., Mar. 25 by the Public Works Officer, U. S. Navy Yard, Mare Island, Calif., for replacing two 10,000 gal. fresh water tanks, replacing salt water piping, replacing plumbing fixtures in quarters and for extending sewer outfalls at U. S. Naval Direction Finder Station, Farallon Island, Calif. under Spec. No. 8151. 2-29

DENVER, COLO.—Bids to 10 a. m., March 17 by the Board of Water Commissioners, at the office of the Moffat Tunnel Extension project, Room 110, City and County Bldg., Denver, Colo., for: (1) Furnishing five pumping units and appurtenances for use in the West Side Filter Plant. (2) Furnishing and installing the Chemical Feed Equipment, Sluice gates, valves, filter controllers, wash water Venturi meter, cast iron pipe lines within the Filter Plant Bldg., Pressure water supply system and miscell. piping, gages, and laboratory equipment for the West Side Filter Plant. (3) Construction of the Filter Plant Building, complete, reinf. concr. wash tank, cistern, and necessary accessory work, West Side Filter Plant. (4) Furnishing the slow mixing and accessory equipment for use in the West Side Filter Plant. 2-26

TACOMA, WN.—Bids to 2 p. m., March 16 by Board of Contracts & Awards, City Hall, Tacoma, Wn., for const. 18,990 lin. ft. 48 ft. pipeline (2,750 ft. steel and 16,240 ft. either steel OR lock joint steel cylinder reinf. concr. pipe). 2-24

TACOMA, WN.—Bids to 2 p. m., March 23 by the Board of Contracts and Awards, Room 307, City Hall, Tacoma, Wn., for furnishing valves for installation in connection with the 1936 Green River Gravity Pipe Line Construction at 20th and "J" Street, and near the Hood Street Pump Station, as follows: Two 24 ft. cone stop valves designed for 150 lb. working pressure for installation in Section "T," Pipe Line No. 4 Extension, Green River Gravity Pipe Line. 2-24

BIDS RECEIVED

LOS ANGELES, CALIF.—Consolidated Steel Corp., 6500 E. Slauson Ave., Los Angeles, $4,322, low to County Board of Supervisors, Los Angeles, for reinforcing the elevated steel water tank tower at Rancho Los Amigos, near Downey, under Spec. 349. 2-18

PT. ARGUELLO, CALIF.—Lyon Brothers, 1363 Cameron Ave., Los Angeles, submitted apparent low bid to Coast Guard, Headquarters, Washington, D. C., for drilling and casing a new well at Point Arguello Coast Guard Station near Arlight, Calif. 2-20

SAN FRANCISCO, CALIF.—Charles L. Harney, 445 Call Bldg., S. F., $29,962, low to the Dept. of Public Works, S. F., for constructing the Bay Bridge Approach Extension to the Auxiliary Water Supply System for fire protection. 2-19

CANYON CITY, ORE.—Schmitt Construction Co., Foot of Knott Street, Portland, Oregon, $17,710, low to City Recorder, Canyon City, Oregon, for construction of waterworks facilities, consisting of construction of 18,500 lin. ft. 4 in. O. D. steel water supply line and a 200,000 gallon concrete reservoir. 2-11

CONTRACTS AWARDED

ALHAMBRA, CALIF.—Award (subject to PWA approval) to Chicago Bridge & Iron Co., 608 South Hill St., Los Angeles, $66,165, by City Clerk, Alhambra, for construction of two steel tank reservoirs with wood roofing. 2-10

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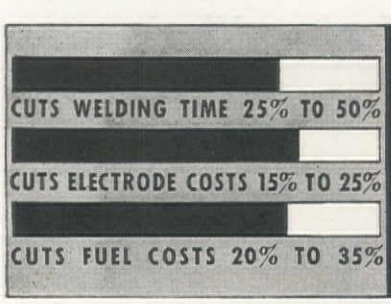

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ENCINITAS, CALIF.—To T. C. Pritchard, 5260 Magnolia Ave., Riverside, $11,918, by San Dieguito Irrigation District, Encinitas, for construction of a reinf. concrete reservoir, 92 ft. dia., 23 ft. deep. 2-19

OAKLAND, CALIF.—To A. Soda & Son, 5231 Grove St., Oakland, $19,000 by East Bay Municipal Utility District, 512 16th St., Oakland, for constructing a 1,000,000 gallon water storage tank at Crockett Hall. 2-14

PASADENA, CALIF.—Award (subject to PWA approval) to Case Constr. Co., 905 Westminster Ave., Alhambra, $55,842, by City Clerk, Pasadena, for constructing reinforced concrete and cast iron water mains. 2-5

SACRAMENTO, CALIF.—To H. W. Robertson, 3004 "F" St., Sacramento, $131,600, by City Clerk, Sacramento, for const. the Clunie Memorial swimming pool and library at McKinley Park, Sacramento. 2-21

SACRAMENTO, CALIF.—To Campbell Construction Co., 800 "R" Street, Sacramento, $315,347 by City Clerk, City Hall, Sacramento, for two overhead storage tanks. 2-29

SAN FRANCISCO, CALIF.—To The Lowrie Paving Co., Inc., 1540 16th St., San Francisco, $126,696, by Public Utilities Comm., San Francisco, for laying 20 in. steel feeder mains in the Park Presidio and Sunset Districts, under S.F.W.D. Contr. No. 106. 2-11

SAN FRANCISCO, CALIF.—To Eaton & Smith, 715 Ocean Avenue, San Francisco, $29,073, by Dept. of Public Works, San Francisco, for constructing 5 reinforced concrete cisterns (Group No. 3) for fire protection on Dolores, 22nd, 24th, 26th, 28th and 30th Streets, in San Francisco, Calif. 2-11

SAN FRANCISCO, CALIF.—To MacDonald & Kahn Co., Ltd., Financial Center Bldg., San Francisco, $193,994, by Public Utilities Commission, San Francisco, for laying the crosstown pipeline in San Francisco, under Water Department Contract No. 80. (See Unit Bid Summary). 2-11

SAN FRANCISCO, CALIF.—To Youdall Const. Co., 215 Market St., S. F., $1,315,280 by Pub. Util. Comm., S. F., for const. the Crystal Springs Pipeline No. 2 from Millbrae to University Mound Reservoir, W.D.C. No. 79. (See Unit Bid Summary). 2-11

SANTA BARBARA, CALIF.—Award (subject to PWA approv.) to Nels Oakeson, 3137 Calle, Fresno, Santa Barbara, $34,724, by City Clerk, Santa Barbara, for const. La Mesa Reservoir, circular concr. 2-10

SANTA BARBARA, CALIF.—Award (subject to PWA approval) to John Oberg, 3470 E. 8th, L. A., $29,800 by City Clerk, Santa Barbara, for const. El Cielito Reservoir, circular concrete. 2-10

SANTA BARBARA, CALIF.—Contract awarded subject to PWA approval, to Daley Corp., 4430 Boundary St., San Diego, $134,694, under Schedules A, B, C, by City Council, Santa Barbara, for construction of a filtration plant. 2-21

SOUTH GATE, CALIF.—To Chicago Bridge & Iron Co., 607 So. Hill St., L. A., $25,660, by City Clerk, South Gate, for furn. and erecting one 150,000 gal. elevated steel tank, including concrete foundations and fence. 2-19

VALLEJO, CALIF.—Award (subject to PWA approval) to Robert B. McNair and H. Gould, 3745 Rhoda Ave., Oakland, $57,120, by City Clerk, Vallejo, for construction of the Gordon Valley Pipeline replacement. 2-4

PORT ORFORD, ORE.—To Hauser Const. Co., Portland., Ore., $22,231, by City Recorder, Port Orford, Ore., for const. an intake reservoir, a water supply and distribution system, including hydrants and other accessories. 2-5

PEARL HARBOR, T. H.—To Hawaiian Dredging Co., Honolulu, T. H., $53,930, by Bureau of Yards & Docks, Navy Dept., Washington, D. C., for improvements to Fresh Water system, Fleet Air Base, Pearl Harbor, T.H., under Spec. 8128. 2-1

MORTON, WN.—To Hendricks & Co., Chehalis, Wn., $37,103 by Town Clerk, Morton, Wn., for constructing improvements to water system. 2-24

Sewer Construction . . . . . .

WORK CONTEMPLATED

MANTECA, CALIF.—L. B. Raab, Consulting Engineer, 109 E. Weber Ave., Stockton, has been retained by the City Council, Manteca, to make a survey and cost estimate on rehabilitation or construction of a new sewage disposal plant and improvements to city streets. 2-10

STOCKTON, CALIF.—At a special election held February 18 bonds in amount of $110,000 were voted by City of Stockton, Calif., for additions to sewage system and sewage treatment plant. Bonds in amount of $50,000 for fire apparatus, were defeated. 2-19

BIDS RECEIVED

BERKELEY, CALIF.—Oakland Sewer Construction Co., 9915 Walnut Street, Oakland, $7,231, low to the City Clerk, City Hall, Berkeley, for constructing a storm sewer on Ashby Ave., from Benvenue St. to Elmwood Court. 2-25

CONTRACTS AWARDED

MONTEREY PARK, CALIF.—To A & B Const. Co., 912 Atlantic Blvd., Hynes, (subject to PWA approval), $235,555, by City Clerk, Monterey Park, for construction of a sewer system. (See Unit Bid Summary). 2-20

SAN FRANCISCO, CALIF.—Awards as follow by Dept. of Public Works, City Hall, S. F., for const. Marina Sewage Pumping Plant: (1) To Healy Tibbitts Const. Co., 64 Pine St., S. F., $96,200 PROP. "A." (2) To Frederick W. Snook Co., 596 Clay St., S. F., $37,884 PROP. "B"—Mechanical Work. 2-5

SONORA, CALIF.—Award (subject to PWA approval) to Underground Const. Co., 6 Alvarado Road, Berkeley, $38,825, by City Clerk, Sonora, for const. intercepting and outfall sewers and sewage disposal plant. 2-4

SELAH, WN.—To L. Coluccio, Securities Bldg., Seattle, Wn., $40,679, by Town Clerk, Selah, Wn., for const. a sewer system. 2-1

River and Harbor Work. . . . .

WORK CONTEMPLATED

LOS ANGELES, CALIF.—Application has been made by the City of Los Angeles, to the U. S. Engineer Office, 751 S. Figueroa St., Los Angeles, for Water Dept. Permit to dredge an area in West Basin, Los Angeles Harbor, varying from 1,000 ft. width between the drawbridge and San Pedro Lumber Co.'s dock to 350 ft. in width at a point north of the city of Los Angeles Transit Shed, all to a depth of 35-ft.; dredge slips 230 and 232 on the Main channel to a depth of 40 ft. and East Channel, Outer Harbor, to a depth of 40 ft. all depths being below mean lower low water; and to deposit the dredged material totaling approximately 836,700 cu. yd. in an area east of Allen Field Airport and W. of the L. A.-Long Beach City Boundary Line and in an area lying between West Channel, Outer Harbor, and Fort MacArthur, and also in an

area north to Cabrillo Beach between West Channel and the property of the Southern Pacific R.R. 2-14

LOS ANGELES, CALIF.—Application has been made by City of L. A. to U. S. Engr. Office, L. A., for War Dept. permit to const. a timber groin in Santa Monica Bay, Calif. at the south boundary of the City of Los Angeles, to extend about 440 ft. seaward from the line of mean high tide. 2-6

LOS ANGELES, CALIF.—Application has been made by City of L. A. to U. S. Engr. Office, L. A., for War Dept. permit to const. 2 lateral extens. to exist. Bellview Pier at Hyperion, Calif. to serve as loading docks for barges conveying old sewage screenings to be dumped at sea. 2-6

CALLS FOR BIDS

LOS ANGELES, CALIF.—Bids to 10 a. m., March 18th by the Harbor Comm., Los Angeles, for dredging in Wilmington and Terminal Island Districts, under Spec. 953, involving: 187,000 cu. yd. dredging E. channel, (WD). 95,000 cy. dredging, Slips, 230 & 232 (TI). 454,700 cy. dredging, W. Basins (W.D.). 2-19

PEARL HARBOR, T. H.—Bids to March 25 by Bureau of Yards & Docks, Navy Dept., Washington, D. C., for extension to quay wall of reinf. concrete construction supported on concrete piles and on concrete cylinders on wood piles and includes timber fender system, trackwork, steel sheet piling, piping systems, elec. work and fittings at the Navy Yard, Pearl Harbor, T. H., under Spec. 8014. Est. cost, $200,000. 2-7

BIDS RECEIVED

LOS ANGELES, CALIF.—Kress Moving Co., Inc., 807 California St., L. A., $40,345, low to General Manager, Harbor Comm., City Hall, L. A., for relocation and reconstruction of the transit shed facility Berth 155, San Pedro, under Spec. No. 948. 2-20

LOS ANGELES, CALIF.—Wm. P. Neil Co., Ltd., 4814 Loma Vista Ave., L. A., $347,000, low to General Manager, Board of Harbor Comm., City Hall, Los Angeles, for construction of a concrete wharf and steel frame transit shed at Berth 155, Wilmington District, under Spec. No. 950. 2-20

LOS ANGELES, CALIF.—L. A. Harbor Dept., low to General Manager, Board of Harbor Comm., City Hall, Los Angeles, for construction of rock riprap bank protection and rubble bulkhead wall at Berth 155, Wilmington District. Rock riprap to be placed 441'x60'x3' after existing rubble and earth is removed. 2-20

LOS ANGELES, CALIF.—Wm. P. Neil Co., Ltd., 4814 Loma Vista Ave., L. A., $41,000, low to General Manager, Board of Harbor Comm., City Hall, Los Angeles, for construction of a timb. apron wharf at Berth 155, Wilmington District, under Spec. No. 949. 2-20

LOS ANGELES, CALIF.—Merritt Chapman & Scott Corp., Box 698, San Pedro, Calif., $153,584, low to General Manager, Board of Harbor Comm., City Hall, Los Angeles, for const. of a creosoted timb. wharf and fender system, under Spec. No. 954. 2-20

CONTRACTS AWARDED

SAN DIEGO, CALIF.—To J. G. Wood & Sons, 3738 Curlew St., San Diego, $10,200, by 11th Naval District, Foot of Broadway, San Diego, for breaking out of concrete, as required, to expose and clean the reinf. steel, clean and sand blasting of exposed concrete surface and exposed reinf. steel and the building up and replacing of broken out concrete by cement gun method, also waterproofing only of repaired areas of concrete wharf, under Spec. 8072. 2-28

SAN DIEGO, CALIF.—Award recomm. to J. G. Wood & Sons, 3738 Curlew St., San Diego, $10,200 by 11th Nav. Dist., San Diego, for breaking out of concr., as required, to expose and clean the reinf. steel, clean and sand blasting of exposed concr. surf. and exposed reinf. steel and the bldg. up and replacing of broken out conc. by cement gun method, also waterpr. only of repaired areas of concr. wharf, under Spec. 8072. 2-20

MARSHFIELD, ORE.—To Coos Bay Dredging Co., Marshfield, $16,783, by City Recorder, Marshfield, Ore., for const. a dock for the City of Marshfield, Oregon, involving removing existing docks and piling, dredging and const. of a new dock 30 ft. x 489 ft., supported on piling. 2-17

SEATTLE, WN.—Awards as follow by the Pacific Coast Co., Smith Tower, Seattle, Wn., for reconstructing Piers A, B & C: (1) To Puget Sound Bridge & Dredging Co., 2929 16th Ave., S.W., Seattle, for wharf, piling and dredging. (2) To Chas. R. McCormick Lumber Co., White Bldg., Seattle, Wn., for lumber. (3) To West Coast Wood Preserving Co., 1118 4th St., Seattle, for piling. Total estimated cost is $257,000. 2-17

Irrigation and Reclamation . .

BIDS RECEIVED

PHOENIX, ARIZ.—Dan Teters & Co., Ontario, Ore., $53,900, low to Bureau of Reclamation, care of Salt River Valley Water Users' Association, Phoenix, Ariz., for alterations to spillway at Roosevelt Dam, Salt River Project, Ariz., under Spec. No. 663. 2-6

YUMA, ARIZ.—David H. Ryan, 1615 Fern St., San Diego, $99,150 low to Bureau of Reclamation, Yuma, Ariz., for const. earth lining on the All American Canal, Sta. 419 to Sta. 601 and Sta. 803 to Sta. 1245, All American Canal system Boulder Canyon project under Spec. 668. 2-6

YUMA, ARIZ.—Bids received as follows by the Bureau of Reclamation, Federal Bldg., Yuma, Ariz., for const. earthwork and tunnels, Sta. 30 to Sta. 931, Gravity Main Canal, Gila Valley Project, Ariz. under Spec. 657: SCHED. 1—(Earthwork, Gravity Main Canal, Sta. 30-00 to Sta. 285-30) Boyce & Igo, Baton Rouge, La., and Yuma, Ariz. (low) $73,200. SCHED. 2—(Earthwork and Tunn. No. 1, Grav. Main Canal, Sta. 285-30 to 330-00) Mittry Bros. Const. Co., 5531 Downey Road, L. A. (low) $210,830. SCHED. 3—(Earthwork and Tunnel No. 2, Sta. 330-00 to Sta. 408-00) Mittry Bros. Const. Co., 5531 Downey Road, Los Angeles (low) $470,745. SCHED. 4—(Earthwork, Gravity Main Canal, Sta. 408-00 to Sta. 931-00) Boyce & Igo, Baton Rouge, La.; and Yuma, Ariz. (low) $200,400. (See Unit Bid Summary). 2-27

ONTARIO, ORE.—John Klug, Nyssa, Ore., $20,521 low to Bureau of Reclamation, Ontario, Ore., for const. earthwork, concr. lining and struct., Locket Gulch Wasteway Channel, Mitchell Butte Division, Owyhee Project, Oregon-Idaho, under Specification No. 760-D. 2-5

AUSTIN, TEXAS—Brown & Root, Inc., Austin, Texas, $323,300, low to Bureau of Reclamation, Austin, Texas, for clearing the Hamilton Reservoir site, Colorado River project, Texas. Work is located about 13 miles west of Burnet, Texas. Work involves about 15,800 acres of clearing and work is divided into two schedules. Spec. 667. 2-5

YAKIMA, WN.—John Klug, Nyssa, Ore., $48,778, low to Bureau of Reclamation, Yakima, Wn., for const. spillway at Kachess Dam, Yakima Project, Washington, under Spec. 669. 2-24

CONTRACTS AWARDED

TURLOCK, CALIF.—To Ed Erickson, Rt. 4, Box 744, Modesto, $3,500, by Turlock Irrig. Dist., Turlock, for canal lining in the Fox-Wagner Ditch east of Ceres. 2-19

MISSOULA, MONT.—To Hale & Bates, Missoula, Mont., $48,329, by Bureau of Reclamation, Missoula, Mont., for const. diversion works and structures, Main Canal, Frenchtown Project, Montana, under Spec. 662. 2-6

ONTARIO, ORE.—To John Klug, Nyssa, Oregon, $20,521 by Bureau of Reclamation, Ontario, for constructing earthwork, concrete lining and struc., Locket Gulch Wasteway Channel, Mitchell Butte Division, Owyhee Project, Oregon-Idaho, under Spec. 760-D. 2-28

Dam Construction . . . . . .

WORK CONTEMPLATED

NATIONAL CITY, CALIF.—The California Water & Telephone Co., 19 West 9th St., National City, has filed its application with the State Engineer for approval of plans and specifications for the construction of the Judson Reservoir Dam to be built on the Rancho de la Nacion, near National City. The Dam will have a maximum height of 60 ft. a crest length of 690 ft. and will contain 80,000 cu. yd. It will be of the rolled embankment type. Outlet tower, collection ditches, overflow structure and connecting pipeline will also be constructed. 2-28

CALLS FOR BIDS

AUSTIN, TEXAS—Bids to 10 a. m., March 31, by Bureau of Reclamation, Austin, Texas, for const. of the Arnold Dam and power plant and the processing of sand and crushed rock for the Arnold and Hamilton Dams, Colorado River project, Texas. Work is located west of Austin and near Burnet and Kingsland, Texas, under Spec. No. 673. Bids are requested on two different types of construction, as follows, and contractor under either schedule shall const. and maintain at his own expense a road betw. the end of the R.R. at Hamilton Dam and Arnold Dam. Bids on: SCHED. 1—(Concrete Gravity Dam)—20,000 cu. yd. com. exc. (open-cut); 25,000 cu. yd. rock exc. (open-cut); 136,000 cu. yd. conc. (dam and spillw. bucket); 7,200 cu. yd. conc. (appur. dam and powerhouse); 11,000 cu. ft. pressure grouting; 15,000 ft. grout and drain. holes (drill); 500,000 lb. reinforcement bars (place); 135,000 lb. std. steel, fittings (install); 285,000 lb. struc. stl. (erect); 415,000 lb. gates, gate hoists, etc. (inst.). SCHED. 2—(Reinf. Conc. Slab and Buttress Dam)—26,000 cu. yd. com. excav. (open-cut); 15,000 cu. yd. rock excav. (open-cut); 34,800 cu. yd. conc. (buttress and face slabs); 8,600 cu. yd. conc. (footgs. and spillw. bucket); 13,000 cu. yd. in mass sections of dam; 7,200 cu. yd. in appurten. to dam and powerhouse; 7,700 cu. ft. pressure grouting; 7,700 ft. grout holes (drill); 3,800,000 lb. reinforcement bars (place); 60,000 lb. std. steel, etc. (install); 285,000 lb. struc. steel (powerhouse, etc.) inst.; 485,000 lb. gates, gate hoists, control mechanism, power penstocks, cranes and crane rails, metal pier noses, etc. (installing). 3-2

CONTRACTS AWARDED

PHOENIX, ARIZ.—To Dan Teters & Co., Box 7, Garnet, Calif., $53,930 by Bureau of Reclamation, care of Salt River Valley Water Users' Assn., Phoenix, for work and alterations to the spillway at the Roosevelt Dam, Salt River Project, Calif., under Spec. 663. 2-28

SANTA BARBARA, CALIF.—Awards as follow by City Council, City Hall, Santa Barbara, for raising Sheffield Dam and lining reservoir with concrete and constructing concrete retaining wall. SCHEDULE "A"—To Kovacevich & Price, Inc., 5400 Imperial Highway, South Gate, $139,810. SCHEDULE "B"—To Case Construction Co., 905 Westminster Ave., Alhambra, $11,388. 2-18

COULEE, WN.—The Bureau of Reclamation adjusted the Mason, Walsh, Atkinson, Kier Const. Co. contract for building the Grand Coulee Dam, making an agreement covering change in project designed and ordered June, 1935. The new contract provides for an additional payment of $6,700,000 to the MWAK Const. Co. for additional excavation and concrete necessary to build the redesigned Grand Coulee Dam. The additional work involves 3,400,000 cu. yd. common excavation; 1,100,000 cu. yd. new concr. 2-1

Railroad Construction . . . . . .

WORK CONTEMPLATED

KALAMA, ORE.—Preliminary surveys have been made by S. Belah, Engineer, Rosenboom Bldg., Kalama, Wn., for construction of a logging railroad to be built along the Kalama River to tap timber in the hills for the Crossett-Western Timber Company, American Bank Building, Portland, Ore., Est. cost $1,000,000. 2-5

BIDS RECEIVED

LOS ANGELES, CALIF.—Bennett & Taylor, 1978 S. Los Angeles St., Los Angeles, submitted sole bid, $212,600 and $7,000 for additional for concr. tower bldg. to General Manager, Harbor Comm., City Hall, Los Angeles, for construction of a railroad electric interlocking plant at E. Thenard & West Thenard Sts., LOS ANGELES, to control movements of trains over six crossings on the L. A. Municipal Terminal R.R. Belt Line track extension Wilmington District under Spec. No. 947. 2-20

LOS ANGELES, CALIF.—Shannahan Bros., Inc., 6181 Eastern Ave., L. A., $91,000, low to General Manager, Harbor Comm., City Hall, L. A., for constructing a standard gauge R.R. track, including grading, track laying, trestle construction, paving, etc., under Spec. No. 946. 2-20

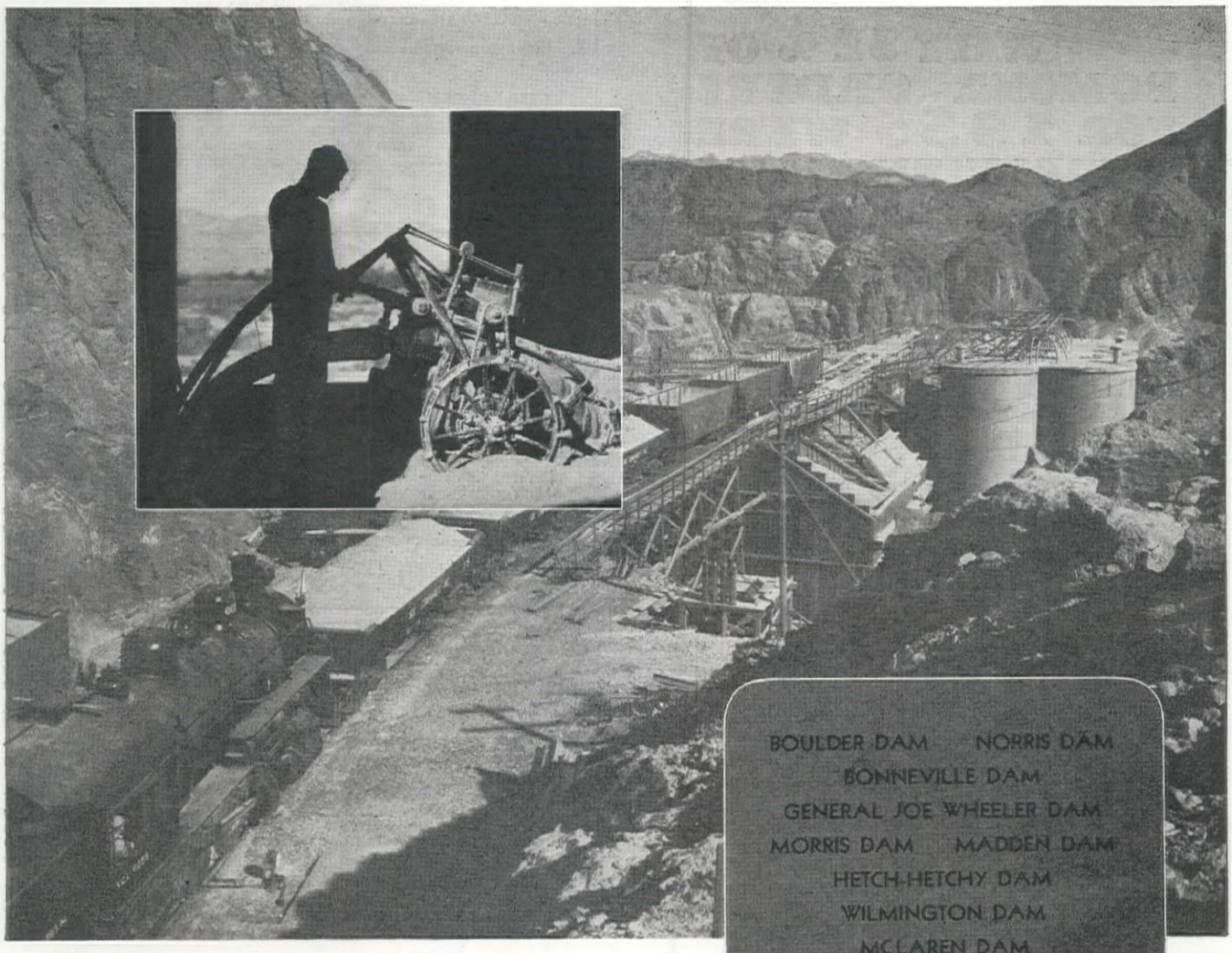
CONTRACTS AWARDED

SAN FRANCISCO, CALIF.—To Eaton & Smith, 715 Ocean Avenue, San Francisco, $22,047 by Public Utilities Commission, San Francisco, for constructing Geary Street tracks between Powell and Kearney Streets, in San Francisco, under Municipal Railroad Contract No. 172. 2-25

Tunnel Construction . . . . . .

CALLS FOR BIDS

PEARL HARBOR, T.H.—Bids to March 25th by Bureau of Yards & Docks, Navy Dept., Wash., D.C., for water supply tunnel, for Aeia, under Spec. 8139. Est. cost $100,000. 2-8



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MISSISSIPPI RIVER

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DAM No. 4	LOCK No. 13
DAM No. 5A	DAM No. 15
DAM No. 6	LOCK No. 16
DAM No. 7	DAM No. 16
LOCK No. 8	LOCK No. 17
DAM No. 8	DAM No. 20
LOCK No. 9	LOCK No. 22
LOCK No. 10	LOCK No. 25
DAM No. 10	DAM No. 26
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P-5

BIDS RECEIVED

EUREKA, UTAH—Bernston & Kuhre, 2336 21st, South, Salt Lake City, Utah, $17,643, low to Town Clerk, Eureka, Utah, for drifting and tunneling for water development. 2-20

CONTRACTS AWARDED

PORTLAND, ORE.—To Orino, Berkmeier & Saramel, Cascade Locks, Ore., $166,904, by Oregon State Highway Comm., Portland, for 0.62 mi. grading on Arch Cape Tunnel Sec. of Oregon Coast Highway, involving 1,278 lin. ft. tunnel and 166 ft. composite pile trestle bridge, FAP 180-E in CLATSOP COUNTY, Ore. (See Unit Bid Summary). 2-8

Pipeline Construction . . . . . .

WORK CONTEMPLATED

SANTA ANA, CALIF.—Application has been made by Sunset Beach Sanitary Dist. of Orange Co., Calif., to U. S. Engr. Office, L. A. for War Dept. permit to const. a 6 in. pipeline for disposal of effluent from a sewage tr. plant; said pipeline to be placed under San Pedro Bay extend. approx. 2,700 ft. (or such distance more or less than 2,700 ft.) as will insure a minimum depth of 20 ft. below mean low water over the highest point of the seaward end of the struc. southwesterly of exist. wooden bulkhead at its intersection with Los Patos Ave., a county rd. at the S.E. limit of Sunset Beach, ORANGE CO. Calif. 2-6

CONTRACTS AWARDED

INGLEWOOD, CALIF.—To Western Pipe & Steel Co., 5717 Santa Fe Avenue, Los Angeles, $10,487 by City Clerk, City Hall, Inglewood, for furnishing, welding and laying in trench, steel pipe and fittings, involving 3,340 lin. ft. 24 in. welded steel pipe. 2-28

SAN DIEGO, CALIF.—To Consolidated Steel Corp., 6500 E. Slauson Ave., Los Angeles, $412,259, by City Clerk, San Diego, for construction of the El Capitan-Lakeside Pipeline from Sta. 104 to Lakeside. 2-5

Power Development . . . . . .

BIDS RECEIVED

PIOCHE, NEVADA—E. C. Nickel, 912 Micheltorena St., Los Angeles, $80,202 (construction work only) and Aluminum Corp. of America, 1031 South Broadway, Los Angeles, $241,885 (aluminum cable) lowest combination of bids to Pioche Power Dist., care of A. W. Thomas, Secty., Pioche, Nev., for constructing about 155 miles high tension power transmission line between Boulder Dam sub-station and Prince sub-station near Pioche, Nev. and for 54 miles of single, wood pole type, feeder lines in Lincoln County, Nevada. 2-8

CONTRACTS AWARDED

PIOCHE, NEVADA—Awards as follow by Pioche Power Dist., Pioche, Nevada, for materials for a 155 mi. power transmission line betw. Boulder Dam Sub-station and Prince Sub-station near Pioche: (1) To Anaconda Copper Co. & General Cable Co., for copper transmission cable to cost $235,000. (2) To Morrison Merrill Co., Salt Lake City, for poles and crossarms. (3) To Westinghouse Elec. Co. and Ohio Brass Co. (jointly) for insulators. (4) To Ohio Brass Co. for hardware. (5) To Electric Power Specialties Co. for steel cable. 2-29

Miscellaneous . . . . . .

BIDS RECEIVED

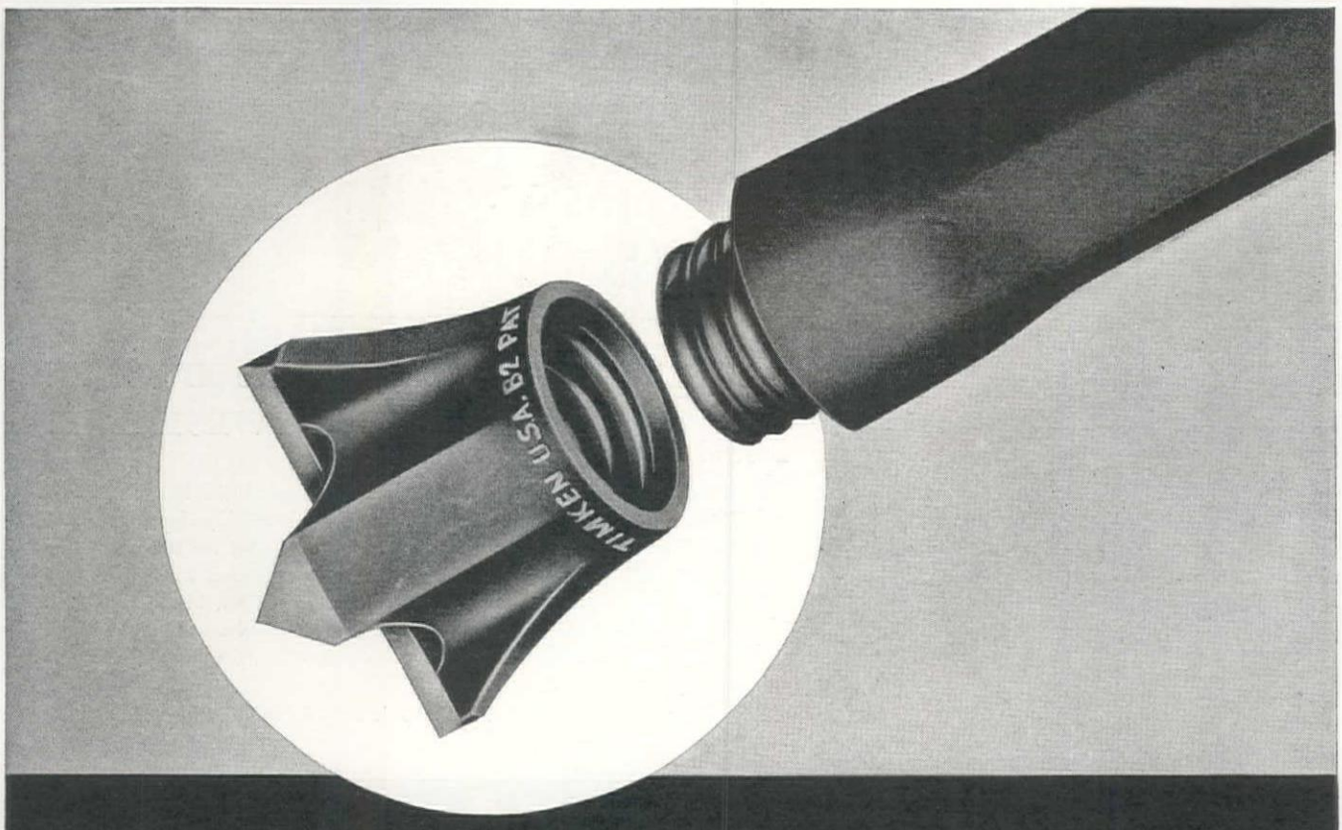
PORTLAND, ORE.—Orino, Berkemeier & Saramel, Bonneville, Oregon, $25,676, low to U. S. Engineer Office, Portland, Oregon., for constructing a Station Building, Section Buildings, sewer system, water tank and column, and water supply system for the O.-W. R.R. & N. Co.'s railroad at Bonneville, Oregon, under Invit. for Bids No. 694-36-257. 2-27

CONTRACTS AWARDED

LOS ANGELES, CALIF.—To Smith Bros. Trucking Co., 1704 E. 16th St., L. A., $7,210 by Purch. Agent., Dept. Water & Power, L. A., for hauling, loading, etc., foundations, under Spec. No. 1857. 2-5

OAKLAND, CALIF.—To Healy Tibbitts Const. Co., 64 Pine St., San Francisco, $1.82 per ton, by Treasury Dept., Proc. Office, Oakland, for furnishing and placing 5,000 tons rock riprap, under Inv. No. 230, on Proj. 65-3-1911, WKS. Proj. 1344. 2-20

SAN FRANCISCO, CALIF.—To Mission Concrete Construction Company, 272 Turk Street, San Francisco, $5,200 by Department of Public Works, San Francisco, for constructing concrete and masonry on the San Francisco War Memorial Court, Van Ness Avenue, Franklin, Grove and McAllister streets, San Francisco. 2-26



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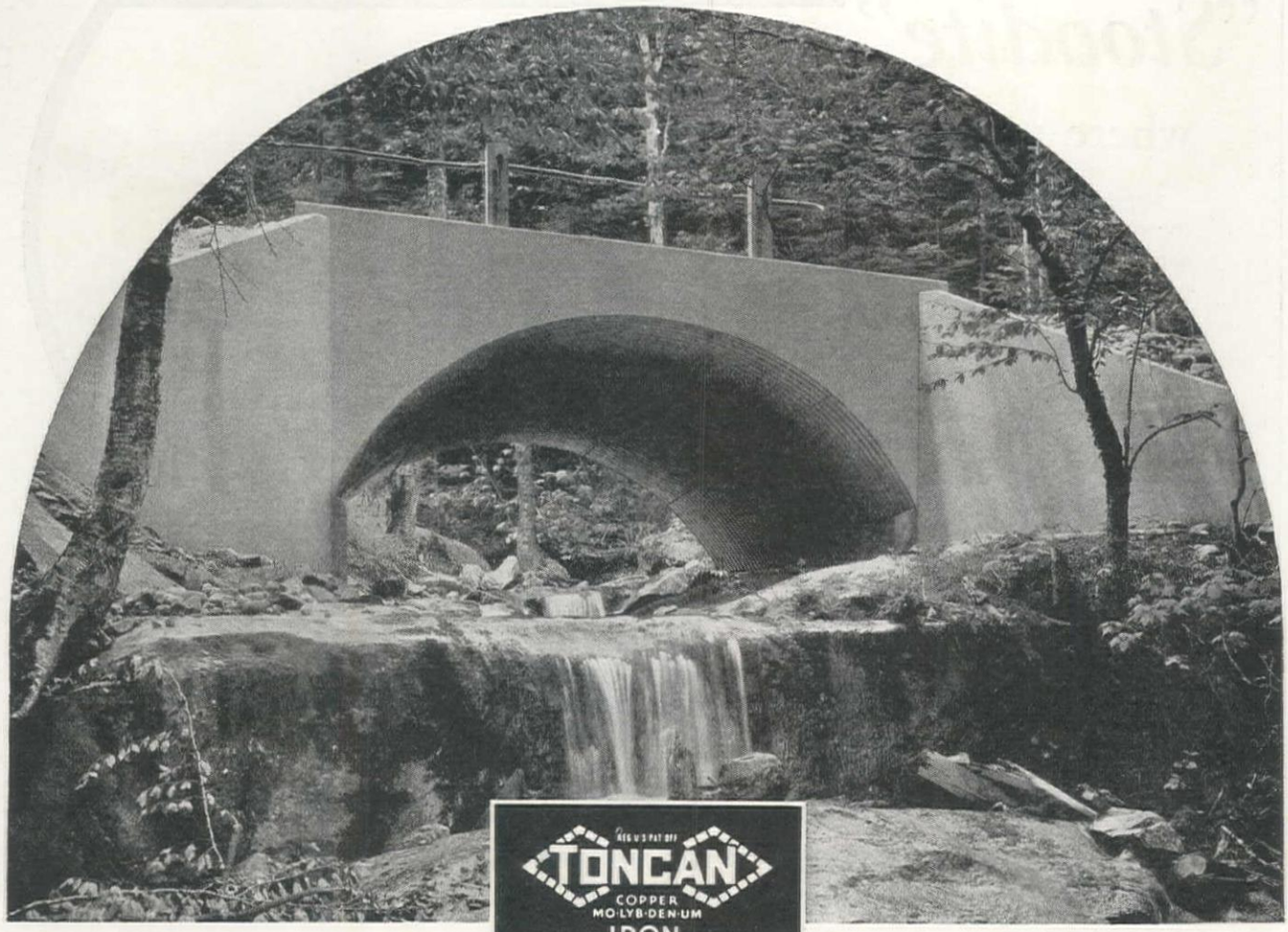

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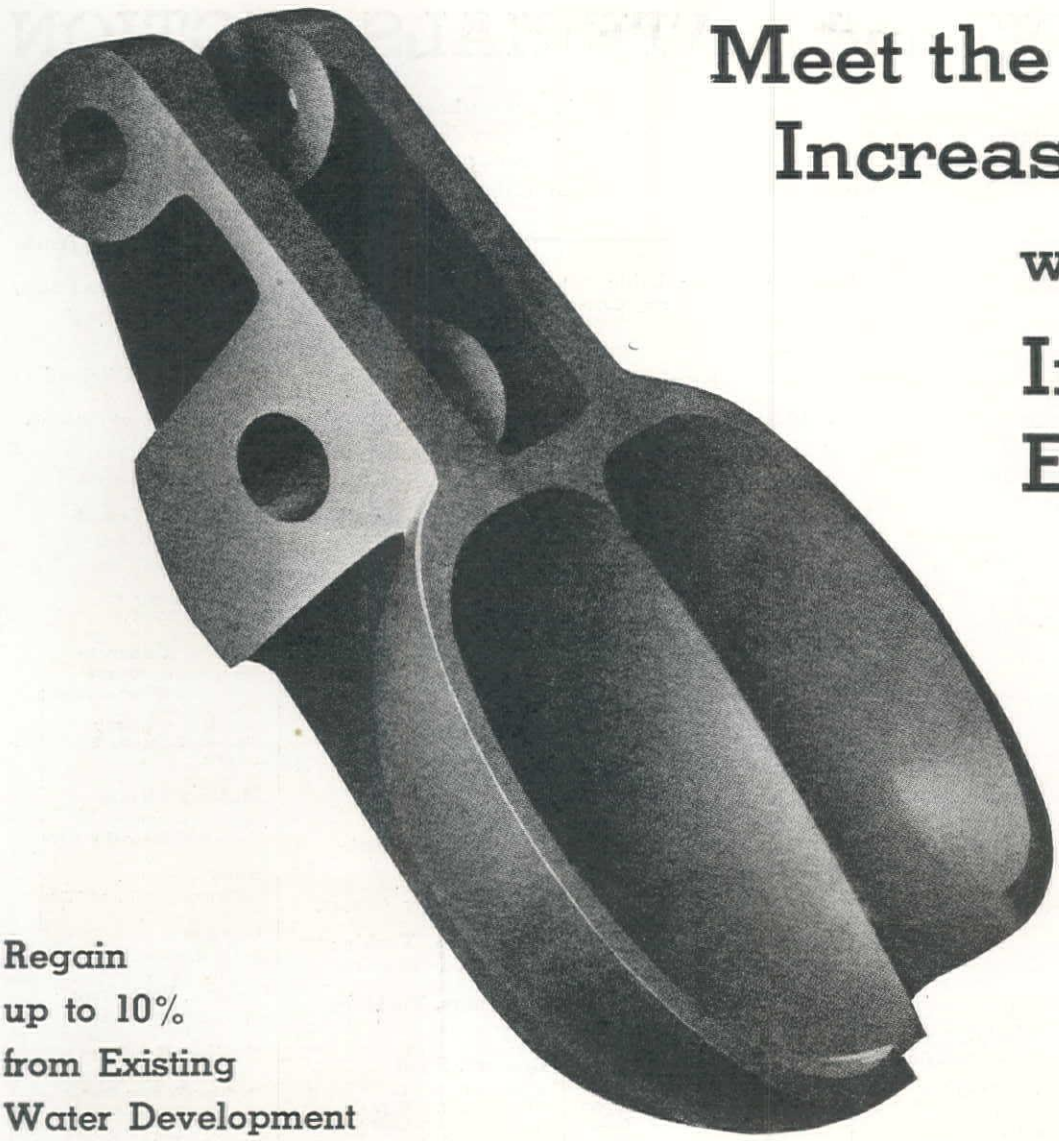

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Page Engineering Co.
Wellman Engineering Co.

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Austin-Western Road Mchy. Co.
LeTourneau, R. G., Inc.

Cable, Highway Guard Rail
American Cable Company
American Steel and Wire Co.
Leschen, A., & Sons Rope Co.
Roebling, John A., Sons Co.
United States Steel Corp.

Cableways
American Steel and Wire Co.
Leschen, A., & Sons Rope Co.
Roebling, John A., Sons Co.

Castings, Steel and Alloy Steel
Electric Steel Foundry Co.
Madsen Iron Works
United States Steel Corp.

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Gardner-Denver Company
Sullivan Machinery Company
Worthington Pump & Mchy. Co.

Concrete Reinforcement
American Steel and Wire Co.

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Link-Belt Co.
Pioneer Rubber Mills

Conveyors, Cement
Fuller Company

Cranes, Diesel, Electric, Gas and Steam
Austin-Western Road Mchy. Co.
Buckeye Traction Ditcher Co.
Bucyrus-Erie Co.
Byers Machine Company
Industrial Brownhoist Corp.
Harnischfeger Sales Corp.
Koehring Co.
Lima Locomotive Works, Inc.
Link-Belt Co.
Marion Steam Shovel Co.
Northwest Engineering Co.
Thew Shovel Co.
Universal Crane Co.

Crushers
Austin-Western Road Mchy. Co.
Iowa Manufacturing Co.
Pioneer Gravel Equipment Mfg. Co.
Smith Engineering Works

Culverts
Austin-Western Road Mchy. Co.
California Corrugated Culvert Co.
Hardesty Manufacturing Co.
Johns-Manville Corp.
Pure Iron Culvert & Mfg. Co.
Toncan Culvert Manufacturers' Ass'n
Washington Corrugated Culvert Co.
Western Pipe & Steel Co.

Derricks, and Derrick Fittings
Clyde Sales Company
Harnischfeger Sales Corp.
Chicago Bridge & Iron Works

Drill Bits, Detachable
Timken Roller Bearing Company

Ditchers
Barber-Greene Company

Drills, Diamond
Chicago Pneumatic Tool Co.
Sullivan Machinery Company

Drills, Rock
Chicago Pneumatic Tool Co.
Cleveland Rock Drill Company, The
Gardner-Denver Company
Sullivan Machinery Company
Worthington Pump & Mchy. Corp.

Dynamite
Apache Powder Co.
Atlas Powder Co.
Halafax Explosives Co.
Hercules Powder Co.
Trojan Powder Co.

Elevating and Conveying Equipment
Adams, J. D., Company
Austin-Western Road Machinery Company
Link-Belt Company

Elevators, Bucket
Link-Belt Co.

Engines, Diesel, Gasoline and Steam
Case, J. I., Company
Caterpillar Tractor Co.
Chicago Pneumatic Tool Co.
Cummins Engine Company
Fairbanks-Morse Company
International Harvester Co.
Worthington Pump & Mchy. Corp.

Equipment, Rebuilt
(See Opportunity Section)

Equipment for Rent
(See Opportunity Section)

Equipment, Used
(See Opportunity Section)

Excavators, Ditching and Trench
Austin-Western Road Mchy. Co.
Buckeye Traction Ditcher Co.
Bucyrus-Erie Co.
Byers Machine Company
Harnischfeger Sales Corp.
Industrial Brownhoist Corp.
Lima Locomotive Works, Inc.
Link-Belt Co.
Marion Steam Shovel Co.
Northwest Engineering Co.
Thew Shovel Co.

Excavators, Dragline
Austin-Western Road Mchy. Co.
Buckeye Traction Ditcher Co.
Bucyrus-Erie Co.
Byers Machine Company
Harnischfeger Sales Corp.
Industrial Brownhoist Corp.
Lima Locomotive Works, Inc.
Link-Belt Co.
Marion Steam Shovel Co.
Northwest Engineering Co.
Thew Shovel Co.

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Atlas Powder Co.
Halafax Explosives Co.
Hercules Powder Co.
Trojan Powder Co.

Ferric Chloride
Great Western Electro-Chemical Co.

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Johns-Manville Corp.

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California Corrugated Culvert Co.
Chicago Bridge & Iron Works
Hardesty Mfg. Co.
Pure Iron Culvert & Mfg. Co.
Toncan Culvert Manufacturers' Ass'n
Washington Corrugated Culvert Co.
Western Metal Mfg. Co.
Western Pipe & Steel Co.

Forms, Concrete
Western Pipe & Steel Co.

Gauges
Sparling, R. W.

Gasoline
Union Oil Co. of California

Generators, Electric
General Electric Co.
Harnischfeger Sales Corp.
Master Vibrator Company

Generators, Turbine
Pelton Water Wheel Co.

Governors, Turbine
Pelton Water Wheel Co.

Graders, Road
Adams, J. D., Co.
Allis-Chalmers Mfg. Co.
Austin-Western Road Mchy. Co.
Caterpillar Tractor Co.

Gravel Plant Equipment
Austin-Western Road Mchy. Co.
Link-Belt Co.
Iowa Manufacturing Co.
Pioneer Gravel Equipment Mfg. Co.
Smith Engineering Works

Hoists, Diesel, Gas, Electric and Hand Power
Chain Belt Company
Clyde Sales Company
Chicago Pneumatic Tool Co.
Harnischfeger Sales Corp.
Industrial Brownhoist Corp.
Link-Belt Co.
Ramsey Machinery Company
Wellman Engineering Co.

Hoppers, Steel
Chicago Bridge & Iron Works
Link-Belt Co.
Standard Steel Works
Western Pipe & Steel Co.

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Chicago Pneumatic Tool Co.
Firestone Tire & Rubber Co.
Goodyear Tire & Rubber Co., Inc.
Pioneer Rubber Mills

Hydrants
Ludlow Valve Mfg. Co., The
Pac. States Cast Iron Pipe Co.

Joints, Asphalt & Cork
Johns-Manville Corp.

Lighting Plants
General Electric Co.
Harnischfeger Sales Corp.

Liner Plates
Western Pipe & Steel Co.

Loaders, Power, Truck and Wagon
Austin-Western Road Mchy. Co.
Barber-Greene Co.
Link-Belt Co.

Lubricants, Oils and Greases
Union Oil Co. of California

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Baxter, J. H., & Co.

Lumber, Treated
Baxter, J. H., & Co.

Meters
Neptune Meter Co.
Sparling, R. W.

Mixers, Concrete
Chain Belt Company
Jaeger Machine Company
Koehring Co.
Link-Belt Company
Western Pipe and Steel Company

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General Electric Co.
Harnischfeger Sales Corp.

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Air Reduction Sales Company

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General Paint Corp.

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Chicago Pneumatic Tool Co.
Gardner-Denver Company
Worthington Pump & Mchy. Corp.

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Western Pipe & Steel Co.

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Industrial Brownhoist Corp.

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Baxter, J. H., & Co.

Piling, Steel
United States Steel Corp.

Piling, Wood
Baxter, J. H., & Co.

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Johns-Manville Corp.

Pipe, Cast Iron
Pacific States Cast Iron Pipe Co.
U. S. Pipe and Foundry Company

Pipe, Concrete
American Concrete and Steel Pipe Company

Pipe Fittings and Accessories
Cast Iron Pipe Research Ass'n

Pipe, Riveted Steel
Chicago Bridge & Iron Works
Western Pipe & Steel Co.

Pipe, Steel
Crane Company
United States Steel Corp.
Western Pipe & Steel Co.

Pipe, Welded Steel
California Corrugated Culvert Co.
Chicago Bridge & Iron Works
Hardesty Mfg. Co.
Toncan Culvert Manufacturers' Ass'n
Washington Corrugated Culvert Co.
Western Pipe & Steel Co.

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Jaeger Machine Company
Johns-Manville Corp.

Powder
(See Explosives)

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Chain Belt Company
Chicago Pneumatic Tool Co.
Crane Company
Fairbanks-Morse Company
Jaeger Machine Co.
Layne & Bowler Co.
Pelton Water Wheel Co.
Pomona Pump Co.
Worthington Pump & Mchy Corp.

Rails, and Rail Specialties
United States Steel Corp.

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United States Steel Corp.

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Asphalt Institute, The
Union Oil Co. of California

Rollers, Compacting
LeTourneau, R. G., Inc.

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American Cable Company
American Steel and Wire Co.
Leschen, A., & Sons Rope Co.

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Caterpillar Tractor Co.
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Austin-Western Road Mchy Co.
LeTourneau, R. G., Inc.

Screens, Sand and Gravel
Austin-Western Road Mchy Co.
Iowa Manufacturing Co.
Link-Belt Company
Pioneer Gravel Equipment Mfg. Co.
Smith Engineering Works

Second Hand Equipment
(See Opportunity Section)

Sewage Disposal Equipment
Chain Belt Company
Dorr Co., Inc., The
Link-Belt Company
Wallace & Tiernan Co., Inc.

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Gardner-Denver Company
Sullivan Machinery Company
Worthington Pump & Mchy. Corp.

Shovels, Power
Austin-Western Road Mchy. Co.
Buckeye Traction Ditcher Co.
Bucyrus-Erie Company
Byers Machine Company
Harnischfeger Sales Corp.
Koehring Company
Lima Locomotive Works, Inc.
Link-Belt Company
Marion Steam Shovel Co.
Michigan Power Shovel Co.
Northwest Engineering Co.
St. Louis Power Shovel Co.
Thew Shovel Company

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Chicago Bridge & Iron Works

Stackers
Barber-Greene Co.

Stand Pipes
Chicago Bridge & Iron Works

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Electric Steel Foundry Co.

Steel, Reinforcing
United States Steel Corp.

Steel, Sheet-Galvanized Corrugated
California Corrugated Culvert Co.
Toncan Culvert Manufacturers' Ass'n
United States Steel Corp.

Steel, Structural
Chicago Bridge & Iron Works
Western Pipe & Steel Co.

Tanks, Metal
California Corrugated Culvert Co.
Chicago Bridge & Iron Works
Western Pipe & Steel Co.

Timber, Creosoted
Baxter & Company, J. H.

Tires, Rubber
Firestone Tire & Rubber Co.
Goodyear Tire & Rubber Co., Inc.

Tools, Pneumatic
Chicago Pneumatic Tool Co.
Gardner-Denver Company
Sullivan Machinery Company
Worthington Pump & Mchy. Corp.

Torches, Carbide
Air Reduction Sales Co.

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Allis-Chalmers Mfg. Co.
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Caterpillar Tractor Company
Cleveland Tractor Co., The
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Utility Trailer Company

Trailers, Semi-Trailers
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Crane Company
Ludlow Valve Mfg. Co., The

Valves, Gate
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Electric Tamper & Equipment Co.
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Adams, J. D., Co.
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Pelton Water Wheel Co.

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Air Reduction Sales Company
American Steel and Wire Co.
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Welding Gas
Air Reduction Sales Company

Weighing Equipment
Fairbanks-Morse Company
Standard Steel Works

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Adams, J. D., Co.
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OPPORTUNITY SECTION

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2—880 ft. Ingersoll-Rand
1—510 ft. Sullivan
1—370 ft. Ingersoll-Rand, two-stage, portable
1—240 ft. Ingersoll-Rand, type 20, portable

ROCK CRUSHERS

1—18 x 24 Llewellyn Jaw Crusher
1—9 x 36 Wheeling, Roller-bearing Jaw Crusher
1—12 x 46 Traylor "Bull-Dog" Gyratory
1—20 x 68 Allis-Chalmers Gyratory
1—2 ft. Symons Disc Crusher

LOCOMOTIVES

2—4-ton, 24" gauge, Plymouth, gasoline
2—8-ton, 36" gauge, Plymouth, gasoline
1—25-ton, 56½" gauge, Plymouth, gasoline
2—5-ton, 36" gauge, Mancha, electric

CARS AND RAIL

15—10-yd. All-Steel Western Dump Cars
40—20-yd. All-Steel Western Dump Cars
36—4 and 5 yd. Koppel side-dump cars, 36" gauge
150 tons 40-lb. rail, relay

ROAD MAKING

1—3000-lb. Madsen Hot Plant
1—Ord finishing machine
1—77 Jr. Austin-Western motor grader
2—10-ft. Austin-Western pull graders
1—Western Maintainer
8000 ft. 9 x 8 road forms (steel headers)
6—4" Barnes double diaphragm pumps

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30—Hoists, gasoline and electric
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1—No. 48 Buckeye, wheel-type, pipe-line ditcher
1—No. 21 Parsons
1—No. 201 Buckeye, ladder type

TRACTORS

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1—80 Cletrac

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3—50-B Bucyrus Erie Diesel Draglines, 50 ft. boom, 10 ft. extension, Atlas Engine, caterpillar mounting.
2—775 P & H Diesel Draglines, 50 ft. boom, Atlas Engine, caterpillar mounting.

The above are part of the surplus construction equipment of the Middle Rio Grande Conservancy District. Wire or write for list of all equipment, which includes pumps, compressors, lighting plants, tractors, shovels, pile driving outfits, concrete mixers, scales, Insley concrete placing outfit, concrete heaters and vibrators, gravel screening plant, compressed air drill sharpeners, shop equipment, gasoline powered hoists with and without skips, bar benders and cutters, carbic floodlights, and other items at bargain prices.

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1½-yd. Northwest Shovel, complete with light plant.
10-ft. Russell Grader.
2—"30" Caterpillar Tractors, with Ateco Bulldozers.
1—LeTourneau Sheepsfoot Roller.

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Oakland, California MErritt 2110

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1—Large machine specially powered with Waukesha Engine—34-5½—new caterpillar crawlers. Rapid transit . . . 10 m.p.h. on the road.
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Concrete-Breakers

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OFFICIAL BIDS

(Additional bids on page 44)

SEWAGE TREATMENT PLANT COLORADO SPRINGS, COLO.

Bids March 7, 1936.
PWA Docket No. 1012

Sealed proposals will be received at the office of the City Manager, City Hall, Colorado Springs, Colorado, until 12 noon, March 7, 1936, for the construction of a Sewage Treatment Plant. Equipment to be furnished by the city. Plans may be obtained from Burton Lowther, consulting engineer, 710 Colorado Building, Denver, Colo. Deposit required, $5.

E. L. MOSLEY, City Manager.

POSITION WANTED

ENGINEER with experience in office details, technical correspondence, compilations and statistics, desires position with engineering firm. Experienced in both office and field work. Box 490, Western Construction News, 114 Sansome Street, San Francisco, Calif.

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Laboratory apparatus necessary in testing materials in the construction of earth fill dams:

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OPPORTUNITY SECTION

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- 1 Triple-drum Steam, 8¼x10.
- 4 Single-drum Slewing Engines.
- 3 Double-drum Electric, 37 and 60 h.p.
- 1 Triple-drum Electric 60 h.p.

DERRICKS:
- 7 10-Ton, Stiff Leg, Timber, 80′ booms.
- 1 10-Ton, Guy, Timber, 80′ booms.

MIXERS:
- 2 2-c.y. Ransomes.

BATCHING EQUIPMENT:
- 2 Complete Aggregate Weigh Batchers, 2-c.y. Capacity, with dial scales.
- 2 Bulk Cement Batchers.

BULK CEMENT UNLOADING PLANTS:
- 2 Power Shovels, Elevators, and Bins, complete for two plants.

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- Vertical and Horizontal Electric up to 1,200 g.p.m.
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- 1 Vulcan No. 1.

Address your inquiries to any of the following:

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