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FEATURED THIS ISSUE

Tunneling under the busy
streets of Los Angeles

How to choose the best equip-
ment for making your own sand

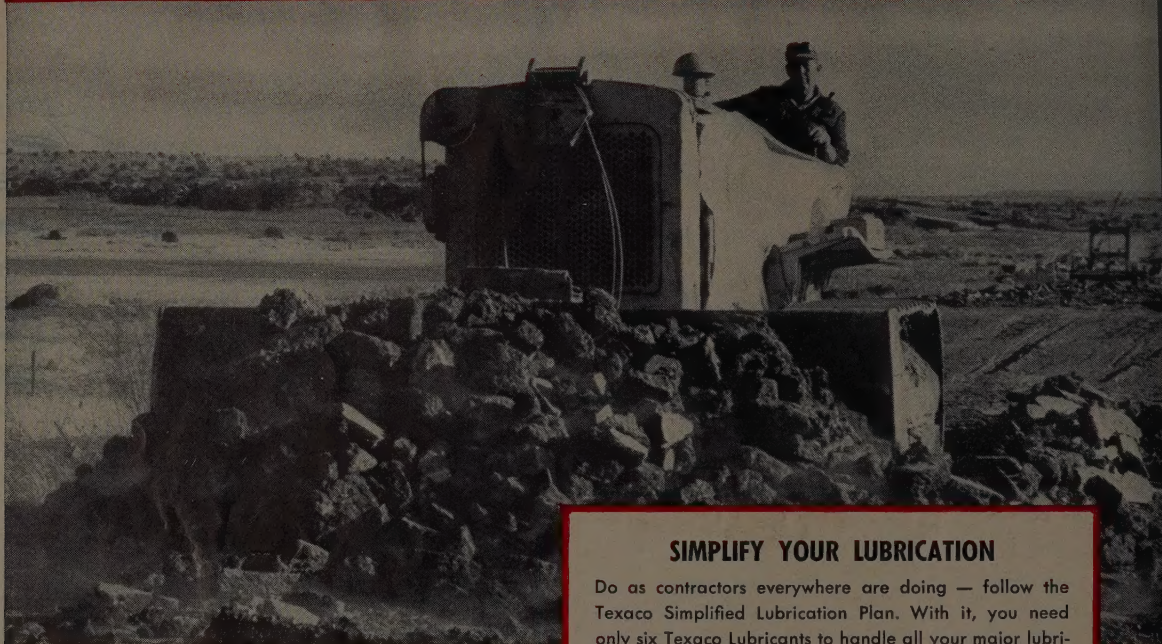
Prestressed concrete used
for roof slabs in Colorado

How the airplane and camera
are helping the engineer

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AUGUST 1953

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WESTERN

CONSTRUCTION

Volume 28

AUGUST 1953

Number 8

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FRONT COVER

LINING the Wellton-Mohawk Canal on the Bureau of Reclamation's Gila Project in southwestern Arizona has been made easier by use of this slipform, developed by the author of the article beginning on page 70 of this issue and adapted by Macco Corp., one of the contractors on the job. This particular machine was designed to line a canal having a 5-ft. bottom width.

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Builders bidding busily

A healthy indication for the future of construction in the West is the sharp bidding competition that has been characteristic on heavy construction contracts of all types awarded this year. Illustrating the situation in at least a figurative fashion is the recent award made by the Alaska District Engineer for some work at Elmendorf Air Force Base. For this job at Latitude 61° North, the winning contractor bid out of Balboa, Canal Zone, Latitude 10° North!

Various reasons for the increased interest are cited, but the fact itself remains, as noted by California's highway department that "competition between bidders on state highway work is extremely strong." Of course, one might note that the measure of competition is usually the number of bidders per project, whereas California's use of the word "between" indicates, in the strictest grammatical sense, only two bidders! But accompanying figures make the facts eminently clear: an average of 6 bidders per job in June 1953, as compared to a figure of 4.8 a year ago.

The healthy aspect of such competition is its evidence of bounce and vitality in Western contracting organizations. As was pointed out on this page two months ago ("Construction follows demand"), no change of administration can alter the basic demand for construction in the West. That demand is a function of population and industrial needs, not of political whims.

Just so much as the federal government withdraws from its leading role in Western public works construction, so much will efforts of smaller, local entities intensify to take its place. And, with all aspects of such construction controlled closer to home, so will Western contractors be operating closer to the pockets of the owner. Moreover, with work administered by a variety of public entities, specifications will incorporate an equal variety of new concepts that will call for sharper pencils among contractors.

Under such circumstances, their ability to compete becomes paramount, especially their ability to *continue* to compete. The situation is tailor-made to the outlook that has always characterized Western contracting. It is difficult to assess the value of the several components of this outlook; rather, it may conservatively be said that the Western outlook adds equal parts of daring, imagination and ingenuity to the solid virtues of skill, integrity and responsibility which the Associated General Contractors have long emphasized as the essential elements of successful contracting everywhere.

"Trouble at the crossroads"

Engineering decisions have recently been on the block for popular judgment in Northern California. The issue is that of highway weight enforcement, given spectacular treatment by timber truckers as they staged a "park down" strike of some 250 heavy combinations at weigh stations in Humboldt and Del Norte counties.

Cause of the trouble was highway patrol action in paring the maximum allowable excess load from 4,000 to 2,180 lb. The difficulty of estimating log loads had been the reason for the former 4,000-lb. tolerance, and truckers felt that any requirement for closer estimating was unrealistic.

The question of realism properly applies only to the load limit figure itself. Here is the source of lay confusion, because there obviously is more variance among state highway load limits than among state highway structural standards. Outside the walls of Western highway departments it is perhaps not generally understood that load limits are derived in engineering judgment—judgment of not only structural strength but economic life as well. Doubtful availability of highway funds may well call for a lower load limit on one road than on another of otherwise equal standards.

Judgment is the *sine qua non* of civil engineering practice. In Northern California's instance of "trouble at the crossroads," the specific engineering judgment that applies might well be publicly summarized. Any decision to explain engineering considerations outside the profession is a further display of good judgment.

Tipping the hat, not passing it

An ill-conceived illusion has been shattered in recent months. It is the widely held notion that engineers of long experience in government service are unfit for responsible positions in private industry. Both the goals of "government engineering" and the atmosphere in which it is practiced have been cited as corrupting influences: "If he has been in government over five years, he has lost his proper professional approach."

Lately, whether as a direct result of federal administrative action or from only a show of administrative intent, many ranking engineers of the federal service have moved over—not down—into heavy engineering and construction firms.

The actions of these individuals combine to stand as a credit to the civil engineering profession and, by implication, the governmental agencies suffering the losses. Industry's decisions of today reflect well upon the decisions of federal engineers in past years. Positive, if belated, evidence is now at hand proving the competence of the federal engineering staffs that have built so much in the Western construction scene.

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AUGUST 1953



Changing soils complicate . . .

Tunnel contract under city streets

PROTECTION of the low Aliso street section of the Santa Ana-Hollywood Freeway junction in downtown Los Angeles against flash floods caused by occasional heavy rains worried city engineering officials considerably, so they awarded a contract to build a storm drain for the area to the George E. Kerns Construction Co. of Long Beach, Calif., on a low bid of \$1,403,317. This is how it was built.

Given a 450-day time limit and the option of several methods of construction, the contractor chose to build the drain in a tunnel. This required the excavation of about 40,000 cu. yd. of material and placing of some 12,000 cu. yd. of concrete. Although the drain's main purpose is to keep the Freeway clear of storm water, it will also relieve some of the other overtaxed drains in the large area surrounding the construction.

The drain is a horseshoe-shaped, reinforced concrete structure, approximately 4,900 ft. long, 3,200 ft. of

By **ALBERT J. SUTCLIFFE**

Resident Engineer
Bureau of Contract Administration
Los Angeles, California

it having an inside diameter of 11 ft. 6 in., the balance having an inside diameter of 9 ft. 3 in. Thickness of the large shell is 12½ in. for the arch and 18 to 24 in. for the V-shaped invert. The smaller section has a 9½-in. arch and an invert of 15 to 18 in.

Tunnel alignment

It enters the Los Angeles River at its east bank, east of the easterly terminus of Ducommon Street. It goes

west under Ducommon Street to Vigness Street, north under Vigness Street to Aliso Street, west under Aliso Street to Alameda Street, and north under Alameda Street, where it terminates in two large catch basins and several smaller ones at Macy Street.

By courtesy of the Police and Traffic departments, the contractor was able to close Lyon Street and use it for an operations area and yard.

A 20- by 40-ft. shaft was sunk, using all of Lyon Street and one traffic lane in Aliso Street. When the shaft was completed, the area in Aliso Street was bridged over and opened to traffic. Traffic on Aliso Street was inconvenienced for only 10 days. This left a 20- by 20-ft. shaft open.

The shaft was sunk to 33 ft. below the street level. Since ground water was encountered at 29 ft., a 6-ft. sump was boxed in at the bottom of the shaft and a Barnes 4-in. centrifugal automatic pump was installed.

Tunneling was difficult because of

PICTURED ABOVE

HOLING THROUGH—This is the Los Angeles River terminus of the new storm drain which runs under busy downtown Los Angeles for about 4,900 ft. It will carry storm water from the Aliso-Alameda streets section of the Santa Ana-Hollywood Freeway junctions.

ground conditions and because of the heavily-traveled streets and the utility lines above the tunnel; there were 46 and two railroad spurs in a block 400 ft. long.

Sometimes the ground changed three or four times a day—hard clay, spongy clay, tight sand and gravel, loose sand and gravel, or sugar sand. Because of these changing conditions a special method of tunneling had to be worked out.

Crown drift

A heading 6 ft. high and 6 ft. above the floor of the tunnel was worked by hand, using Thor air spades and wheelbarrows. This was done by using a hand bar to poke a slot 2 ft. ahead and 6 in. wide at the liner plate, then a 2-in. x 6-in. x 2-ft. spiling or shingle was put in the slot, back end resting on the liner plate and front end on a block on grade. This method was continued from the top down the side until enough room was made to accommodate a liner plate. These liner plates were 18 in. wide and 3 and 4 ft. long. The liner plates were bolted together to form the upper part of the horseshoe end and the ends were set on foot blocks.

When the upper heading was about 40 ft. ahead of the bottom, two steel I-beams were pushed up to the face and the back ends of the I-beams were supported on a scaffolding of 12 x 12-in. timbers built up from the floor of the tunnel. The I-beams were tied to the scaffolding with timber binders. This scaffold was wide enough for the Eimco No. 40 rocker shovel to muck out underneath. Jacks to support the crown were set on the I-beams and against the crown plates. The I-beams were close enough on centers so that wheelbarrows could get by on each side.

The lower half of the tunnel was worked with air spades and the mucking machine filling a 4-cu. yd. car, pulled to the shaft by a Greensburg Monitor Locomotive with storage battery motor. The dirt was then hoisted to the surface by a Northwest

40 truck crane with a 1-yd. clamshell bucket. The muck was hauled to a state-owned spoil bank in Elysian Park.

As the bottom half of the tunnel advanced, the liner plates were brought down and set on steel channels which rested on 4 x 12 x 18-in. foot blocks. The crown supports were removed and, when the ends of the I-beams were reached, were pushed ahead by the mucker. The top half of the tunnel was worked in three shifts which piled muck in front of the mucker. The machine and crew on the lower core of the tunnel only worked one shift a day.

Brackets were set on each side of the tunnel, 15 ft. apart and 6 in. inside the line of excavation. A line strung from one, past the forward one, was used for working line and grade. The surveyors checked line and grade each day. As the surveyors had a hole only 40 by 20 by 30 ft. deep to put their lines underground, 6-in. holes were put through from the surface at various places to the excavated section of tunnel to check their line. At no time were they off more than .03 ft.

Adits to speed work

Originally the contractor had planned to do the entire job except catch basins, man holes and the like from the one shaft, but the contractor on the adjoining freeway had excavated alongside deeper than the Kerns tunnel. In case of a storm this action might have caused the tunnel to cave in, so it was thought advisable to concrete that section as a precaution. As mining and concreting were not practical through one adit, another shaft was sunk out of traffic at

MUCKING OPERATIONS (right picture) have stopped temporarily while the Eimco No. 40 Rocker Shovel mucking machine with H & L bucket teeth gets a checkup. More telescopic forms (right foreground) are ready to be placed. The left picture shows concrete pumping operations with a Rex No. 160 Pumpcrete. Pumping distance was kept to a maximum of 400 ft. since there were several 90-deg. turns in the line most of the time.

Aliso and Alameda streets. Quick sand brought on the possibility of more danger later on, and another shaft was sunk in the sidewalk between Alameda and Macy streets to comb this.

Re-steel and liners

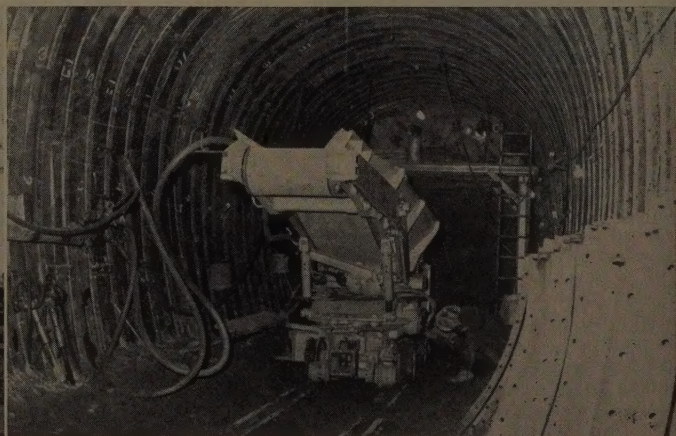
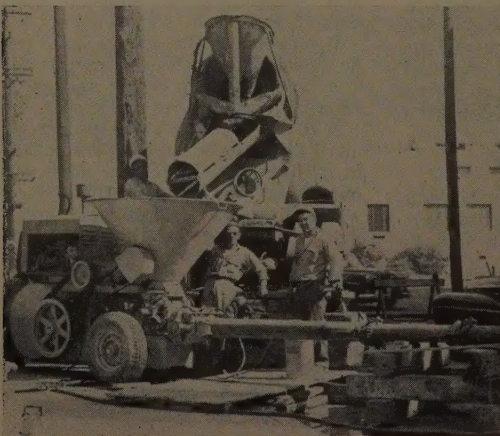
Armco Drainage & Metal Products Inc., liner plates, used as tunnel support, were left in place for the outside form for the concrete. These plates, 3 and 8 gauge, were prefabricated and fitted together to form the horseshoe shape. The bottom plates were set on an 18-in. channel set in turn on the foot blocks. Several curves on this job were of different radii and the plates fitted accordingly. To make the plates fit, a section of tunnel liner was bolted together in the yard and laid on its side. The company engineer laid out the curve on the section and had it cut into sections with a torch. This was then dismantled and set up in the tunnel for the curves.

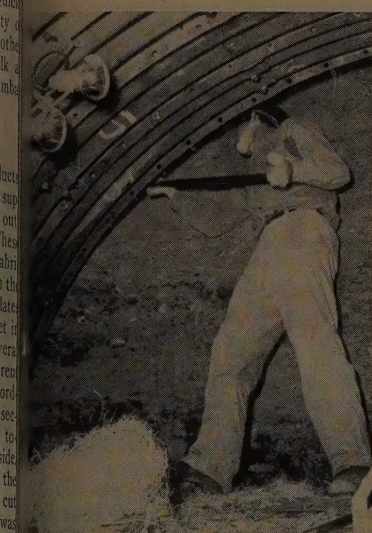
The reinforcing steel, roughly 40 tons of it, was furnished by Bethlehem and placed by Anthony C. Mehele. It was found that the best method for placement was to preform the steel before it went into the tunnel. Bending it around a steel form in the tunnel put angles in the steel instead of a smooth curve.

Concrete

The concrete, furnished by Blue Diamond, came to the job in 6-cu. yd. transit-mixed loads. It was pumped from the surface through holes conveniently located near the shafts by a Rex No. 160 Pumpcrete machine. The pumping distance was kept to 400 ft. or less, since there were several 90-deg. turns in the line most of the time.

For the larger bore, Kerns used a set of telescopic forms and a carrier, owned by the City of Los Angeles, which had been used on a former project of the same size. The forms were in eight 8-ft. long sections, and on the straight-away 64 ft. was poured at a time. On the curves, the forms





INSTALLING 18-in. wide Armco liner plates the tunnel heading, workman is shown bolting sections together to form the upper part of the horseshoe right against the tunnel face.

were set on tangents. Since the 8-ft. form did not conform to the permissible tangent length, a good deal of formwork had to be done on the curves and shorter pours were made for the curves. On the smaller bore, a set of similar forms, made by the Loran Engineering Co., more nearly fitted the excavation on the turns.

The carrier was long enough to transport 40 ft. of forms. A hydraulic jack on each end of the carrier's top jacked the platforms up. Two steam-bolt jacks on each side jacked the panels into side position. The bottoms rested against the invert curb and on blocks on the invert. Spreaders and wedges kept them in position when the carrier, which was moved manually on a light track, was removed.

Vibration

The standard slick line was used except for the curves, where a 6-in., high-pressure hose was used with air success. The concrete was vibrated with two external Viber Air Vibrators, Model PX8 with air-operated vice clamp. These were hung on the form cross pieces. On the panels, a light air hammer with a square-end drill was used. Due to the curvature of the forms, internal vibration was impractical. The invert from 18 in. thick at the center to 2 ft. at the outlets, including a 4-in. curb with keyway, was generally poured in sections up to 180 ft. An electric stinger was used for vibration. The invert was poured separately.

As mentioned before, some ground water was encountered which was found to be high in sulphur. Type V cement was specified in the area where this water was encountered. For a while type V cement was not

obtainable, and the contractor was permitted to use Darex in the mix plus 10% extra cement, air entrainment to be between 3 and 5% regardless of slump. The concrete with Darex gave a pour that was quite easy to work. Although allowable slump for the concrete was 3 to 5 in., it was found that a 5-in. slump was needed to get a good bond with the steel and a good consolidation in the arch forms. It was estimated the 12,000 cu. yd. of concrete would take care of the tunnel proper.

Formwork

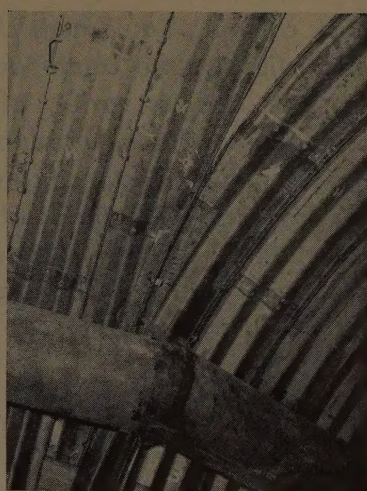
Specifications permitted the arch forms to be removed at 350 psi. This was reached in 12 hr., permitting the pour to be made in the daytime and the forms to be removed and reset on the graveyard shift.

The arch forms, hinged at the top, had three panels on each side with windows in them. This permitted them to be collapsed so that one section could be moved through another.

For the forms for the invert curb, Inspector G. G. Thomas, city inspector, designed a 6-in. channel fastened to bolt holes in liner plates with screw eyes and turnbuckles. These forms could be moved and set up in a short time and brought to line and grade by turning the turnbuckles. This required no braces or struts between the curbs and left that area free for both the pumpcrete line and a working area. The invert was poured first with a keyway on top of the curb.

Sections 3-ft. long were left out of the arch pour at manhole locations and the MH and MH sections were poured as monolithic sections.

As mentioned before, several unforeseen complications were encountered which slowed the work down. Several of the storm drains and sewers were laid as much as 50 yr. ago and no accurate records were available. A sewer that was shown as sev-



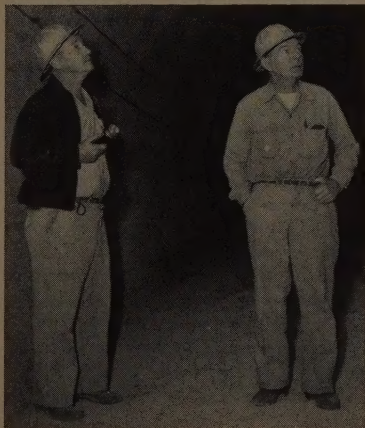
ANGLE at center line shows where the tunnel takes a sharp turn. At each change of direction, a gusset section was fabricated and installed to take care of the gap before another standard sized plate could be used.

eral feet above the top of the tunnel was actually below the design line of the soffit. Since this line was old and rotten, liner plates had to be cut and the pipe shored up with a scaffold. As an extra precaution, a steel pipe was inserted in the sewer itself. Because many of the utilities had not been backfilled properly, the ground was loose and full of voids, causing the ground to run. Excelsior was used to stop up the runs.

Troubles underground

From station 1 plus 00 to 3 plus 50, 40-ton slabs of granite were encountered. During one of the periodic storms early in the city's history, the Los Angeles River had started to cut through its bank and endanger both the business section of the city and the main line of the Santa Fe Railroad. To stop this, large granite boulders, weighing 40 tons and more, were dumped in the breach under the Santa Fe tracks. The tunnel had to go through this fill. At the same point, a 42-in. storm drain was encountered. This drain was on the plan in its original position. However, when the river bank was concreted the alignment of the drain was changed and no record made. This drain intruded over 2 ft. into the tunnel. All of this was underneath the Santa Fe main line track, with less than 12 ft. of loose boulder-filled earth between the top of excavation and the tracks. Because of the railroad, the boulders, which were 8 and 10 ft. square, could not be blasted but had to be removed chunk by chunk by the plug and feather method, all hand labor. Then the tunnel had to be realigned around the 42-in. drain in this boulder-strewn fill. Kerns could not afford to lose any

AUTHOR Albert J. Sutcliffe (left) and G. G. Thomas, a city inspector, look at the concrete tunnel lining on the storm drain job for which Sutcliffe is resident engineer.



Concluded on page 76

Rock crushing equipment characteristics can be combined to meet an endless variety of pit or quarry conditions, production requirements, and specifications for grading—Knowledge of the capabilities and economies of crushing, milling, and sizing units is essential when...

PLANNING the plant for PRODUCTION of STONE-SAND

By **W. R. EASLEY**

Western Manager

and

JOHN H. CHEAVENS

Chief Engineer

Western-Knapp Engineering Co.

Division of

Western Machinery Co.

MANUFACTURING sand is a process that actually starts at the primary crusher, and continues through the aggregate and sand plants to the final dewatering equipment ahead of the finished product stockpile. The process, or flowsheet, will depend to a great extent on whether the material source is entirely from a quarry or from a gravel deposit. Where raw material is obtained entirely from a quarry, it naturally follows that all aggregate, both coarse and fine, must be produced by reduction in crushers, rolls, mills or similar equipment. The selection of the successive reduction units together with the intermediate sizing and grading equipment must result in a plant producing not only the specified gradations of coarse aggregate and sand, but with a minimum of surplus sizes, which would have to be wasted.

Character of source

An average quarry contains rock of very uniform characteristics; and for this reason, the flowsheet and equipment selections can be quite accurately predetermined. Crushing and grinding tests on representative samples can be made from which the types and sizes of equipment best suited for producing the specified products can be determined. In the cases where the raw material is obtained from gravel pits, a somewhat different approach to the manufacturing process must be made. Any gravel deposit may vary in character over a large range of sizes and physical structure. The material may have been deposited in successive eras by streams arising in widely separated locations, and may vary considerably in size and geological structure.

Mining of such deposits must be done selectively, and the aggregate and sand plants must be designed and equipped for flexibility of operation to meet anticipated changes of feed characteristics. The usual problem to be met by the plant handling gravel pit material is: To manufacture the sizes that are deficient in the natural material by reducing the surplus sizes with a minimum of over-all plant waste.

CONTRACTORS in the West need to be familiar with the methods and equipment for manufacturing sand for concrete. More and more frequently, as sources of natural sand become scarcer, they will be required by specification or by economics to make the fine aggregate to be used for a concrete structure.

The engineering approach to this construction problem was reviewed in some detail in the February 1953 issue of *Western Construction* by an authority from the Office of the Chief Engineers. The article discussed current specifications for fine aggregate, with particular attention to the strict grading requirements when air entraining agents are used. As part of the discussion the author indicated the commonly used types of sand producing equipment and the general arrangement of the plant. However, space did not permit any detailed description of the equipment units and their operating characteristics.

To provide the readers of *Western Construction* with this important additional information to complete our coverage of the subject the present article, from an equally authoritative source, has been secured. It is presented for contractors, superintendents, and construction engineers who must be informed on this important subject.—Editor.

In the reduction of quarry rock to gravel to sand, the objective is not primarily to obtain a final product of uniform size, as in ore reduction or cement manufacture, but to obtain graded products within fairly well defined limits. It is a fortunate quirk of nature, therefore, that the breaking of rock, whether by impact or crushing, results in a gradation approximating that best suited for concrete aggregate. The plant designer and operator thus has as his main problem the selection and placing of equipment to control the size limits for each reduction and simultaneously to make up any deficiency of sizes in the normal breakdown to meet the stated specifications.

Secondary crushing

Assuming that a suitable primary breaker has been selected, the next pieces of reduction equipment in the plant flowsheet directly affecting the sand making process are the secondary, and in some instances, tertiary crushers. This further reduction of primary crusher product is almost invariably required where the source of raw material is a quarry, but may not be necessary in gravel pit operation where natural gradation of small sizes is close to specifications.

The secondary crusher will usually take as a feed the screened product from the primary crusher in sizes ranging from 2½ to 6 in. With feed sizes from 2 to 3½ in., the secondary crusher will usually produce the required reduction for the small sizes of coarse aggregate and sand materials. In cases where the secondary crusher feed is larger than 3½ in., the discharge setting is usually increased and a tertiary crusher is installed to produce the finer sizes required.

It was pointed out in a preceding article (*Western Construction*—February 1953) that of the presently available reduction equipment, those units which produce material with the least waste and lowest metal consumption usually produce rock and sand particles having the least desirable shape and grading for concrete. In the reduction of quarry rocks, it is necessary to obtain final products graded from maximum size coarse aggregate

Table I—Weight, Horsepower, and Capacities of Cone Type Crushers

Size of Crusher	Shipping Weight, lb.	Hp.	Capacity of Indicated Discharge Setting, tons/hr.						
			1/8"	3/16"	1/4"	3/8"	1/2"	5/8"	3/4"
2 ft.	10,000	25-30	6	8	10	15	20	—	—
3 ft.	22,000	60-75	15	20	30	40	50	60	—
4 ft.	44,000	100-150	20	35	50	75	100	125	—
5 ft.	80,000	150-200	—	60	90	120	150	200	230
7 ft.	150,000	250-300	—	120	150	250	300	360	420

the finest sand particle. This requirement in itself will normally rule out for secondary crushing the use of roll crushers, pulverizers and impact breakers, such as the hammer mill. The product from such units will contain a higher percentage of fines than required for concrete specifications. Their best use is for intermediate crushing as a tertiary unit for further reduction of a portion of the secondary crusher product to make up a deficiency in fine sizes.

Cone or reduction gyratory crushers

The cone type and reduction gyratory crushers are most widely used as secondary units, with the trend greatly in favor of the former. Table I shows pertinent data on these crushers, together with capacities based on a medium-hard material. Capacities are given in tons of 2,000 lb. per hour. Cone crushers will produce about 15% of material larger than discharge setting. This material must be returned to crusher if no oversize is desired.

The cone or reduction gyratory crusher is a pressure type breaker, operating with a reciprocating movement against particles in any vertical line. It consists essentially of a fixed crushing surface in the shape of a truncum of an inverted cone, within which is a movable crushing surface in the shape of an upright conical truncum (see illustration). The movable surface gyrates on the axis of the fixed cone, alternately decreasing and increasing the distance between the two surfaces. The speed is such that the time of each gyration is less

than that required for pieces of rock to fall clear of the parallel zone by gravity; hence all rock particles are crushed several times in passage through the crusher. The converging crushing surfaces are flared down and out, thus providing a discharge opening and crushing area for the finer sizes, equal to or greater than that for the coarser sizes. This eliminates the choking effect which occurs in jaw crushers where the area occupied by the finely crushed materials is considerably less than that in the coarse crushing zone. The maximum ratio of reduction through a cone-type crusher should not exceed about 5:1. That is, for a minus 1/2-in. product the largest size in the feed should not exceed 2 1/2 in.

Product size is controlled by raising or lowering one of the crushing surfaces to decrease or increase the space in the crushing chamber. Adjustment is made by use of screwjack principle or by a hydraulic method, depending upon type of manufacture. The adjustment is also used to compensate for wear of the crushing surfaces. Protection of the equipment from

un-crushable material such as tramp steel is provided by coil spring or hydraulic action, which automatically opens the crushing chamber to allow such material to pass and subsequently returns the crushing surfaces to their original relative spacing. Although these protective features will usually prevent major damage to the equipment, they should be considered as emergency devices only. It is normal practice, and strongly recommended, that magnets be installed ahead of these crushers to remove tramp iron in the feed.

Other than normal machinery wear, the reduction gyratory crusher requires very little maintenance and parts replacement except for the crushing surfaces. These latter usually consist of removable manganese steel liners which are readily replaced when worn.

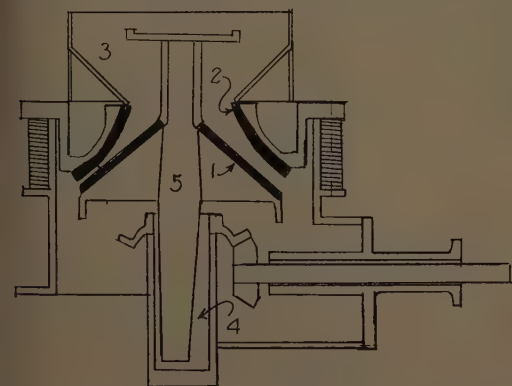
The reduction gyratory crusher like most other types of crusher units operates efficiently when fed uniformly at a rate near maximum capacity. Therefore, the flow of material to the machine should be controlled by means of a feeder from a storage or surge bin, or by closely regulating the flow through preceding pieces of equipment in the plant.

Roll crushers

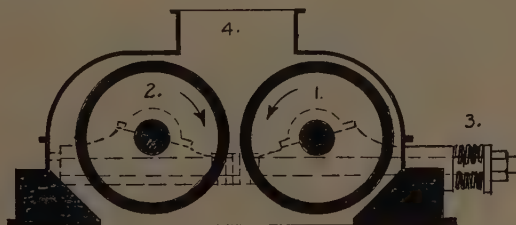
Rolls are normally used, when practical, in the final crushing stage. They consist essentially of two cylinders mounted on horizontal shafts which are driven in opposite directions so that the corresponding points on the cylinder faces are moving toward each other (see illustration). One

Table II—Weight, Horsepower, and Capacities of Roll Crushers

Size of Crusher, Diam. x Face, in.	Shipping Weight, lb.	Hp.	Size Feed, Max., in.	Roll Setting, in.	Capacity, tons/hr.
24 x 12	12,000	6	5/8	5/32	7
30 x 14	21,000	11	7/8	7/32	14
36 x 16	40,000	16	1	1/4	20
42 x 18	66,000	24	1 1/4	5/16	30
48 x 20	80,000	32	1 1/2	3/8	40
54 x 24	100,000	50	1 3/4	7/16	62
60 x 30	150,000	75	2	1/2	92
72 x 36	250,000	130	2 1/4	9/16	163



SECTIONS through principal reducing units aid evaluation of their capabilities and limitations. Main elements of a cone crusher (left) are (1) mantle, (2) concave, (3) feed hopper, (4) eccentric, and (5) main shaft. For the roll crusher (below), numbers refer to (1) fixed roll, (2) movable roll, (3) tension springs, and (4) feed hopper. Cone crushers are less apt to choke, since crushing area and size of opening are greater at discharge end.



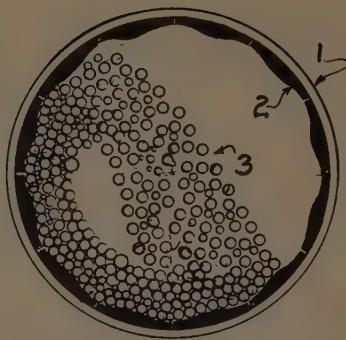
cylinder is mounted on fixed bearings while the other is on movable bearings restrained by heavy coil springs. The revolving rolls act radially on the material to be crushed, drawing it toward the narrowest space between them and finally breaking it by compression. Product size is controlled by adjustment of space between the roll faces. The lower limit of size for efficient roll crushing has not been clearly established, but is probably not below 10 mesh. The ratio of reduction through rolls is very low, running from about 2 to 4 for the average heavy duty choke crushing service. However, in very heavy duty choke-crushing with a high circulating load and crushing to about 10 mesh, the ratio of reduction may run up to 15 or 20.

The crushing cylinders ordinarily consist of a permanent central core of soft iron to which a removable shell of manganese steel is fastened. Wear of roll shells is due primarily to abrasion resulting from slipping of the faces past the rock particles and gouging by hard particles. Iron loss will depend largely on the characteristics of the material being crushed, but is normally somewhat higher than that of the cone or gyratory crusher.

Operational choice

Rolls may be free fed or choke fed, the former indicating the rolls are fed at such a rate that each entering particle is crushed and ejected before the following one is nipped; while in the latter case, the rolls are kept full of unbroken material and crushing is done not only through the contact with the rolls but also by attrition between the particles. Free crushing will produce a large proportion of coarser sizes with a small proportion of fines. For fine product, the feed must be increased to produce choke crushing. The capacity and efficiency of roll crushers are considerably greater when choke crushing is employed rather than free crushing.

Successful roll operation depends on frequent inspection and immediate attention to abnormal conditions. Shafts must be kept in alignment, spring tension properly maintained, and unequal wear of shell faces and flanging of ends should be minimized. All bolts must be kept tight and shims maintained to prevent roll faces from slapping together. Capacities of rolls vary greatly according to size of roll,



GRINDING MILL is simple in principle, consisting of (1) a shell, (2) liners, and (3) a charge of balls or rolls. Crushed product characteristics vary markedly between rod and ball mills, and may further be affected by milling speed.

reduction ratio, method of feeding and character of material. Efficiency increases with the weight of the revolving parts and with the speed up to the point of nip failure.

Table II gives operating data on roll crushers. Horsepower is based on medium hard rock, and will increase 40% or more for hard rock. Capacities are based on 4:1 reduction. Size of feed is maximum that will be nipped by rolls of the given diameters. Rolls will produce about 15% of material larger than roll setting. This material must be returned to rolls if no oversize is desired.

Impact breakers

The hammer mill, variously known as swing hammer crusher, pulverator or impactor uses the principle of a blow struck in space to effect crushing. The machine comprises essentially a number of flailing hammers, mounted on a rotating shaft, which strike rock particles when they are falling freely through air. Although it has occasionally found a place in reduction of hard abrasive materials, its use is almost wholly confined to the softer, easily crushable materials such as phosphates, gypsum, asbestos rock and is particularly useful for clay materials which would clog reciprocating type crushers. The product of the hammer mill has a very desirable shape for concrete aggregate, but the extremely high wear of steel parts usually makes it an uneconomical machine for reduction of quarry rock or pit gravel to sand grades.

Grinding mills

The grinding mill is essentially cylindrical or conical shaped barrel loaded to somewhat less than one-half its volume with steel rods or balls, termed grinding media, and with openings in the ends for feeding and discharging. The mill may be supported by hollow bearings at each end which also serve as the feed and discharge openings, or by bearings equipped with steel tires around the shell which are mounted on rollers. The cylindrical shell and the ends are equipped with replaceable liners which are usually manganese steel or other abrasion resisting material.

Reduction or grinding of the coarse feed is accomplished by revolving the mill and thereby causing the rods or balls to be elevated to an angle at which gravity overcomes the friction and centrifugal force. The charge then cascades downward, grinding the rock particles by repeated impact, rolling or sliding action between the balls or rods. The feed entering at one end is acted upon repeatedly as it passes through the length of the mill and is reduced further in size each time a particle is caught between two balls or rods or between the grinding medium and the shell.

Mill action varies

While the ball and rod mills are mechanically similar, the relative dimensions and their grinding action are somewhat different. The length of the ball mill runs from about .7 to 1 times the diameter, while that of the rod mill ranges from 1 1/3 to three times the diameter. The difference in grinding action of a ball or rod charge can best be explained by comparing the contact between adjacent balls or rods. Rods making up a grinding charge are parallel, and tend to meet adjacent rods in a line contact. Therefore, they will bear on and expend most of their crushing force on the larger particles and allow the finer particles a freer passage between the rods. Balls, on the other hand, meet adjacent balls in a point contact and particles of material at these points are ground to a fine state. In general, rod mills are used for coarser grinding from a nominal 1-in. feed to a nominal 10-mesh product, and for producing a material with a minimum of fines and a minimum of tramp oversize. Ball mills are used for reduction of large particles to a product of any desired size, with a higher proportion of fines.

Rods for sand

The rod mill has the greater application in the process of manufacturing concrete sand, primarily because it produces a graded product with a minimum of fines. However, there are certain conditions of raw material source and character of specifications where the use of a ball mill is required to produce the required gradations.

Table III—Weight, Horsepower, and Capacities of Rod Mills

Mill Size, Diam. x Length, ft.	Shipping Weight, lb.	Hp.	Capacity, 90% through mesh, tons/24 hr.				
			4M	8M	16M	30M	50M
4 x 8	33,000	50	400	250	200	150	120
5 x 10	50,000	100	750	550	450	300	260
6 x 12	80,000	175	1300	850	750	550	450
7 x 12	100,000	250	1800	1400	1000	750	600
8 x 12	140,000	325	2400	1700	1400	1000	800
9 x 12	150,000	450	3200	2550	1900	1300	1000

Table IV—Weight, Horsepower, and Capacities of Ball Mills

Mill Size, Diam. x Length, ft.	Shipping Weight, lb.	Hp.	Capacity, through mesh, tons/24 hr.			
			30M	50M	100M	200M
4 x 4	20,000	30	60	40	20	10
5 x 5	30,000	75	140	90	45	20
6 x 6	45,000	100	320	200	100	50
7 x 7	64,000	200	570	280	140	70
8 x 8	97,000	300	900	450	220	110

Closed or open circuit

The type of mill for a particular product and the circuit in which it is to be used must be considered simultaneously. Circuits are divided into two broad classifications: open and closed. In open circuit, which is more commonly used, the material is fed at a rate designed to produce the correct finished product in one pass through the mill. In a closed circuit, the mill product is discharged into a classifying device, which returns the oversize material to the mill for further grinding and delivers the fine material as a finished product.

In some instances of sand production, open circuit grinding will result in a product meeting specifications. This is particularly true when only a relatively small portion of pit run material must be ground to make up certain size deficiencies in the natural sand. It is often desirable, and sometimes necessary on difficult problems, to employ a closed circuit, either in whole or in part, to obtain a plant with flexibility to meet changing raw material conditions. Some complex conditions have required the installation of a grinding mill in closed circuit, including two or more classifiers, with provisions for returning any portion of the oversize product of each classifier to the mill for re-grinding. Flexibility for meeting any conditions of raw material characteristics and specification demands can be obtained by selection of the proper grinding mills and classifiers and the adequate design of the entire circuit.

Tables III and IV show approximate capacities, weight and power requirements for rod and ball mills. Capacities are given in tons per 24 hr., with medium hard rock feed. Maximum size of lump in feed is 1 in. for the rod and ½ in. for the ball mill. Capacities will decrease by as much as 20% for very hard rock, and will increase as much as 40% for very soft rock. Capacities for the rod mill are based on open circuit wet grinding, and on wet grinding in closed circuit with classifier for the ball mill.

Dry versus wet grinding

The basic principles in dry grinding are the same as in wet grinding, but there are several important differences in operation. Power consumption is from 15% to 50% higher in dry than in wet grinding; ball or rod and liner wear is from 10% to

25% less in dry grinding; capacity of a dry mill per unit of mill volume or per unit of weight of tumbling charge is less than in wet grinding; the feed to a dry ball mill must be free of moisture, although the rod mill is able to grind materials containing moisture.

Wet grinding for sand

Because the material source or grinding mill feed usually contains water, or water is used elsewhere in the sand circuit, and because dust problems, which are encountered in a dry grinding circuit, are difficult and costly to cope with, dry grinding is seldom employed in sand manufacture.

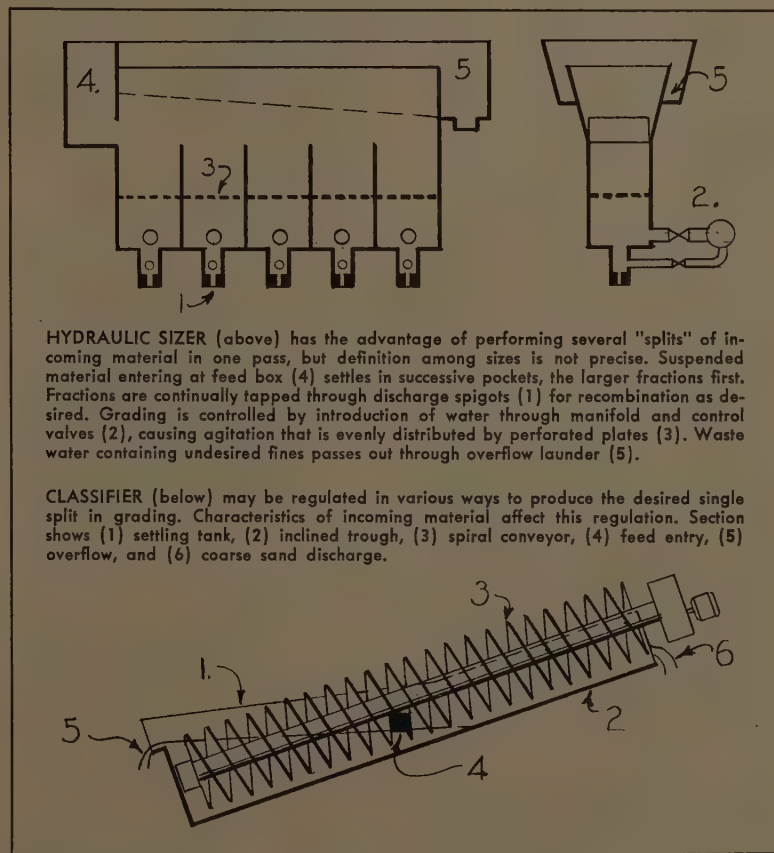
Conditions which affect the operation of the grinding circuit are as follows:

SIZE OF FEED—In small mills, a coarse feed will cause a coarse prod-

uct, because the balls or rods are light in weight or small in number, and the speed is such that their momentum is small. In large mills where adequate force is available for breaking large lumps readily, considerable variation in size of feed will cause only a small variation in size of product.

PULP DENSITY—Pulp density will range from 60% to 80% solids by weight. Between reasonable limits, pulp density has small direct effect on grinding except as it affects wear of steel and pulp flow. A low pulp density will result in high steel consumption, as there will be more direct steel-to-steel contact. A high pulp density provides a greater proportion of solids between the crushing surfaces, and thus utilizes to a maximum all such crushing surfaces with lower steel loss. In general, it is usually desirable to maintain as high a percentage of solids as is consistent with good pulp flow.

MILL SPEED—Operating speeds of mills range between 50% and 85% of critical speed. Critical speed is that theoretical speed at which the outer layer of grinding media will just centrifuge. At lower speeds, the grinding media will roll and slide over one another in a mass near the bottom of the mill, giving a so-called cascading action. At higher speeds, the grinding media are carried up to a



certain extent and allowed to fall on the material at the bottom of the mill, which action is called "cataracting." Indications are that cataracting will break down the coarser material more rapidly than cascading and it does not produce as much very fine material.

Water requirements for a grinding circuit will vary over a wide range, depending on the amount and type of classifying or sizing necessary after or in conjunction with the actual grinding. The water required within the ball or rod mill only will range from 35 to 80 gal. per ton of dry feed where the mill discharge is from 85% to 75% solids by weight. However, the water required for subsequent sizing or classifying may range from 500 to 2,000 gal. per ton of sand. Except for the comparatively small amount of water retained in the finished sand stockpile, the water used throughout the plant may be reclaimed and re-used. This is normally done only where there is not an ample, low cost water supply.

Classifying or sizing

In the process of "manufacturing" sand, either in whole or to make up size deficiencies, the larger pieces of rock are broken down to smaller sizes by use of crushers, rolls, impact breakers or grinding mills as described above. Although the various reduction units will produce, under proper control, sand gradation approaching specification requirements, refinements are almost invariably necessary.

The following specifications for gradation of sand on a current public works project are representative of requirements which the present day contractor is called on to meet:

Sizes (Square Mesh Sieve)

Retained on #4.....	0- 5%
Pass #4, retained on #8.....	5-15%
Pass #8, retained on #16.....	10-20%
Pass #16, retained on #30.....	20-30%
Pass #30, retained on #50.....	18-30%
Pass #50, retained on #100.....	11-22%
Pass #100, retained on #200.....	6- 9%
Pass #200, retained on —.....	4- 6%

To supply a sand which will be graded within the limits of the specifications, the common practice is to separate the original sand into various size groups and re-combine these sizes in the proper proportion. The extent of this separation will depend on the size characteristics of the feed. With original feed having a deficiency or surplus in but one or two size groups, one or two separations only may be required. However, if the original feed deviates from the specifications in several or all sizes, many separations and re-apportionments will be necessary.

Equipment suits needs

The present trend in sand plant design is toward flexibility, by providing equipment with which several separa-

tions can be made. Changes in sand specifications or in feed characteristics can thus be handled without costly and expensive revisions to the physical plant. For this purpose, several types of sizers or classifiers are available, the proper selection of which will depend on plant capacity, possible specifications changes, possible changes of feed characteristics, space available for installation and capital investment limits.

Hydro-sizer

The hydraulic sizer is being utilized in cases where it is necessary, because of specification or feed changes, to separate the feed into several size groups and re-combine with proper proportions. One type of sizer, as shown in the accompanying sketch, consists of a tank divided into several pockets or compartments through a header. The feed enters the sizer at one end, and settles into the successive pockets as it passes through the length of the tank. The larger particles of sand tend to settle out quickly and drop into the first compartments, with the smaller sizes carried farther along the tank. Settling of the particles is opposed in each compartment by the upward current of water which is controlled by individual valves. Sand dropping to the bottom of the tank is discharged continuously through spigots and re-combined to suit specifications by using splitters to remove excess quantities of any size group. The excess sizes may be returned to a grinding mill to make up deficiencies of smaller sizes in the present feed, or placed in stock piles for later use when deficiencies occur.

Classifier or dewaterer

The classifier, sand preparation machine or dewaterer is used extensively

for separation of sand into size groups and for final dewatering of the combined specification sand. These machines are similar in construction, varying in minor details to suit the specific use to which they are put. One type consists essentially of an inclined trough with a large diameter spiral conveyor fitted in it, as is shown in the sketch. As feed enters the pool in the lower section, the coarser materials tend to drop to the bottom, with the finer particles tending to remain in suspension. Overflow, caused by continuous addition of new feed to the pool, removes the fine material. Coarser particles which have settled to the bottom of the pool are continuously removed by the spiral conveyor. The point of size separation between the fine and coarse material is controlled by size of machine, pulp density maintained in the pool, agitation in pool, velocity of pulp flow, physical characteristics of sand feed and other factors.

Classifier advantages

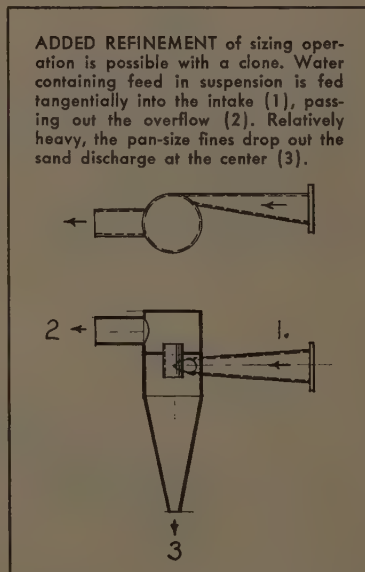
Closer size separation can be made with classifiers than with hydro-sizers, although obviously only one split can be made of a given feed. Where many separations are not required, the use of one to three classifiers may prove to be the more economical, efficient and flexible method.

The dewaterer which is essentially the same as the classifier in construction is almost invariably used to remove excess water from the final sand product. In this case the overflow is practically free of solids, and the sand carried up the open trough by the spiral conveyor is drained of water so that when discharged at the upper end it contains only from 15% to 18% moisture.

"Clone" and hydro-separator

Very fine or "pan" sizes of sand present a problem in meeting sand specifications, especially when their retention in the final product is required. In many cases the volume of water in the circuit is so great that very fine particles are carried in suspension over the hydro-sizer or dewaterer. The clone provides one means of saving these fines. It consists of a cone-shaped vessel into which the feed is introduced tangentially and at high velocity. The solid particles are thrown out of the water medium by centrifugal force and settle to the bottom for continuous removal by spigot. The primary disadvantages of the clone have been comparatively high wear from abrasion and considerable power consumption to provide the necessary pressure head for operation.

The saving of fine material may be accomplished by use of a hydro-separator, which is comprised of a tank to form a large, quiet settling pool, with slowly moving rakes in the bot-



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Tapered joint for sewer pipe

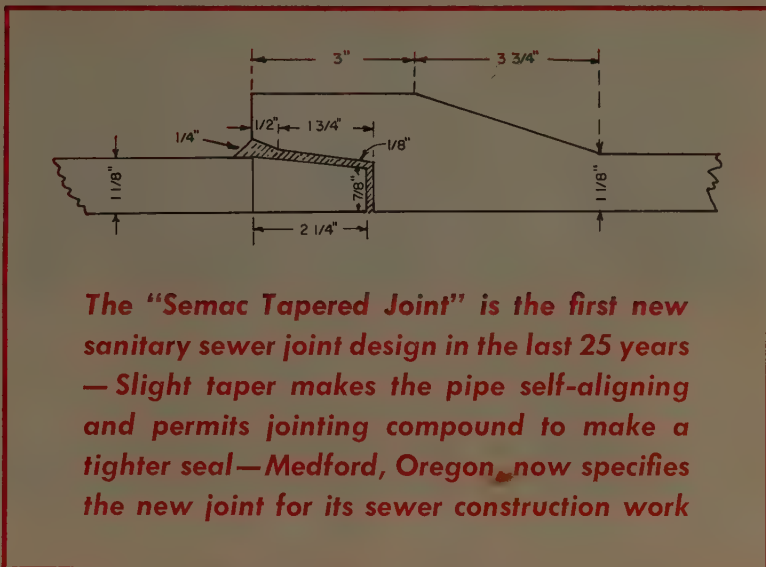
IN THE FALL of 1952, the City of Medford was planning a sanitary sewer system to serve what is known as the "Country Club Park Addition to the City of Medford." This is an area on the east side of town where many new houses have been constructed. The topography of the area was such that a gravity system would serve all but seven houses, located on the south end of the project. These could best be served by a sewage ejector discharging through 300 ft. of pressure line into the gravity system.

Final design of the system indicated 1,170 lin. ft. of 10-in. pipe would be required for the trunk line and 4,000 ft. of 8-in. pipe, plus 900 ft. of 4-in. pipe for house laterals. Other items included twenty-one 42-in. precast manhole structures, two square manholes, plus numerous wyes and $\frac{1}{8}$ -bends. The sewage ejector which was installed is a 50-gpm. single unit Jennings, manufactured by the Nash Engineering Corp.

A survey of the area indicated that the water table was close to the surface and infiltration would be a major problem.

After careful study of all available

CLOSE-UP of a finished joint. Both Atlatic 77 and Pressitite compounds were used for joint material and both proved satisfactory.



The "Semac Tapered Joint" is the first new sanitary sewer joint design in the last 25 years — Slight taper makes the pipe self-aligning and permits jointing compound to make a tighter seal—Medford, Oregon, now specifies the new joint for its sewer construction work

By
**EDWARD N.
MCKINSTRY**
City Engineer
Medford,
Oregon



information, it was decided that the new "Semac Tapered Joint" should be given a trial. The office of the City Engineer felt that the project was of sufficient size and adverse enough conditions to prove the worth of this new type of joint. Consequently specifications were written to cover the tapered joint as manufactured by the Medford Concrete Construction Co.

Development of joint

The "Semac Tapered Joint" is believed to be the first new design of sanitary sewer joints in the last 25 yr. It was designed by Russell Semon, president of the company, who began to experiment with the project in 1951. His objective was to design a joint that would be easier and more economical to lay than the conventional bell and spigot type and at the same time guard as much as possible against infiltration, that old bugaboo of engineers and contractors.

Experiments were conducted with the first tapered joints, which were hand-made, to determine the most

practical angle of taper and the minimum annular space that would allow the jointing compound to make a tight seal. It was also designed so that the pipe should be self-aligning. These purposes were accomplished in the final design.

The pipe was patented in 1952 under the trade name of "Semac Tapered Joint," and a limited amount of 4-in. pipe was manufactured for local use on house laterals. Concrete mortar, used on the first pipe laid, proved to be satisfactory, but it was felt that a mastic joint would be more economical and better for the larger size pipe. In 1952 the manufacture of 6-in. pipe was begun. Then forms were made for the 8-in. pipe and the first 8-in. tapered-joint pipe began to come off the assembly line.

Choice of compounds

The question arose as to what type of joint was to be specified for the sewer job. It was felt that a mastic compound, which could be used as delivered on the job, would be most suitable. Atlatic 77, as manufactured by the Atlas Mineral Products Co., or equal, was specified. It was also specified that both bell end and spigot end of the pipe should be primed at least 24 hr. previous to laying in the trench, and that all joints be free of any dirt or water before application of the mastic compound.

The primer used was that recommended by the manufacturer of the mastic compound. During construction, both Atlatic 77 and Pressitite



LENGTHS of 8-in. pipe have been coated with sealing mastic and stand ready to be placed in the trench as part of the "Country Club Park Addition" to the Medford sanitary sewer system.

compounds were used for joint material, and both proved satisfactory. Accompanying sketch shows the detail of the joint. It should be noted that the annular ring has a clearance of only $\frac{1}{8}$ in. This allows for the minimum space necessary to place the pipe in position, which causes it to be self-aligning when laid in the trench.

Experiments in placing the mastic jointing compound proved that best results were obtained by placing the mastic on the spigot end of the pipe. When the mastic was placed on the bell end of the pipe, any excess was forced into the inside of the pipe. Due to the physical characteristics of the mastic, it presented a real problem in removal. By placing the mastic on the spigot end of the pipe, the problem of removal was eliminated.

Costs

Because of the small annular space, less jointing compound was used. A

RUBBER GLOVES protect the hands of a worker who is placing joint material on a section of 8-in. pipe.



close check of the mastic used showed a requirement of approximately 1 lb. per joint at a cost of \$0.10 per lb. Since $2\frac{1}{2}$ -ft. joints were used on this job, the cost per foot for jointing material was approximately \$0.04. This would be reduced to \$0.03 $\frac{1}{3}$ per foot for 3-ft. length of pipe.

The contractor used only three men to lay the pipe. One man on top to place the mastic on the pipe and haul the pipe to the pipe layer, one man to lay the pipe, and one man for fine grading.

The contractor proceeded to lay several hundred feet of pipe to line and grade, and then a man would come back and shape the excess mastic around the end of the bell. This may not have been necessary as far as infiltration was concerned, but it was felt that it would lend a better appearance and also take care of any voids in the annular ring.

Under fair conditions three men can lay 500 ft. of 8-in. pipe in 8 hr. It is felt that under ideal conditions this figure would be exceeded by several hundred feet.

Infiltration

After inspecting and testing, the pipe can be backfilled immediately. This is quite an advantage where it is necessary to maintain traffic. No time is lost waiting for the joint material to cure. Also, any slight movement in the pipe which occurred during backfill operations did not seem to affect the joint. Infiltration tests were made as the line was completed.

Because of the high water table, there was water in the trench at all times. A series of small dams was constructed and the water backed up over the trench for testing. Infiltration measurements showed a flow of 3,966 gal. per 24 hr. per mi. of pipe, which is approximately 0.4 of the allowable under the specifications. However, it is felt that even better

results can be obtained on the next job. Observation of the line since construction has indicated that there is less infiltration now than at the time of completion.

During cold weather, the mastic should be heated to at least 70° F. Heating should be indirect, because application of a flame directly to the mastic drives the curing vehicle from the compound.

Use "catches on"

The "Semac Tapered Joint" has been used on several smaller jobs since the initial installation and has proven very satisfactory. The City of Yreka, Calif., is installing 1,000 ft. of 6-in. pipe for sewer mains. Montague, Calif., has used 3,000 ft. of 4-in. tapered joint for house laterals.

Experiments are being conducted with a rubber ring gasket, $\frac{3}{16}$ in. in diameter, made by the Garlock Packing Co. It would fit on the spigot end of the pipe. Use of this gasket would insure a water tight joint, but, of course, would increase the cost of installation. To date it has not been used commercially on the tapered joint pipe.

Personnel

City of Medford personnel on this job were under the supervision of Vernon Thorpe, public works director; Edward N. McKinstry the author; and Robert A. Duff, city superintendent. Willard F. Stoneburner of Springfield, Oregon, was the contractor on the job.

GROUND WATER in the trench shows how close to the surface the water table is in the area and how much danger of infiltration exists.



Colorado builders make use of . . .

Prestressed concrete roof slabs



New Loveland school building roof system contains pretensioned, precast channel slabs, 5 ft. wide, which bear on window mullions, brick piers, and brick-bearing walls — Clear spans vary in length from 20 to 30 feet

USE OF PRESTRESSED concrete in structures in Colorado has been mainly applied to the construction of roof systems for buildings. It has found satisfactory application in warehouses, meat processing plants, cold storage plants, schools, bakeries and other similar projects.

Extent of the roof systems has varied from supporting beams for wood or lightweight slabs to the complete roof systems of long-span, prestressed, precast slabs or prestressed, precast beams and slabs. Clear span of the beams has varied from 17 to 80 ft. These beams have had a rectangular cross section, or a typical I-shaped cross section, with variations of the I-section.

Slab designs

Slabs have consisted of three major types: One is the channel-shaped cross section in which the two flanges have been designed to support the load with the web spanning between the flanges; this type has been used where many openings are necessary and in some cases the slab has had an opening which extends completely from one flange to the other. The other two types in cross section are a single T and a double T. In these types the entire cross-sectional area is used for compression, thus reducing the size of the member required.

By

**GEORGE C.
HANSON**

Engineer

Phillips-Carter-Osborn,
Inc.



The single T has found use in conditions of heavy loading and long spans while the double T has been used to replace the channel slab where openings were unnecessary and it was possible to have continuous bearing at the ends of the slabs.

PRESTRESS concrete construction, especially for building roofs, has taken a firm grip on the Denver area since its introduction there (*Western Construction*—February 1953, pp. 80-82). This article, written by an engineer with a firm which has designed most of the prestressed units in the area, brings the situation up to date.—Editor.

Clear span of the channel slabs has varied from 17 to 30 ft., while the most widely-used span of the double T has been from 20 to 25 ft. These two types have been designed for the usual roof loading in this area of 30 psf. plus whatever additional load, such as roofing, insulation, piping and other superimposed loads, the slab is required to support. The single T has varied in span from 40 to 50 ft. Loading on one case for a 50-ft. span was 173 psf. live and superimposed load. This load was in addition to the dead load of the member.

Tensioning methods

Both the pretensioning and the post-tensioning methods have been used in the manufacture of the prestressed concrete members used in this area. For the small beams and the slabs the pretensioning system has been used, while for the large beams and some of the single-T sections the Freyssinet system of post-tensioning has been used. There are several reasons for the combination of the two methods in a plant of the type operated by Prestressed Concrete of Colorado, Inc.

Use of the pretensioning method is especially applicable to members which have a nominal number of strands and a large volume of members having the same cross section



PRETENSIONING beds stretch out into the distance. Bed in foreground has a 600-kip capacity while the bed at the top of the picture has a 300-kip capacity. The roofed-over section between the beds contains tensioning mechanism which can be used by both.

and number of strands but which may be of variable length. This allows many of the members to be cast with one tensioning operation on the pretensioning bed, which has a casting length of 280 ft. The tensioning mechanism is capable of tensioning 50 of the 5/16-in. strand manufactured by John A. Roebling's Sons Corp. in one operation requiring about 5 min. to complete the tensioning. This time does not include that required to place the strand in the pretensioning method, but these strands can be placed as quickly in several members as the cables can be placed in one post-tensioned member.

Why post-tensioning method

The post-tensioning method is very advantageous for the manufacture of members having a long span or heavy loading or both. By the use of this method it is possible to concentrate the strand in a smaller area, which cannot be done in pretensioning due to the necessary area of concrete required around each strand to develop the bond in that strand. Also, due to the small number of heavy beams in proportion to the light members required for a structure, it would not be economically feasible to construct a pretensioning bed and mechanism capable of handling the heavy pulls and then using this bed only a few times to its capacity and at other times using it at a small percentage of its capacity. Thus, it is felt that in using the post-tensioning method for most of the beams the pretensioning bed is used more efficiently for the production of slabs and small beams and the necessity of constructing a

large costly pretensioning bed is eliminated.

A typical although somewhat unusual building being constructed using prestressed channel slabs for the roof is the Loveland Elementary School at Loveland, Colo. This school was designed by John K. Monroe, architect, and Phillips-Carter-Osborn, Inc., structural engineers.

Channel slabs

The roof system consists mainly of pretensioned, precast channel slabs 5 ft. wide which bear on 4-in. square window mullions, brick piers, or brick bearing walls and vary in clear span from 20 to 30 ft. The channel slabs of 20-ft. clear span have an overall depth of 11 in., while the others have a depth of 14 in. with a maximum number of strand in the channel slabs of 30-ft. clear span. For the other slabs with spans greater than 20 ft. but less than 30 ft., the same cross section as the 30-ft. slab has been used with a reduction in the number of strand required.

The single T section was used in one area of the building requiring a clear span of 48 ft. By the use of the single T-section it was possible to hold the total depth of the section to 16 in., thus giving the desired ceiling height without an increase in desired height of this part of the building.

In the classroom section and some parts of the main section of the building, a large expanse of window area was desired. To obtain this window area, 4-in. square structural mullions were placed about 5 ft. on centers to accommodate the width of window desired. Width of the channel slabs was established to allow a 1/4-in. tolerance. Plates were cast in the bottom of the flanges of the channel sections at the end of the flanges to match plates welded to the top of the 4-in. square mullions. Upon erection, the outside edge of the channel slab was aligned with the center of the

mullion and the two plates welded together for stability.

At windows where an overhang was desired, it was accomplished by a cantilever slab of reinforced concrete construction poured monolithically with the pretensioned slab. The spandrels at the head of the windows and for the remainder of the perimeter of the building, were also poured monolithically with the channel slab. This was accomplished by forming the bridging at the ends of channel slabs in such manner that upon erection this bridging in the separate slab would blend together to form a continuous spandrel.

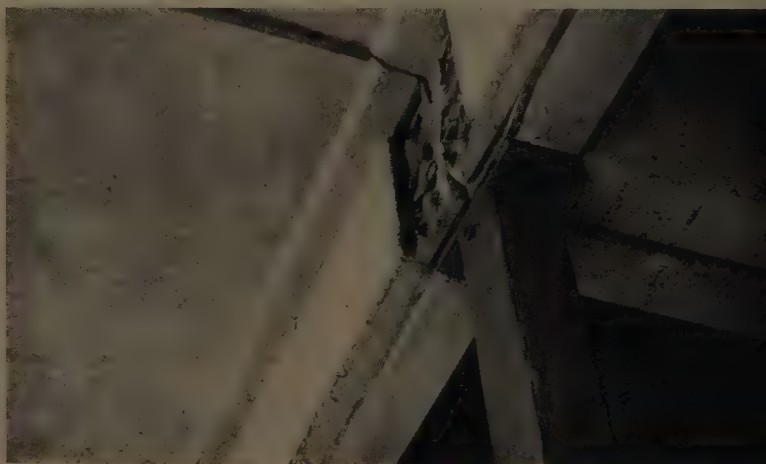
For the ceilings in the various rooms of the school, the flanges of the channel section will be exposed concrete, while the web of the channel will have acoustical tile cemented to the concrete. By making the clear distance between the top of the flanges 4 ft., it will be possible to use standard cut sections of acoustical tile without the additional cost of cutting to fit between the flanges.

Manufacture of prestressed units

Casting of the pretensioned prestressed concrete units for the construction of this roof was done in the casting yard of Prestressed Concrete of Colorado, Inc., at Denver. The maximum roof area cast in one day was about 1,300 sq. ft. This was accomplished by pouring seven of the 30-ft. clear span slabs in one operation. The over-all length of these slabs, including the overhang on each end, was 36 ft., 10 in., and the width was 5 ft.

The first operation for the casting of the slabs on the pretensioning bed is to anchor the base form to the bed. This form is anchored at the beginning of the series of pours and is not removed until all slabs of the type have been cast. In the anchoring of this form, provisions must be made for the horizontal movement which

CLOSE-UP of 4-in.-square structural mullion-supporting slabs. Plates cast in bottom of flange of the channel section bear upon the plates welded to the top of the mullion.



curs upon the release of the tension the strand. This movement is used by the shortening of the part the strand, which is left between the ends of the several sections, when the tension is released from the tensioning supports.

The base form for the channel slabs consists of that part which will form the bottom of the web and the inside of the flanges. Forms for the outside of the flanges have to be removed after each pour for removal of the slab from the bed and replaced for the next pour. In the forming of the single T or double T slabs, the entire form may be anchored to the bed and does not require the removal of any part of the form for the removal of the slab. This provides a saving in cost in the manufacture of the T slabs over that of the channel slabs.

Anchorage for the separate strands are then pressed upon the strand at each end. They are placed at a point, measured when the strands are cut, so that these anchorages will be the same distance apart on all of the strands. In this manner the same tension is obtained in all of the strands. The strands are then placed in the form at their proper location, and all are tensioned in one operation. Tension is maintained by blocking the tensioning bed until the desired compressive strength in the concrete has been attained. This arrangement of holding the tension in the strand without the use of the jacks makes it possible to use one set of jacks to tension both prestressing beds.

Advantages of long beds

Proper tension is obtained by coordinating the pressure on the jacking equipment with total elongation of the strand. One of the advantages of a long pretensioning bed is apparent by this operation. In the tensioning of the strand, the unit deformation is known. For a short length of strand the total deformation of the strand will be very small, while in a length of strand 200 ft. or longer the deformation will be 15 in. and more. Thus, a very small amount of error in elongation of the strand in a short length will cause a great percentage of tension difference, while in a long length of strand the variance in elongation can be much greater without an appreciable amount of difference in the tension of the strand. Any mild steel required is then placed in the forms and the concrete is poured.

When the pour is complete, the beds are covered and low-pressure steam is turned into the bed for overnight curing of the slabs. The desired compressive strength will be attained by a curing period of from 15 to 17 hr. The following day the slabs are removed from the bed and the operation is repeated. In this manner it is possible to pour a set of slabs each day, thus allowing the most efficient use of the pretensioning bed and forms.



THIS IS HOW the roof looks directly following erection and before the final grouting. The flanges will remain exposed, but they will be painted and acoustical tile will be cemented directly to the bottom surface of the web.

Forming the channel slabs with an overhang, such as the one used in the Loveland school, made it necessary to use a separate form for each slab. For slabs of different lengths these forms had to be rebuilt for each length. This additional cost, it was felt, was overcome by casting the spandrels as part of the slab. In casting other sections without the overhang, it is possible to lay a continuous base form on the bed and block off the various slabs at the proper length by the use of headers. Where bridging is required, this can be cut out of the form at the proper position. For a later pour of different length, this is re-covered and the bridging form moved to another location without too great a loss in time caused by changing the forms.

The number of slabs which can be poured in one operation is determined by the length of the slabs to be cast. Supports for the dead end of the pretensioning bed are set at 20-ft. intervals. The total length is set so the dead end of the bed may be set as close as possible to one of these supports. In this way, the waste of strand is held to a minimum.

Erection of slabs

Upon removal of the slabs from the bed, they are stockpiled until an ample supply is available to warrant a day, or several days, of erection. Handling of the units is very similar to the erection of structural steel. Slabs or beams are transported by trucks from the plant to the site and placed in their proper position in the structure as they are unloaded from the truck. This procedure eliminates double handling of the members at the site.

The number of trucks required to maintain continuous operation of the crane at the site is controlled by the distance to the site, road and traffic

conditions and the ease of placement of the members at the site. The slabs for the Loveland school were transported from the plant to Loveland, a distance of about 50 mi., and operation was maintained continuously by the use of four trucks. Erection time at the job averaged about 15 min. per slab due to the end construction of the slabs and the close tolerances maintained. Other slabs, 5 ft., 8 in. wide and 23 ft. long with full bearing and covered ends, have been placed at an average time of 5 min. per slab. This results in a total roof area of 130 sq. ft. being placed every 5 min.

Deflection test

A deflection test on one of the 30-ft. clear span channel slabs showed a very small amount of deflection in relation to span. To approach results of uniform loading for moment and deflection, loads were applied at the quarter points of the slab. With a load equivalent to the design load, which included live load, insulation, and roofing, the deflection was 0.224 in. The second load applied was equivalent to two times the live load, plus $1\frac{1}{2}$ times the roofing and insulation, plus $\frac{1}{2}$ times the slab load. With this load, the total deflection was 0.900 in.

Cost summary

The average cost per square foot of roof area for the entire prestressed concrete roof of the Loveland school was \$1.52. This cost includes manufacture, transportation, and erection of all the prestressed concrete roof slabs. It has been found that the cost of prestressed concrete members will vary, as in other types of construction, directly with an increase in the span of the members and also the loading of the member. Considering the fact that some members had a span of 48

Concluded on page 128

Slip form guide devised for . . .

Lining the Wellton-Mohawk Canal



ELIMINATION of expensive guide rails in the paving of a number of miles of concrete lined ditches was the writer's object when he was assigned the job of supervising development and construction of the Wellton-Mohawk Division of the Gila Project canal system in Arizona. (*Western Construction*—August 1952, p. 70.)

So he directed fabrication of a small slipform, designed to be guided by nothing more than the trimmed subgrade of the ditch, at the Project's shops at Yuma. Its use proved to be extremely successful; thus a new field in the development of low-cost canal lining was opened.

For trimming of the subgrade ahead of the lining, the writer rebuilt the back end of an old, outmoded Ruth dredge belonging to the government. It managed to trim about 5 mi. of small ditch ahead of the slipform. Results within a tolerance of 1 in. for grade and 6 in. for line were obtained. Primary rough excavation was by dragline.

Excavation and trimming equipment

It is important to note at this point that the key to a successful canal-lining operation is not the concrete lining equipment, but it is the excavation and trimming equipment for preparation of subgrade.

The placement of concrete by slipform is not a new idea, since this equipment has been in use and constantly improved for the last 25 yr. or more. However, the "Front End Guide," as developed on the Gila

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Project, was thought to be a new idea. Nevertheless, a preliminary novelty search in the Patent Office revealed United States Patent No. 992,649, issued May 16, 1911, in the name of George W. Gale, which, in the writer's opinion, covered the idea.

Exceptional developments of modern special equipment that will excavate and trim in a single operation were made by Macco Corporation and by Morrison-Knudsen Company, Inc., during 1952.

The Macco machine is a converted old Buckeye bucket-type trencher which was rebuilt in the contractor's shops. The wheel is constructed so the center section can be revised to fit 5-, 3-, or 2-ft. bottom width ditch.

The Morrison-Knudsen machine is a new wheel-type Buckeye trencher which was converted at the manufacturer's plant. The excavating and trimming equipment, as well as the slipforms used by these two contractors on the Wellton-Mohawk Division of the Gila Project, is shown in following photographs. (The slip forms are the subgrade guided type.)

The Macco equipment has successfully completed 50 mi. of ditch and the Morrison-Knudsen equipment about 20 mi.

In the writer's opinion, the Morrison-Knudsen wheel-type excavator

Gila Project shops at Yuma, Arizona, used to fabricate author's idea for trimmer and slipform — Macco and Morrison-Knudsen also converted old machines for this purpose

and trimmer is the best piece of equipment developed to date. The maintenance has been less and, more important, the capacity is large, so the progress can be adjusted to that of the slipform. Consequently, long reaches of trimmed ditch do not have to be left open between trimmer and liner.

However, one necessary and important improvement to this machine would be the addition of more area of crawler track on the ground so that in sandy soil one side or the other will not dig in and throw the wheel out of plumb. There is at present no compensating adjustment to keep the wheel vertical.

Maximum progress obtained with the 5-ft. liner was about 3,000 lin. ft. in 10 hr., and with the 2-ft. liner about 4,500 lin. ft. in 8 hr. These machines have proved their practicability and saved thousands of dollars for both the project and the contractors.

THIS TRIMMER was rebuilt from the back end of an out-moded Ruth dredge. It was used to trim about 5 mi. of small ditch.



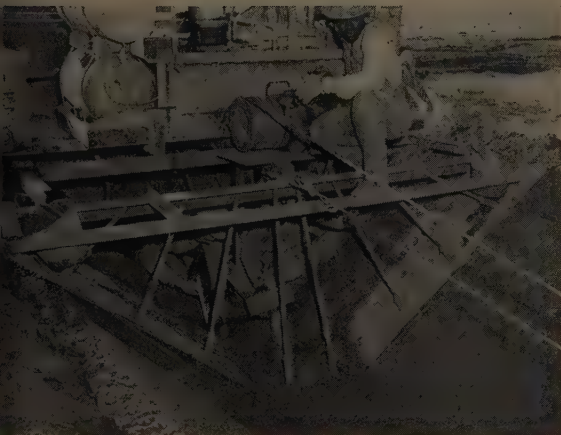


It takes all kinds of equipment to line a canal . . .

CONVERSION of equipment to suit the requirements of a special job is illustrated here. Morrison-Knudsen converted a Buckeye trencher (upper left) to cut and trim a ditch with a bottom width of 2 ft. Macco's 5-ft. width slip form (upper right) and 2-ft. slip-form (lower left) machines are shown in action on the canal. The Morrison-Knudsen slip form machine (lower right) is also set to pave a 2-ft. bottom. Meanwhile, "Old Red," another Morrison-Knudsen employee, levels lateral berms which are too narrow for the earth-moving machines.



. . . Even Old Red struts his hour upon the stage



PHOTOGRAMMETRY—

What it is and how it is used



AUTHOR Alonzo C. Hammon pieces together a mosaic from separate aerial pictures taken at the request of one of his firm's clients.

By ALONZO C. HAMMON

Hammon, Jensen & Wallen
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PHOTOGRAMMETRY is the science of measuring from photographs. It is used by medical doctors, scientists, tailors, and the various engineering professions, just to mention a few. The doctor uses it for stereoscopic study (3-D) of the anatomy, while the tailor takes pictures of you instead of measuring for that new suit. However, when I speak of photogrammetry in this article, I'm thinking of that phase dealing with planimetric, topographic, and photo mapping, primarily from aerial photography.

Photogrammetry is not something new. In fact, according to the records, it was some 102 yr. ago that a Frenchman first compiled map data from photographs. Of course it wasn't from aerial photography, it was from terrestrial photographs. After World War I, when use of the airplane as a camera platform became possible, the science of aerial photogrammetry came into its own.

It was not until just before and during World War II that this science really became a practical tool of industry, engineers, and map makers. During and since that war, the number of firms and government agencies specializing in photogrammetry has increased many times. There were about eight or ten private concerns in this business before the war; now there are probably fifty firms special-

Aerial photography is one of the engineer's newest tools in planning highway transmission line routes, subdivisions, and forest roads — Photogrammetrists used three-dimensional films long before the movies had them

izing in some phase of the work. Many government agencies also are working in this field; in fact few branches of the government service do not now have a photogrammetric mapping section.

The American Society of Photogrammetry, organized in 1934 in Washington, D. C., now boasts almost 4,000 members and a number of active sections throughout the United States. Some of our more active sections are meeting here in the Western United States.

Photogrammetric mapping is not something new just being tried out. It has become an essential tool to many engineers, planners, foresters, geologists, tax assessors, and others. The demand for the photogrammetrist is growing every day and will continue to grow as others realize that he can produce results quicker, cheaper, and in greater detail.

Aircraft

One of the questions generally asked is what kind of aircraft is used in this work, and how about the helicopter? The types of planes used are many: DC 3's, Beech AT 11's, B-17's, Lockheed PV 1's, P-38's, PB4Y's, and Cessna 170's and 180's, just to mention a few.

The aircraft used depends on the job at hand. Does the job call for high altitude flying or very low flying where the speed of the plane must be slowed down to a minimum? Is the target area a long way from base?

ONE MORE method of getting "mileage" out of engineering staffs (*Western Construction*—June 1953, pp. 74-82) is presented in this article in line with the editorial policy of acquainting the readers of *Western Construction* with every possible means of alleviating the current shortage of engineers.—Editor.

What kind of equipment is needed for the mission? If it is an airborne magnetometer survey (used for petroleum and mineral exploration), much equipment is needed and several men are required to operate it, therefore large plane is needed.

We do not use the helicopter for aerial photography mainly because of the vibrations it sets up. It is used, however, to transport field parties to establish the horizontal and vertical controls necessary for precise mapping. The United States Geological Survey was able to complete the control work for the Death Valley project in one field season by using helicopters to move their men from peak to peak for their triangulation work. Without this aid they claim it might have been a three-field-season job.

In addition to aerial photography, the airplane is used to parachute control signal materials and equipment in on the peaks to be used. This saves time and a lot of back-packing. Materials such as poles, wire, flagging, tools, etc., are parachuted in with burlap as the chute. Very little breakage is experienced this way.

Photography

Aerial mapping cameras used today vary in focal length from 4 to 24 in., and range from a single lens to a nine-lens instrument. The standard single lens camera in use today shoots a 9 x 9-in. photo and carries a roll of film up to 200 ft. long. The cameras are both automatic and manually operated. The focal length used depends on the job to be done and the type of plotting instrument to be used.

Among the multiple-lens cameras used today, one is the twin-plex, which takes two slightly oblique photos at once. This is a rather new development for use in a specially-designed stereoplotting instrument. Another is the trimetrogon camera, with its three lenses taking one vertical and two oblique wing pictures. This was used a great deal during the war to map and chart large areas at a small scale, and is often used for control flights. And there are also

four-, five-, eight-, and nine-lens cameras.

Still another type camera is the continuous strip camera, which is designed so that the film passes over a slit opening for its exposure. The speed with which the film moves over the slit opening is synchronized with the speed of the plane and gives a continuous strip photo 9 in. wide and as long as desired up to the length of the roll of film. This type of photo has been especially valuable for military intelligence and wild game counts. Photos of somewhat similar nature are now being produced by a single lens camera that takes a photo 9 in. wide and 18 in. long in line of flight. This is being used in route planning.

A large scale topographic mapping job, such as would be required for highway planning, subdivision planning, transmission lines, and the like, would require a single lens, precision camera with a 4-, 6- or 8¼-in. focal length lens, depending on the plotting equipment used. The focal length of the camera and the desired scale of photography in turn control the flying altitude of the airplane over the ground datum. The 12- to 24-in. focal length, single-lens camera with high flying is generally used for mosaic work, while an 8¼-in. lens or less is essential where there is little ground relief.

The type of film and camera to be used is a decision the photogrammetrist must make for every job. He must decide whether to use panchromatic (black and white), infra-red, or color for the jobs. Height of the flight, the film used, and the atmospheric conditions to be encountered will determine the type of filter to be used.

Instruments

The plotting instruments used by the photogrammetrist work on the principle of the old-fashioned parlor stereopticon, but with the precision of a fine instrument. These plotters, as they are called, cost up to \$60,000, and it takes as long as 3 yr. to train an operator, provided he has the proper background. He not only has to have keen vision (in both eyes), and a topographical sense, but he also must learn to interpret what he sees in a



ONE OF THE lower-priced plotters in use today is this PL-3 Ryker Plotter. Harry Owens, a forester photogrammetrist, uses it to plot contours from its three-dimensional view.

drawing. He must know the theory of the photographs and the mechanics of the plotting machine. He also needs patience and power of concentration.

The photogrammetrist rates plotters according to their "C" factor. When a plotter has a 1/500 C factor rating, we are saying the machine is capable of contour plotting at an interval of 1/500 of the flying height to standard accuracy specifications. Standard accuracy specifications of photogrammetric mapping generally calls for 85-90% of all contours to be within one-half contour accuracy and no contour out over one contour. A horizontal accuracy of from 1/50 to 1/40 in. is required at published scale. Plotters in use today vary in their "C" factor rating from as low as 1/300 up to 1/2000 and maybe better. But no matter what "C" factor is claimed for the plotting instrument, it still takes good photography, good controls, and an experienced operator to produce results.

The PL-3 & 4 Ryker plotter, which has a "C" rating of 1/500, is one of the lower-priced plotters in use today. It is an excellent instrument for planimetric and resource mapping. It has also been used for topographic mapping at scales as large as 1 in. equals 400 ft., and contour interval of 10 ft.

This instrument uses contact prints.

The Multiplex plotter, with a "C" factor rating of approximately 1/750, is used a great deal for large area mapping at small scales. It is especially good for bridging controls. The Multiplex uses a 2-in. square glass diapositive reduction of the original 9 x 9-in. photograph.

The Kelsh plotter, which has a "C" factor rating of approximately 1/1250, is a very popular instrument in use today for large scale mapping, profiling, etc. This plotter uses 9 x 9-in. contact glass plates.

The Zeiss stereoplanigraph, with a "C" rating claimed by some to run as high as 1/1500 to 1/2000, is used on large-scale work. It is an excellent instrument for bridging controls. This is one of the most expensive instruments.

There are many more plotting instruments in use, but space does not permit mentioning all of them. The Kelsh plotter and the Multiplex seem to be the most popular of the instruments used in this country today to meet our mapping needs.

Route planning

Some of our state highway engineers have learned the value of photogrammetric mapping over the old field methods. They have learned that the photogrammetrist can furnish them more data in less time, at a big saving in cost, than they have ever attained before. They have also found they can do a more intelligent job of planning from the data furnished than they ever could before. The highway departments of some eastern states have set up complete photogrammetric outfits of their own, while in the West the private photogrammetric firms have furnished the services needed.

Specifications of a highway mapping job recently let by the State of California Division of Highways called for the completion in 75 days of 4.5 mi. of mapping approximately

DESIRABLE SCALES OF PHOTOGRAPHY

Use	Scale of Photography	General Uses
Highway, Pipeline	1:20,000 to 1:40,000	Preliminary studies of rural areas
Transmission lines	1:12,000 to 1:20,000 1:3,600 to 1:4,800	Preliminary studies of urban areas For precise study and mapping of route selected
City planning	1:7,200 to 1:9,600	Enlargements are usually made to as large as 1 in. equals 100 ft. scale
Subdivision	1:3,600 to 1:4,800	Mapping of area at scale 1 in. equals 100 ft. scale showing 5-ft. contours
Forestry	1:15,000 to 1:20,000	For timber stand maps and determination of volumes

$\frac{1}{2}$ mi. in width at a scale of 1 in. equals 50 ft. They called for aerial photography, photo indexes, planimetric, and topographic map tracings at 1 in. equals 50 ft. scale, with all map work tied in to controls established at modified second order accuracy. The controls were to be monumented by marked iron pipes and tied into the Coast and Geodetic Survey triangulation system. Five-ft. contours were required until they were spaced $\frac{4}{10}$ in. apart, then 2-ft. contours were required.

The specifications called for standard map accuracy, which means field checking by the department engineers. This cost the highway department approximately \$2,000 per mi. The cost for smaller scale maps at 1 in. equals 200 ft., with 5-ft. contours will run approximately \$1,200 per mi. Prices will vary with the relief and ground cover encountered, as well as the control problems.

Where rerouting of roads or construction of new roads is planned, small-scale photography is first flown, from which mosaics are prepared for studies. When the approximate alignment is decided on, then large scale aerial photography is undertaken, from the results of which large-scale, precise maps are made for final estimating.

Whether the engineer is locating a road, a transmission line, buried cable, pipe line, or any other such project, he can hardly afford to do without aerial photography in covering the area because of land values today. Telephone engineers have found a big saving in the use of photos to indicate routes for their buried cables through cut-over lands and second-growth timber, rather than through a virgin stand of timber. Preliminary tower location in rough country is best done using aerial photography. Appraisal of timber damages in the right-of-way can be facilitated through use of the photos and maps, coupled with some field sampling of the timber.

The Department of Water Resources of one of our Western states is planning several hundred miles of canals based on topographic maps compiled from aerial photography. A number of contracts for the photogrammetric work have been let. For aerial photography, photo indexes, and mapping 10-ft. intervals at scale 1 in. equals 200 ft., the cost has run approximately \$700 per mi.

Subdivision planning

Subdivision engineers generally prefer maps from aerial photography at scale 1 in. equals 100 ft., with 5-ft. contours. Where a flat area is encountered, 2-ft. contours are usually required as well as spot elevations photogrammetrically read on a 100-ft. grid system. On a map of this kind, one can show the slide areas, brush, timber, and rock outcroppings, as well as the usual map detail. We have found that developers of tracts like to



LARGE-SCALE mapping is being done on this Kelsh Plotter by Ed Grundel, who is plotting the topography for a highway relocation job in Marin County, California.

have a mosaic of the area with a transparent overlay of the topographic map to lay over it for promotional purposes.

The shape of the area as well as the ground cover is a factor in determining the cost per acre of a subdivision tract. A rectangular area of a 1,200-ac. tract was mapped at approximately \$5 per ac., while other 1,200-ac. tracts run as high as \$8.50 per ac. because of the irregularity of the area and dense ground cover. For areas of dense ground cover, it is necessary for a field party to go on the ground to contour some areas. But even the latter will present a favorable comparison with a complete ground mapping job. Three hundred acres is about the smallest area that can be economically mapped by aerial methods.

Resource studies

With the values of timber today and the high cost of operations, it is necessary for the lumber companies to know what they have and just where it is. With these conditions existing, they have turned to the photogrammetrist and forester for help. This combination has been able to give more accurate information, give it quicker, and give it for less cost per acre for large areas than users of ground methods alone.

The timbered areas are first classified according to their significant characteristic on the aerial photographs. This classification is then transferred by a stereoplottting instrument to an accurate base map and the areas are measured. A "cruise" or field sample is then made and the resultant data

are applied to the classified areas. Properly executed, this technique produces more accurate timber volume estimates than are possible from an equal amount of work done entirely on the ground.

With the aerial photos, a timber stand map, and a planimetric map of the area, the forest engineer can make long-range plans. He can lay out his logging areas, roads, railroads, etc. After he has worked out his road plan, topography can be run for the road system where needed, thus keeping costs down. Twenty-five-foot contours seem to be adequate for the needs of most forest road planning. They usually can be prepared for about half of the cost of ground work.

These techniques are applicable to ranch lands management and other resource planning and management. Likewise they can be used in the field of equalizing property tax assessment, as was recently done in the privately-owned timber lands of Del Norte County, California.

Other applications

A coal mining firm needed an inventory of its stock piles at some 30 different locations as of a certain date. A photogrammetric firm was called for this task. The areas were flown in one day, and in less than a week the results of photogrammetrically contouring the stock piles were received by the mining firm.

A large wine company needed to know how many pounds of grapes were drying in trays in its vineyard. Aerial photos were taken of the area and at the same time a ground crew weighed a few trays of grapes for a sample factor. The total length of the rows of trays was measured on the photos, and the sample weight factor was applied.

A concern needed to know how many sq. ft. of space in each of five industrial areas were used respectively as sidewalks, paved streets, parking lots, residences, industrial buildings, and open areas. A photogrammetrist was given the job. An aerial photo enlargement was made of each area to a certain scale and overlaid with a piece of clear acetate. Then the various classifications were cut out with a sharp knife and put in separate envelopes, and the contents of each envelope then weighed to determine its proportion of the total area. The weight factors were then converted to square feet.

As for military uses of photogrammetry, there are many. It has been said that probably 80% of military intelligence is gained from aerial photography.

In these and many other ways the photogrammetrist and his tools are being turned to for the part they can play in getting a job done. For those in the engineering and related fields who have not yet become acquainted with them, a worthwhile friendship may be in store.

lasting contractors drive ...

Diversion tunnel at Box Canyon

Gibson & Roberts excavate 10,000 cu. yd. in pushing 38 x 38-ft. hole through 225 ft. of limestone rock in an inverted-horseshoe-shaped section—Downstream portal goes through fractured and blocky material

By **BILL ROBERTS**

Gibson & Roberts, Blasting Contractors
Spokane, Wash.

ON OCTOBER 1952, Gibson & Roberts, blasting contractors of Spokane, Wash., contracted to drive a 135-ft.-long diversion tunnel for the Pend Oreille River at Box Canyon Dam in northeastern Washington. (See *Western Construction*—May 1952, p. 136 for unit bid prices on this job.) The tunnel, an inverted horseshoe section, is 38 ft. wide and 38 ft. high. It is driven through a crystalline limestone rock formation, fairly tight except for the downstream portal which goes through fractured and blocky material. The tunnel excavation proper amounted to 10,000 cu. yd., in addition to some forebay channel and transition material at the upstream portal. Lower water level is 20 ft. above the invert.

The yardage involved did not warrant a large outlay for a drill jumbo,

so it was decided to drive the tunnel in three lifts. Two four-wheel drive, self-propelled, wagon drill carriages were modified to mount Joy jibs carrying 12-ft. steel change, 4-in. Worthington drifters. These machines could drill a horizontal hole 15 ft. above the floor. One self-propelled, four-wheel-drive carriage mounted a conventional wagon drill U arm with a 12-ft. change boom suitable for lifters and the row above it.

An electric Eimco 104 with 1½-yd. bucket and two Koehring Dumpsters handled the mucking detail. This setup required four men per shift and a mechanic on day shift. Pacific-General-Shea, the prime contractors, wanted the tunnel driven in two months with an extra allowance for the open excavation at the upstream portal.

AUTHOR Bill Roberts (left) and Frank Gibson, who run the blasting contractor's firm of Gibson & Roberts, are framed against the diversion tunnel for the Pend Oreille River which they drilled in a subcontract from Pacific-General-Shea, contractors on a joint venture to build Box Canyon Dam in northeastern Washington for \$7,721,389.



ROCK BOLT holes are being drilled for the diversion tunnel at Box Canyon Dam. The bolts, which are 20 ft. long, are being installed parallel to the tunnel's axis and 8 ft. outside its perimeter. After this installation is finished, 6-in. channels will be bolted over the loose areas with 8-ft. rock bolts.

The forebay channel reached the downstream portal in January 1953, and the tunnel was ready to start. It turned out that the rock at the portal was very loose, although it tightened up satisfactorily 50 ft. inside. First a row of 20-ft. rock bolts parallel to the axis of the tunnel and 8 ft. outside the perimeter was installed. Then some 6-in. channels were bolted over loose areas with 8-ft. rock bolts.

A 5 x 7-ft. heading was driven in about 20 ft. and the back was rock-bolted with 6- and 8-ft. bolts. This heading was enlarged, a row of holes at a time, and each new segment of exposed back was rock-bolted. After two weeks of this slow progress, the tunnel's top lift was in about 30 ft. and the crown tightened up.

On the top lift, 68 holes were used per round. Bits were 2¼-in. Type 2 Carset. The rapid positioning of the Joy jibs and the 12-ft. feed machines enabled three men to drill out in about 6 hr. average time. Loading, blasting, blowing smoke, scaling, and rock-bolting averaged one shift. The third shift mucked out and moved the drills in.

In February, the top lift was holed through and the flared transition at the upstream portal was drilled with jointed rods. The second lift was



A NATURAL ROCK plug, left as a cofferdam at the upstream port of the diversion tunnel, stands ready to be blasted out to allow the water of the Pend Oreille River to rush through and clear the foundation area of Box Canyon Dam. Only enough of the tunnel to permit a smooth flow of water through will be lined. The generator penstock will have a relatively low head, since the high flow of the river will be used to drive the power generators.

drilled with a combination of 24-ft. horizontal holes on 4-ft. centers and 12-ft. vertical holes in the center section where there was headroom for a wagon drill. At the upstream portal, a natural rock plug was left as a cofferdam. The third and bottom lift was drilled on 4 x 3-ft. spacing, vertical holes, 6 in. below grade. The powder used was Atlas Gelodyn No. 1, 2 x 12 in., and DuPont regular delay caps. The holes were shot with a DuPont CD-type machine.

Superintendent for Gibson & Roberts was Paul Wilson. A. E. Gilligan was the engineer for Harza Engineering and Charles Bisordi was project manager for Pacific-General-Shea.

Chief Joe "on schedule"

"ON SCHEDULE" is the construction report from Chief Joseph and Albeni Falls dams in the Pacific Northwest, said Col. E. C. Itschner, Portland district engineer for the Corps of Engineers.

Installation of powerhouse equipment is the only major construction contract remaining to be let at Chief Joseph, he said, and added that completion of the powerhouse at Albeni Falls is scheduled for early 1954.

More gas for Southwest

INCREASED SUPPLIES of natural gas in New Mexico, Arizona, and California were assured when the Federal Power Commission approved the application of El Paso Natural Gas Co. to increase the daily capacity of its pipeline system by 400,000,000 cu. ft. (*Western Construction*—March 1953, p. 104).

Estimated cost of the program, which will include 1,056 mi. of pipeline and additional compressor capacity of 161,860 hp., is \$175,250,000.



EXCAVATED MATERIAL from the tunnel is loaded into one of the two Koehring Dumpsters used on the job to handle the mucking detail by an electric Eimco 104 mucking machine with a 1½-yd. bucket. The mucking required the services of four men on each shift in addition to a mechanic on the day shift. Approximately 10,000 cu. yd. were excavated from the tunnel by this means.

TUNNEL CONSTRUCTION

... Continued from page 59

dirt through this section because of the railroad above.

Toward the northerly terminus of the tunnel, quicksand caused by sulphur springs was encountered. Foot blocks would not hold. Larger foot blocks and spreaders (light rail) had to be used. Even at that the tunnel went down 6 in. It was later jacked up into place and the invert immediately poured through this section.

At the time of writing, all tunnel excavation is finished, all the invert is poured, and two-thirds of the arch is poured. Still to be built are several catch basins, manholes, and one structure which must pass over one storm drain and go underneath another. The main difficulty with this will be

traffic and power lines which must be relocated. However, plans have been made and no further difficulty is anticipated.

Personnel for the project, contracted for by the City of Los Angeles, are Floyd Doran, designer, Storm Drain Division; Albert J. Sutcliffe, resident engineer; G. G. Thomas, Sr., and Roy Lawrence, city inspectors, and Al Wright, city surveyor. Lloyd Aldrich is city engineer.

For the George E. Kerns Construction Co., George and Fred Kerns are field superintendents; Eddie Maffitt, project engineer; M. G. Holwick, excavation superintendent; Joe Yankosky and John Sampstead, shifters; Lloyd McNeece, master mechanic; William Thompson, concrete foreman; Thov Groven, electrician; and Herman (Dutch) Raspe, steel foreman.

SAW-CUT CONTRACTION JOINTS

... are a successful result of experiment and practice on California highway work

Experience permits analysis of techniques and costs—
Blades are most costly item — Timing of cutting
operation is key to results obtained

LATE IN 1952, the California Division of Highways began sawing the weakened plane joint in concrete pavement and to date nearly 260,000 lin. ft. of these joints have been sawed on five paving projects. In this relatively new procedure the groove to form the weakened plane contraction joint is sawed by diamond rimmed blades after the concrete has hardened.

Projects constructed so far have been largely of an experimental nature and while some recommendations can be made at this time, no definite sawing procedure has been decided upon as yet. Joints constructed appear to be superior to the premolded paper strip type of weakened plane joint specified in the past. Several short sections of concrete pavements were placed in 1947 and 1948 in which the contraction joints were sawed; recent observation of these joints disclosed the excellent performance of this type of construction. The sawed joint is at present, however, a more expensive joint.

Equipment

Contractors have supplied two general types of equipment for use in sawing pavement concrete, the single-bladed machine and the multiple-bladed machine. Both types are capable of sawing an equal quality joint but the advantages of each are still somewhat controversial.

The single-bladed concrete saw consists primarily of a compact gasoline engine mounted on a four-wheel carriage balanced so that it can be easily moved from one location to another. Generally the power unit is used to drive the cutting spindle and the machine must be propelled by the operator. Originally designed for other types of concrete sawing, the single-bladed machines are adaptable to constructing pavement joints. This type of equipment is manually guided and requires a chalk line for proper joint alignment. Speed of sawing varies from 1½ ft. to 4 ft. of 2-in. depth joint per min., depending on the age and character of the concrete.

By D. G. EVANS

Construction Engineer
California Division of Highways

The multiple-bladed concrete saw has been especially developed to saw transverse joints in pavement concrete. The machine is mechanically propelled along the pavement and the cutting carriage is power driven transversely across the pavement at a constant rate on guide rails or wheels. Separate power units are provided for each of these operations. The cutting carriage is equipped with two or more blades placed in tandem.

A TYPICAL Western advance in highway construction methods has been application of the concrete saw for cutting weakened plane contraction joints. It is spectacular in its contrast to the older, entirely different method for achieving the same result—use of premolded paper strips.

California has been able to study its cost experience with saw cutting on a 4-month "sample" covering 260,000 lin. ft. of joint. Its analysis is thereby accurate and unclouded by the necessity for revising past costs upward by estimate or formula. In addition, California highway engineers can look to experimental costs more than 5 years old for data on performance of these joints under traffic.

The accompanying experience report was prepared for the publication of California's Department of Public Works. For the use and benefit of Western highway engineers and superintendents, *Western Construction* is pleased to present the article in these pages also.—Editor.

The cutting cycle requires from 3 to 5 min. per joint which in turn will require one to two shifts per day to keep abreast of an average day's run of the mixer.

Both types of machine feature a water-spray system for cooling the blade and lubricating the cutting. The saw blades revolve at approximately 3,300 rpm., and ample quantities of water are necessary to protect the expensive diamond set blades. For large scale sawing it is necessary to provide an auxiliary water truck to supply the large quantities of water needed. An inadequate water supply will result in lower blade footage and in the more extreme cases a warped blade.

Saw blades

The concrete saw blades now in use for joint sawing are 10- and 12-in. diameter segmented circular steel disks with diamond cutting edges. The saw blade is a high-grade steel and the cutting edge is set with commercial-grade diamonds.

The groove made in the concrete by the saw varies from around 3/32 in. to 3/16 in., the variation being due to the condition of the blade and the age of the concrete. Ordinarily, new blades cutting green concrete produce the widest cuts, while cuts by worn blades in hardened concrete result in the narrow sharp-edge grooves.

Prices currently being quoted for the concrete saw blade at the retail level are \$130 for the 10-in. size and \$150 for the 12-in. size. Footages from these blades have varied greatly. On one project an average of 450 lin. ft. of 2-in. groove was obtained per blade; on another, the average was nearly 850 lin. ft. It now appears that 800 to 850 lin. ft. may be reasonably expected from each blade with present equipment and sawing procedure.

There are two principal factors influencing blade wear, age of concrete and type of aggregate. More footage will be obtained with blades cutting hardened concrete than green concrete. Sand particles work loose when the concrete is green and the increased abrasion decreases the blade life.

Footage that can be obtained with each blade is in direct proportion to the hardness of the coarse aggregate used in the concrete. The State of Washington reports footages of 700 lin. ft. per blade sawing aggregate of basaltic nature, while the midwestern



DEVELOPED especially for pavement joint work, the multiple-bladed saw is self powered along the pavement headers, has independent power for the transverse carriage mounting the blades.

states have cut 2,000 to 3,000 ft. of concrete having limestone aggregate. However, with the various California aggregates not much difference in blade footage is anticipated on that account.

The contractors' men must become familiar with the specialized equipment used in sawing concrete. Failure of the water supply, for example, may ruin a blade or a set of blades in a few seconds. An excessive rate of sawing also reduces blade life considerably.

Costs

The cost of sawing joints is directly related to the type of aggregate used, the time at which the concrete is sawed, the efficiency of the operation of the saw, and the rate of sawing.

The depth of cut is necessarily another item to be considered. To date, joints have been sawed to a depth of 2 in., but in an effort to reduce costs several test sections of 1½-in. joints have been placed. From these sections, it appears that a 1½-in. groove is effective in producing a weakened plane and in several future contracts this depth cut will be specified. The blade life is not directly proportional to the depth of cut and only a 10% to 15% reduction in sawing costs is expected as a result of this shallower groove.

The unit costs, based on an assumed production of 800 cu. yd. of paving concrete per day, 850 lin. ft. of 2-in. joint per blade, an operating crew of two men per shift and two shifts per day, equipment rental of \$4 per hr. for water truck and 2 cents per lin. ft. of joint for the machine, would be approximately 75 cents per cu. yd. of concrete or 27 cents per lin. ft. of joint. Analyzing this cost further:

Items	Cost lin. ft.	Per Cent
Blades	\$0.17	63
Labor	0.05	19
Equipment	0.05	18

It should be noted from this analysis that the bulk of the cost of sawing is in blade wear and any savings in this item will materially reduce the overall cost. Presumably a 1½-in. depth cut would average out around 24 cents per lin. ft.

Basic factors

When the concrete is first placed on the grade it begins to undergo several chemical and physical changes that result in a slight but important decrease in volume. This decrease in volume is due to:

- (1) Loss of mixing water (drying shrinkage).
- (2) Temperature drop (due to atmospheric temperature changes and loss of heat of hydration).
- (3) Hardening of the cement paste (hardening shrinkage).

The decrease in volume, if uncontrolled, will result in initial transverse random shrinkage cracks at intervals of 60 to 90 ft. If weakened planes are constructed in the pavement, the concrete will crack directly at these plane

locations and form a regular transverse opening called a contraction joint. Whereas the random shrinkage crack will spill under the action of traffic due to its irregularity, the straight well-constructed contraction joint that occurs at a weakened plane is spill-free.

Weakened plane contraction joints had previously been formed by a 2-in. premolded paper strip placed in the fresh concrete. These joints, while economical, were difficult to maintain in the proper position during the finishing operation, which later often resulted in severe spalling. Nevertheless this paper insert did have the advantage of being in position when the initial shrinkage began and this had the direct effect of controlling the first shrinkage cracks.

Construction procedure

In making the initial transverse control cuts to prevent random cracking of the slab, it is necessary to wait until the concrete hardens sufficiently to permit sawing without tearing and yet saw the groove before uncontrolled random cracking occurs. It is only necessary to cut the 60-ft. joints (or control joints) to control the early shrinkage and once these are cut the stress is relieved and no further cracking should be experienced within a reasonable length of time. The intermediate joints may then be cut 24 or 48 hr. later when a better joint will be obtained at a lower cost.

The time at which the control joints should be cut varies greatly and in general is directly related to climatic conditions. Physical and chemical composition of cements and water-cement ratios are undoubtedly influencing factors of a secondary nature.

It has been found that the time at which the control cuts must be made will vary from 7 hr. on a hot day to 26 hr. in cool, foggy weather. The sawing operation of these control joints might be compared to the concrete finishing operation, as there exists only a certain period in which

SINGLE-BLADED machines have been adapted from other original purposes in concrete cutting but are preferred by some contractors for their versatility. Cutting speeds of single- and multiple-bladed rigs are comparable.



work can be done. Trained operators can usually determine the proper time for sawing after a few trial cuts. Generally, it has been found that some raveling must accompany the sawing of the control joints, for a neat sharp-edged joint is obtained, the concrete has hardened to a point where shrinkage stresses probably have already resulted in random cracks, though they may be difficult to see. If a slight raveling and water ponding of the joint occurs, it indicates that the concrete has not yet hardened sufficiently to result in damaging shrinkage stresses.

Crack control

Since loss of the excess mixing water (over that required for hydration of the cement) is one of the major sources of early shrinkage, delaying this water loss will also delay tensile stresses in the concrete and allow more time in which to cut the weakened plane. This is particularly true of the initial lane. Continued heavy fogging of the fresh concrete until the final curing operation gets under way will aid in this respect. Of course, that portion of the volume change due to hardening and the temperature variation will be uncontrollable. Large variations in temperatures between day and night, together with low humidity and high winds, appear to be the most difficult in which to control random cracking. As for any individual day, the greatest number of random cracks have occurred in that part of the day's pour which had been completed before noon. It is this portion that hardens quickly and which must be watched closely. The afternoon's pour sets slowly and there appears to be considerable time in which to cut these control joints. In this respect, the State of Colorado reports similar experiences.

Matched cuts

Any joint that has opened in the initial lane must be matched by a control joint in the companion lane. This is very important, since if it is not done a random crack across the second lane will invariably result. When pouring the second lane, it is necessary to mark all joints that have opened in the first lane so as to know which joints are critical. It has been found that the best system is to have a man paint in the morning each joint that has opened in the first lane. The opened joints are widest at this time and most easily detected.

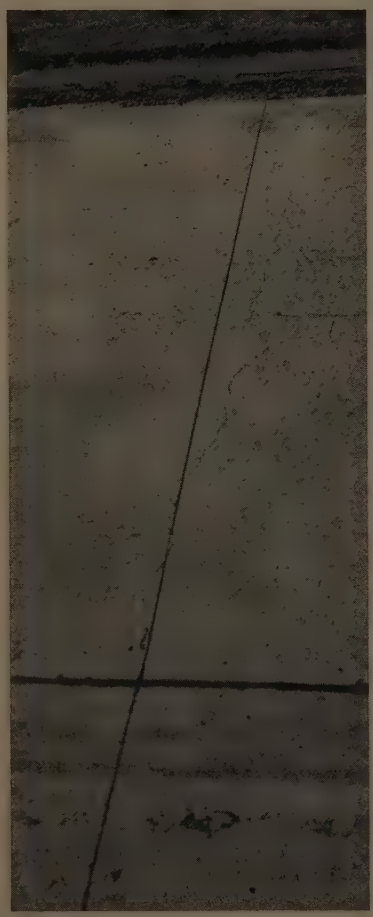
The sawing of the control joints in the companion lane is more critical as to timing, and under certain conditions it will be impossible to cut the pavement before a random crack occurs.

The critical nature of the companion lane stems from the fact that in addition to the normal shrinkage stresses of the concrete, the initial lane transmits through the tie-bolt



PROPERLY TIMED sawn joint is neat and straight, with a minimum of raveling at the edges. An absolutely clean joint indicated that the pavement had set first, and random cracking may therefore have already taken place.

MATCHED joints in adjacent lanes are a must. The random crack shown opened up before the saw cut was made in that lane, was encouraged by presence of timely saw cut in foreground lane.



assemblies to the companion lane additional volume change stresses. At times, the initial lane will transmit enough stress to the second lane to result in a random crack before the concrete has set hard enough in the latter to permit sawing. When it is evident that this is happening, it will be necessary to start inserting pre-molded paper strips to form joints.

Diagonal joint construction

Contraction joints have been sawed both normal and diagonal to the center line of the pavement. Under certain conditions, the diagonal joint has proven more difficult to saw and has resulted in a more serious random crack pattern. As a result, it is recommended that the diagonal joint not be specified until the sawing technique has been better perfected and construction personnel become better acquainted with the operation.

Conclusions

Based on field observations of the experimental sections placed in 1947 and 1948, as well as of the more recently constructed projects, the following advantages are apparent at present in the sawed joint over the premolded paper weakened plane contraction joint:

- (1) The sawed joint insures a groove that is vertical and straight which is surrounded by a concrete that is of equal quality to that found elsewhere in the pavement. There is less spalling at the joints with the result that a better riding pavement is obtained.
- (2) The narrow groove of the sawed contraction joint is not noticeable at average driving speeds and the pavement appears as a continuous white ribbon.
- (3) The sawed joint permits a better sequence of operation of the concrete finishing equipment train. The operation of the Johnson float is simplified since there are no paper strips to "roll" or "pull" and extra passes of the float are eliminated.

Slip-form method used in . . .

Pouring grain elevator fast



Almost 2,500 cu. yd. of reinforced concrete placed in 5½ days at San Francisco grain terminal — Piles driven through 65 ft. of soft mud to lens of sand strata

CONCRETING BY the slip-form method was used to pour 2,471 cu. yd. of monolithic reinforced concrete in 5½ days by Macdonald Engineering Co. on a \$582,000 contract to double the 500,000-bushel capacity of the grain elevator at the Islais Creek grain terminal late in May.

The slip-form method has become accepted as the conventional way to put up such a structure in the last several years since the technique was introduced in this country. It was originally devised in Sweden.

This job, ordered by California's Board of State Harbor Commissioners, involved placing an additional nest of 21 bins next to the existing facility at Pier 90. The two structures will be connected by means of interlocking basements underground and galleries at the top. Three conveyor belts, covering some 320 ft. in length, will run through both basements, and two conveyors will carry grain through both galleries, dumping it into the appropriate bins.

Rests on sand strata

Construction on the new addition began with the driving of 1,468 support piles by the Duncanson-Harrelson Co. under a subcontract. The Douglas fir piles, which are 70 ft. long, were driven on 3-ft. centers.

Difficulty was encountered right at the start when test borings went down 150 ft. before reaching bedrock. They revealed the presence of soft mud all the way down, with the exception of a sand stratum 14 ft. thick "floating" 65 ft. below the surface on more soft mud which extends to the bay bottom. The piles, which have diameters of 9 in. at the tip and 15 in. at the butt, were driven some 4 ft. into the sand, which geologists claim was a beach at some time eons ago. The piles are embedded 15 in. in the foundation slab at their butt ends.

Driven at batter

Because of the soft mud, it was extremely difficult to keep the piles in their specified locations as the surrounding piles were driven. Excessive drift was noted in some cases. Pile driving started at the center line with the piles driven plumb. Each succeeding row toward the outer edge was driven at a slightly greater batter, reaching a maximum slant of one in five at the outer row, in order to distribute the weight over 40% more area.

The piles were driven by a double-acting 50C Vulcan steam hammer generating 15,000 ft. lb. of energy. The hammer, running on stationary

leads, weighed approximately 5,000 lb.

The foundation slab, poured directly above the piling, was designed to resist an earthquake shock of 10% gravity. The added strength was added because of the large amount of mud below the structure. Dimensions of this slab are 2 ft. 6 in. thick, 77 ft. 8 in. wide, and 249 ft. 6 in. long. It contains 1,000 cu. yd. of reinforced concrete. The basement walls, which are 8 ft. high, took an additional 1,150 cu. yd.

Interstices also used

Work on the slip-form section of the structure began on May 25. The forms were built 4 ft. high of 1 x 4-in. tongue-and-groove, kiln-dried, flooring lumber. They followed the contours of the bins, which have outside walls 7 in. thick and interior walls 6½ in. thick. The bins have inside diameters of 19 ft. 5 in. each. This leaves 12 diamond-shaped interstices between the rows of circular bins. They will also be used for grain storage by means of ingress and egress chutes leading from and to the different belt conveyor systems.

After the floor slab, which is 10 in. thick x 58 ft. wide x 136 ft. long, was poured, the form structure was built. Decking was laid over the open spots, leaving only the form openings for pouring concrete to form the bin walls, and the whole structure was made into a single unit by means of interlocking trusses and 2 x 12-in. walers bolted together. Scaffolding was added to hang below the form for the use of patching crews.

Common walls

A forest of vertical steel reinforcing bars, ¾ in. in diameter, were set on 12-in. centers. More support comes from the 1-in. diameter round steel jacking rods, set eight to a circular bin and running from the floor slab to the floor of the gallery, 86 ft. above. Although each bin was ringed with eight jacking rods, the rod where the bins joined to form a common wall sufficed for both adjoining bins. Therefore, only 136 rods were placed.

Some 145 (9 for replacement) Simplex mechanical pump jacks were used for the actual lifting operation. The jacks were bolted to circular sleeves, bolted in turn to the entire form framework, which climbed the jacking rods each time the pumping mechanism was jacked up a notch. The platform decking was supported on steel I-beams, 15 in. deep and 21 ft. long, with thicknesses of .41 in. at the web and ¾ in. at the flange. The I-beams, an integral part of the form

structure, traveled up with the rest of the platform. There were 21 of them, each placed across the diameter of a circular bin. They will be left as a permanent part of the gallery deck flooring with their ends embedded in concrete after the gallery deck is poured.

Synchronized jacking

Jacking was synchronized by a centralized water level system. The master jack in the center of the deck was connected to a water tank, attached to small diameter piping and hose to water level at each subsidiary jack. Whenever the central jack was raised, the level above each other jack showed how far off the horizontal it, and the slip-form, were. Approximately every 3 min. the man in charge of the central jack blew a whistle and members of the 21-man jacking crew moved from jack to jack and lifted each the number of notches needed to make the level bubble come to center position again. A lift of one notch was equal to a rise of about $\frac{1}{4}$ in.

The form traveled up an average of $\frac{1}{2}$ in. per hr. in this manner. When it reached the top of the bins, it was used to pour the gallery floor slab also, which took an estimated 400 cu. yd. of concrete. The gallery walls and roof were to be made of corrugated iron.

SLIPFORMING the 1-in. jacking rod in its steel grip is a Simplex mechanical jack which helps provide the lifting power for the slip-form. The jack is firmly bolted to a wooden yoke which pulls forms, deck, workmen, and all up the jacking rod.



THERE'S NO time for dawdling when a slip-form pour is on a 24-hr. schedule. Concrete buggies are concentrated at the twin hopper (center right) at the same time more reinforcing steel is being placed (center left) and members of the jacking crew lift the form the requisite number of notches.

The bin pour was made on a 24 hr. a day basis. Concrete for the whole job, an estimated 5,000 cu. yd., was furnished by Pacific Coast Aggregates, Inc., which brought the material some 3 mi. to the job in transit-mix trucks from its San Francisco batch plant. The batches were furnished in 6-sack mixes with no additive whatsoever and a slump varying between 4 and 5 in.

Flexible pouring chute

A concrete lift tower of tubular scaffolding was erected next to the pour area. The transit-mix trucks dumped their loads into a hopper-type bucket at its base, the bucket was hauled to the top of the tower and its contents dumped into a hopper which had a chute extending down into a twin-hopper Gar-Bro bucket, from which it was possible to load two concrete buggies at once. The chute was sufficiently flexible to enable its angle of incline to flatten out as the form traveled upward. The tower hopper was raised whenever the form reached another 6-ft. higher elevation, thus keeping the pour going without having to stop for constant adjustment of the bucket.

Despite all precautions, some concrete spalling and cracking was encountered. This was patched by men working on the suspended scaffolding, using a 1:2 standard grout mix. The entire exterior will receive a "mud" coat consisting of a mixture of cement and lime (98 lb. of Medusa white cement to 50 lb. of hydrated lime) to fill all fine holes and make it waterproof. Interior walls were also patched and smoothed to guard against any chance of grain lodging and attracting rats or other vermin.

Biggest day's pour of the job was on May 28, when 489 cu. yd. were placed. The space under the grain chutes in the base of each bin was left hollow, rather than filled with concrete, to reduce the weight on the foundation piling. A second truck pit was added, as an additional design feature, to the new structure to help cut down waiting time for trucks trying to load or unload grain and thus reduce demurrage fees for the terminal operator.

Rubber joint designed

Another interesting design feature was the provision to join the two buildings at ground level, where the main belt conveyors go from one to the other, with an absolutely watertight seal. A flexible rubber joint, 2 $\frac{1}{2}$ in. wide, was placed in sliding sections with water-proofing membrane and copper water stops. This material was used to provide for differential settling between the two structures where the conveyor belts extend. The curve of settlement on the old building, erected in 1949 (*Western Construction*—March 1949, p. 71) is leveling off, so the design engineers feel that a 2 $\frac{1}{2}$ -in. flexible joint is more than adequate, since it should stretch quite a way before it snaps.

Personnel

Board of State Harbor Commissioners personnel include S. S. Gorman, chief engineer; W. F. (Bill) Peleaux, resident engineer, and Jack Futscher, who relieved Peleaux at night. Macdonald Engineering had M. G. (Mike) Karr and Richard (Dick) Hawco on the job as superintendent and assistant superintendent, respectively.



Bid invitations issued for . . .

Construction of Monticello Dam



ONE THOUSAND calendar days will be allowed for construction of Monticello Dam to the contractor who is awarded the job by the Bureau of Reclamation. Bid invitations were issued by the Bureau's chief engineer at Denver, Colo., on May 27. The bids were to be opened July 30 at the office of the Bureau's construction engineer at Winters, Calif.

A major feature of the Bureau's Solano Project in California, the dam is to be built on Putah Creek at the junction of Yolo, Solano, and Napa counties, about 30 mi. west of Sacramento.

Arch-type design

The dam is to be an arch-type concrete structure, about 295 ft. above foundation and about 1,000 ft. long at the crest. About 260,000 cu. yd. of concrete will be required for the construction of the dam, and an additional 10,000 cu. yd. are to be placed in the spillway.

The spillway, having a discharge capacity of 48,600 cfs., comprises an uncontrolled, overflow, glory-hole crest structure, 72 ft. in entrance diameter; a concrete-lined vertical transition and shaft approximately 200 ft. deep; a 28-ft. diameter concrete-lined outlet tunnel 440 ft. long; and a 40-ft.-long concrete-lined outlet channel.

Designed for a capacity of 2,800 cfs., the outlet works consist of trashrack structures; a gantry crane and emergency bulkhead gate; two 90-in.-diameter outlet pipes through the dam, each controlled by a 54-in. hollow jet valve and equipped with guard valves; and concrete and steel operating platforms for the valves.

Alternates on bridge work

In addition to construction of Monticello Dam and appurtenant works, the specifications call for the relocation of 1.5 mi. of highway and the construction of a concrete bridge 449 ft. long crossing Putah Creek with a 26-ft. roadway; and a temporary detour connecting road 1.5 mi. in length, including a temporary timber bridge 224 ft. long with a 24-ft. roadway. Alternative bids are invited for the concrete bridge, calling for either a monolithic concrete bridge deck (Design No. 1), or for a precast, prestressed concrete bridge deck (De-

sign No. 2). Major quantities are shown in box on opposite page.

The Solano Project is a multiple-purpose development, authorized by the Congress in 1952 for initial construction, to conserve the run-off of Putah Creek by storage in the 1,600,000-acre-ft.-capacity Monticello Reservoir for the purpose of meeting the urgent needs for water at important national defense establishments and the municipal and industrial demands of the cities of Vallejo, Benicia, Fairfield, and Suisun, as well as to provide irrigation water in the county and flood control for the lower reaches of Putah Creek. The project development includes plans for future modification of Monticello Dam to provide generation of power.

Area to be served

The project service area lies between the Coast Range on the west and the Sacramento River on the east, at the extreme southern end of the Sacramento Valley. The southern edge of Solano County borders on Suisun and San Pablo bays, which are inland extensions of San Francisco Bay. Putah Creek flows along the northern border of Solano County after leaving an elongated drainage basin that extends northwestward into the Coast Range in Napa and Lake counties.

AT THE TOP OF THE PAGE

ARTIST'S SKETCH shows how the 295-ft.-high, arch-type concrete dam is supposed to look when finished. Specifications on the Monticello Dam project also call for highway relocation and construction of a 449-ft. concrete bridge across Putah Creek, 30 mi. from Sacramento.

SPECS for MONTICELLO DAM

... include major quantities tabulated here. The Solano Project is the first major work undertaken to provide comprehensive control of a west side watershed in the Sacramento-San Joaquin valley. A major purpose of the project, unlike others in the Central Valley, is to supply water for municipal use in cities immediately northeast of San Francisco Bay.

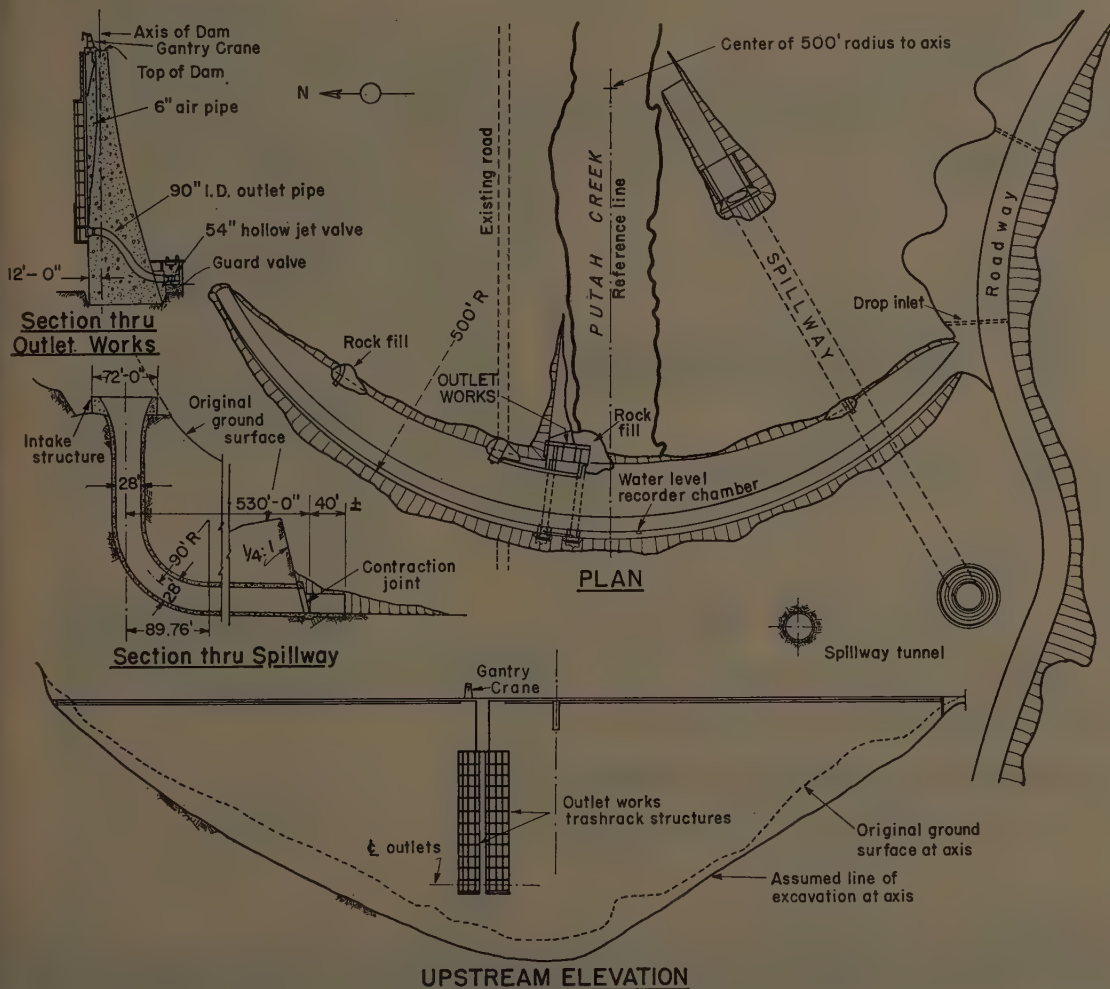
Streambed elevation at the dam site is about 190 ft. Dam crest is at el. 460. Foundation excavation will add some 25 ft. to the total height of the structure, with a grout curtain extending about 125 ft. into the foundation rock below.

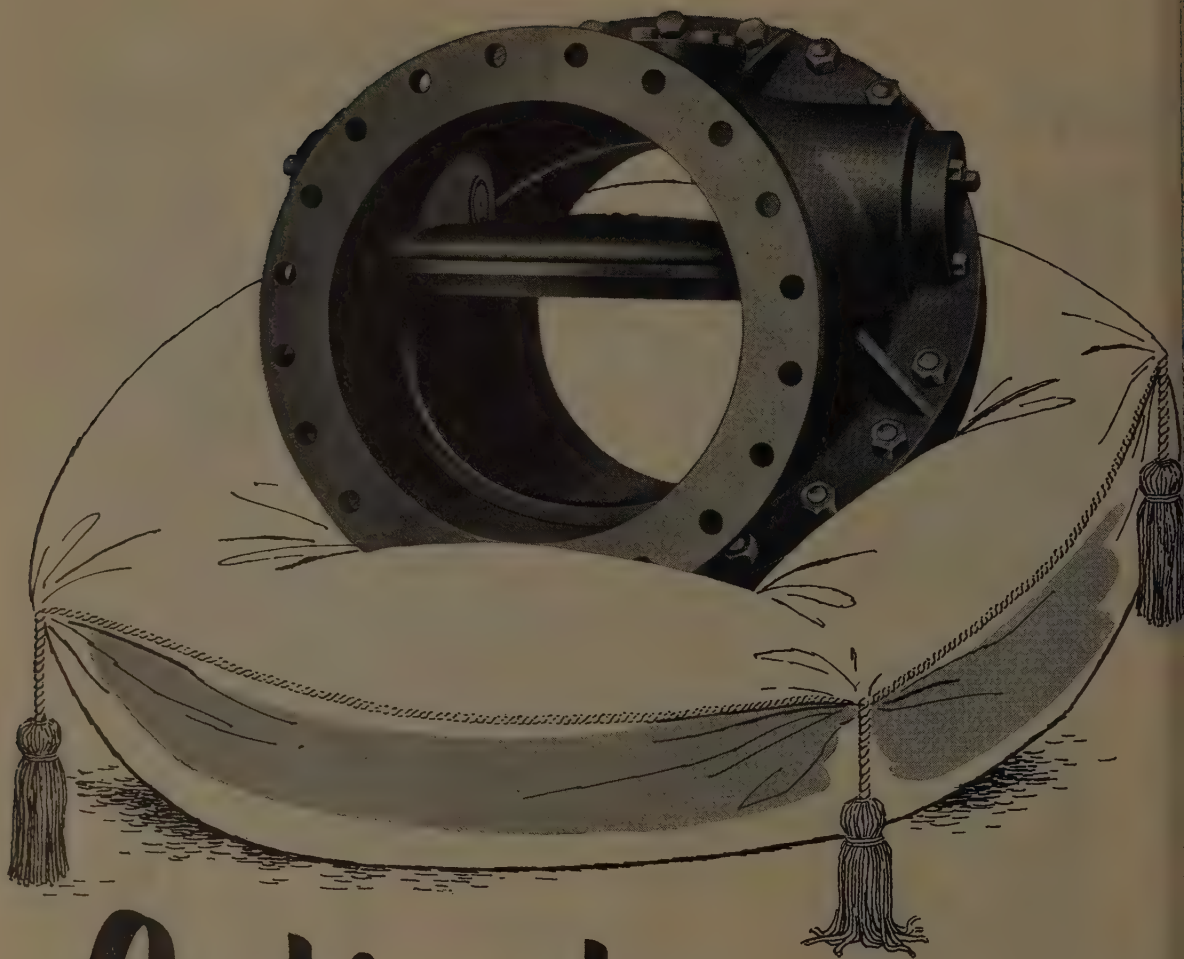
MAJOR QUANTITIES FOR THE DAM AND SPILLWAY

Concrete	(cu. yd.)	270,000
Excavation	(cu. yd.)	112,000
Drilling grout and drainage holes	(ft.)	50,000
Grouting	(sacks)	43,000
Furnishing and placing reinforcing steel	(lb.)	500,000
Installing mechanical equipment and related metalwork	(lb.)	735,000
Furnishing and installing permanent steel tunnel supports	(lb.)	100,000
Cooling concrete	(cu. yd.)	255,000

MAJOR QUANTITIES FOR CONSTRUCTION OF ROAD AND BRIDGE

Clearing right of way	(ac.)	26
Excavation, all classes, for roadway	(cu. yd.)	371,000
Overhaul of excavation for roadway	(station cu. yd.)	1,900,000
Backfill	(cu. yd.)	11,000
Furnishing and placing reinforcement bars in abutments and piers of Putah Creek bridge	(lb.)	170,000
Concrete in bridge deck, Design No. 1	(cu. yd.)	880
Furnishing and placing reinforcement bars in bridge deck, Design No. 1	(lb.)	220,000
Furnishing and installing miscellaneous metalwork for bridge, Design No. 1	(lb.)	21,000
Concrete in bridge slab, Design No. 2	(cu. yd.)	385
Furnishing and placing reinforcement bars in bridge slab, Design No. 2	(lb.)	88,000
Constructing and erecting precast prestressed concrete beams for bridge, Design No. 2	(beams)	32
Furnishing and installing miscellaneous metalwork for bridge, Design No. 2	(lb.)	26,000





Cushioned

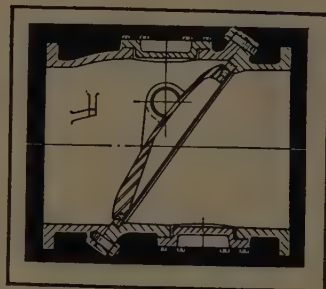
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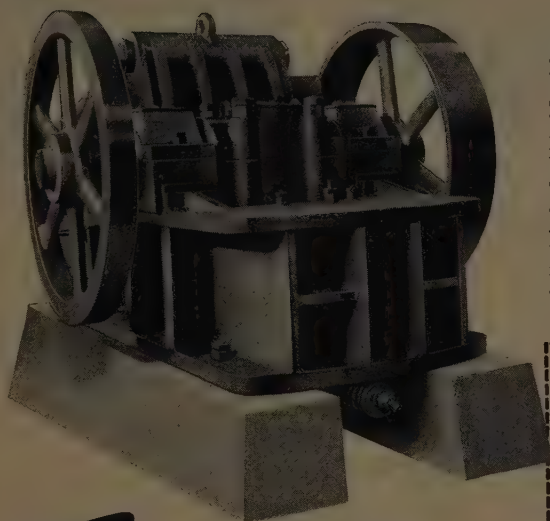
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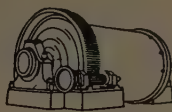
Primary Gyratory Crushers



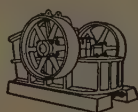
Rotary Kilns



Secondary Gyratory Crushers



Ball Mills



Jaw Crushers



Apron Feeders

HOW IT WAS DONE...

Steel bridge travels 200 mi. to new home

MOVING a 28-yr.-old, 413-ft.-long steel bridge some 200 mi. from San Diego to Calleguas Creek near Oxnard was accomplished smoothly by the Progressive Transportation Co. recently, despite the fact that the eight 104-ft.-long steel trusses were moved intact.

Two truck cranes were used to lower each of the 19-ton trusses onto semi-trailers and dollies. The trusses, which reached their new home via a highway route carefully selected to avoid overhead obstructions, were hoisted into

place by another pair of cranes.

The bridge, furnished by the Bailey Bridge Equipment Co., can safely carry H20-S16 loading, and its 28-ft. clear width can accommodate a 25-ft. roadway. When it is erected on the new piers, with a new reinforced concrete deck, it is expected that the structure will be equal to a new bridge. Macco Corp. dismantled and re-erected the superstructure and drove the foundation piling. Fred D. Kyle was general contractor.



*Whoops! the journey will soon begin—
its deck is off and ready to go*



*Mission accomplished,
here's the bridge up at its
new site, Calleguas Creek,
Ventura County*

Down comes the first truss



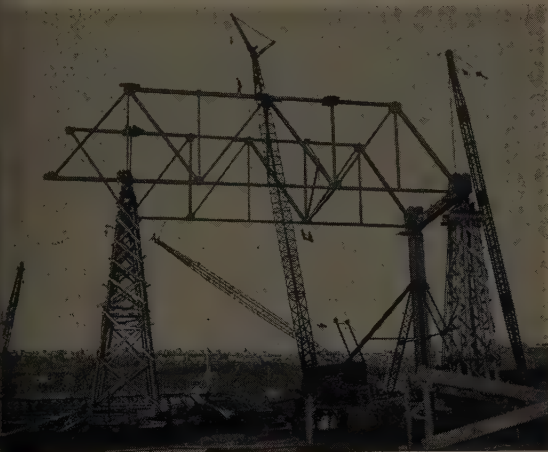
*... And now, somewhere on the road,
it turns a tight corner*



HOW IT WAS DONE

Temporary towers support largest cantilever roof

STARTING A building by placing the roof first sounds right, if you can figure out some way to keep it up in the air until you can build the supporting walls. But when the roof will probably turn out to be the largest cantilever type in existence when finished, as is the case with the new Boeing Airplane Co. hangar at Seattle, Wash., the problem becomes even tougher.



SUPPORTED on wooden towers until the permanent steel columns could be erected are the first roof trusses which will be placed on the new Boeing Airplane Co. hangar. Tiny figure of steel worker can be seen strolling nonchalantly on top of truss near center crane boom.

It was solved by placing the roof trusses on temporary wooden support towers, resembling oil well derricks, until the permanent steel supporting columns could be erected. These columns, by the way, are quite notable in that the roof, which is 780 ft. long and 206 ft. wide, is supported on only two of them. Each one is 65 ft. high, weighs 39 tons, and will support about 5,000,000 lb. of weight.

Since the columns are each about a third of the way in from the end of the building, ground anchors have been

set outside the hangar. Steel tension columns were run from the roof to the anchors for additional support. Each anchor point will be subjected to an upward pull of about 333,000 lb.

"The roof is like a bridge over a river, and we are putting it up like a bridge," said Charles Edmonds, project superintendent for American Bridge Division, United States Steel Corp., which held the steel structure contract.

Personnel on the job, which cost \$5,622,000, included Boeing representatives John Taylor, major project engineer; Russ Hutchinson, construction engineer, and Robert Braley, chief of contract construction. The general contractor was Howard S. Wright & Co.

Concrete saw speeds removal of asphalt pavement section



"THIS PARTICULAR job almost nailed my hide to the wall," comments Chester S. Yardley of Santa Rosa, Calif. The job consisted of sawing 1,800 ft. of 9-in. macadam base asphalt to a depth of 3½ in. Yardley's crew tackled this job using a Clipper Concrete Saw.

Although the 3½-in. deep cut specified by the city was a greater depth than is usually required, the job was completed in only 12½ hr., an average of 2½ ft. per min.

This sawing was done in order to facilitate the removal of a center section of E St. in Santa Rosa where an abandoned water main had caused the pavement to settle. Sawing before removing the failed area made possible a faster job and left straight, smooth shoulders to which to pour back the replacement material.

The city also specified that free-flowing traffic be maintained. This was accomplished by completing all sawing before starting the break-out. Another obstacle that had to be overcome was the possible rejoining of the asphalt at the cut which might result from the wheel traffic of heavy trucks and the 90-deg. summer heat. To prevent this, Yardley sifted fine sand into the finished cut.

Cheyenne finds a way to oust the rats and stench from city dump

A RAT-INFESTED, smelly eyesore was an accurate description of the Cheyenne, Wyo., city dump when Bob Adams, commissioner of public improvements, decided to do something about it. He obtained an International TD-18A crawler tractor equipped with a Drott Bulldam shovel, shown widening an eroded gully at the dump site, and had it spread, compact, and cover the refuse with between 18 in. and 2 ft. of dirt. Some 152 cu. yd. of refuse are dumped and covered daily. The new method has eliminated all fire hazard and smoke nuisance from the dump, eradicated between 15,000 and 20,000 rats, and provided the city with valuable industrial property.



HOW IT WAS DONE...

Steel sheets used as concrete forms

COCONUT TREE lumber is out of date in Hawaii, the land of the waving palms where they're putting up large reinforced concrete buildings these days.

Instead they're using Bethlehem Pacific's Mayari-R steel sheets, which are fabricated into concrete forms for floor slabs, columns, and walls on such projects as the Hawaiian Electric Power Plant, Iolani School, and the Kalihi Homes.



EASY AS PIE, well almost, to place Mayari-R concrete forms for a pour. This is the roof of Iolani School, near Honolulu.

ONCE the forms are in place, it's a simple matter to tie a network of reinforcing steel bars and dump concrete as fast as the crane will work.



Mayari-R is a special analysis steel whose greater strength results in important weight-saving advantages. It also possesses greater corrosive resisting qualities than ordinary carbon steel. It was selected for these patented concrete forms primarily because of its greater strength. After the forms had been used continually over a period of time, however, it became apparent that they withstood corrosion much better than mild steel.

They are fabricated from 12-gage Mayari-R sheets which are cut to specified width and length. Their edges are then formed on a brake. Final step in their fabrication is assembly and welding. While in use on the job, they are held firmly together by metal lugs.

During installation the Mayari-R forms are placed side by side on wooden supports. After a sufficient number are in place to cover a floor, reinforcing steel is placed over them. The concrete is poured, and after it has settled the forms are stripped away, leaving a smooth, marble-like finish to the concrete.

Simplified Thermit welding process used to join steel reinforcing bars

A NEW METHOD of joining steel reinforcing bars in long, continuous lengths has been developed by the Met & Thermit Corp. It has been field tested by the Corbet Construction Co. and has been found to meet the soundness and strength requirements of the State of New York Engineering Department.



IT'S EASY to weld steel reinforcing bars together when all you have to do is step back and let the mold do all the work. This shows 1 1/4-in. bars being welded on a bridge pier.

The new procedure, essentially a simplification of the 50-yr.-old Thermit welding process, is said to be speedier and more economical than electric arc welding or other welding methods.

Essentially the process, which is described as a pre-heatless weld, consists of using a split, pre-formed mold with a self-tapping crucible. The mold is clamped around the joint and luted, a metal disc is placed at the bottom of the crucible portion of the mold and covered with fine washed punchings, then the proper amount of Thermit is poured into the mold and ignited. All the operator has to do next is step back and watch. The whole weld can be made in 3/4 min. from start to finish. Compare this procedure with conventional welding methods.

Preliminary preparation for the weld consists of squaring the ends of the two pieces to be joined with an oxy-acetylene torch. This is to remove any injured metal caused by the shearing operation at the steel mill. The ends of the bars are cleaned of loose scale and slag and lined up roughly. The bars are spaced from 1/2 to 5/8 in. apart to allow space for the weld metal. Then they are ready to be welded.

LOTS of muck and mud was complicating earthmoving operations at a power plant, so the Euclid Road Machinery Co. put an experimental rubber-tired tractor on the job. Known as the Model TPM, or "prime mover," it is powered by a 300-hp. engine and is mounted on 24:00 by 25 tires. It weighs 48,000 lb., and comes equipped with a blank foot bulldozer blade. Working under extremely wet conditions, this TPM is loading scrapers with larger loads and in less time than is normally possible. For example, three 15.5-yd. scrapers are averaging 18.1 yd. each.



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And while you're there, watch the mobility on true tractor-type crawlers. Note how smooth hydraulic control enables the operator to "feel" the load at all times. It's easier on both man and machine. And far easier on maintenance. You'll sell yourself on P&H in a hurry.

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SALT LAKE CITY, Utah.....Western Machinery Company, 2300 South Main Street
SEATTLE 8, Washington.....Bow Lake Equipment Co., Inc., 300 Michigan Avenue
SEATTLE 4, Washington.....Glenn Carrington & Co., 91 Columbia Street
SPOKANE 1, Washington.....Construction Equipment Co., W. 1118 Ide Avenue

HOW IT WAS DONE...



DRIVING test piling for a proposed new bridge to replace the longest wooden bridge in the United States is a 20-ton Lorain Moto-Crane, Model MC-414, operated by a Hansen & Parr Co. crew (above). The barge, appropriately enough labeled "The Thing," is in Lake Pend Oreille, Idaho. The present bridge extends across the end of the lake near Sandpoint.



KEEPING CEMENT from sticking to the walls of storage bins is a problem which has concerned many manufacturers and users. One method of solving it was devised by the Stow Manufacturing Co., which suspended a Stow 2-hp. BU electric concrete vibrator from a pulley over the top of a storage bin and slipped the vibrator head into a pipe attached to the outside of the bin (below). Other pipes can be placed at different points on the bin so the vibration can be concentrated where it is needed.



REPAVING a street center strip with a minimum of hand labor and interference with traffic flow was accomplished by the Schloss Paving Co. by using a Warner & Swasey Gradall (left). The Gradall was used to rip temporary asphalt from the 4,900-ft.-long section and to grade the strip for the concrete base. E. C. Behrend (man in plaid jacket at left), the job superintendent, devised this wooden beam attachment to the scraper blade to spread and finish the 8-in. concrete base. The notched overhangs at the ends of the beam provided a 2 1/2-in. depth clearance to bring the hot mix top course up to grade.

Electric tool speeds big bolting job

AN EXAMPLE of how to take a tool which was designed for one purpose and adapt it to another purpose was demonstrated during construction of a new Coca Cola plant at Spokane, Wash.

The tool was the Thor Electric Impact Wrench, usually used for tightening and removing nuts rapidly in industrial assembly operations.

The problem facing E. N. Van Noy, job superintendent for the John H. Sellen Construction Co. of Seattle, the contractor, was how to tighten 10,000 1/2-in. bolts used to hold 5,000 form ties which held the wall forms for the building together and how to loosen them again after the pour was made and the forms were ready to be stripped.

Water-tight walls were specified for the building, which explains why so many form ties were needed for each pour. A Thor service engineer recommended use of the impact wrenches to speed up the operation. On-the-job comparison revealed that the automatic wrenches did the run-down and removal of bolts at about 10 times the speed of hand wrenches, and tired the workmen much less.



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UNIT A	1.26	.40	6.38	20-yd.	46,500 lbs.
UNIT B	1.09	.39	4.98	21-yd.	49,750 lbs.
UNIT C	.74	.40	6.25	18-yd.	48,250 lbs.

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AUGUST 1953

Hells Canyon controversy rages (continued)

LOTS OF HEAT but not much light has been generated in recent months in the controversial Hells Canyon Dam debate over whether or not the Federal Power Commission is going to approve the Idaho Power Co.'s application to build three power development dams on the Snake River near the Idaho-Oregon border.

The opposition stemmed from supporters of a long-time plan of the Department of the Interior to build a multi-purpose dam 510 ft. high at the site (*Western Construction*—February 1953, p. 92). This plan received a rebuff on May 5 when Secretary Douglas McKay announced that he was withdrawing his department's objection to the Idaho Power scheme (*Western Construction*—June 1951, p. 212).

After that, July 7 was the magic date, looked forward to by both sides as the day when FPC hearings would start. One of the first witnesses, Gen. Thomas M. Robins, retired from the Corps of Engineers, injected a new note when he told Commission members that the Hells Canyon site was actually only the third best in the area. He said that sites at Kooskia on the Flathead River and Nez Perce on the Salmon River would give better flood control but that strong local opposition to these sites had appeared.

Other new developments include a possibility that a group of public utility districts in southwestern Washington will apply to build a multi-purpose dam at Hells Canyon in accordance with the Department of the Interior's original plans, and an invitation to President Eisenhower to come out West and visit Hells Canyon so he could see for himself what was going on. This invitation was issued by the executive committee of the Washington State Grange, which is supporting federal construction of the dam.

Further encouragement to supporters of federal construction came from a report of an engineering study made by John S. Cotton, consulting engineer of San Anselmo, Calif., who was commissioned by the Interior Department last October 20 to compare the public and private power construction plans.

Cotton's report, in essence, said

that the multiple-purpose dam proposed by the Interior Department is "economically feasible, completely develops the power resources, and is most attractive from all points of view. The construction of this scheme would provide 600,000 additional low-cost firm kilowatts which otherwise would be lost forever."

On the other hand, Cotton said, Idaho Power's three-dam plan (which calls for dams from 120 to 270 ft. high at Brownlee, Oxbow, and Hells Canyon with a combined installed capacity of 695,000 kw.) "is much less desirable from an economic standpoint than the Hells Canyon multiple-purpose scheme proposed by the Bureau of Reclamation."

Idaho Power Co., however, is not without its supporters. Governor Len Jordan of Idaho announced he was in favor of the FPC's approving the private power project. He wrote Leon M. Fuquay, secretary of the FPC, that FPC approval "would be a genuine contribution toward maximum resource development by local enterprise rather than by federal appropriation."

Meanwhile Governor Arthur B. Langlie of Washington disagreed with the conclusions of the Cotton report. He said that his own engineering report, made by Holland Houston at his request, convinced him that federal construction of Hells Canyon was neither sound nor economical.

One more alternative dam site was proposed by Senator Henry Dworshak of Idaho, who announced that he favored a dam at Mountain Sheep where the Salmon and Snake rivers join. He came to this decision after preliminary conference with Army engineers and members of the Interior Department.

Bridges aren't wasted in Montana

RECLAMATION of bridges is being practiced in Montana where three former forest service spans which crossed creeks in the Hungry Horse Dam (*Western Construction*—July 1951, p. 97) Reservoir area were sold to Flathead County.

They will be joined to form a three-

span, single-lane bridge across the North Fork of the Flathead River at Polebridge. The old bridge was bolstered with two cables to hold it up through the summer until piling can be driven to support the new bridge.

Alaska public land review speeded up

SPEED-UP of a review of all public lands in Alaska reserved for Department of Interior activities has been ordered by Secretary Douglas McKay. He reported that lands which are no longer needed will be made available for sale, lease, or other disposal in accordance with public land laws.

FORMING AN X against the sky are these two crane booms, which are lifting the steel framework of the new office and laboratory building of the California Department of Public Health into place at its Berkeley site. Floyd Ross, State Division of Architecture, is resident engineer on the job. The steel beam (center) is being lifted by a Koehring No. 304 20-ton truck crane. The rear crane, mounted on the upper deck, is a Lorain rotating 12-ton crane rig. The Koehring has an 80-ft. boom and the Lorain has an approximately 85-ft. boom. Both cranes were rebuilt in the shops of Independent Iron Works, which holds a \$440,000 contract for steel erection.



Folsom Dam work going full speed ahead

WORK ON Folsom Dam on the American River in California started on a 24-hr.-a-day basis in July as soon as a cofferdam was high enough to avert the river's flow and permit concrete pouring operations to start on the main structure.

The project has been plagued by a series of storms in recent months. *Western Construction*—June 1953, p. 41; March 1953, p. 96; February 1953, p. 92) which have washed out the cofferdam just as it was in a position to start shunting the river through the diversion tunnel.

Army engineers want to place 110,000 cu. yd. of concrete before the rains start again. This will make the main dam high enough so that the cofferdam will not be needed any more, they say.

About 60% of the right wing, earth-fill dam has been finished, according to Col. C. C. Haug, Sacramento district engineer for the Corps of Engineers. Haug added that 1,800,000 cu. yd. of fill remain to be placed in the eight dikes which will help impound 1,000,000 acre feet of water, expected to fill the upstream reservoir after the job is finished.

Results of the various floods seem to have reached as far as Washington, D. C. There the Senate earmarked \$9,000,000 for Folsom Dam in the Corps of Engineers Civil Works budget for this year. This was \$1,000,000 more than the House of Representatives allowed the project in its version of the same bill. By the time this appears in print, the actual amount allowed should be known, since from all indications Congress was working toward an August 1 adjournment.

Wot hoppen'd?

THE MYSTERY of where the 100-ft.-long center section of an 18-ft.-wide bridge over the Spokane River near Post Falls, Idaho, disappeared was being pondered by local highway officials recently. They said that the river was flowing too swiftly for a search boat to be launched. Maybe they should try a classified ad.

Annual report available on Upper Colorado River

THE FOURTH Annual Report of the Upper Colorado River Commission, dated March 30, 1953, has been made available to the public at a cost of \$1 a copy.

It includes a review of the findings on the study of the inflow-outflow method during the last year and a report on reservoir evaporation studies. It also contains a copy of the bill to

authorize the Secretary of the Interior to construct, maintain, and operate the Colorado River Storage Project and participating projects.

Copies may be obtained from the Upper Colorado River Commission, 520 Rood Avenue, Grand Junction, Colorado.

Mare Island naval shipyard gets \$6,700,000 addition

MAINTENANCE and repair of electronics equipment for the U.S. Navy will be done in one building when the new five-story, \$6,700,000 structure

now being built at the Mare Island Naval Shipyard, Vallejo, Calif., is finished.

The building, which will measure 200 by 168 ft., will be supported by some 90 reinforced concrete columns, 32 ft. high, containing 2,200 tons of reinforcing steel in 1½-in. and 1⅝-in. diameter rounds and 1-in. squares. Two large traveling cranes will be placed in a high runway wing on one side of the windowless building.

Holding the general contract on a joint venture are Grove, Shepard, Wilson & Kruge of California, Inc., and Fred J. Early, Jr., Co. Bethlehem Pacific Coast Steel Corp. is providing the reinforcing steel.



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Tilt-up construction manual available

PUBLICATION of Part I, Construction, of the new and revised manual on precast concrete tilt-up construction by F. Thomas Collins, consulting engineer and well-known authority on the subject, should be good news for all concerned in these days when interest in tilt-up construction is continually growing. Collins outlines all facets of tilt-up methods, giving concise coverage to such topics as tilt-up history, patent situation, lifting platforms, bond breakers, forming panels, special inserts, concrete admixes, lightweight mixes, curing concrete, erection technique, bracing, foundations, painting tilt-up, connections, roof slabs, lift slab, prestressing walls, prestressing girders, sandwich slab construction, costs, subcontractors, labor saving items, estimating, and scheduling operations. The various construction details are illustrated by drawings and diagrams by the author. This 70-page manual is priced at \$25 per copy, plus sales taxes that apply. It is available to professional organized groups and to students at a special rate of \$2.50 per copy. Collins plans to handle the subscriptions through the schools of engineering and Associated student book stores on each campus. Part II, Design, outlining engineering fundamentals for the layout and structural design of precast concrete, both conventionally reinforced and prestressed, will be available soon. Further information and copies of Part I can be obtained from F. Thomas Collins & Associates, Consulting Engineers, Box 212, San Gabriel, Calif.

WASHO testing reported

TESTING at the WASHO Test Road near Malad, Idaho (*Western Construction*—June 1953, p. 68), is proceeding according to schedule and will continue until the subgrade freezes in late fall.

Test trucks with tandem axles loaded to 32,000 and 40,000 lb. per pair of axles operate over varying thickness of asphalt pavement in the two lanes of one test loop. Single-axle units, loaded to 18,000 and 22,400 lb. per single axle, operate over identical pavements in another test loop. Present plans for 1954 call for operation during the spring break-up when the most goes out of the sub-soil.

Operations this year have been in warm weather. The moisture content of the subgrade soil has increased so the underlying soil is less stable. Thus, the first 1,000 axle applications caused marked damage to some of the 6-in. sections, amounting to failure in the wheel path nearest the pavement

Gillette, Wyoming, then . . .



Editor, *Western Construction*:

In the July issue of *Western Construction*, on page 83, the article "Gillette, Wyoming, uses soil cement base on city streets" naturally interested me because I spent a few years around 1919, as District Engineer for the State Highway Department, covering the five northeast counties of that state. This was right after the first World War and road building was just getting started in that territory. At that time it consisted principally of new alignment, putting in culverts and cattle passes, and grading with very little desirable surfacing material. In fact, I am sending you a picture of the main street in Gillette (the same one as illustrated in your article where a soil cement base had been constructed) showing conditions as they existed around 1919 or 1920.

It is possible that you may want to reproduce it as a matter of interest to some of your readers in Wyoming.

J. E. JELICK, Manager
Portland Cement Information Bureau
San Francisco, Calif.

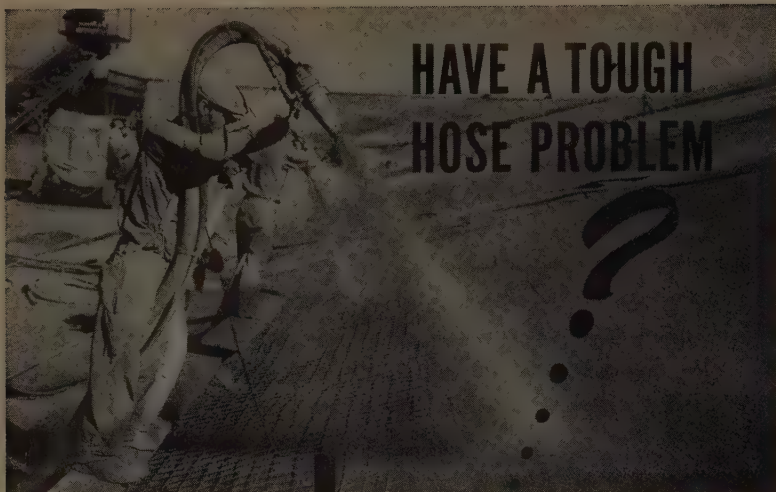


. . . And now (30 years later)

edge. Damage has also been noted in some spots of the outer wheel path of the 10-in.-thick sections. No serious distress is yet evident in any of the 14-, 18-, or 22-in. sections, however, aside from minor depressions in the wheel paths.

Pavement behavior thus far was anticipated by the design engineers, who included sections which were underdesigned as well as those considered adequate or overdesigned. Minor pavement failures, consisting

of rutting and cracking of the asphaltic concrete surface, are repaired by means of thin bituminous skin patches. When it is no longer possible to carry traffic over these areas by means of skin patches, the immediate failed area is rebuilt in order to avoid penalizing adjacent sections. The pavement maintenance and reconstruction required by the failures this summer will be conducted in such a manner as to delay test traffic as little as possible.



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SAFETY

Job accidents take their toll

THESE were the accidents that resulted in death or serious injury on the West's construction jobs during the last reported month:

Oliver Bryan, 30, was killed instantly on May 24 at Cheyenne, Wyo., when the asphalt tank-truck on which he was working exploded and burst into flame. H. B. Bryan, his father, Bill Bryan, a brother, and Cal Woll were injured in the blast. According to bystanders, the men had been using a weed burner to heat up asphalt deposits in the bottom of the tank.

An avalanche swept a snowplow and the four-man crew which was clearing a road with it over a 2,000-ft. drop on May 26 in Glacier National Park, Mont. William Whitford, 45, the driver, and George Beaton, 45, were found dead under tons of snow. Frederick E. Klein, 31, was taken to a hospital at Whitefish unconscious and in critical condition. The fourth man, Jean M. Sullivan, 59, was buried under snow in a sitting position for 8 hr. before he was found by members of the 60-man rescue crew; yet he apparently suffered no serious injuries.

ACCIDENTAL DEATHS and serious injuries on the West's construction jobs are reported each month in the interest of promoting safety-on-the-job.

Dominick Asprea, 53, a sewer contractor, was killed May 28 at Lake City, Wash., when a 13-ft. deep excavation he was inspecting caved in and buried him. Police said there were no supporting timbers to shore up the sandy soil.

Chester E. Erickson, 41, suffered fatal injuries on May 19 at Ruth, Nev., while working on an electric shovel.

James Oliver, 40, was killed on May 7 near Othello, Wash., when a grader which he was operating overturned.

Romulo Cerruti, 37, suffered third-degree burns of his feet, body, and arms on May 22 while working on a construction project near Paso Robles. He stepped on a fallen power line carrying 12,000 volts.

Mike Mullins, an employee of the George I. Miller Construction Co., was injured on May 12 at Reno, Nev., when a 6-ft. bank caved in and partially buried him.

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Mexico; Foulger Equipment Co., Salt Lake
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Co., Helena and Billings, Montana; Columbia
Equipment Co., Portland, Oregon; Star Ma-
chinery Co., Seattle, Washington.



CASE

By CLIFFORD S. CERNICK, Anchorage

SOURCE OF SUPPLY for contractors in Alaska that's quite commonly overlooked is military surplus, which is still available from time to time at Elmendorf, Ladd and Eielson airfields. Range of items available often include heavy equipment, tires and replacement parts—items which can be readily absorbed on both big and little jobs.

PROBLEMS OF CONSTRUCTION in the far north still are stumping engineers and construction men who have to face them. Local engineers point out that in the Arctic and sub-Arctic Nature is very often the construction man's biggest obstacle. Recently, Col. Berndt Balchen of the Air Corps called on engineers to help solve such problems, including development of fuels, lubricants and explosives to meet Arctic requirements. Also needed is development of materials and methods for all-year-around construction such as concrete pouring and mortar fabrication.

MOTHBALLS FOR BARROW: One of the biggest oil ventures in the north—the Navy explorations at Point Barrow—is going into mothballs indefinitely. Construction experts, U. S. Navy officials and oil men are "closing the project out." Work was stopped on the venture, according to Capt. Robert H. Meade, director of Naval Petroleum reserves, "... after serious consideration and full consultation of congressional Armed Forces committees."

BIG STEP FORWARD in development of Alaskan timber resources has been taken with opening of Alaska Plywood Corp.'s multi-million dollar Juneau plant. Plant is now beginning to harvest Alaska's vast spruce forests, and is first plywood mill established in Alaska.

CIVILIAN CONSTRUCTION TEMPO in Alaska cities indicated by the fact that Fairbanks civilian projects amounting to \$2,607,833 started in first six months of the year. Commercial building in major cities including Anchorage, Fairbanks, Juneau and Ketchikan is important part of the economy of these cities, although military construction is major activity.

SEWARD BOOMING—Destruction of military dock at Whittier in \$20,000,000 fire has caused diversion of cargoes to Alaska to seaport of

Seward, now experiencing a boom and heavy influx of workers by reason of the transfer. Plans meanwhile proceeding for rebuilding of the Whittier facility.

FAIRBANKS HOTEL is being planned to ease the severe housing shortage there, and adequately accommodate tourists. Arrangements for a campaign to raise funds are being carried out in Fairbanks by the Hockenbury Hotel System. Preliminary plans for the building contemplate a seven-story structure in the \$1,000,000 class.

HOUSING CONSTRUCTION in Alaska continuing at full tilt during around-the-clock daylight period. More than 1,000 individual houses being completed in Anchorage area alone. Indication as to extent of individually-financed housing in territory is FHA announcement that Alaskans have made loans totalling \$90,545,710 with the Federal Housing Administration since 1934. Already constructed in the territory under FHA are 4,221 single-family units and 4,034 multi-family units (apartments).

OIL BOOM CITY RISING—One of America's biggest oil concerns setting up a new town at Icy Bay as headquarters for oil explorations along Alaska's west coast. Five hundred tons of equipment being used by the Kerr-McGhee company, which is handling construction of the "oil town." An air strip has been constructed and materials can be landed on the ocean beach by using small barges. The oil exploration is being carried out over an area of 1,024,403 ac. of land in the coastal area by the Phillips Petroleum Co.

HOW COLD IS PERMAFROST? Engineers of the U. S. Geological Survey want to find out. This summer they plan to measure temperature of perpetually frozen ground in the interior of Alaska. Temperature checks will be taken from a few feet below grass roots all the way down to bedrock. Difficult problem in making the temperature readings at various subterranean levels will be how to drive through rock-hard frozen ground without thawing it.

ALASKA JOB-SEEKERS WARNED: Governor B. Frank Heintzleman has asked would-be construction workers to stop coming

to the territory unless they have in advance. Alaska's governor in the unemployment problem in the territory as one that is "rapidly coming critical." Many unskilled are stranded in Alaska without fuel to return home, Heintzleman pointed out. He added that construction volume had not reached anticipated high peak this year.

HYDRO PROJECT FOR KENAI is aim of Great Lakes Electric Power Inc., of Anchorage which has applied for a permit to put up hydroelectric facilities at Grant Creek and Gr. Lake on Alaska's Kenai Peninsula. Company plans to serve several towns, including seaport of Seward, Kenai and Moose Pass.

ALASKAN GLACIERS may reveal answer to a number of perplexing construction problems. Seeking the answers is a group making intensive studies of these massive rivers of ice. Group, known as Juneau Ice Field Research project, is headed by Dr. Lawrence E. Nielsen, scientist who leaves from Monsanto Chemical Corporation. Road construction in Alaska, often hampered by encroachment of glaciers, may benefit by results. Things scientists will study include rate of movement of these ice fields. Group will also try to find out why Taku glacier is advancing at a time when most others are retreating.

BETTER PHONE SERVICE Alaska is aim of Alaska Communications System, a governmental agency which has announced plans for \$7,004,449 construction program during coming year. ACS plans to add several new channels to the 11 now linking Alaska with the states.

PERSONNEL PROBLEMS of the District Engineer office in Alaska are being partially solved by current program of student aide training. Forty-seven student engineers, including one Egyptian student and two born in Shanghai, are now at work in the Anchorage District Corps of Engineers office. The men were recruited from colleges throughout the United States, Canada and Alaska. Jobs allow students to earn money while gaining practical experience in his chosen profession, and provides DE with pool of potential manpower.

ROADS: Road-building in Alaska continues apace in Alaska's interior with work being pushed on several major arteries including the newly opened Anchorage-Seward highway and Richardson and Glenn highways (mostly maintenance).

Defense roadbuilding is strong factor with Alaska District Engineer calling for paving bids covering nearly every unpaved road on Elmendorf Airbase, largest in the territory.

astal town plans seawall project

CONDONDO BEACH, Calif., has hired R. L. Patterson to prepare an overall plan for a seawall project which will provide a permanent barrier against storms from the Pacific Ocean, which have often battered the community in recent years.

id calls issued for Snowy Mt. project

THE SNOWY MOUNTAINS Hydroelectric Authority of Australia has called for three bids on work expected to cost more than \$100,000,000. The work will involve driving the Cumabene-Tumut Tunnel to a 21-ft. diameter through 14 mi. of the Great Dividing Range; building the Tumut Pond Dam (concrete arch type) 290 ft. high; and building a large underground power station on the Upper Tumut River, installed capacity to be 20,000 kw.

Sutherland Dam work will end—after 27 yr.

COMPLETION DATE on Sutherland Dam, near San Diego, Calif., has been scheduled for the first of the year. This isn't so unusual, but the fact that the dam was started 27 yr. ago is. It was abandoned for lack of funds in 1928 and stood idle until 1952, when a completion contract was awarded to Bent Construction Co. and George Daley Corp.

Salt Lake sewer system may be financed by bonds

A PLAN to finance the proposed Salt Lake County (Utah) suburban sewer system was presented to county authorities by members of a financial firm which had been acting as fiscal agents of the district.

The main outfall sewage line and treatment plant would be paid for by issuing \$2,410,000 in general obligation bonds, if the plan is accepted. Then \$6,480,000 in revenue bonds would be issued to finance building the rest of the project, which would include tying in the various districts to be serviced by the new plant.

A-bomb cracks Nevada dam

SEVERE CRACKS in the face of Loon Lake Dam near Georgetown, Nev., were caused by recent atomic bomb tests at Frenchman's Flat, according to local public utility district officials. They reported that one jolt was especially sharp, its concussion moving a water flume 1 ft.

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ENGINEERS ON THE MOVE

Wilbur A. Dexheimer has been named new Commissioner of the Bureau of Reclamation by President Eisenhower, filling a post left vacant since the resignation of Michael W. Straus in February. Dexheimer, a Denverite and a long-time employee of the Bureau of Reclamation, was recently in Australia as advisor for the Snowy Mountain Hydroelectric Authority's construction preparations for the Adamaby Tunnel, the longest and largest irrigation tunnel in the world. Before the announcement of his appointment to the top Reclamation post, the Interior Department stated that Marvin C. Nichols of Dallas, Tex., previously mentioned as possible new Commissioner, had requested that his name be withdrawn as Secretary of the Interior Douglas McKay's choice for the job.

Francis C. Burton was appointed traffic engineer of Albuquerque, N. Mex., succeeding David F. Dabney, who resigned last December.

Mike Miller, a vice president of Henry J. Kaiser Co., has been placed in charge of all activities connected with joint venture work concerning Kaiser Engineers Div., Henry J. Kaiser Co. He has been associated with the heavy construction industry for many years, having joined Kaiser at the time of Hoover Dam construction. He then moved on to Bonneville Dam; later to Grand Coulee Dam, where he became manager during the last year of its construction, and in 1941 became general manager of one of the three Kaiser shipyards at Vancouver, Wash. His new head-

quarters will be in Oakland, Calif., necessitating a move from Willow Run, Mich., where he has been located since the close of World War II.

Recent changes in the city staff of Olympia, Wash., resulted in the appointment of Leland L. Spahr, former construction superintendent for Matthew McCarthy Co., as city engineer. He succeeded Charles H. Williams. Ray Force, former superintendent of streets, has been replaced by Robert Wood, field engineer in the city engineering department. Chester Kirsop, formerly city electrical inspector, now supervises traffic engineering. W. R. Turner, city building inspector, has been appointed city superintendent of buildings and grounds.

Donald F. Bolton has resigned from the California Division of Highways, for which he was a bridge engineer, to accept a position as assistant to the chief bridge design engineer of the Alaska Road Commission at Juneau.

W. F. Henager, Jr., is now job engineer and superintendent for Guy F. Atkinson Co. on a dredging and sand drain highway job at Marysville, Wash. He was formerly with Atkinson as field engineer at Swan Island, Portland, Ore.

After serving two years as engineering consultant with the House Committee on Interior and Insular Affairs in Washington, D. C., James K. Carr has resigned to accept a position as consulting engineer of the

Sacramento (Calif.) Municipal Utility District. Carr was with the Bureau of Reclamation at several posts in California before his association with the House Committee.

Carl D. Franks, for 14 months executive vice president of the Portland Cement Association, has been elected to the presidential office, succeeding the late Frank T. Sheets. His new post is the culmination of many years service with the Association beginning in 1916 when it first was established. Before starting his most recent service as executive vice president, he was vice president for promotion, supervising all the Association's promotional activities, including the work of 27 district offices serving cement users in 46 states, the District of Columbia, and British Columbia.

According to the announcement made by R. A. Hummel, Chairman of the Board of Directors, G. Donald Kennedy has been elected executive vice president, succeeding Franks, and E. F. MacArthur has been elected treasurer, succeeding the late A. B. Stall. Appointments were all effective May 18, date of the beginning of the Association's Spring Meeting held in New York City.

Recent reorganizations in the staff of Pacific Gas & Electric Co. resulted in the following appointments: Dunlap D. Smalley, vice president of operations, is now vice president and assistant general manager. George H. Hagar succeeded him as vice president of operations. Arthur J. Swank, manager of general construction, is now vice president of general construction.

Thomas B. Copeland, formerly operating man and manager of P. G. & E.'s Shasta Division, was appointed general superintendent of transmission and distribution. He succeeds George A. Peers, who is now manager of electric operation, a position formerly held by Hagar. Copeland has been succeeded by Leigh H. Smith, manager of the company's Richmond district.

Ira W. Collins is now assistant to George H. Hagar. Every operational detail in P. G. & E.'s electric system is under his immediate direction. He, in his turn, has been replaced as general superintendent of power control by Jack H. Martin. Robert H. Miller, formerly general superintendent of communications, is Martin's new assistant. Robert L. Brinton succeeded Miller in charge of P. G. & E.'s network of radio and telephone communications.

The Pacific Northwest Conference, American Society of Civil Engineers, elected new officers at its convention in Seattle in the middle of May. Professor Fred H. Rhodes, Jr., Univer-

RESIDENT ENGINEER on the Box Canyon Dam diversion tunnel (see pages 75-76) for the Harza Engineering Co. is A. E. Gilligan (left). Pacific-General-Shea holds the \$7,721,389 contract, and project manager on the job is Charles Bisorti (right).



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359 - 359A	2½ to 3 tons
353 - 353A	Medium
354 - 354A	Heavy-Duty

ONE-WAY SECTIONAL TRIP PLOWS

271 - 271A	1½ to 2½ tons
272 - 272A	2½ to 3 tons
273 - 273A	3½ to 5 tons
275 - 275A	5 tons and up

"V" PLOWS

261	1½ to 2½ tons
262	2½ to 3½ tons
263	3½ to 5 tons
265	5 tons and up

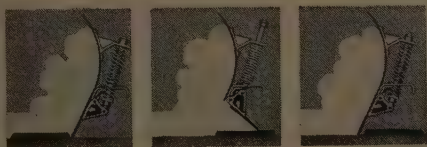
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Snow Plows are *rugged*; reinforcing and bracing were developed from tests under the most adverse conditions.

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Baker Sectional Tripping feature. Blade swings back over obstruction; snaps back fast into normal position.



THE BAKER MANUFACTURING COMPANY • SPRINGFIELD, ILLINOIS

sity of Washington, is chairman; **Harold J. Doolittle** is vice chairman; **Hamilton K. Johnson** is secretary-treasurer, and **Glen Holcomb**, head of the Oregon State College School of Engineering, is director.



George M. Williams
(see item
below)

George M. Williams is the new Division Engineer of Division 9, Bureau of Public Roads, heading BPR activities in New Mexico, Colorado, Wyoming, Utah, and part of South Dakota. He succeeds **B. W. Matteson**, who retired recently after 18 years in the position. Williams' headquarters are now in Denver. He joined BPR soon after graduation from the University of Colorado in 1927, and later transferred to the San Francisco office. During World War II he was an engineer on the Alcan Highway. In 1948 he served as chief bridge engineer in the Philippines. Before his new appointment, he was in charge of the BPR forest-park unit out of San Francisco.

W. E. McKibben, locating engineer for the Washington State Highway Department's Spokane district, was promoted to assistant construction engineer at Olympia headquarters. **B. L. Huffman**, formerly district resident engineer, succeeded McKibben in Spokane.

C. A. Winnet, engineer of Columbia County, was elected president of the Washington State Association of County Engineers at their annual convention at the end of May. **Earl Barnwell**, Snohomish County Engineer, is 1953 vice president, and **B. Loyal Smith**, Walla Walla County Engineer, is secretary-treasurer.

After 28 years with the Corps of Engineers, **Joyal R. Morton**, construction chief and special assistant to the district engineer at Sacramento, recently resigned to accept a position as advisor on construction problems for Morrison-Knudsen Co., Inc. His resignation caused District Engineer **Col. C. C. Haug** to do considerable shuffling in that area. **Lt. Col. John B. Beckham**, who has been supervising military construction since April 1952, immediately assumed Morton's civilian construction role. **Robert B. Jenkinson** moved along from his position as project engineer at Folsom Dam to become Haug's special assistant. **Charles F.**

Beatie, project engineer at the nearly completed Pine Flat Dam, will take over Jenkinson's duties at Folsom Dam. Both projects, which are almost identical in size, are located in the foothills of the Sierra Nevada.

Morton, incidentally, earned the nickname of "dean of the rivers" during his long employment at Sacramento. He was involved in construction of the Stockton deep water channel, and drainage and control work in the Sacramento Valley.

CALENDAR OF MEETINGS

Sept. 1-4—Joint Meeting, International Association for Hydraulic Research and Hydraulics Division, American Society of Civil Engineers, University of Minnesota, Minneapolis.

Sept. 10-12—American Concrete Pipe Association, annual short course school of instruction at Sherman Hotel, Chicago, Illinois.

Sept. 14-16—Associated General Contractors, mid-year board meeting at Edgewater Beach Hotel, Chicago.

Sept. 19-20—Executive Committee, American Concrete Pipe Association, annual meeting at Castle Harbour Hotel, Bermuda.

Sept. 24-25—American Road Builders' Association, County and Local Roads Division, national highway conference at Dell View Hotel on Lake Delton, Wisconsin.

Oct. 7-9—Western Association of State Highway Officials, annual meeting at La Fonda Hotel, Santa Fe, New Mexico.

Oct. 8-10—Region 11, Associated Equipment Distributors, annual meeting at Pebble Beach, Calif.

Oct. 8-10—American Concrete Pressure Pipe Association, annual convention at Ponte Vedra Inn, Ponte Vedra, Florida.

Oct. 8-10—Structural Engineers Association of California, fall convention at Ahwahnee Hotel, Yosemite National Park, Calif.

Oct. 14-16—National Reclamation Association, annual meeting at Mapes Hotel, Reno, Nevada.

Oct. 15-18—Region 12, Associated Equipment Distributors, annual conference at Gearhart Hotel, Gearhart, Oregon.

Oct. 29-30—Southwest Regional Meeting, American Concrete Institute, at Rice Hotel, Houston, Texas.

1954

March 1-4—Associated General Contractors, 35th annual convention at Statler Hotel, Los Angeles.

DEATHS

John W. Isbell, 90, founder of the Isbell Construction Co. of Reno, Nev. (*Western Construction*—September 1948, pp. 103-104), died July 12 at San Diego, Calif., where he had been living in retirement, after a lingering illness.

His family came by wagon train from Buffalo Springs, Tex., his birthplace, to Southern California in 1880 when he was 5 yr. old. His first construction job was on the Santa Fe Railroad north from San Diego. Then he built roads and became road commissioner for San Diego County.

In 1913 he formed the contracting firm with his sons, building roads all over Southern and Central California and expanding the firm with every contract. During World War II, the firm engaged in a stripping operation at Kimberly, Nev., and has operated in Nevada and Northern California ever since.

Franklin A. Stratton, 39, a civil engineer with the Bureau of Reclamation, died June 15 at Medford, Ore.

Charles Hugh Paxton, 78, retired engineering instructor at UCLA, died June 21 at Los Angeles.

William Laughland, 82, a retired Oakland, Calif., contractor, died June 8 at Sacramento.

Howard M. Smitten, 75, a Berkeley, Calif., consulting engineer, died June 30 at Tucson, Ariz., of a heart attack. He had been in Arizona on a bridge job for the Utah Construction Co.

Ronald D. Coleman, Jr., 33, a superintendent with the Delbert Beebe Construction Co., was killed in an automobile accident on June 16 at Hawthorne, Nev.

Roy L. Bair, a Spokane, Wash., contractor, died July 2. He was a past president of the Spokane Chapter, AGC, and had served as a national director of the organization.

L. J. Howard, 38, in charge of the mechanical shop for Glenn Groves Electrical Contractors at Ephrata, Wash., was killed in an automobile accident May 31.

E. E. Kalbaugh, a field engineer with Trojan Powder Co., died May 19 at Sacramento, Calif.

Richard A. Davies, 78, retired civil engineer, died May 6 at Seattle.

**AD HARSH
CONCRETE
FAST**

BLAW-KNOX CONCRETE PAVING SPREADERS

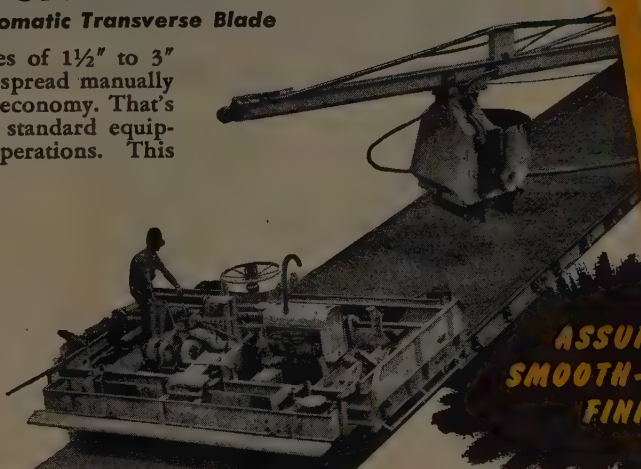
with the Automatic Transverse Blade

MODERN harsh, dry mixes of 1½" to 3"

lump concrete are extremely difficult to spread manually or by makeshift methods with speed and economy. That's why Blaw-Knox Spreaders have become standard equipment in so many high-speed paving operations. This spreader with the Transverse Blade is the *only* spreader that automatically moves the concrete longitudinally and transversely at the same time, spreading it uniformly to the width and elevation required, no matter where it is placed on the subgrade.

A Vibratory Attachment may be added to compact the concrete simultaneously with the spreading operation, increasing its density and strength and insuring dense pavement edges, free from honeycomb. Blaw-Knox Spreaders easily keep pace with the output of two 34-E pavers.

Available in two standard adjustable widths—10' to 15' and 20' to 25'.



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FINISH**

BLAW-KNOX FINISHING MACHINES

This double-screed pavement finisher assures high daily production and a smooth-riding finish regardless of the type of concrete mix used. Its rigid and sturdy structural frame is combined with proper weight distribution to minimize weaving and lateral thrust on the side forms, even when operating on concrete that is dry, harsh and difficult to manipulate. The large, wide front and rear screed ends prevent wastage of concrete over the side forms. Both standard sizes—10' to 15' and 20' to 25'—are easily and quickly adjustable for width. Screeds are telescopic.

Blaw-Knox Finishing Machines are available with a Vibratory Attachment for consolidating and compacting difficult mixes of concrete, assuring a smooth finish while maintaining maximum production schedules.

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FOR**

HIGH-SPEED, LOW-COST CONCRETE PAVING CONSTRUCTION

Mechanization is the key to greater efficiency and economy in modern concrete paving operations. And the key that opens the door to greater profit on *your* job is 100% mechanization with the Blaw-Knox "Complete Package" of concrete construction equipment, developed to bring unified, balanced, "assembly-line" methods to road building operations. The Blaw-Knox "Complete Package" of cost-cutting equipment contains every piece of equipment you need, from forms to finisher, to give you the step-by-step mechanization that assures high-speed, low-cost concrete paving construction.

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SUPERVISING THE JOBS



Ed Edwards (left), shovel operator; Bill Taylor (center), master mechanic, and Roy Austin (right) are Ukropina-Polich-Kral crew members at work on Farmington Dam and rock plant, Calif. Dam project manager is A. J. (Swede) Ingwersen; general superintendent is Paul Wilcox; C. W. Le Count, assisted by Lindy Rogers, is office manager, and George Welton is foreman. Ingwersen supervises at the rock plant, where Tom Gibson is foreman.

Glen Dusky is superintending a \$194,302 award for 8 miles of grading and draining in Lewis and Clark County, Mont., for Otis Williams Co.

B. G. Andrews is superintending for Gibbons & Reed Co. on a \$140,771 award for 7½ miles of surfacing near Riverside, Clark County, Nev.

J. C. Lawrence project manager, is heading construction of the Wilsonville Bridge in Oregon for Guy F. Atkinson Co. W. J. Clough is job engineer; B. M. Baker, Clyde Estep, John Goss, W. J. Finucane, Floyd Neff, and Floyd Jasper are pile driver foremen; Hugh James is concrete foreman; Curtis Jondahl is office manager, and Robert McKenzie is office engineer.

Construction of the Ebey Slough Bridge at Marysville, Wash., a million dollar award held by Guy F. Atkinson Co., is headed by L. O. Grossnickle, general superintendent. Other key men are: Harold Percival, carpentry superintendent; Ben Veenhuizen, master mechanic; "Whitey" Berg, pile driver foreman; Gordon Hamm, concrete foreman, and Al Linschied and Charles Saar, carpentry foremen.

Twelve employees of the Wyoming State Highway Department received service awards on the first of May. Gardner Manfull, project engineer, and Martin Bergin, maintainer, received 30-year awards. Other recipi-

ents were: Art Woodward, head bookkeeper, and Otto Leisinger, maintainer, 25 years; Horace Titus, chief bridge designer, 10 years; Thomas Bader, section foreman; Ernest Bennett and Ralph Miller, rodmen; Elmer Hitt, engineer; E. C. King and M. K. Wright, mechanic's helpers, and William Matthews, maintainer, 5 years.

Two highway projects held by A. Teichert & Son in Sacramento are headed by Will Staring, project manager; Stan Buchanan, general superintendent, and Oran Cobb, assistant superintendent. On one of them Ronnie Parker is resident engineer and C. W. Waserby is inspector. On the other, Art Keiber and George Parham hold corresponding positions.

Robert K. Boyd is heading Guy F. Atkinson's \$3,389,766 job for 6.3 mi. of grading and surf., 4 bridges and 3 pedestrian undercrossings in Los Angeles County, Calif.

Jack Bushnell, superintendent for Benton Contracting Co., is at the site of 7 mi. of surfacing north of Clifton, Ariz. C. M. Shearer, vice president of the contracting company, is in charge of all operations. John J. Gibson is secretary and treasurer.

Highway construction in the vicinity of Chehalis, Wash., is going on under supervision of A. N. Toolson, project manager, and Roy Ladd, general superintendent for Gibbons & Reed Co., contractor. Shirley Craig,

Stanley A. Brown, general superintendent, and Joe Olson, job superintendent, smiling, from left to right in left picture, and Roy Cunningham, assistant superintendent (right picture), are doing general construction work at the Sacramento (Calif.) State Fair Grounds, for Barrett & Hilp, contractor.



Dick Cartwright, and Slim Adams are foremen, and Bob Renzleman is office manager.

Another Arizona highway project, 3½ mi. of grading and surfacing west of Wickenburg on the highway to Ehrenberg, is supervised by Arthur W. Rogers and E. O. Olson, bridge superintendent. Tanner Bros. hold the contract.

C. A. Derrer is supervising 2½ mi. of widening and surfacing between San Diego and La Mesa, Calif., for V. R. Dennis Construction Co., contractor.

R. A. Heintz Construction Co. has K. R. Cater as general superintendent of grading and surfacing on the Hubbard Highway in Portland. V. W. Wilkinson, grade foreman; Orin M. Cork, master mechanic, and Lovell Johnson, resident engineer, are also on the job. The \$582,000 award began in May 1952 and is scheduled for completion by August 15 of this year.

Kenneth Cornell, project manager and Paul Wilcox, general superintendent, are at work on a \$396,000 highway job in California for Ukropina-Polich-Kral, contractor. Roy Austin is grade foreman, Eugene Marple is labor foreman, Virgil Bostick is master mechanic, and C. W. Le Count, assisted by Lindy Rogers, is office manager. Harold (Red) Atherstone and George Krol are also on the job.

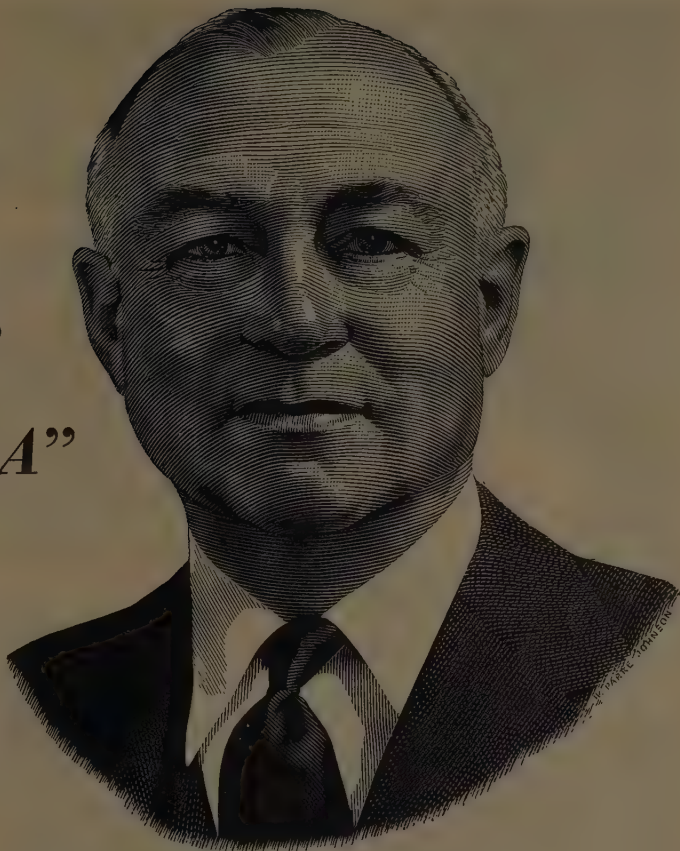
D. Boyd Robinson, superintendent and Harold Blair are heading 7 mi. of gravel surfacing and oiling in Hill County, Mont., for O'Neil Construction Co.

The Carson Construction Co. of Helena, Mont., lists R. S. Merrill, superintendent; Wesley Lane, excavation foreman; George Elmer Peterson, concrete foreman, and Marne



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WESTERN CONSTRUCTION





Whitey Yeager is plant superintendent on a job for concrete pipe manufacturing in the Sacramento vicinity for Stockton Construction Co., Inc. **Chet Covey** is plant manager. The pipe will be used in connection with construction of Sacramento's new sewage treatment plant.

Merrill, office manager, as key personnel for the company's \$678,000 contract for extension of the utilities system at Kodiak Naval Air Station, Alaska.

Northwestern Construction Co., which is putting in a portion of Highway 99 south of Olympia, Wash., lists **Dan Fiorito**, project manager; **Don Vizzari**, general superintendent; **Mike Cernick**, foreman, and **Bill Bishop**, equipment mechanic. The same firm has a rough grading job on Highway 10 east of North Bend, Wash. Fiorito serves as project manager on this latter location also. **John Vineyard** is superintendent.

Charles Walsh, supervisor; **Jack Downey**, grade foreman, and **Jack Stum, Jr.**, concrete foreman, are heading the job for L. M. White Contracting Co. on an award for a road job in Tucson, Ariz.

The \$1,070,270 Tongass highway project near Ketchikan, Alaska, is being supervised by **Glenn V. Stevens** for S. Birch & Sons and Lytle & Green. **Joe Spencer** is rock superintendent.

D. M. Kelly, supervisor; **William L. Hibbs**, construction engineer, and **George Nodwell**, assistant superintendent, are on a \$578,190 highway job in Tucson, Ariz., for San Xavier Rock & Sand Co.

Dan Eagen, supervisor, and **Conwell Wallace** are on the job for Walling Construction Co.'s award for road work in Custer County, Mont.

Supervisor **Max L. Marshall** is heading the Morrison-Knudsen Co., Inc., \$211,600 award for grading and surfacing along the North Fork of the Payette River in Idaho. **Arthur L. Heward** is office manager.

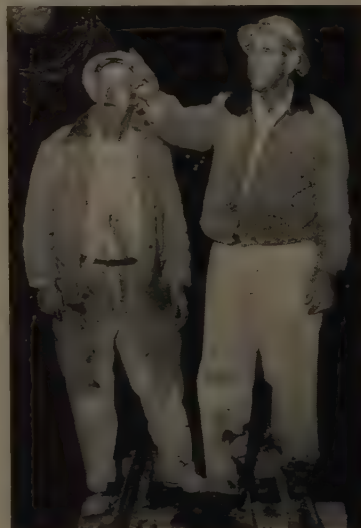
Claude Sellard is general superintendent for Contractor **Robert D. Morrow** on construction of an elementary school going up in Salem, Ore. **Stan Wolcott** is excavation superintendent for Salem Sand & Gravel Co. which is doing that phase of the work. **Robert Hansen** is superintendent for Nelson Bros., subcontractor for plumbing and heating.

Don Boots and **Bob VanderBoegh** are supervisors for Peter Kiewit Sons' Co. on highway work east of Vancouver, Wash. Others on the job are: **Art Olson**, grade superintendent; **Dick Johnson**, job engineer; **Coy Carter**, pipe laying superintendent; **Phil Fisher** and **Jim Hills**, clearing foremen; **Jack Lyons** and **Mike O'Rourke**, mechanical foremen.

W. J. Pickle is superintendent of rock crushing operations near Forks, Wash., for Sjoboen Bros., contractor.

The huge tilt-up job going on at the Marine Corps Training Center at Twenty-nine Palms, Calif. (see *Western Construction*—May 1953, pp. 83-86), by joint venturers Twaits-Morrison-Knudsen-Macco is headed by **J. F. McKee**, general superintendent; **D. G. Hall**, project manager; **F. S. McGarvey**, project engineer; **George Adair**, concrete superintendent; **D. D. Peterson**, precast superintendent; **Robert Harper**, carpentry superintendent; **Robert Gunville**, erection superintendent; **Herb Fassler** and **Frank Wilson**, precast foremen; **S. O. Davison**, Dick Lake, and **Mike Maloney**, carpentry foremen; **Jim Frank-**

Fred (left) and George Kerns are field superintendents right on the job for **George E. Kerns Construction Co.**'s award for the Los Angeles tunnel construction job covered on pages 57 to 59 of this issue.



Le Roy Morse is general superintendent on a highway repair job at Birso, Calif., for M. J. Ruddy & Son. **Joe Mo shell** is project manager and **Fred Fu nari** is assistant superintendent.

lin, structural engineer; **Dave Williams**, finisher foreman; **Clifford White**, labor foreman; **Reuben Anderson**, equipment superintendent; **Dave Carter**, day shop foreman, and **Glen Brunner**, night shop foreman. Job completion is scheduled for November 1.

Ralph Steele, general superintendent, is winding up work for **Verni Jarl**, contractor, on a \$300,000 grading and surfacing job in Salem, Ore.

Jack Kaiserman is supervising about 13 mi. of grading and draining in Coconino County, Ariz., for Fisher Contracting Co.

Bob Calou and **Tom Bond** are superintendent and timekeeper, respectively, for **Fredrickson & Watson Construction Co.** on a \$239,985 road construction job in Oakland, Calif.

Construction of Dexter Dam in Oregon is headed by the following men: **Henry O. Montag**, project manager; **R. E. (Bill) McNutt**, Montag's assistant; **T. H. (Buck) Schaefer**, earthwork superintendent; **Arnold Lindeland**, Schaefer's assistant; **Don Whiteaker**, earthwork engineer; **W. W. Wyatt**, structural engineer; **Al Patten**, master mechanic, and **Clarence Timmerman** and **Van B. Eddy**, grade foremen. **McNutt Bros.** holds the contract.

Karl Loss, project manager; **H. E. Christman**, superintendent, and **Tom Brooks**, office manager, are heading construction on Sly Park earthfill dam and dike in El Dorado County, Calif., for **Fredrickson & Watson Construction Co.** and **M & K Corp.**, joint venturers on the \$2,716,785 project.

Paul Johnson is supervising for **Mead & Mount Construction Co.** on a \$6,000,000 contract for a 23-story office and club building in Denver, Colo.

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"Century" pipe installation from Grand River Dam to the City of Chouteau, Oklahoma.
 Engineers: Hoil Engineering Corp., Contractors: Eagle Construction Co., both of Tulsa.

CONTRACTS

Summary of bids and awards for major Western projects

Alaska

\$1,367,900—Anderson Construction, Inc., and Montin-Benson Corp., 243 Central Bldg., Seattle—Award for a heating plant addition in the north area, Ladd Air Force Base; by C. of E.

\$2,287,547—S. Birch & Sons and Lytle & Green, Central Bldg., Seattle—Award for 16 two-story 8-family quarters, Ladd Air Force Base; by C. of E.

\$2,500,000—Carson Construction Co., Box 1153, Helena, Mont.—Low bid (basic) for high school at Ketchikan; by Alaska Public Works.

\$285,526—City Electric & Fixture Co., 2014 Third Ave., Seattle—Award for a complete outside electrical distr. system, incl. poles, transformers, and substation, Ladd Air Force Base; by C. of E.

\$1,284,683—Morrison-Knudsen Co., Inc., 603 Hoge Bldg., Seattle—Award for outside utilities, incl. 6 fuel storage tanks, a pump station with fuel distr. system, roads, drainage system and appurtenances, Elmendorf Air Force Base; by C. of E.

\$460,100—Oaks Construction Co., Anchorage—Low bid for runway extension and a seaplane basin, Juneau Airport.

\$2,629,836—J. H. Pomeroy & Co., Inc., 333 Montgomery St., San Francisco—Low bid for family housing and other varied work at Kenai; by C. of E.

\$470,925—Schmid & Lewis, 2604 W. Lynn St., Seattle—Low bid for an underground aqua conversion system, Elmendorf Air Force Base; by C. of E.

Arizona

\$376,905—Arizona Sand & Rock Co., Box 959, Phoenix—Low bid for 7½ mi. of borrow, select material, plant-mixed bitum. stabilized base, and armor coat, Holbrook-Lupton hwy. beginning about 45 mi. from Holbrook, Apache County; by St. Hwy. Dept.

\$174,741—Copper States Construction Co., Box 863, Mesa—Low bid for 3 mi. of grading, select material and aggregate base, prime coat, bitum. plant mix, and seal coat, East McDowell Rd. (48th St. to Scottsdale Rd.), Maricopa County; by St. Hwy. Dept.

\$1,990,791—Morrison-Knudsen Co., Inc., 411 W. 5th St., Los Angeles—Award for earthwork, conc. lining and structures, Dome Canal, and Unit I, Dome Distr. System, Wellton-Mohawk Div., Gila Project; by USBR.

\$456,686—Orr & Orr Construction Co., 1702 W. Fillmore St., Phoenix—Low bid for 3.3 mi. of grading, select material, aggregate base and bitum. surf., Globe-Show Low hwy., beginning about 48 mi. from Globe, Gila County; by St. Hwy. Dept.

\$111,909—Selby Drilling Corp., 2401 Crenshaw Blvd., Los Angeles—Low bid for anchoring rock slab at Hoover Dam and power plant, Boulder Canyon Project; by USBR.

California

\$677,210—Bert C. Altfilisch, 8131 E. Rosecrans St., Paramount—Low bid for channel excavation in Coyote Cr., and levee facing San Gabriel River, Long Beach; by Los Angeles Flood Control District.

\$620,917—Gordon H. Ball & San Ramon Valley Land Co., 685 Delaware St., Berkeley—Low bid for 2.5 mi. of grading and paving and 2 reinf. conc. bridges on U. S. 99 nr. Woodland Wye, Solano and Yolo counties; by Div. of Hwys.

\$364,845—Fred J. Early, Jr., Co., Inc., 22138 So. Vermont Ave., Torrance—Award for sewage treatment plant, Porterville; by City.

\$850,063—Erickson-Phillips & Weisberg, 350 Market St., Concord—Award for a reinf. conc. girder bridge crossing Peta-

luma Creek and Northwestern Pacific Railroad Co. tr. in Sonoma County; by Div. of Hwys.

\$278,314—Gallagher & Burk, Inc., 344 High St., Oakland—Award for widening 5.3 mi. of Sign Rt. 4 and widening a reinf. conc. bridge south of Monument and Martinez, Contra Costa County; by Div. of Hwys.

\$1,008,648—M. H. Golden Construction Co., 3485 Noell St., San Diego—Low bid for bridges on Wabash Freeway between Federal Blvd. and Harbor Dr., San Diego; by City.

\$171,600—Theodore R. Gregory, 1112 Wellington Ave., Pasadena—Low bid for sewage treatment plant in Del Mar area, Camp Pendleton; by U. S. Navy.

\$168,647—Griffith Co., 1060 S. Broadway, Los Angeles—Award for 2 mi. of grading and paving on Imperial Hwy. between La Mirada Ave. and Fullerton Rd., Orange County; by Div. of Hwys.

\$772,539—J. E. Haddock, Ltd., 3538 E. Foothill Blvd., Pasadena—Award for 3.6 mi. of grading and asph. conc. paving and a steel girder bridge between Inglewood Ave. and Normandie Ave., Los Angeles County; by Div. of Hwys.

\$226,908—Hallmark Construction Co., 595 S. 10th St., Glendale, Ariz.—Low bid for replacement of water lines in certain areas and effluent lagoons for sewage plant No. 3, Camp Pendleton; by U. S. Navy.

\$179,985—Humboldt Constructors, Inc., 125 W. 5th St., Eureka—Award for 1.8 mi. of grading and surf., Sign Rt. 101, east of Klamath, Del Norte County; by Div. of Hwys.

\$3,062,215—Judson Pacific-Murphy Corp., 4300 East Shore Hwy., Emeryville—Award for bottom lateral bracing for Golden Gate Bridge, San Francisco; by Golden Gate Bridge & Hwy. Dist.

\$2,145,245—Peter Kiewit Sons' Co., 345 Kieways Ave., Arcadia—Award for aviation fuel storage facilities, Point Loma Naval Supply Depot, and fuels receiving facilities, Miramar Naval Air Station; by U. S. Navy.

\$185,415—Kevry Construction, Inc., 655 Peralta St., San Leandro—Award for interceptor sewer, San Pablo; by San Pablo Sanitary Dist.

\$454,625—Vido Kovacevich Co., 3145 Rosemead Blvd., Rosemead—Low bid for improvements on Imperial Hwy., Central Ave. to Main St., Los Angeles; by City.

\$1,081,046—Lord & Bishop and M. J. B. Construction Co., Box 812, Sacramento—Low bid for 4.3 mi. of grading and surf. and 2 reinf. conc. overcrossings to provide a 4-lane divided hwy. on U. S. 99, Ripon west, San Joaquin County; by Div. of Hwys.

\$651,648—Charles MacClosky Co., 112 Market St., San Francisco—Low bid for widening a bridge and ½ mi. of plant-mixed surf. approaches, U. S. 99 nr. Dunsmuir, Siskiyou County; by Div. of Hwys.

\$747,000—Macco Corp. and Morrison-Knudsen Co., Inc., 14409 S. Paramount Blvd., Paramount—Low bid for strengthening rubble breakwater, Crescent City, Del Norte County; by C. of E.

\$242,805—W. F. Maxwell, 634 S. Western Ave., Los Angeles—Award for Bull Creek flood control channel, San Fernando; by Soil Conservation Service, San Fernando.

\$293,067—W. F. Maxwell and Hermreck & Easter, 634 S. Western Ave., Los Angeles—Award for 2.7 mi. of grading and surf. and 2 bridges on St. 138, Meiners Oaks, Ventura County; by Div. of Hwys.

\$1,952,765—Theo. G. Meyer & Sons, 200 Quint St., San Francisco—Low bid for 300 dwelling units and site development, Easter Hill Village; by Housing Authority of City of Richmond.

\$1,432,825—Midstate Construction Co. and Stolte, Inc., 8451 San Leandro St., Oakland—Low bid for tuberculosis hospital, Fresno; by Fresno County.

\$455,037—Munn & Perkins and Paul E. McCollum, Jr., Box 1092, Modesto—Award for about 4.8 mi. of grading and plant-mixed surf. on untreated rock base, between 1 mi. west of Aqueduct Canyon rd. and Palmdale, Los Angeles County; by Div. of Hwys.

\$319,856—Oberg Bros. Construction Co., 401 W. Florence Ave., Inglewood—Award for sanitary sewers, storm drains, bridge abutment, and a retaining wall, Harbor Freeway between Jefferson Blvd. & 21st St., Los Angeles County; by Div. of Hwys.

\$1,147,085—Parish Brothers, Box 6, Benicia, and Harms Bros.

ward for runway strengthening and widening, Travis Air Base; by C. of E.

580—George R. Patterson Construction Co., Box 2004, Kton—Low bid for 2.57 mi. of grading and surf., Klamath Forest, Siskiyou County; by BPR.

520—O. B. Pierson, 9521 Flower St., Bellflower—Low for a 6-lane, 400-ft. bridge on San Gabriel River Parkway, by Los Angeles County.

994—Standard Materials, Inc., 1411 Ninth St., Modesto—Award for 4.2 mi. of widening and resurf. on U. S. 99 betw. Creek and Buhach Rd., Merced County; by Div. of Hys.

74,577—B. J. Ukropina, T. P. Polich, Steve Kral, & John Ukropina, 201 E. Las Tunas Dr., San Gabriel—Award for inf. conc. and structural steel overhead and a reinf. conc. ahead betw. E. 26th St. and Washington Blvd. over railroad tracks, and grading the approaches, Los Angeles County; Div. of Hws.

1,553—Volpa Bros., 233 Nielsen, Fresno—Award for 8.2 of widening and surf. on Sign Rt. 152, betw. Merced county line and Califa, Madera County; by Div. of Hws.

7,190—R. A. Wattson Co., Box 747, North Hollywood—Low bid for improvements and steel water pipe on Franklin St., Oxford St. to Bronson Ave., Los Angeles; by City.

8,921—Claude C. Wood Co., Box 599, Lodi—Award for 1 mi. of widening and surf. on Sign Rt. 4 betw. 1 mi. west San Joaquin County line and Valley Springs, San Joaquin and Calaveras counties; by Div. of Hws.

Colorado

2,077—Bales & Kite, 511 Title Bldg., Kansas City, Mo.—Award for Schedule 2, first 13 mi. of Boulder Creek supply canal with timber bridge decks, nr. Boulder, Colorado—Big Thompson Project; by USBR.

274,860—Ball Construction Co., San Antonio, Tex.—Low for a 300-unit housing project, Denver; by Denver Housing Authority.

35,690—James B. Kenny, Inc., 32nd and Osage Sts., Denver—Award for sewage disposal plant, Arvada; by City.

Idaho

31,714—A. A. Corder, Vancouver, Wash.—Award for 2½ of grubbing, grading and draining, McCall-Stibnite hwy.; BPR.

40,775—Morgan Electric Co. and Wismer & Becker, 109 W. Harrison St., Seattle—Low bid for installation of equipment and completion of powerhouse for Albeni Falls Dam; by C. of E.

16,874—Morrison-Knudsen Co., Inc., 319 Broadway, Boise—Low bid for Schedule B, runway extension, taxiway extension and airfield lighting, Gowen Field, Boise; by C. of E.

82,437—Jack B. Parsons, Smithfield, Utah—Award for 6.7 mi. of grading and draining, U. S. 191, Utah State Line—North Oneida County; by St. Dept. of Hws.

448,849—Duffy Reed Construction Co., Box 1092, Twin Falls—Award for grading, draining, and rd.-mixed bitum. surf., 0.9 mi. on St. 52 and 4.9 mi. on St. 16, betw. Vanderdassen and Emmett, Gem County; by St. Dept. of Hws.

215,991—Western Construction Co., Box 628, Pocatello—Award for reconstruction of roadbed and bitum. surf., 7.2 mi. of Old Oregon Trail betw. Lava Hot Springs and Pebble, Blannock County; by St. Dept. of Hws.

Montana

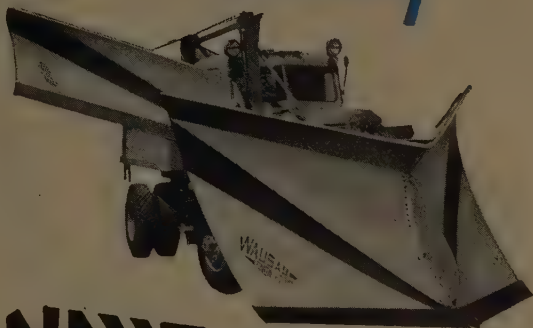
156,087—Stanley H. Arkwright, Inc., 1200 Sixth Ave., North, Billings—Award for 6.1 mi. of grading, gravel surf., and a 8-ft. treated timber pile bridge, Roundup West and South Hwy., Musselshell County; by St. Hwy. Comm.

167,060—Holzworth Construction Co., First Natl. Bank Bldg., Miles City—Award for 9.9 mi. of grading and gravel surf., Glendive-Richey hwy., Dawson County; by St. Hwy. Comm.

6209,475—Kiely Construction Co., Drawer 246, Butte—Award for 10.8 mi. of bitum. surf., Yellowstone Trail Hwy., Mineral County; by BPR.

6118,920—Lease & Leigland, 1501 N. 35th St., Seattle—Low bid for a 600,000-gal. prestressed conc. reservoir, Great Falls Air Force Base; by C. of E.

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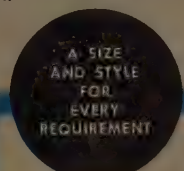
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Southern Idaho Equipment Co., Idaho Falls and Boise, Idaho
Allied Equipment Co., Reno, Nevada
Studer Tractor & Equipment Co., Casper, Wyoming
Cate Equipment Co., Salt Lake City, Utah

\$184,710—**Morgenstern & Schett**, Missoula—Award for 5 mi. of clearing, grubbing, grading, and draining, North Fork of Flathead River Rd., Flathead County; by BPR.

\$222,221—**Nilson-Smith Construction Co.**, 812 S. Second St., Great Falls—Award for 6 mi. of grading and gravel surf., Polson-North and Pablo to Kalispell hwy., Lake County; by St. Hwy. Comm.

\$179,182—**Nilson-Smith Construction Co.**, 812 S. Second St., Great Falls—Award for 13.1 mi. of grading, gravel surf., and rd.-mix oiling, Valier West hwy., Pondera County; by St. Hwy. Comm.

\$314,765—**Nilson-Smith Construction Co.**, 812 S. Second St., Great Falls—Low bid for asph. conc. and conc. extension of runway and taxiway, Gore Field, Great Falls; by C. of E.

\$142,035—**E. G. Perry & Son and Union Credit**, Townsend—Low bid for 3.6 mi. of closed drains and 9.2 mi. of open drains, and structures, Buffalo Rapids Project; by USBR.

\$226,340—**Lou Richardson**, Box 513, Miles City—Award for 9.5 mi. of gravel surf. and plant-mixed oiling, Miles City-Terry hwy., Custer County; by St. Hwy. Comm.

\$189,173—**Lou Richardson**, Box 513, Miles City—Award for 12.7 mi. of grading and rd.-mixed oiling, Roundup-Forsyth hwy., Rosebud County; by St. Hwy. Comm.

\$215,585—**Chas. Shannon Co.**, 502 S. Washington St., Butte—Award for 22.5 mi. of bitum. surf., Clark Fork Hwy., Sanders County; by BPR.

\$305,704—**Thomas Staunton**, 806 First Natl. Bank Bldg., Great Falls—Award for 11 mi. of grading, gravel surf., and road-mixed oiling, Grassrange-Jordan hwy., Petroleum County; by St. Hwy. Comm.

\$189,331—**R. J. Sundling Construction Co.**, Livingston—Award for 6.9 mi. of grading, gravel surf., and rd.-mix oiling, Absarokee-West hwy., Stillwater County; by St. Hwy. Comm.

Nevada

\$2,000,000—**R. H. Fulton & Co.**, Box 1526, Lubbock, Tex.—Low bid for about 110 mi. of 10¾-in. gas pipe line, betw. Topock, Ariz., and Las Vegas; by Nevada Natural Gas Co.

\$213,398—**Isbell Construction Co., Inc.**, S. Virginia Rd., Reno—Award for 2.61 mi. of excavation and rd.-mixed surf., St. Mt. Ski Bowl to Grass Lake, Washoe County; by St. D. of Hwys.

New Mexico

\$282,282—**Brown Contracting Co.**, Box 1479, Albuquerque—Award for 14.1 mi. of asph. surf., seal coating, and 2 bridge, Clayton-Moses rd., Union County; by St. Hwy. Dept.

\$422,385—**Hoak Construction Co.**, 621 63rd St., Des Moines, Iowa—Low bid for 360 mi. of overhead ground wires, existing 115-kv. transmission lines, Rio Grande Project; by USBR.

\$116,050—**Lowdermilk Bros.**, Espanola—Award for 6.7 mi. of asphalt surf., Questa-Arroyo Hondo rd., Taos County; by St. Hwy. Dept.

\$375,842—**Lowdermilk Bros.**, Espanola—Award for 13.4 mi. of bitum. surf. and seal coat, Taylor Springs-Abbott rd., Colfax County; by St. Hwy. Dept.

Oregon

\$1,365,000—**American Elin Corp.**, New York City—Low bid for furnishing autotransformers for McNary-Ross transmission line; by BPA.

\$141,565—**Atlas Construction Co.**, 9210 N.E. Halsey St., Portland—Low bid for sewage treatment plant, Myrtle Point; by City.

\$285,426—**Berke Bros.**, 7923 N.E. Halsey, Portland—Award for 2.6 mi. of grading and paving, North Corvallis Section, Pacific Hwy. West at Corvallis, Benton County; by St. Hwy. Comm.

\$191,500—**General Construction Co.**, 4850 N.W. Front Ave., Portland—Low bid for channel stabilization works nr. upper end of Umpqua River training jetty; by C. of E.

\$151,435—**Hamilton & Thomas**, Box 726, Eugene—Award for 294-ft. reinf. conc. deck girder Willow Creek bridge having three 98-ft. prestressed conc. girder spans on new alignment of Columbia River Hwy. at Heppner Junct., Gilliam County; by St. Hwy. Comm.



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CONTRACTORS and ENGINEERS

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\$162,410—**Peter Kiewit Sons' Co.**, Box 491, Longview, Wash.—Award for 356-ft. reinf. conc. and steel truss bridge over Rinehart Creek on Oregon Coast Hwy. south of Port Orford, Curry County; by St. Hwy. Comm.

\$136,352—**F. H. McEwen**, 1673 Villard St., Eugene—Low bid for reconstruction of market rd. No. 36, a bridge trestle, reconstruction of approaches and raising Lowell Bridge, and grading county rd. No. 360, nr. Lowell, Lookout Point Project; by C. of E.

\$278,000—**Schrader Construction Co.**, 3030 S.E. Hawthorne Ave., Portland—Award for salmon hatchery nr. Olney; by St. Fish Comm.

\$656,750—**H. C. Werner, Inc.**, 3170 W. 11th St., Eugene—Low bid for southwest unit, interceptor sewer, Portland; by City.

\$232,146—**Everett L. Wiggins**, 5655 N. Delaware St., Portland—Award for sewage treatment plant, Coquille; by City.

Utah

\$140,771—**Gibbons & Reed Co.**, Box 1113, Salt Lake City—Low bid for surf. 7.4 mi. of secondary road, Clark County; by St. Road Comm.

\$643,216—**Gibbons & Reed**, Box 1113, Salt Lake City—Low bid for Alternate 3, construction of a 200 x 8,300-ft. runway, Municipal Airport, Salt Lake City; by Salt Lake City Corp.

\$531,675—**Paulsen Construction Co.**, 1425 Jefferson St., Salt Lake City—Award for water treatment plant in City Creek Canyon, Salt Lake City; by Salt Lake City Corp.

\$124,985—**Thorn Construction Co., Inc.**, Box 111, Springville—Award for 3.7 mi. of plant-mixed bitum. surf., Pleasant Grove to American Fork, Utah County; by St. Rd. Comm.

Washington

\$1,549,275—**Bennett-Campbell, Inc.**, Seaboard Bldg., Seattle—Low bid for 4-story addition to Bon Marche dept. store, Seattle; by Allied Stores, Inc.

\$2,989,645—**Campbell Construction & Equipment Co.**, 1150

Folsom St., San Francisco—Low bid for Schedule A, 10 airplane nose docks, Fairchild Air Force Base, Spokane; by C. of E.

\$1,963,085—**A. J. Cheff Construction Co.**, Seattle—Award for Chandler powerhouse, penstocks and discharge lines; by USBR.

\$512,540—**Cherf Bros. Construction Co.**, Roy F. Johnson and Sandkay Contractors, Inc., Ephrata—Low bid for earthwork pipe lines and structures, Area W6B laterals (Block 76), Wenatchee Canal Laterals, Columbia Basin Project; by USBR.

\$152,650—**D-H Paving Co.**, 6808 Highway 99, Vancouver—Award for seal coat and asph. cement on 72.6 mi. of various st. hwy., Lewis, Kitsap, Mason, Jefferson, and Grays Harbor counties; by St. Hwy. Comm.

\$190,765—**G. D. Dennis & Sons**, 7355 S.E. Johnson Creek Blvd., Portland—Award for shoofly railroad at The Dalles Dam site, Klickitat County; by C. of E.

\$1,761,320—**English Elec. Export & Trading Co., Ltd.**, 2 Beaver St., New York City—Award for 10 transformers for Chief Joseph Dam; by C. of E.

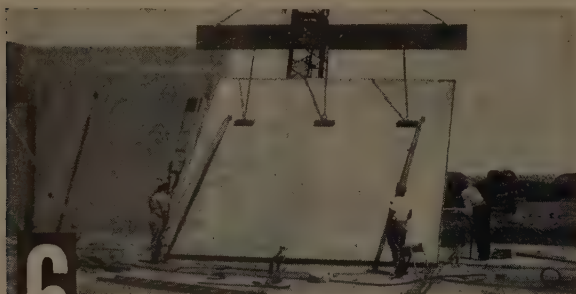
\$462,506—**N. Fiorito Co.**, 844 W. 48th St., Seattle—Award for a highway overcrossing south of Chehalis on P. S. H. No. 1, Lewis County; by St. Hwy. Comm.

\$2,428,470—**Grove, Shepherd, Wilson & Kruege, Inc.**, 120 6th Ave. No., Seattle—Low bid for underground reinf. conc. tank with connecting pipes for waste storage facilities, Hanford Works, Richland; by AEC.

\$872,482—**Peter Kiewit Sons' Co.**, Box 491, Longview—Award for clearing, rolling, draining, and paving 6.5 mi. of P. S. H. No. 1, Rocky Point to Castle Rock, Cowlitz County; by St. Hwy. Comm.

\$435,010—**Larson Construction Co.**, Box 120, Astoria, Ore.—Low bid for 20 ponds and other facilities, fish hatchery at Cathlamet; by State Dept. of Fisheries.

\$1,383,095—**Osberg Construction Co.**, 1132 N. 128th St., Seattle—Low bid for 70 mi. of laterals, sublaterals and waste ways, Laterals Area P-9, Potholes East Canal; by USBR.



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501—P. L. Saddler, Box 898, Wenatchee—Award for grading, draining, and rip rap, 3.8 mi. of P. S. H. No. 1, Lewis County; by St. Hwy. Comm.

771—J. D. Shotwell Co., 3113 So. Pine St., Tacoma—Award for grading, rolling, and asph. conc. surf., 8.9 mi. of P. S. H. No. 9, Bogachiel River to Hoh River, Clallam and Jefferson counties; by St. Hwy. Comm.

820,997—Winston Bros. Co., McLaughlin, Inc., F & S Contracting Co., Johnson, Drake & Piper Co., Inc., Donovan Construction Co., C. F. Lytle Co., S. Birch & Sons Construction Co., Foley Bros., Inc., and Fegles Construction Co., Ltd., 15 Carroll Ave., St. Paul, Minn.—Award for completion of excavation for and construction of substructure for the first main unit bays and station service bay, fishway turbine bay and complete assembly bay of powerhouse at The Dalles Dam, Columbia River; by C. of E.

Coming

3,289—England & Roth Construction Co., 712 St. Cloud Rapid City, So. Dak.—Award for 8 mi. of grading and base course surf., Gillette-Broadus rd., Campbell County; by St. Hwy. Dept.

9,694—Peter Kiewit Sons' Co., Box 875, Sheridan—Award for 1.3 mi. of grading, storm sewer, combined curb and gutter, graded gravel base course, and plant mix surf., North Main Sheridan; by St. Hwy. Dept.

9,772—Peter Kiewit Sons' Co., Box 875, Sheridan—Award for 3.8 mi. of reshaping roadbed, and 12.3 mi. of base course surf. and oil treatment, Torrington-Francel rd., Goshen County; by St. Hwy. Dept.

4,512—Knisley-Moore Co., Box 77, Douglas—Award for 1 mi. of grading and surf., a treated timber bridge and a concrete arch, Iron Mountain rd., Laramie County; by St. Hwy. Dept.

6,270—LeBoeuf-Dougherty Co. and Erickson & Pierson, 1000 Cutting Blvd., Richmond, Calif.—Award for superstructure, Snake River bridge, for relocation of U. S. 89; by U. S. BR.

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Eklutna funds authorized

THE SUM of \$33,000,000 as a total authorization for the Eklutna power project in Alaska (*Western Construction*—July 1963, p. 122) seemed assured when the U. S. Senate passed a bill providing for that amount. The House Interior Committee had already approved the same amount in a similar bill.

Property owners sue Colorado over hwy. bridge

SIX Glenwood Springs, Colo., property owners have filed suit in a federal district court to stop construction of a \$55.4M state highway bridge across the Colorado River, claiming that completion of the bridge will cause them business losses. The Gardner Construction Co. has the contract.

Earthquake and blast effects report available

"THE PROCEEDINGS of the Symposium on Earthquake and Blast Effects on Structures," held in Los Angeles in June 1962, are now available in a 320-page book at a cost of \$5. Student rate \$3.

Containing only extemporaneous discussions by the panels and from the floor is contained much information on design of structures for dynamic loads which is not available in print elsewhere, according to the Earthquake Engineering Research Institute.

Some 24 papers on such subjects as motion of earthquakes, blast forces on structures, analysis of structural response, properties of structures and materials, earthquake effects on structures, blast effects on structures, and earthquake provisions of building codes are included in the book.

Earthquake examples used range from the San Francisco quake of April 18, 1906, and the Long Beach quake of 1933 to the Tehachapi earthquake of July 21, 1952.

Copies of the proceedings may be obtained by writing to Roy W. Clough, secretary, Earthquake Engineering Research Institute, Department of Engineering, University of California, Berkeley 4, California.

UNIT BID PRICES

Selected abstracts for Western projects

Dam

Substructure for The Dalles Dam Powerhouse

Washington and Oregon—The Dalles Dam Site—C. of E. Winston Bros. Co., McLaughlin, Inc. F & S Contracting Co., Johnson, Drake & Piper Co., Inc., Donovan Construction Co., C. F. Lytle Co., S. Birch & Sons Construction Co., Foley Bros., Inc., and Fegles Construction Co., Ltd., St. Paul, Minn. submitted a \$29,320,997 joint low bid before the Corps of Engineers in Portland for completion of the excavation and construction of the substructure for the first 14 main unit bays and station service bay fishway turbine bay, and complete assembly bay of the powerhouse at The Dalles Dam site. Unit bid submitted were as follows:

(1) Winston Bros. Co., McLaughlin, Inc., F & S Contracting Co., Johnson, Drake & Piper Co., Inc., Donovan Construction Co., C. F. Lytle Co., S. Birch & Sons Construction Co., Foley Bros., Inc., and Fegles Construction Co., Ltd., St. Paul, Minn.	\$29,320,997
(2) J. A. Jones Construction Co., Charles H. Tompkins Co., S. A. Healy Co., and M. J. Boyle & Co.	31,587,215
(3) The Arundel Corp., The Hunkin-Conkey Construction Co., L. E. Dixon Co., and The American Pipe & Construction Co.	32,777,341
(4) Guy F. Atkinson Co. and Ostrander Construction Co.	34,688,794
(5) Consolidated Builders	34,697,097
— Morrison-Knudsen Co., Inc., and Peter Kiewit Sons' Co.	35,617,656
(6) Contracting officer's estimate	36,677,520

EXCAVATION	(1)	(2)	(3)	(4)	(5)	(6)
1 job maintenance of cofferdams.....	\$204,000	\$186,000	\$147,500	\$300,000	\$232,500	\$85,600
1 job furn., install, and oper. initial pumping facilities 25,000 gpm. capacity.....	\$282,000	\$240,000	\$225,000	\$400,000	\$301,000	\$229,500
8 5,000 gpm. unit, furn., install, and oper. additional pumping facil.	\$15,302	\$15,000	\$4,000	\$5,000	\$3,765	\$41,700
491,950 cu. yd. excav., unclassified.....	2.26	4.50	5.00	3.02	3.00	3.30
39,600 sq. yd. final foundation cleanup.....	2.45	3.90	5.85	3.60	4.00	3.60

DRILLING AND GROUTING	(1)	(2)	(3)	(4)	(5)	(6)
6,000 lin. ft. drilling drain holes.....	1.63	2.40	.65	1.50	1.20	1.25

CONCRETE WORK	(1)	(2)	(3)	(4)	(5)	(6)
798,500 bbl. cement, portland.....	4.60	3.90	3.00	4.00	4.40	4.80
614,200 cu. yd. concrete.....	20.22	24.20	27.50	28.20	29.65	30.00
25 cu. yd. lightweight concrete.....	46.00	60.00	145.00	110.00	67.00	52.40
1,725 lin. ft. 8-in. conc. pipe drain.....	2.40	3.60	2.10	3.00	2.40	2.35
4,640 lin. ft. 8-in. half-round CMP drain, in place.....	2.50	3.60	2.60	5.00	2.60	2.25
230 lin. ft. 12-in. half-round conc. pipe drain, in place.....	3.00	3.60	2.35	4.00	3.50	3.30
28,170 lin. ft. rubber water stop.....	3.00	2.85	2.25	2.00	2.70	3.50
11,060 lin. ft. drill. and grout. anchor bars.....	2.15	1.90	.75	1.25	1.60	1.55

MECHANICAL EQUIPMENT	(1)	(2)	(3)	(4)	(5)	(6)
Lump sum, elevator, complete.....	\$46,000	\$46,500	\$41,500	\$42,000	\$44,000	\$48,000
Lump sum, plumbing fixtures and equip.....	\$13,100	\$13,200	\$11,250	\$10,000	\$12,600	\$5,800
Lump sum, sewage disposal sys., compl. excl. of steel and cast iron pipe.....	\$6,000	\$2,500	\$7,000	\$8,000	\$12,600	\$4,800
Lump sum, intake valves and hydraulic units for station service units.....	\$90,000	\$100,000	\$68,500	\$82,500	\$82,000	\$93,600
41 ea. diffusion chamber gates.....	\$5,000	\$4,000	\$3,780	\$3,800	\$3,900	\$5,476

STRUCTURAL STEEL AND MISCELLANEOUS METALWORK	(1)	(2)	(3)	(4)	(5)	(6)
66,704,000 lb. reinf. steel, in place.....	.0937	.09	.09	.10	.092	.10
180,600 lb. structural steel, in place.....	.29	.21	.175	.20	.15	.21
96,400 lb. station service penstock, in pl.....	.385	.32	.415	.40	.25	.36
641,900 lb. cast iron pipe and fittings, in pl.....	.37	.37	.46	.35	.35	.42
255,000 lb. steel pipe and fittings, 12-in. & under, in place.....	.39	.37	.575	.52	.42	.40
864,750 lb. steel pipe and fittings over 12-in. in place.....	.248	.28	.365	.22	.30	.39
4,400 lb. valves, 6-in. and under, in pl.....	1.20	1.10	1.47	.90	1.01	1.25
50,700 lb. valves, 8-in. and over, in pl.....	.70	.75	.96	.50	.60	.77
10,100 lb. iron castings.....	.50	.36	.58	.55	.44	.66
1,000 lb. misc. non-ferrous metal pipe and appurtenant fittings.....	2.00	2.00	2.00	2.00	1.35	2.35
169,000 lb. steel grating, fishway deck.....	.47	.30	.36	.26	.34	.27
851,070 lb. corrosion resist. clad steel plate.....	.66	.70	.565	.80	.60	.71

Continued on page 120

DROP BALLS—PAVEMENT BREAKERS—

Quality Carbon and Alloy Steel Castings

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Expanded Shale Aggregate***

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When used in monolithic construction, NEW BASALITE Aggregate produces a lightweight concrete that is high in strength and very low in absorption.

Check these definite advantages!

- Curing shrinkage held to an absolute minimum
- Insulative properties four to five times greater than river gravel concrete of the same cement content
- Structural concrete readily can be made that does not exceed 105 lbs. per cubic foot—utilizing conventional slumps to give proper placement
- Comprehensive strengths of 2,500 to 3,500 PSI easily obtained with conventional water-cement ratios, with normal cement content
- Compressive strengths up to 5,000 PSI can be designed
- Excellent workability and placement characteristics



• This cross section of a typical test cylinder of a conventional slump concrete shows the rounded particles, the good gradation and the excellent placement of the material.

These factors mean that definite savings in foundation and steel cost can be effected in design...high strength mixes are possible with far less cement because of shape...less labor is required to provide good placement when compared to other lightweight concrete.

And...this vastly superior NEW BASALITE Shale Aggregate is now being used in NEW BASALITE Lightweight Masonry Units...for home and general construction.

* The NEW BASALITE aggregate is made by calcining shale to incipient fusion of particle surface after the raw material has been crushed and graded. Individual particles are well rounded and have a tough skin surrounding a vesicular interior.

Investigate thoroughly!... Satisfy yourself!

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Throughout
ROUNDED EXPANDED
SHALE AGGREGATE

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Here is a completely new ratchet lever hoist designed to bring you added safety and convenience. The Model RG incorporates the time-proved ratchet and pawl principle originated by Coffing—makes it hold positively at all times—no friction-type brake to slip or freeze—chain is free wheeling when not under load.

Many New Advantages

COIL CHAIN Swings or wraps in any direction for greater flexibility in use.

SIX OPERATING POSITIONS Handle operates in any position, works on full or partial strokes—for ease of handling in close quarters. Safety stops prevent spinning of handle.

BIG SAFETY FACTOR For your protection the Model RG has 100 percent overload safety factor, although the warranty covers only up to rated capacity. "Safety-valve" handle bends at point of maximum safe overload.

SIMPLE TO SERVICE The Model RG may be completely disassembled with only a screwdriver for easy servicing. Not necessary to return it to the factory for repairs.

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Mighty-Midget Pullers • Spur-Geared Hoists
Differential Chain Hoists • I-Beam Trolleys

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UNIT BID PRICES CONTINUED

	(1)	(2)	(3)	(4)	(5)	(6)
257,650 lb. corrosion resisting steel	1.11	.85	.75	1.00	.90	
624,000 lb. rail (all)	.24	.17	.175	.17	.22	
133,750 lb. hand railing	.82	.60	.52	.65	.76	
80,700 lb. steel storage tanks	.70	.36	.365	.24	.38	
700,000 lb. misc. steel and metalwork	.55	.38	.355	.52	.56	
5,011,300 lb. all guides and storage latches	.441	.30	.26	.33	.30	
102,700 lb. diffusion chamber grilles	.47	.31	.33	.30	.30	
3,390 lb. sheet steel air duct, in place	1.00	2.40	2.50	1.50	1.20	2
1 job, electric fan, grilles, air diffusers, and insulation for heating sys., in pl.	\$3,400	\$2,400	\$2,500	\$1,500	\$2,100	\$5.

ARCHITECTURAL WORK

Lump sum, misc. architectural features	\$111,921	\$145,000	\$120,000	\$125,000	\$121,000	\$98,3
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INSTALLATION OF GOVERNMENT-FURNISHED EQUIPMENT

Lump sum, install draft tube pier nosings	\$6,000	\$7,200	\$7,500	\$5,000	\$6,300	\$5,70
Lump sum, install foundation bolts for generator rotor erection plates	\$2,600	\$8,000	\$1,800	500.00	\$2,700	980.0

ELECTRICAL WORK

372,467 lb. steel conduit, fittings, and outlet boxes	.68	.75	.70	1.15	.55	.8
9,450 lb. elect. cabinets and boxes, galv. sheet steel	1.40	3.00	1.15	1.75	.84	1.1
6,620 lb. galv. cast iron boxes	1.30	2.00	1.20	2.50	1.80	1.9
19,500 lb. non-metallic conduit and fittings	.40	.35	.34	.75	.29	.3
16,200 lb. bare copper ground conductor and fittings	1.15	1.15	1.05	2.50	1.10	1.6
Lump sum, lighting sys. fits., switches, receptacles, and wire	\$101,208	\$85,000	\$94,000	\$105,000	\$83,500	\$127,50
42 ea. lighting cabinets	490.00	380.00	475.00	525.00	600.00	295.00
3 ea. 480-volt power cabinets	\$1,100	750.00	\$1,000	945.00	\$1,320	815.00
9 ea. dry type lighting transformers	550.00	450.00	500.00	750.00	464.00	\$1,06
8,000 lb. low-voltage power cable	1.50	1.25	1.30	2.00	1.56	1.2
Lump sum, luminous ceiling, complete	\$19,700	\$17,000	\$17,500	\$17,500	\$14,800	\$20,50

Small earthfill dam project in California

California—Marin County—County. Low bidder for construction of Big Carson dam project was John Delphia, Patterson, who submitted a bid of \$1,439,530 before the Marin Municipal Water District. Work includes stream diversion, excavation, the earthfill barrier, concrete spillway, and access road. Unit bids submitted were as follows:

(1) John Delphia	\$1,439,530	—	L. A. & R. S. Crow	\$1,785,94
(2) Piombo Construction Co.	1,485,333	—	T. E. Connolly, Inc.	1,800,74
(3) Macco Corp.	1,589,719	—	Ralph O. Dixon	1,894,85
(4) Guy F. Atkinson Co.	1,676,590	—	Charles L. Harney, Inc.	2,436,91
— Kemper Construction and J. F. Blake Co.	1,777,290	(5) Engineer's estimate		1,423,72

	(1)	(2)	(3)	(4)	(5)
Lump sum, diversion and care of creek and unwatering foundation	\$38,280	\$36,790	\$21,000	\$11,300	\$32,50
4,700 cu. yd. bench excav.	5.75	2.90	3.40	4.20	3.0
600 cu. yd. trench excav.	9.00	5.90	5.40	18.00	5.0
1,100 lin. ft. installation of 36-in. outlet pipe	5.60	6.00	5.20	4.20	6.7
7 mitters fabrication of mitters 36-in.	27.00	30.00	145.00	120.00	50.0
Lump sum, installation of outlet wye and inlet bend	470.00	500.00	\$1,050	700.00	\$2,00
Lump sum, installation of gate valves, meters and appurt.	500.00	550.00	990.00	840.00	\$1,50
900 lin. ft. drill holes and grout anchor bars outlet pipe	1.30	1.50	6.60	1.70	2.5
100,000 lb. reinf. steel and anchor bars outlet pipe jacket	.09	.09	.12	.12	.13
3,000 lb. reinf. steel outlet struct. and inlet struct. anchor block	.09	.09	.12	.12	.16
300 cu. yd. formed conc. in outlet pipe jacket, cut-off walls and anchor bars	45.00	55.00	150.00	45.00	60.0
500 cu. yd. trench conc. in outlet pipe jacket, cut-off walls and anchor block	31.00	45.00	48.00	45.00	50.0
38,800 cu. yd. foundation excav.	1.15	.50	.78	1.60	1.0
26,000 cu. yd. foundation excav. stock-piled	.46	.14	.46	.50	.3
38,800 cu. yd. foundation excav., wasted	.62	.14	.74	.75	.3
2,000 lin. ft. drilling grout holes 0-ft. to 20-ft.	4.70	2.75	4.00	5.70	2.7
1,100 lin. ft. drilling grout holes 20-ft. to 75-ft.	5.00	5.50	4.00	6.25	4.5
200 lin. ft. drilling grout holes 75-ft. and up	5.20	5.60	4.00	6.50	6.2
100 holes grout connections	11.00	11.00	13.00	12.00	25.0
3,300 cu. ft. furnish and place grout	3.50	3.00	4.00	3.00	3.7
88,100 cu. yd. stripping borrow areas	.88	.45	.62	.95	.5
5,000 cu. yd. furn. and place rock drain	11.00	8.00	7.80	9.00	5.0
612,500 cu. yd. impervious embank. Zone I	.79	.73	.735	.96	.5
195,700 cu. yd. pervious embank. in rock fill, Zones II & III	.10	.14	.55	.95	.5
10,000 cu. yd. pervious embank. in riprap	.80	.14	.94	1.50	1.5
Lump sum, preparation of log booms	600.00	\$1,000	\$1,100	750.00	\$1,50
3,200 cu. yd. excav. for inlet struct.	1.40	.80	3.80	1.20	4.2
225 lin. ft. drilling holes and grouting anchor bars for inlet structure	4.00	4.00	6.60	3.00	2.7
41,000 lb. reinf. and anchor steel in inlet struct.	.09	.09	.13	.12	.1
275 lin. ft. installation of 48-in. cement lined steel pipe in inlet struct.	16.00	17.00	24.00	18.00	22.0
285 cu. yd. concrete in inlet struct.	53.00	70.00	83.00	78.00	86.0
Lump sum, installation of sluice gates in inlet struct.	\$1,800	\$2,500	\$4,600	\$3,000	\$5,00
Lump sum, installation of crse. and fine screen in inlet struct.	650.00	650.00	615.00	\$1,000	\$1,60
6,300 lb. installation of misc. metal work in inlet struct.	.25	.25	.26	.42	.4
239,000 cu. yd. rock excav. for spillway	1.08	1.69	.98	.50	1.2
80,000 cu. yd. waste of rock excav. in spillway	.15	.15	.70	.85	.5
9,800 lin. ft. drilling holes and grouting anchor bars in spillway	1.30	1.40	3.30	1.65	2.2
251,500 lb. reinf. steel and anchor bar steel in spillway	.09	.09	.12	.12	.12
2,290 cu. yd. conc. in spillway weir and lining	44.00	62.00	50.00	47.00	65.0
380 cu. yd. conc. in spillway bucket	36.00	48.00	48.00	36.00	55.0
106 holes weep holes in spillway struct.	7.00	3.00	6.50	2.00	3.0
Lump sum, channel clearing below spillway	\$1,000	\$1,375	\$3,400	500.00	\$1,00
Lump sum, turn. mats. and erect footbridge across spillway	\$2,100	\$3,000	\$1,800	\$1,500	\$2,50
11,900 cu. yd. widen existing road	1.20	1.25	1.10	1.35	.4
29,100 cu. yd. excav. for north road	.90	.96	1.00	1.00	.5
29,500 cu. yd. excav. for pumpine road	.70	.40	1.00	.75	.4

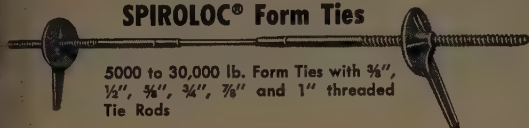
Continued on page 122

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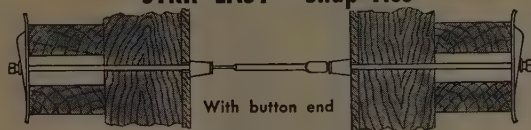
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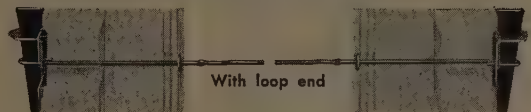
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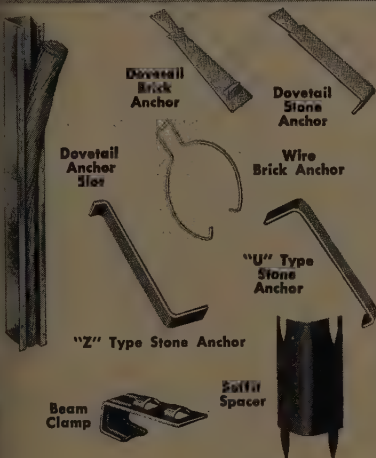
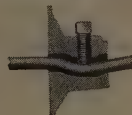


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STONE-SAND PLANTS

... Continued from page 64

tom to remove the settled material. The large area plus a long overflow weir, which extends completely around the tank circumference, allows very fine particles to settle and tends to give a clear water overflow. The principal disadvantage of the hydro-separator for this service is first cost and space required; operating cost being negligible.

Conclusions

The selection of reduction and sizing equipment to provide sand meeting specific specifications requires a thorough study of all conditions. Quarries should be extensively sampled and crushing and grinding tests performed to determine types and sizes of machines best suited for the operation. Gravel deposits should be thoroughly sampled to obtain a close analysis of the material.

With a large amount of oversize material, such as would be normal in a quarry operation, the gyratory crusher may be best adapted for primary breaking because of its large capacity. Where oversize material is a smaller portion of the total required aggregate, the jaw crusher will probably be better suited.

For secondary crushing, the trend is toward the cone or reduction gyratory, with rolls finding a useful place in some cases where a deficiency of larger sand sizes occurs and where the low installation cost will overcome the usually higher operating and maintenance costs.

For manufacturing the greater portion of smaller sizes of sand from quarry rock, or for making up sand size deficiencies in gravel pit deposits, the rod mill finds the most favor, especially when operated in a flexible closed circuit. The ball mill will be best suited to make up the finer and pan sizes, although in some cases it may be used to better advantage than the rod mill for over-all grinding.

The extent to which sizers, classifiers and similar equipment is used in conjunction with crushing and grinding equipment in the manufacturing and production of specification sand, will depend on the magnitude of the project, flexibility desired or required, character of raw material source, water supply, capital investment limits and many other factors.

Prime factors influencing the successful and economical operation of an aggregate plant, incorporating the "manufacture" of sand, are testing and sampling of the material source, proper selection of equipment from a physical and economical viewpoint, a plant design which is flexible enough to meet changing feed characteristics and specifications without costly construction revisions and a plant designed to be operated with the minimum number of attendants.

UNIT BID PRICES CONTINUED

	(1)	(2)	(3)	(4)	(5)
Lump sum, constr. of a temporary access road	\$4,000	\$2,000	\$3,700	\$5,000	\$3,000
100 sta. roadway grading	10.00	13.50	33.00	12.00	5.00
600 lin. ft. culvert installation on north roads	2.10	4.00	6.60	3.50	2.00
570 lin. ft. culvert installation on pumpline road	3.00	4.00	6.60	3.50	2.00
Lump sum, special culvert installation of Little Carson Creek and North Fork	\$1,400	\$4,800	\$2,300	\$3,600	\$2,000
5,000 lin. ft. installation of 12-in., 16-in., 24-in. welded steel pipeline	4.70	5.00	5.75	5.50	3.00
40 meters field fabricate miters for pipeline	20.00	25.00	45.00	25.00	20.00
7 cu. yd. furn. and place anchor blocks	6.00	120.00	60.00	60.00	70.00
350 cu. yd. excav. for pump ramp	2.60	4.00	3.40	1.50	1.00
2,400 lb. reinf. steel for pumping plant ramp	.09	.09	.13	.18	.10
41 cu. yd. conc. for pumping plant ramp	100.00	120.00	160.00	50.00	70.00
Lump sum, constr. of housing for power hoist	900.00	\$1,000	\$1,300	\$1,000	\$1,000
Lump sum, install. of pumping plant, 12-in. pipe and equip.	\$1,850	\$1,800	\$2,500	\$2,000	\$3,000
Lump sum, constr. of chlorination building	\$7,200	\$8,000	\$14,440	\$8,500	\$5,000

Streets and Highways

Road construction at Lowry Air Force Base

Colorado—Lowry Air Force Base—C. of E. Spillane Construction Co., Lakewood, submitted a low bid of \$207,299 before the Corps of Engineers for construction of roads and drainage structures at Lowry Air Force Base. Unit bids were as follows:

(1) Spillane Construction Co.	\$207,299	(4) Northwestern Engineering Co.	\$249,480		
(2) Lowdermilk Bros.	223,394	(5) Government estimate	203,010		
(3) Peter Kiewit Sons' Co.	227,953				
	(1)	(2)	(3)	(4)	(5)
5,000 cu. yd. general excav.	.75	1.20	1.19	2.00	.50
20,000 cu. yd. borrow	1.00	1.25	1.19	2.50	1.00
10 ea. Type A headwalls	100.00	300.00	200.00	200.00	100.00
1 ea. Type B headwalls	148.50	400.00	250.00	220.00	138.00
666 lin. ft. 18-in. pipe culverts	6.40	6.50	10.00	10.00	5.00
11,000 sq. yd. 7-in. base course	.99	.90	1.10	1.25	1.10
7,000 sq. yd. 8½-in. base course	1.30	1.20	1.40	1.50	1.40
15,000 gal. bituminous prime coat	.20	.20	.24	.25	.10
3,000 ton surface course	9.36	6.50	9.50	10.80	9.00
45,000 gal. bituminous matl. for surface course	.17	.17	.18	.16	.10
7,000 gal. bituminous matl. for seal coat	.20	.22	.30	.25	.20
275 ton mineral aggregate for seal coat	8.32	8.00	11.00	9.00	7.00
28,500 lin. ft. curb and gutter	2.65	3.00	2.20	2.30	2.40
92 lin. ft. railroad crossing	10.00	75.00	20.00	6.00	16.00
4 ea. railroad signs	50.00	500.00	100.00	50.00	40.00
390 lin. ft. 12-in. storm drains	4.96	4.75	7.00	9.00	4.50
1,812 lin. ft. 18-in. storm drains	6.98	6.50	9.00	10.00	6.50
380 lin. ft. 24-in. storm drains	8.92	7.75	12.50	11.00	8.50
5 ea. manholes	300.00	400.00	500.00	200.00	350.00
24 lin. ft. manhole overdepth	30.00	50.00	70.00	30.00	50.00
7 ea. Type A inlet	380.00	375.00	600.00	200.00	275.00
32 ea. Type C inlet	250.00	300.00	430.00	250.00	255.00
1,000 B.F. lumber	.20	.50	.25	.40	.10
100 cu. yd. excav. and replacing unstable matls. for drain. and culverts	5.00	4.00	6.00	8.00	4.50
9.5 acres seeding	500.00	350.00	800.00	200.00	300.00
50 cu. yd. spot subgrade reinforcement	20.00	6.00	5.00	5.00	4.00

Canyon road in Wyoming

Wyoming—Teton County—BPR. Taggart Construction Co., Cody, was awarded a \$492,003 contract by the Bureau of Public Roads on the basis of a low bid for 5½ mi. of heavy grading and base course surfacing on the Hoback Canyon route through Teton National Forest. Work involves 384,000 cu. yd. of unclassified excavation. Unit bids submitted were as follows:

(1) Taggart Construction Co.	\$492,003	(4) Knisely-Moore Co.	\$592,000		
(2) Peter Kiewit Sons' Co.	497,283	(5) Engineer's estimate	466,720		
(3) Brown Construction Co.	574,234				
	(1)	(2)	(3)	(4)	(5)
Contingent sum, misc. force account work	\$1,000	\$1,000	\$1,000	\$1,000	\$1,000
2,800 cu. yd. unclassified excav.	.69	.60	.76	.88	.60
23,200 cu. yd. unclassified excav. for struts.	5.00	4.00	5.00	7.00	3.00
1,200,000 sta. yd. overhaul	.65	.40	.65	.52	.40
22,000 cu. yd. mi. overhaul	.02	.02	.03	.02	.10
Contingent sum, obliteration of old roadways to be paid for as earned	.10	.25	.30	.23	.20
7,200 units watering of embank.	\$1,000	\$1,000	\$1,000	\$1,000	\$1,000
540 units watering of base course	3.00	1.50	.50	2.50	2.00
Lump sum, providing and maintaining water plant or plants	\$2,500	500.00	\$8,000	\$2,000	500.00
1,800 hr. rolling of embankment	5.00	8.00	12.00	10.00	8.00
150 hr. rolling of base course	7.00	7.00	9.00	9.00	10.00
22,400 ton subbase matl.	.90	1.60	1.20	1.15	1.00
18,200 crushed gravel or crushed stone base course, Cl. 2, Grading D-1	1.10	1.70	2.00	1.53	1.40
78,500 sq. yd. processing bituminized base	.15	.15	.20	.13	.10
92,000 gal. M.C. cutback asph., Grade 2 or 3	.16	.20	.16	.18	.10
282 cu. yd. conc., Class A (air-entrained conc., low-alkali cement)	81.75	90.00	80.00	82.00	70.00
20,100 lb. reinforcing steel	.17	.20	.20	.18	.10
3,242 lin. ft. 24-in. C.G.S.M. culvert pipe	9.00	9.00	7.00	8.00	7.00
60 lin. ft. 42-in. C.G.S.M. culvert pipe	18.00	20.00	14.00	18.00	12.00
3,400 lin. ft. 6-in. perf. C.G.S.M. pipe underdrain	5.00	5.00	6.00	5.60	5.00
30 ea. conc. maintenance marker posts	8.00	20.00	15.00	25.00	20.00
7 ea. gates (swinging pole gates 14 ft.)	200.00	90.00	40.00	27.00	50.00
16,900 lin. ft. buck fence (4-pole)	.50	.60	.40	.56	.40
230 ea. timber guide posts with warning reflectors (tr.)	5.00	8.00	8.00	8.00	6.00
Lump sum, removing concrete culvert wings	350.00	400.00	350.00	450.00	600.00

UNIT BID PRICES CONTINUED

Select material, bituminous road mix and seal coat

Arizona—Maricopa County—State. Benton Construction Co., Inc., Phoenix, submitted low bid of \$100,000 before the State Highway Department for about 10.8 mi. of subgrading at dips and structures, material, bituminous road mix, and seal coat, beginning at the town of Maricopa and extending to the Maricopa County line. Unit bids submitted were as follows:

Benton Construction Co., Inc.	\$121,009	Tiffany Construction Co.	\$140,866
Larsen Contracting Co.	129,555	Orr & Orr Construction Co.	142,292
Johnnie Iben Construction Co.	129,796	M. M. Sundt Construction Co.	146,494
Eddie Givens Contracting Co.	130,934	Royden Construction Co.	146,556
B. L. Gustafson	139,999	Dale F. Payne	149,113
Copper State Construction Co.	133,532	Tanner Bros.	152,368
D. A. Flickinger	140,003	Fisher Contracting Co.	164,212

	(1)	(2)	(3)	(4)	(5)	(6)
100 cu. yd. stripping pits	15	.18	.20	.25	.20	.20
100 gal. provide water supply	700.00	\$5,000	\$1,400	\$2,500	\$1,000	500.00
20 hr. rolling	2.40	1.00	2.10	1.50	2.50	2.00
100 ton select material (CIP)	8.50	7.50	6.75	7.00	8.00	8.00
100 ton cover mat. for seal coat (Type B) (CIP)	.54	.61	.565	.62	.65	.60
100 ton bitum. mix (Cl. I-road mix) (CIP except cost of liquid asphalt)	4.45	4.50	4.10	4.50	5.50	5.00
75 ton liquid asphalt for bitum. mix (Grade SC-3 or SC-4) (CIP)	.99	1.20	1.44	1.20	1.25	1.25
106 ton emuls. asph. for seal coat (Gr. A) (CIP)	29.25	32.00	29.50	32.00	32.75	31.00
20 lin. ft. road guard (Std. C-7) (CIP)	35.00	33.00	31.00	34.00	33.00	32.00
30 ea. guide posts (Std. C-8) (Type B) (CIP)	7.20	3.00	4.00	3.50	3.50	3.50
1 ea. survey monument and cover (Std. C-1) (CIP)	9.90	7.00	5.00	6.00	6.00	6.00
1 lump sum, subgrading at dips and stru.	60.00	40.00	85.00	50.00	50.00	50.00
	\$1,075	\$1,000	\$3,000	\$1,000	\$2,755	\$4,800

41½ miles of rolling and seal coating on U. S. 60

New Mexico—Catron County—State. Armstrong & Armstrong, Roswell, received an award from State Highway Department on the basis of a low bid of \$73,148 for 41½ mi. of rolling and seal coating on U. S. 60, Quemado to Datil area. Unit bids were as follows:

Armstrong & Armstrong	\$73,148	(4) Brown Construction Co.	\$79,073
O. D. Cowart	75,734	(5) Floyd Haake	86,441
Skousen Construction Co.	76,915	(6) Engineer's estimate	77,312

	(1)	(2)	(3)	(4)	(5)	(6)
35 hr. rolling, steel tired roller	7.50	5.00	6.50	7.00	8.00	6.00
35 hr. rolling, pneumatic tired roller	4.50	5.00	5.00	4.00	5.00	5.00
55 bbl. cutback asphalt, Type MC-5	9.00	8.00	8.50	8.40	7.50	7.50
20 ton aggregate for seal coat	4.70	5.60	5.45	5.80	7.10	6.00

Grading, paving, and two concrete slab bridges

Washington—King County—State. N. Fiorito Co., Seattle, won an award from the State Highway Commission on the basis of a low bid of \$819,913 for 4.9 mi. of road construction and two reinforced concrete slab bridges on P.S.H. No. 2, from the middle crossing of the Snoqualmie River to Tanner. Unit bids were as follows:

N. Fiorito Co.	\$819,913	(3) Goetz & Brennan	\$975,077
Northwest Construction Co.	858,675		

	(1)	(2)	(3)
19.68 acres clearing	500.00	600.00	900.00
19.32 acres grubbing	500.00	500.00	900.00
1,770 cu. yd. common excav., incl. haul of 600 ft.	.40	.38	.55
1,320 cu. yd. solid rock excav., incl. haul of 600 ft.	2.00	2.00	1.75
735 cu. yd. common trench excav., incl. haul of 600 ft.	3.00	2.00	3.00
1,330 cu. yd. sta.'s. overhaul	.02	.01	.02
515.3 M. cu. yd. sta.'s. overhaul	4.50	4.00	6.00
2,250 cu. yd. channel change excav., incl. haul	.70	1.00	.95
290 cu. yd. excav. of unsuitable mat., incl. haul	3.00	2.00	2.00
4,250 cu. yd. special borrow in place	.75	.60	1.20
1,607 cu. yd. structure excavation	3.50	4.00	3.50
23 days smooth-wheeled power roller	60.00	60.00	55.00
82 days tamping roller	60.00	50.00	60.00
42 days pneumatic-tired roller	60.00	50.00	60.00
62 days mechanical tamping	45.00	45.00	45.00
0.612 lin. ft. slope treatment Class A	.20	.20	.18
444.2 sta. (100 ft.) finishing roadway	17.50	12.00	20.00
4,727 lin. ft. reconstruction roadway ditches	.30	.60	.30
461 M. gals. water	3.00	3.00	3.00
430 cu. yd. sand filler in place, incl. haul	2.00	3.00	2.50
15 cu. yd. gravel backfill for foundations	10.00	6.00	5.00
211 cu. yd. gravel backfill for drains	7.50	8.00	9.00
5,630 ton selected roadway borrow	.95	1.45	1.50
8,445 ton cr. stone surfacing top course	2.00	2.55	2.30

LIGHT BITUMINOUS SURFACE TREATMENT—METHOD A

6,499 sq. yd. preparation, construction, finishing	.05	.10	.05
153 ton asphalt cement MC-3	42.50	50.00	45.00
1,333 cu. yd. furn. and placing crushed cover stone	4.50	4.50	4.60

TYPE I-1 ASPHALTIC CONCRETE PAVEMENT

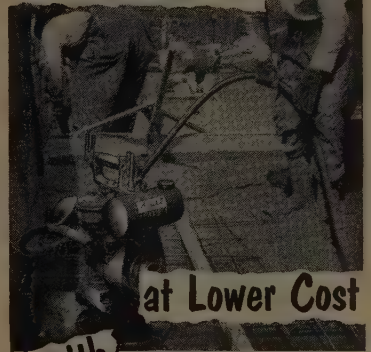
3,402 ton Class C wearing course	8.25	7.50	7.50
7,666 ton Class L leveling course	8.25	7.50	7.50
3.75 mi. preparation of untreated roadway	200.00	300.00	250.00
177 cu. yd. new fine mineral aggregate	5.00	4.50	4.60
31 ton asphalt cement MC-3 prime coat	42.50	50.00	42.50

ONE COURSE CONCRETE PAVEMENT

16,507 sq. yd. cement conc. pavement std. 14 day mix 8-in. sec.	3.55	3.70	4.20
19,630 lbs. pavement reinforcement Type No. 2	.12	.12	.13
504 only, dowel bars without rubber caps	.30	.30	.30
168 lin. ft. pavement headers	3.00	2.00	1.50
324 sq. yd. concrete placed as extra thickness	3.00	3.65	3.20

Continued on page 124

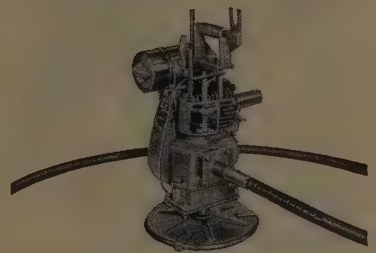
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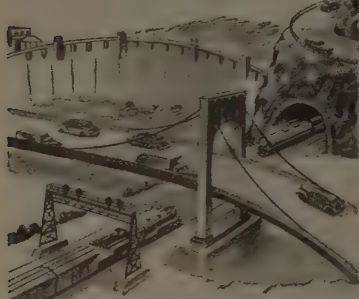
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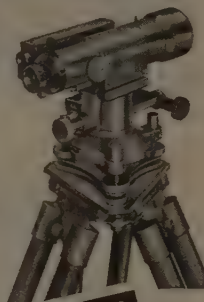


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UNIT BID PRICES... CONTINUED

OTHER ITEMS

	(1)	(2)	(3)
4,871 sq. yd. shaping, preparation and finishing median and gutter.....	.05	.50	
13,241 lin. ft. asphaltic concrete curb	.73	.65	
23.7 cu. yd. concrete, Class A	80.00	80.00	90
21.0 cu. yd. concrete, Class C	65.00	80.00	90
2,587 lb. steel reinforcing bars	.15	.13	
1,005 lin. ft. concrete or V.C. drain pipe 6-in. diam.	1.00	1.00	
402 lin. ft. place conc. culv. pipe 12-in. diam.	2.00	2.00	2
1,188 lin. ft. std. reinf. conc. culv. pipe 18-in. diam.	4.00	4.00	
513 lin. ft. std. reinf. conc. culv. pipe 24-in. diam.	6.25	6.00	
357 lin. ft. std. reinf. conc. culv. pipe 30-in. diam.	10.00	9.50	
339 lin. ft. bit. ctd. corr. met. culv. pipe 16 ga., 8-in. dia., Type 2 ..	3.00	2.60	
78 lin. ft. bit. ctd. corr. met. culv. pipe 16 ga., 12-in. dia., Type 2 ..	4.00	3.30	
204 lin. ft. bit. ctd. corr. met. culv. pipe 16 ga., 18-in. dia., Type 2 ..	4.50	4.60	
177 lin. ft. relaying conc. culv. pipe 14 ga., 24-in. dia., Type 2 ..	6.00	6.00	6
42 lin. ft. relaying conc. culv. pipe 18-in. diam.	2.50	3.00	2
42 lin. ft. relaying conc. culv. pipe 24-in. diam.	3.50	4.00	3
100 lin. ft. relaying wood stave water pipe 4-in. diam.	2.00	3.00	1
9 only catch basins	125.00	125.00	135
11 only concrete inlets	75.00	100.00	85
13,820 lin. ft. beam guard rail	3.00	2.80	3
76 only reinf. conc. right-of-way markers	7.00	7.00	7
221 only reinf. conc. spot posts (posts furnished)	10.00	7.00	12
68 only monument cases and covers (cases and covers furn.)	20.00	15.00	35
6,110 cu. yd. loose riprap, Class B	3.50	3.00	2
22 cu. yd. hand placed riprap	30.00	35.00	30
2 cu. yd. rubble masonry riprap	40.00	50.00	40
3,102 sq. yd. removing cement concrete pavement	.75	.60	
3,960 lin. ft. removing reinforced concrete gutter lip	.50	.20	
13 only removing cement concrete headers	50.00	30.00	30
131 lin. ft. removing cement concrete spillway	1.00	1.00	1
Lump sum, removing portions of existing box culvert	300.00	400.00	\$2.00
5,075 lin. ft. removing cable guard rail	.40	.25	
7 only removing wood spot posts	2.00	3.00	2

BRIDGES (2)

800 cu. yd. structure excavation	6.00	5.00	10.0
94 cu. yd. concrete, Class A	75.00	70.00	80.0
263 cu. yd. concrete, Class B	70.00	70.00	80.0
100 lin. ft. reinf. conc. bridge railing	10.00	10.00	8.0
37,500 lb. steel reinforcing bars	.13	.12	.1

Six bridges and plant-mixed surfacing for 5 miles of the Bayshore Freeway

California—San Mateo County—State. Piombo Construction Co., San Francisco, submitted the low bid of \$3,749,132 before the State Division of Highways for about 5 mi. of the Bayshore Freeway between 0.1 mile north of 16th Ave. and 0.2 mile south of Bransten Rd. Work includes grading, plant-mixed surfacing, cement-treated base, and construction of six bridges and widening of one bridge. Unit prices were as follows:

(1) Piombo Construction Co.....	\$3,749,132	(5) Chas. L. Harney, Inc.....	\$4,276,990
(2) L. C. Smith Co.....	3,749,629	(6) Macco Corp. and Morrison-Knudsen Co., Inc.....	4,536,756
(3) Peter Kiewit Sons' Co.....	3,839,392	— Guy F. Atkinson Co.....	4,624,243
(4) Fredrickson & Watson Construction Co. and M & K Corp.....	3,876,596		

	(1)	(2)	(3)	(4)	(5)	(6)
465 cu. yd. removing concrete.....	10.00	4.20	8.00	11.80	3.60	4.00
74,250 lin. ft. removing traffic stripe.....	.13	.10	.14	.13	.10	.10
Lump sum, clearing and grubbing	\$50,000	\$35,000	\$5,400	\$86,000	\$39,000	\$13,200
247,400 cu. yd. roadway excavation	.13	.30	.30	.29	.67	.33
31,800 cu. yd. structure excavation	3.80	2.00	3.00	2.60	3.20	4.30
78,000 cu. yd. mud stripping	.50	1.00	.40	.52	.87	1.00
16,500 cu. yd. ditch and channel excavation	.75	1.25	1.00	1.42	1.20	1.30
56,000 sq. yd. compacting original ground.....	.06	.08	.08	.04	.06	.15
1,740,000 ton imported borrow, Type A.....	.71	.68	.75	.68	.80	.95
1,740,000 ton imported borrow, Type B.....	1.85	2.00	1.80	1.95	1.75	2.05
9,200 ton rock blanket material	4.90	3.65	3.70	2.93	2.80	4.20
94,700 lin. ft. vertical holes (sand drains)	.45	1.11	.85	.90	.80	
35,600 ton sand backfill and blanket (sand drains)	2.85	3.00	2.90	3.22	3.35	3.08
22,300 cu. yd. salvaging and relaying base matl.	.65	.90	.70	.23	1.60	1.07
1,280 ton sand backfill (abandoned struct.)	3.90	4.00	2.00	3.78	2.30	3.75
263,300 ton imported base material	1.15	1.22	1.10	1.40	1.70	1.68
Lump sum, dev. wat. sup. & furn. wat. equip.....	\$15,000	\$40,000	\$1,300	\$36,311	\$20,000	\$15,000
49,500 M. gal. applying water	1.40	.80	1.60	1.10	1.80	1.70
Lump sum, finishing roadway	\$3,000	\$8,000	\$5,000	\$19,000	\$18,000	\$9,800
15,600 bbl. portland cement (cem. tr. base)	3.50	3.90	4.25	3.86	4.00	3.85
223,000 sq. yd. mix. and compact. (cem. tr. base)	.22	.25	.22	.20	.20	.18
35,000 ton untreated rock base	2.60	2.65	2.10	2.67	2.90	2.80
32,500 sq. yd. reconstructing existing shoulders.....	.20	.18	.25	.18	.25	.24
345 ton liquid asphalt SC-1 (pen. tr. & pr. ct.)	33.00	30.80	30.00	32.50	41.00	30.00
90 ton liquid asphalt SC-2 (pen. tr.)	33.00	30.00	30.00	34.00	40.00	29.00
397 ton asphaltic emuls. (prt. bndr., cur. sl. & sl. ct.)	37.00	32.00	40.00	36.50	48.00	34.00
320 ton sand (penetration treatment)	6.70	5.00	8.00	6.00	6.00	4.80
1,250 ton screenings (seal coat)	6.90	7.00	8.00	5.10	6.20	7.20
49,500 ton mineral aggregate (P.M.S.)	5.40	4.00	4.85	5.82	4.80	5.00
35 ton liquid asphalt SC-4 (P.M.S.)	5.40	23.00	25.00	5.82	25.00	29.00
2,440 ton paving asphalt (P.M.S.)	5.40	23.00	25.00	5.82	25.00	26.00
167 sq. ft. placing plant-mix ditch lining	1.50	.20	1.00	.40	1.00	1.00
410 lin. ft. raised traffic bars	2.00	1.60	2.00	1.90	1.90	2.00
3,590 cu. yd. Class "A" Portland cem. conc. (structs.)	52.00	50.00	52.00	51.00	50.00	54.00
1,180,000 lbs. structural steel	.13	.1075	.12	.128	.12	.12
Lump sum, clean and paint structural steel	\$15,500	\$14,654	\$18,350	\$18,500	\$13,500	\$20,000
30,400 lbs. miscellaneous iron and steel	.30	.30	.30	.30	.39	.47
12 M.F.B.M. treated redwood timber	200.00	340.00	750.00	300.00	300.00	540.00
1,220 lin. ft. furn. untreated timber piling	1.20	.95	.80	1.00	.80	.70
61 ea. driving timber piles	65.00	82.00	65.00	65.00	30.00	66.00
18,626 lin. ft. furn. concrete piling	3.40	4.00	4.40	3.40	3.30	4.20
408 ea. driving concrete piles	70.00	71.00	80.00	78.00	70.00	85.00
7,369 lin. ft. furn. steel piling	3.80	4.80	3.00	4.00	2.80	3.00

UNIT BID PRICES CONTINUED

	(1)	(2)	(3)	(4)	(5)	(6)
70 ea. driving steel piles	84.00	85.00	100.00	91.40	88.00	157.00
79 ea. steel pile splices	31.00	25.00	35.00	30.00	40.00	26.00
140 cu. yd. broken concrete riprap	12.00	15.00	26.00	18.00	12.00	11.00
2,404 cu. yd. Class "B" port. cem. conc. (curbs, gutters, sidewalks)	37.50	32.00	35.00	34.00	40.00	37.00
150 ea. curb dowels	1.00	1.00	1.00	1.10	.70	1.80
20 ea. right-of-way monuments	6.00	6.90	9.00	6.50	7.00	7.00
40 ea. survey monuments	30.00	25.00	30.00	23.00	30.00	30.00
160 ea. portable timber barricades	42.00	25.00	30.00	35.00	40.00	24.00
2,352 lin. ft. steel railing	8.80	7.75	9.00	8.30	8.00	9.00
215 lin. ft. corrug. metal bridge railing	8.80	5.00	6.00	4.50	6.00	3.60
970 lin. ft. salvaging existing guard railing	1.40	1.30	1.20	1.30	1.00	1.50
970 lin. ft. reconstr. salv. guard railing	1.70	1.60	1.50	1.30	2.00	1.80
820 ea. guide posts and markers	6.00	6.50	7.50	6.20	8.50	6.80
35 ea. horizontal reflector units	8.20	8.50	10.00	8.20	10.00	9.00
12,900 lin. ft. 36-in. chain link fence (wire top)	.90	.77	1.10	.97	.95	1.00
27,600 lin. ft. 72-in. chain link fence (rail and wire top)	1.50	1.55	1.70	1.54	1.50	1.50
6 mi. new property fence	\$1,900	\$1,854	\$2,000	\$1,950	\$1,850	\$2,000
192 lin. ft. 12-in. reinf. conc. pipe, Type A (std. str.)	3.20	3.55	3.00	3.30	2.50	3.00
48 lin. ft. 12-in. reinf. conc. pipe, Type A (3000-D)	3.50	3.60	6.00	3.30	3.30	3.50
2,200 lin. ft. 12-in. reinf. conc. pipe, Type B (std. str.)	5.20	5.00	6.00	4.60	4.60	4.80
104 lin. ft. 12-in. reinf. conc. pipe, Type B (3000-D)	5.40	5.15	6.00	4.90	4.80	4.50
136 lin. ft. 15-in. reinf. conc. pipe, Type B (std. str.)	6.50	5.90	7.00	5.60	6.00	6.00
2,648 lin. ft. 18-in. reinf. conc. pipe, Type B (std. str.)	7.80	7.00	8.00	6.60	6.80	7.25
68 lin. ft. 18-in. reinf. conc. pipe, Type B (3000-D)	8.00	7.15	8.00	6.80	7.00	8.00
400 lin. ft. 21-in. reinf. conc. pipe, Type B (std. str.)	9.20	8.20	9.00	7.70	8.50	8.50
88 lin. ft. 21-in. reinf. conc. pipe, Type B (3000-D)	10.80	9.80	11.00	9.20	9.50	10.00
1,000 lin. ft. 24-in. reinf. conc. pipe, Type B (std. str.)	10.60	9.40	10.00	9.00	9.00	9.60
96 lin. ft. 27-in. reinf. conc. pipe, Type A (std. str.)	7.60	8.20	9.00	7.60	9.00	8.50
868 lin. ft. 27-in. reinf. conc. pipe, Type B (std. str.)	12.15	11.30	11.00	10.20	10.50	11.50
736 lin. ft. 30-in. reinf. conc. pipe, Type B (std. str.)	13.70	12.90	13.00	11.50	12.00	12.50
1,028 lin. ft. 45-in. reinf. conc. pipe, Type B (std. str.)	22.30	20.50	21.00	18.50	21.00	23.00
800 lin. ft. 48-in. reinf. conc. pipe, Type B (std. str.)	24.10	22.00	23.50	20.10	23.00	25.00
60 lin. ft. 54-in. corr. metal pipe (12 gauge)	20.80	15.85	19.00	20.30	23.00	21.00
568 lin. ft. 48-in. nestable pipe cover (12 ga.)	14.40	17.00	19.00	24.20	22.00	23.00
540 lin. ft. salvaging exist. pipe culverts	2.00	1.50	3.00	1.65	2.60	1.80
540 lin. ft. relaying salv. corr. metal pipe culv.	2.00	1.50	1.50	1.65	2.10	2.40
471,800 lb. bar reinf. steel	.09	.0793	.09	.083	.08	.08
2 ea. 18-in. automatic drainage gates	40.00	45.00	90.00	50.00	80.00	70.00
1 ea. 21-in. automatic drainage gate	50.00	60.00	100.00	60.00	100.00	80.00
1 ea. 27-in. automatic drainage gate	90.00	90.00	170.00	100.00	150.00	160.00
1 ea. 48-in. automatic drainage gate	240.00	240.00	310.00	234.00	400.00	480.00
78 lin. ft. 8-in. welded steel pipe (10 gauge)	3.00	7.00	6.00	2.54	5.00	2.00
6 ea. adjusting manholes to grade	30.00	35.00	75.00	77.00	45.00	120.00
1 ea. manhole pipe seal	20.00	50.00	50.00	55.00	40.00	50.00
10 ea. salvaging manhole frames and covers	6.00	20.00	22.00	27.50	25.00	18.00
3 ea. reinstalling salv. manhole frms. & covrs.	25.00	25.00	35.00	27.50	25.00	35.00
17 lin. ft. new manholes	40.00	35.00	60.00	47.00	30.00	40.00
ump sum, sign frames	\$1,500	\$1,700	\$1,200	\$1,350	\$7,000	\$5,000
7,270 lin. ft. metal plate guard railing	3.20	3.10	3.50	3.25	3.60	3.50
ump sum, remov. & saly. traffic sig. & hwy. light.	\$1,273	\$1,216	\$1,400	\$1,300	\$1,200	\$1,200
ump sum, electrical work on struts.	\$3,900	\$3,675	\$4,200	\$3,850	\$3,600	\$4,000
ump sum, highway lighting	\$70,000	\$67,025	\$76,600	\$70,500	\$65,000	\$70,000
ump sum, illuminated signs	\$6,500	\$6,205	\$7,100	\$6,500	\$6,300	\$6,500

Sewerage

Sewer construction in Portland

Oregon—Portland—City. H. C. Werner, Inc., Eugene, submitted a low bid of \$656,747 for construction of the interceptor for the southwest unit of an intercepting sewer and sewage treatment project for the City of Portland. Unit bids submitted were as follows:

(1) H. C. Werner, Inc.	\$656,747	(3) Atlas Construction Co.	\$845,659
(2) Empire Construction Co.	665,764	(4) George W. Lind Co.	878,527

	(1)	(2)	(3)	(4)
3,800 cu. yd. trench excavation and backfill	2.60	4.00	2.60	4.75
6,108 lin. ft. 42-in. reinf. conc. sewer pipe in place	14.50	15.95	14.00	15.10
3,782 lin. ft. 36-in. reinf. conc. sewer pipe in place	13.00	12.00	10.00	13.40
500 lin. ft. 30-in. reinf. conc. sewer pipe in place	11.00	11.33	8.30	10.35
1,716 lin. ft. 24-in. reinf. conc. sewer pipe in place	8.00	9.50	7.00	6.85
4,271 lin. ft. excav. for 34x60-in. tunnel	42.00	40.00	83.00	72.60
4,271 lin. ft. 34x60-in. monolithic reinf. tunnel lining in place. This includes furn. and install. reinf. steel	28.00	22.75	32.00	30.50
5,700 sq. yd. hard surface pavement cut and replaced	6.00	6.00	7.00	7.35
400 sq. yd. water or oil bond pavement cut and replaced	3.00	3.00	6.00	3.00
50 sq. yd. sidewalk cut and replaced	7.00	4.90	6.50	6.25
110 lin. ft. curb cut and replaced	3.00	2.50	5.00	1.40
650 lin. ft. 8-in. drain tile in place in tunnel including excav. and backfill	4.00	4.50	2.50	4.50
200 cu. yd. screened gravel in backfilling drain ditches, in place	6.00	6.50	8.00	5.90

Continued on page 126



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U. S. Steel addition completed

AN INCREASE of 68% in sheet and tin plate production was foreseen with completion of an extensive construction program at United States Steel Corp.'s Pittsburgh, Calif., Columbia-Geneva Steel Division.

Some 63,000 cu. yd. of concrete and 7,400 tons of structural steel were used to build the installations, which included a four-stand cold reduction mill, a second continuous pickling line, additional annealing furnaces, a side trim and recoil line, a slitting line, a continuous galvanizing line, and a second high-speed electrolytic tinning line.

Nevada cities plan joint sewer plant project

COOPERATION among the cities of Reno and Sparks and the commissioners of Washoe County in Nevada is clearing the way for a proposed \$1,000,000 joint sewer plant project, according to S. Thomas Hilberg, Reno city manager.

The new plant would handle 10,000,000 tons a day, Hilberg said, and although it would mean a heavy cash outlay in the present, the long-time return would be worth it.

UNIT BID PRICES CONTINUED

	(1)	(2)	(3)	(4)
40 cu. yd. Class 4 conc. (4 sacks per cu. yd.) for cradles, footings, etc.	36.00	29.00	30.00	50.00
22 ea. standard manholes—Type A base depth 7 ft.	290.00	215.00	200.00	195.00
19 ea. standard offset manholes—Type C base depth 15 ft.	\$1,400	\$1,025	\$1,800	\$1,100
Lump sum, diversion manhole—24-in. diversion pipe, base depth 7 ft.	\$3,450	\$1,750	\$3,600	\$4,200
4 ea. drop manholes—Type B, base depth 7 ft., 15-in. drop pipes	392.00	320.00	350.00	750.00
2 ea. drop manholes—Type C, base depth 7 ft.	990.00	650.00	\$2,200	\$1,600
219 lin. ft. depth of manholes in excess of base depths	26.00	29.50	30.00	27.00
Lump sum, special junction struct. (SW) per drawing SW15	\$3,185	\$2,075	\$3,800	\$6,000
Lump sum, special manhole with 22-ft. well casing (SW43) per drawing SW19	1,820	910.00	\$1,800	\$2,500
Lump sum, special struct. 11,000-volt cable crossing complete with splicing of cables, etc. (See the Pacific Power & light Co., for plans and specifications)	\$20,940	\$18,500	\$19,250	\$17,600

Miscellaneous

"Shoofly" at The Dalles Dam site

Washington—Klickitat County—C. of E. G. D. Dennis & Sons, Portland, submitted a low bid of \$190,766 before the Corps of Engineers for construction of about 1 mi. of single track for the Spokane Portland & Seattle Railway "shoofly" at The Dalles Dam site. Unit prices were as follows:

(1) G. D. Dennis & Sons.....	\$190,766	(4) Gibbons & Reed Co.	\$203,793				
(2) Guy F. Atkinson Co.....	196,422	(5) Parker-Schram Co.	223,188				
(3) Fred H. Slate Co., Oregon Ltd., and E. C. Hall Co.	196,696	Morrison-Knudsen Co., Inc.	268,939				
		(6) Contracting officer's estimate	177,577				
		(1)	(2)	(3)	(4)	(5)	(6)
120,000 cu. yd. excav., unclassified	1.08	1.15	1.10	1.225	1.25	1.0	
50 hr. additional rolling	12.00	10.50	10.00	10.00	15.00	14.5	
30 lin. ft. 24-in. diam. conc. culvert pipe	10.00	13.65	4.50	10.00	8.00	8.2	
4,220 tr. ft. track laying	7.57	7.85	7.46	6.35	7.00	6.2	
3,000 cu. yd. ballast matl., in place	4.75	4.20	5.90	5.70	7.00	3.2	
580 rod right-of-way fence, barbed wire, in pl.	5.15	4.20	6.00	5.40	9.10	6.6	
1 ea. cattle guard, and "A" frames, in place.....	90.30	90.00	400.00	170.00	750.00	360.0	
2 ea. barricades, in place	89.25	52.50	250.00	35.00	65.00	46.0	
1 ea. car bumper, in place	315.00	380.00	500.00	360.00	500.00	380.0	
5,000 lin. ft. signal communication lines complete, in place	2.10	1.75	2.00	1.66	3.00	2.0	

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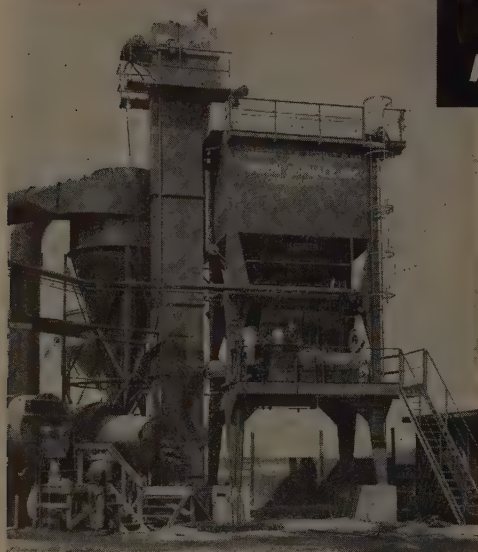
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DENVER PRESTRESS

... Continued from page

ft., and many had a span of 30 ft. with an overhang cast monolithically with that section, this cost compares favorably with other equivalent types of construction.

Cost figures to date have shown that with slabs spanning 20 to 25 ft. and with ordinary bearing conditions these slabs can be manufactured and erected with a cost to the customer of \$0.80 to \$0.85 per sq. ft. This cost will increase as the span increases and as the erection conditions become more difficult. Roof construction consisting of prestressed concrete beams, with spans from 50 to 80 ft., and a prestressed concrete slab cover of about 25 ft., will vary in cost to the customer, in place, from \$1.40 to \$1.80 per sq. ft. of roof area.

Personnel

Architectural design of the Loyland Elementary School was prepared by the office of John K. Monro Architect, Denver. Structural design was done by the firm of Phillip Carter-Osborn, Inc., Engineers, Denver. This firm has done most of the other prestressed concrete design in this area and also the design of the pretensioning bed and tensioning mechanism for the pretensioning plant of Prestressed Concrete of Colorado, Inc.

Manufacture and erection of all of the prestressed concrete units which have been constructed in this area has been performed by Prestressed Concrete of Colorado, Inc. This has consisted of both pretensioned and post-tensioned members. In most cases the prestressed concrete part of the building has been subcontracted from the general contractor for the building. In a few cases, this part of the contract has been made directly with the owner.

Organic bonding seminar to be held by Eutectic

THE FIRST comparison seminar ever held on organic bonding will be given this fall by the Eutectic Welding Alloys Corp. at its training institute in Flushing, N. Y. Lasting four days, it is open to all who wish to investigate the adhesive bonding of materials.

The seminar will be kept to a practical level. The theory of bonding will be discussed, but metallurgy will be held to a minimum. It will be presented as a service to industry and there will be no charge. Those attending, however, will be expected to pay their own transportation and accommodation charges. Requests for further information should be made to Eutectic Welding Alloys Corp., 40-40 172nd St., Flushing, N. Y.

NEW LITERATURE

801

Physical testing apparatus for soils, asphalt, and concrete materials

Oiltest, Inc., is offering a 72-page color photograph illustrating and describing its complete line of physical testing apparatus for engineering tests of soils, concrete, and bituminous materials. Each aspect of these materials is treated comprehensively, with instructions for the various kinds of testing equipment which are described and illustrated. For example, a section on bituminous testing covers ductility, stability, penetration, softening point, and distillation, and for each of these phases the booklet tells what machine to use and how it works.

802

about expandable concrete forms

The advantages of Rubora concrete forms are covered in this booklet published by Kurt Orban Co., Inc., American distributor for the European manufacturer. In case you are wondering exactly how these reusable expandable forms do operate, drawings and pictures in the brochure will answer your questions. Also tells you how Rubora forms save labor costs, are quickly placed, save storage space, are lightweight, and eliminate waste of material because they can be used to form any required panel size.

803

Brochure on concrete gunning equipment

A 4-page bulletin in orange, black, and white gives you up-to-date information on the new, improved models No. 750 and No. 1250 Bondors, concrete gunning equipment. Included is a detailed explanation of the "gunned" or "air placed" concrete aggregate principle. Application photographs show this equipment in use on actual jobs. Also recommends Bondors for the construction, repair and maintenance fields. This useful information is available from Air Placement Equipment Co.

804

Bulletin on Cleveland Model 110 Trencher

The subject of the Model 110 trencher is taken up in a new 2-color, 8-page bulletin published by Cleveland Trencher Co. Action photographs show numerous job applications illustrating the versatility of the Model 110. Its design and construction features are described in the

center spread, which also contains a numbered outline photograph showing position of the important parts. Complete dimensions and specifications are given. Includes information on optional extra equipment for special trenching requirements and a table of 48 closely-spaced digging-wheel and crawler-speed combinations available in this machine.

805

On Fiberglas insulation for metal buildings

An interesting bulletin offered by Owen-Corning Fiberglas Corp. covers their line of Fiberglas insulation materials. Divided into three parts, it points out the advantages which these products offer as insulation material for steel and aluminum buildings as well as metal buildings. Drawings and written instructions show how to apply the Fiberglas to walls and roofs, to old buildings, and to buildings in the process of being erected. Complete specification tables are included.

806

Euclid "lever action" scraper described

An explanation of the features of the new "lever action" 15.15 yd. scraper is contained in a 16-page catalog folder issued by Euclid Road Machinery Co. You will find out how the new scraper design eliminates all cable (with the exception of a short length used to open the apron) through the use of vertically-mounted jacks actuating levers which independently control the bowl, apron, and ejector.

807

Brochure on sand dryers

Standard Steel Corp. recently issued Bulletin No. 5323 covering their rock and sand dryers. The brochure contains information on the dryers' rugged frame mounting, compact electric drive, and combustion chamber, plus close-up photos of the trunnion wheels and tire mountings. Also contains details on the latest Standard Dust Collectors and Wet Washing Systems.

808

Informative booklet on diesel electric sets

Complete coverage of Caterpillar diesel electric sets is offered in a new 20-page, profusely-illustrated booklet (Form 30507), which is offered by Caterpillar Tractor Co. Includes de-

scriptions of the many features of these electric sets, discussions of both self-regulated generators and completely automatic sets, and lists of attachments and specifications. Cut-away views illustrate the general construction of all Cat electric sets.

809

Directory for hard surfacing

A new edition of Weldirectory 466 covering the subject of hard surfacing is now offered by The Lincoln Electric Co. A detailed introduction covers the general subject, taking into consideration service required, service conditions, part to be surfaced, dimensions, and finish required. Of special interest is a new 3-page chart or hardsurfacing guide which can help answer many of your questions regarding types of hardsurfacing material, and the choice of the material best suited to a particular type of service.

810

"Solving Roof Problems"

A recently-issued, highly-informative booklet is concerned with roof maintenance. Illustrated by photographs, drawings, and diagrams, the 32-page bulletin thoroughly explores such subjects as the various types of roofs, how they are built, what factors enter into their deterioration, and how roof troubles can be diagnosed and treated. Offered by The Tremco Manufacturing Co.

811

Information on concrete joints

Well designed and illustrated, this 3-color, 24-page bulletin discusses poured, pre-molded, ribbon and vibrated joints for concrete highways and airports. The publisher, Flexible Road Joint Machine Co., tells you how modern mechanization methods make it possible to do a better job, faster, and at lower cost.

812

For making better ditches . . .

Two 4-page brochures published by E. V. Briscoe & Son let you know how you can make better formed ditches by use of their ditcher and well-shaped canal bank contours by use of the Briscoe sloper. Pictorial displays show these two machines in action right on the jobs which illustrate the varied tasks they can perform.

813

Various gates and valves

Bulletin 1252, recently published by Stephens-Adamson Manufacturing Co., covers their line of gates and valves for handling bulk materials. Included are air-lock gates and valves, ash gates, bin and bunker bottom and sidewall gates, drip-proof gates, dump-type gates, double-quadrant gates, dust-tight gates, loading gates

for conveyors, and many others. Unusual units listed include the "Twistite" double closure bin valve and the Moore bin gate. Each is photographed, described, and presented with diagrams and design charts.

814

Maintenance guide for "Cat" engines

Another cartoon-type instruction booklet (Form 30562) has been issued by Caterpillar Tractor Co. This one covers the proper operation and care required for Caterpillar's four large V-type engines, the D397, D386, D375, and D364. You'll find out maintenance tips on the fuel system, lubrication system, cooling system, air intake, and exhaust system, to mention some of the main problems considered.

815

Thorough treatment of metal hose

Titeflex, Inc., recently has published Catalogue No. 200, a 50-page treatment of Titeflex helically-wound, flexible, metal hose and Uniflex helically-corrugated, flexible, metal hose. Featured in the engineering data section are charts showing frictional losses versus flow rates for various sizes of metal hose and conduit. These flow charts, believed to be the first ever offered in a metal hose catalog,

can be used as a standard for flexible metal hose of various types. In addition to complete descriptions and specifications for the line of flexible metal hose, fittings, and assemblies, the catalog contains information for ordering Titeflex flexible metal conduit and ferrules, Uniflex hose assemblies, ignition shielding, and components for reciprocating engines, Titeflex bendable pipe, and Titeflex high- and low-frequency leads.

816

Uni-Form Panels

How Uni-Form Panels and Universal service helped build one of the world's largest steel mills is the subject of a new 16-page informative booklet released by Universal Form Clamp Co. A pictorial description shows how the job was done where 9,000,000 sq. ft. of contact area had to be formed into structures—large, small, complicated, and simple. Also contains close-ups of the panels and how they are erected.

817

Brochure on gas-shielded, arc-welding torches available

Details and specifications of the newest Heliarc torches have been combined by Linde Air Products Co., Div. of Union Carbide & Carbon Corp., in a recently released catalog, Form 7979. All torches described have

the latest developments in the inert gas-shielded, arc-welding field. Also contains charts giving selection data on electrodes, nozzles, and argon cylinders, along with detailed information on argon regulators and flow meters.

818

"Meet the Heavyweights"

Wayne Crane Div., American Steel Dredge Co., Inc., has issued a new page catalog which illustrates in color their heavy-duty, self-propelled wheel-mounted Model 20 crane. On the job photos show you the many applications to which this crane may be applied. Also includes a spread displaying its component parts in detail and two full pages of complete specifications, operating data, and lifting capacities.

819

Bulletin available on tunneling lining

A new bulletin, available from Armo Drainage & Metal Products Inc., describes how tunneling may be simplified by the use of Arco lining plates so that it isn't necessary to tear up expensive pavements, thereby disrupting traffic and business, in order to install sewers and other underground structures. Contains photos of various types of installations and a table of physical properties.



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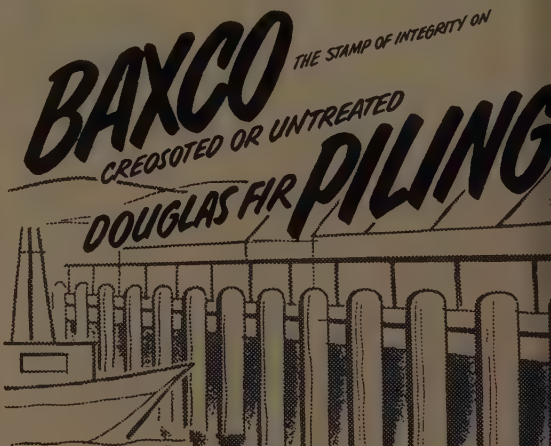
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terature briefs . . .

820

COMMUNITY WORKERS—In 8 pages, this booklet published by **Catpillar Tractor Co.** shows how Cats are used for modern, sanitary landfill methods to handle refuse and garbage communities of all sizes.

821

ELECTRIC TOOLS—Of special interest for woodworkers, these two illustrated books are offered by **Portable Machine Co.** One, "Operating Electric Routers, Planes, and Shapers," gives complete instructions for the use of the portable tools; the other, "Operation of Electric Saws," contains information on advanced uses.

822

CLAMPS FOR CURBS—All of the plans for Pacific clamps for installations on curbs, gutters, and other related jobs has been described in a new bulletin issued by **Pacific Engineering Sales Co.** Extensive use of diagrams shows standard applications.

823

WATERPROOFING—Six pages with charts and photographs about the various Silicone water repellents for treating leaky masonry walls. The repellents are products of **L. Sonnenrath Sons, Inc.**

824

ELECTRICAL MOTORS—**U. S. Electrical Motors, Inc.**, is offering scale drawings of its Syncrogear line motors. Includes three views of

each of its 30 various motors. The drawings are designed to be inserted under a layout of a machine or other equipment and traced in the proper size and position.

825

STAINLESS STEEL FRONTS—A 40-page booklet devoted to stainless steels for store fronts and building entrances has just been published by the **Committee of Stainless Steel Products, American Iron and Steel Institute.**

826

COPPER, BRASS PRODUCTS—A file-size bulletin listing nearly 70 catalogs and technical handbooks on copper and brass products has been published by **Chase Brass & Copper Co., Inc.** The listing includes descriptions of copper, alloys, bus conductors, wire, tubing, rivets, burs and washers, and pipe products.

827

SHOVELoader—The Shovel loader, its construction and industrial uses, applications and attachments, specifications and performance characteristics, is the topic of a brochure issued by **Baker-Lull Manufacturing Co.**

828

HYDRAULIC PULLERS—A new service manual illustrating the use of hydraulic pullers on truck, tractor, and automobile maintenance has been released by **Owatonna Tool Co.** Covers three hydraulic rams with capacities of 17½, 30, and 50 tons, hydraulic puller sets in each of the three ca-

pacities, and shop and bench presses for use with each size of Power-Twin Center-Hole ram.

829

STAMP CO HANDIWINCH—Stampco Products has just issued a 2-color catalog sheet illustrating the Handiwinch. Includes specifications, costs, and engineering features, plus various construction and industrial applications.

830

GAR WOOD LINE—Three new specification booklets have been issued giving detailed information on the ¾-yd. Model 75A and Model 75B excavators, the 75BT truck cranes, and their available attachments, manufactured by **Gar Wood Industries, Inc.**

831

WELDING ROD—A brief bulletin by **Rankin Manufacturing Co.** describes Ranite F, a new hard surfacing welding rod. Lists application procedures, specifications, and prices.

832

TRENCH DIGGING—An 8-page illustrated bulletin offered by **Cleveland Trencher Co.** is on the improved and versatile Model 92 trencher, designed for use on cramped city and suburban jobs.

833

PLASTIC CONSTRUCTION MATERIALS—Plenty of facts about plastic construction materials is contained in this 35-page booklet prepared specifically for corrosion engineers by **Atlas Mineral Products Co.**

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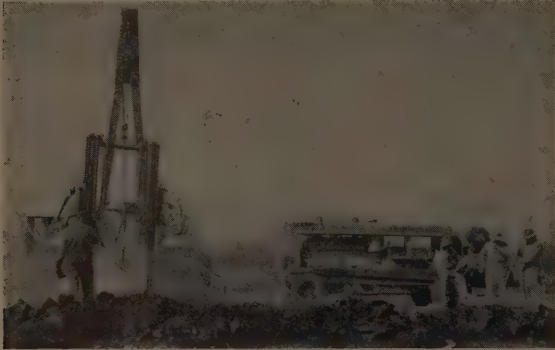
NEW EQUIPMENT

More information on any of the items in this section may be obtained by using coupon on page 131.

B34

Twin boom pipe line drill is completely mechanized

A brand-new, practical, rock-drilling outfit for pipe line trenching is this new twin boom pipe line drill, the TBD-126. Completely mechanized, its air feed assemblies and

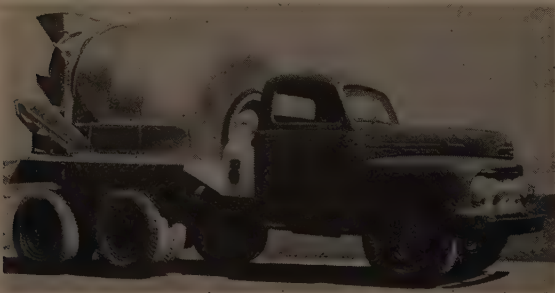


drifters are suspended from crawler tractor booms. Recommended for use with the manufacturer's 600 cfm. diesel engine compressor as power unit, it can become a self-contained continuously moving drilling unit. The 4-in. drifter used in the drill is said to have the hitting power and strong rotation which achieves fast drilling with an efficient hole-cleaning blow. No steel change is required for normal drilling, since actual feed is 8 ft. One-man operated, the manufacturer says it can be used wherever crawler tractors can operate, no matter how rugged the terrain. Manufacturer is Schramm, Inc.

B35

New mixer features unusual operating principle

A new 4½- to 5½-cu. yd. hydro-mixer features drum drive by reversible hydraulic motor, operated by power take-off from the truck transmission. As a result, this new feature saves weight by eliminating a heavy auxiliary gasoline engine and permits installation of the machine on shorter wheelbase trucks. (Most 10-wheel trucks have a 147-in. average wheelbase for increased maneuverability.) The new drum drive operates the drum at 8 to 12 rpm. for charging or discharging, and 3 to 5 rpm. for mixing in



transit. Valve control changes direction of the fluid in the hydraulic motor, and a check valve prevents the drum from rolling back while shifting gears. 67 gal. of water and 24 gal. of oil are carried in a rear-mounted tank with outlets for tempering and washing. This sturdy mixer is manufactured by Willard Concrete Machinery Sales Co.

B36

Trailblazing transportation worries end with Tournatrain, a rubber-tired railroad

There are plenty of areas here in the West and elsewhere where where movement of equipment and supplies creates a giant-sized headache for contractors. A reasonable antidote has been provided by R. G. LeTourneau Inc., by introduction of the Tournatrain, a rubber-tired locomotive and freight car combination capable of economic operation over pathless desert sands or a cheaply constructed road through what are ordinarily difficult



areas to traverse. Inventor R. G. LeTourneau says the heart of the Tournatrain is the "electric wheel," which carries a large pneumatic tire and has within its rim an electric motor and gear reduction. These electric wheels are being built in different sizes to take tires from 5 to 10 ft. in diameter. They derive their energy from the locomotive which mounts diesel-engine-driven electric generators. The engineer, from his cab on the locomotive, applies power at will to all wheels of the Tournatrain. In this way each freight car provides propulsion for its own load—each car pushing and pulling at the same time. There are no brake shoes to wear out because the same electricity that drives the wheel can be used to hold it back going down hill. Only an automatic spring-loaded brake is provided for emergency. A simple automatic steering device duplicates the path of the locomotive for each car in its turn so that the locomotive can pull up to a street intersection and make a right-angle turn and every car will come up to the same spot and make the same turn.

This Tournatrain locomotive does not pull the cars like an ordinary diesel-electric railroad train. Every car pulls itself, with the locomotive merely supplying the electricity and leading the way. The ordinary train requires that grades be nearly level because of the traction, while the Tournatrain can climb a steeper grade than an automobile, so that tunneling a mountain or zigzagging up its sides is not necessary.



Ever since you were knee-high to a hop-toad, you've heard about America's wonderful *natural resources*—the bountiful fertile fields, the towering timber growth, the boundless water power, and the untold wealth of gold, iron, oil, silver, coal and other natural treasures that lie buried in the ground.

Is it because America has *more* natural resources than any other country that Americans enjoy the world's highest standard of living? No—many countries have as much—some have more.

Then is it because Americans *do* more with what they've got?

Yes! And the reason is as plain as the nose on your face. It's because Americans are free to develop their natural resources—and their natural resourcefulness—in the wholesome climate of *open and strenuous COMPETITION*.

COMPETITION—not “regimentation”—is what eggs a man on to do his best.

COMPETITION—not government control—is what urges a business to give its customers ever greater value for their money.

So let's say “NO SALE” to the *ism* peddlers who would have us swap our U. S. A. system of free competition for their “planned” regimentation—trade our U. S. A. freedom and plenty for their serfdom and poverty!

* * *

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THE COMPETITIVE SYSTEM DELIVERS THE MOST TO THE GREATEST NUMBER

New air clutch handles added torque capacity loads

Designed to handle higher torque capacity loads with more compactness is the new Model PO, a series of air-actuated clutches recently introduced. An unusual design stressing light weight and narrow clutch width permits the PO to be installed in less shaft space with closer shaft-bearing center distances. A single set of air-cooled springs assures quick, positive plate release and equal distribution of release pressure. Smooth, accurate air actuation is effected through insulated and air-cooled diaphragms. Fabricated from specially developed alloys, the new Model PO is now of-

fered in 2 and 3 plate, 24-in. size. It was designed to offer a selection of standard models to fit any job where remote control is desirable and complicated linkage is intolerable. Manufacturer is Twin Disc Clutch Co.

838

Asphalt developed for cold-storage construction

Laykold Insulation Adhesive is a heavy-bodied asphaltic emulsion which has been developed for use in cold insulation construction. Applied cold, it eliminates the cost of heating equipment. It is compounded without the use of fire-hazardous petroleum solvents, water-absorbent clays, or any other type of fillers which

could cause re-emulsification. It is used for vapor barriers with various kinds of asphalted papers, fabric, felt, glass, fiber, or metal foil; for all types of formed or block insulation placed in the conventional manner; for holding flat roof-deck insulation; for insulating surrounding air-conditioning ducts that are properly banded, as well as a seal for perimeter insulation around concrete floor slabs. Manufacturer is American Bitumuls & Asphalt Co.

839

Portable circular saw cuts to 4 3/8 in.

The recently introduced S-12 saw is a portable air-powered circular saw with a maximum cutting depth of 4 3/8 in., is reported to have more than enough power to handle all jobs within its capacity range. Powered by a Multi-Vane air motor, it is designed for use on 90 psi. air pressure. The



110 Rigger's Block
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8-10 Rigger's Block
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Block—Safe,
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S-12 is designed with safety in mind, and, because the motor is close to the center of the saw, the weight is evenly distributed between the handles for good balance and easy handling. The motor and blade housing, base, blade guard, and handles are cast aluminum to keep weight down and to increase durability. Simple adjustments change depth and angle of cut. The unit, which is available with a complete set of blades for cutting various materials, is supplied in a sturdy metal carrying case. Manufacturer is Ingersoll-Rand Co.

840

New vibratory paving tube available

A powerful vibratory paving tube has been introduced for use on construction of concrete airport runways, toll roads, and concrete highway paving in general. The assembly, which attaches to either the front of a finisher or the rear of a spreader, consists of 2 to 5 vibratory elements, according to the width and depth of slab, each embodying two rather

ely parallel tubes on which is mounted a powerful, vibratory, submersible motor. Current is supplied to the power plant mounted on the present equipment, and the tube is raised and lowered into the concrete by the operator. Thus, according to the manufacturer, thorough and complete internal vibration is furnished through the full width and depth of the slab. It is said to give greater compressive strength and impermeability of the hardened concrete of the dryer, more economical mixes, uniform compaction, and faster finisher progress. Manufacturer is Jackson Vibrators, Inc.

841

Team-cleaning machine discharges 150 gal. per hr.

A new, low-priced, high-capacity team-cleaning machine, capable of discharging 150 gal. of balanced cleaning solution per hr., is now offered by Clayton Manufacturing Co. Completely self-contained, the unit has a graduated range of cleaning pressures extending from 30 psi. for such jobs as paint stripping, to 100 psi. for the rapid cleaning of heavily-incrusted or grease-coated parts and surfaces. Full working pressure is attained in 2 min. from a cold start, thus



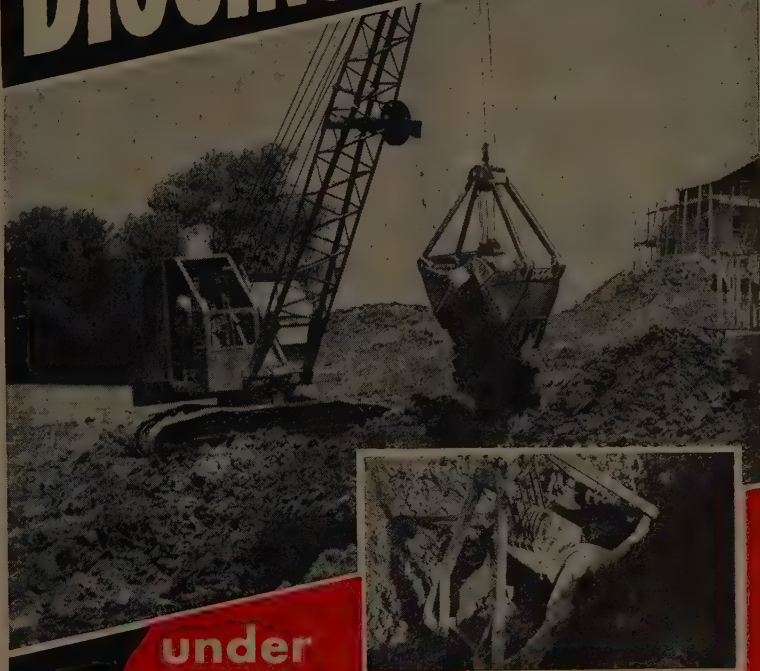
eliminating the need to keep the machine in operation on a standby basis. Equipped with a 15-gal. solution tank, a wide variety of models is available: oil-fired and gas-fired; electrically-driven and gasoline engine-driven; portable; stationary, or trailer. Each can be equipped optionally with remote nozzle control.

842

Belt conveyor series has unique spun end rolls

Strength, simplicity of design, and better balance describe the new Stephens-Adamson 220-Series Simplex belt conveyor carriers. Spun end rolls, said to be unique, and welded steel frames are featured. A seamless steel tube houses tapered roller bearing and is bored for precision alignment between roller diameter and bearing. A die-cast labyrinth seal protects the bearing, which can be adjusted for proper clearance by taking up nuts which support rolls in carrier brackets. Other specifications are: rolls which can be lifted from frame for

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Proof of this is evidenced in the predominance of Owen Buckets seen in operation everywhere on large and small construction projects.

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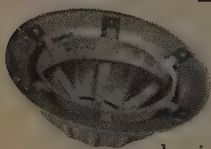
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inspection without tools; flexible, high-pressure lubrication tubes which can be arranged for three-shot lubrications from one or both sides of conveyor, and roller assemblies and parts which are interchangeable. Manufacturer is **Stephens-Adamson Manufacturing Co.**

B43

Water feed attachment speeds concrete drilling

A water feed attachment made for use with special Tilden Water Feed Concrete Core Drills of 1½- to 8-in. diameters, recently has been developed. The new device is said to increase drilling speeds up to 300%. Water flowing through the drill's core cavity removes cuttings and debris and at the same time lubricates and cools the drill. Specifically designed for production drilling of holes more than 4 in. deep where many holes are required, they are particularly recommended for drilling concrete, including crossed reinforcing bars. Manufacturer is **Tilden Tool Manufacturing Co.**

B44

Hydraulic shop press develops 17½ tons

Equipped with the easily detached 17½-ton Power-Twin Ram, a new, inexpensive hydraulic press has just been announced by **Owatonna Tool Co.** The press also comes with a new hydraulic hand pump which develops 10,000 psi., and a 6-ft. high-pressure hose which connects pump and ram. A 15,000-psi. gauge supplies actual pounds or tons pressure used.

B45

Twin Disc Clutch Co. offering two-stage torque converter

Providing maximum operational efficiency, **Twin Disc Clutch Co.**'s new Two-stage torque converter is reported to develop up to 4:1 torque multiplication at stall, combined with progressively increasing engine speed during acceleration and uniform pull-down under load. In that way it meets the requirements of certain engine

applications needing converter drive with specific performance characteristics. Principal feature is its free-wheel reaction or stator blades, which provide complete unloading of the engine at high-speed, no-load conditions—with low hp. absorption for greater economy, and with minimum cooling requirements.

B46

Henry's new backhoes improved and reinforced

Utilizing the same basic design of previous Henry hydraulic backhoes, the new 1953 models B-8-3 and BA-8-



3 have been reinforced at all points of stress, with double strength material now being used in the pedestal and boom assemblies. Other improvements include: the adjustable stabilizer which keeps pedestal and mainframe in the correct perpendicular position regardless of terrain; the dipper stick is now made of complete box-channel construction for greater strength and elimination of twists; hose guards have been added to the pedestal to eliminate hose damage; and diamond-tread foot plates have been added to the draw-bar arms for greater safety. Manufacturer is **Henry Manufacturing Co.**

B47

Variable power eyepiece now featured on Gurley Levels

The need for more than one eyepiece for changes of magnification now is eliminated on **Gurley Levels** by the introduction of a variable power eyepiece. This eyepiece per-

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Less initial cost — Lower upkeep

1½ HP to
5 HP

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GV-1, GV-2 & GV-3 Models Now Equipped
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Interchangeable Flexible Shafts.

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ts a gradual change from high to
y magnification and is said to give
clear, flat field devoid of aberrations
any point of selection. By use of
VP Eyepiece, visibility under poor
ighting can be improved by lower
magnification, and the turbulent ef-
t of heat waves, rising through the
e of sight, is minimized with the
ver power. One of the two caps
plied with the eyepiece incorpo-
es a haze filter, useful for making
ng sights under adverse conditions.
anufacturer is W. & L. E. Gurley.

848

Heavy-duty ripper available for dozers

A new, over-the-moldboard, heavy-
uty ripper for all medium and large
ozers has been announced by Hen-
ey Equipment Co. Carefully selected
ad heat-treated steels are said to



make the ripper rugged enough to
bsorb the toughest ripping jobs. It
s especially recommended for use
where the grade has been lost or
when corner cuts are required. One
complete unit weighs about 300 lb.,
and up to 6 units can be used on a
dozer for grubbing, clearing, and
rock raking.

849

Brighten up roof construction by using colored asphalt

Not only black but red and green
colored asphalt is available as a pro-
ective coating on smooth surface
asphalt roofs and metal surfaces. May
easily be applied when cold. Said to
withstand the most severe weather-
ing conditions, Laykold Fibercoat,
the new product, has been approved
by the U.S. Armed Forces. Manufac-
turer is American Bitumuls & As-
phalt Co.

850

Improved steel electrodes announced by Airco

A new, improved E6010 electrode,
the Airco 78E, has just been an-
nounced by Air Reduction. This new
electrode for welding mild steel in all
positions offers deep penetration
without undercutting, a minimum of
spatter, and uniform weld deposits
without fingernailing. It is recom-

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Chicago 2, Ill.

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Re: Valley Highway Project, Denver

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Concrete Form Presdwood and have been more
than satisfied with it ever since.

Right now we are using this material to line
forms made with low-cost sheathing, for the
bridges we are building for the Valley
Highway

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on this project, was so impressed with our
results that he is now using Concrete Form
Presdwood

It's the best material we know of for exposed
or architectural concrete.

Very truly yours,

Lawrence Construction Co.

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MASONITE CONCRETE FORM PRESWOOD cuts heavy construction costs, too!

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wherever you want a smooth surface with a minimum of
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fits like wood—leaves no wood-grain texture. In large
4' x 8' and 4' x 12' panels, ready to save you money!

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Give You *All 12 Superior Features for Better
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FEATURES	MAR- LOW	PUMP "A"	PUMP "B"	PUMP "C"	PUMP "D"	PUMP "E"
1. Non-Recirculatory Positive Priming	YES	YES	NO	YES	NO	NO
2. Self-Cleaning	YES	YES	NO	YES	NO	NO
3. Low Suction Inlet	YES	NO	NO	NO	YES	NO
4. Horizontal Discharge	YES	NO	YES	YES	YES	YES
5. Metal - to - Metal Grease-Lube Seal	YES	YES	YES	YES	YES	YES
6. Vacuum Gauge Plug	YES	NO	NO	NO	YES	YES
7. Discharge Gauge Plug	YES	NO	NO	NO	YES	NO
8. Supplied Complete with Male Fittings	YES	NO	NO	NO	NO	NO
9. Impeller Keyed to Shaft	YES	NO	NO	NO	NO	NO
10. Only One Gasket	YES	YES	NO	YES	NO	NO
11. Replaceable Wearing Parts	YES	YES	YES	YES	YES	NO
12. Convertible Base and Chassis	YES	NO	YES	YES	NO	NO



322

Yes! Marlow, and Marlow alone, gives you *all* the features in dependable engine-driven, self-priming centrifugal pumps that bring you high efficiencies and low operating and maintenance costs. That's why contractors are buying *more Marlows than any other pumps!*

For complete information on how Marlow can help give you more pump performance — at less cost — see your Marlow dealer or write for Bulletin C-52.

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Branch Plants: DeQueen, Arkansas
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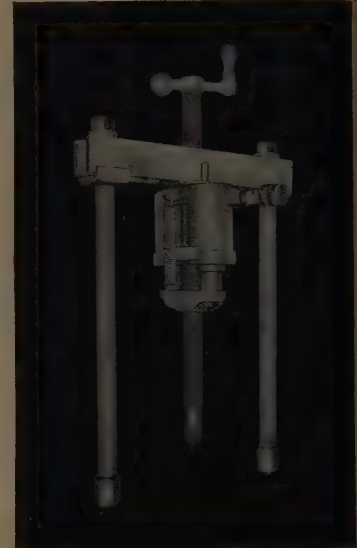
Distributors and Dealers everywhere

mended for fabrication of mild steel involving plate and rolled sections, castings, fired and unfired pressure vessels, structural frames, pipe line and all classes of marine work where high ductility and tensile strength are essential.

851

OTC Push-Pullers adapted to Power-Twin Center-Hole rams

New use for the OTC Push-Puller is their adaptation to the OTC Power-Twin Center-Hole hydraulic rams



Four sizes of the Push-Pullers, with a complete assortment of attachments and adaptors, can now be used with hydraulic power to speed up maintenance pulling and installing operations involving gears, bearings, sheaves, pulleys, pinions, and couplings. Available capacities range from 17½ to 50 tons. Users already having an OTC Push-Puller may adapt it for use with the Center-Hole ram by ordering an inexpensive attaching plate. Manufacturer is Owatonna Tool Co.

852

Special concrete anchor studs simplify fabrication

The development of special concrete anchor studs designed to simplify fabrication and improve the quality of steel curb angles, trench frames, column guards, joists, and other structural members to be anchored in concrete or masonry has been announced by Nelson Stud Welding Div., Gregory Industries, Inc. These new fluxed anchor studs, manufactured of high-quality, cold-drawn steel with a tensile strength of 75,000-85,000 psi., are welded in the angle or on the faces of steel members without causing distortion. Accessories for use with portable stud-welding equipment insure accurate alignment so that work can be done,

the job site if necessary. Simple
 le-mounted production units de-
 ned for use in shops will install
 hor studs at the rate of four to five
 min.

853

10-oz. safety hat meets specifications

Although classed as a cap, the 10-oz.
 "marty," the Bullard aluminum Hard
 Boiled headpiece, meets industry and
 federal specifications of 40-lb. impact
 resistance. It is said to be the lightest
 light head-protective device yet de-
 veloped. Fabricated from aircraft



grade aluminum, it has the usual
 Hard Boiled head protection design
 with a ribbed crown, which adds extra
 protection without sacrificing resili-
 ency. Its permanent satin finish will
 not reflect and cause blind spots in
 the eyes of other workers. A visor
 protects the front of the face, and the
 curved brim edge is wide enough to
 keep the ears and neck safe. One size
 fits all heads because of the fully ad-
 justable headband. Entire inside as-
 semblies are easily removed and re-
 placed. Made by E. D. Bullard Co.

854

Mobile bar and channel shear developed by Manco

An addition to Manco Manu-
 facturing Co.'s Guillotine line of hy-
 draulic cutting tools for bar and chan-
 nel stock is the Model 20-339, which
 has a cutting capacity of up to 1/2 x 2-
 in. flat bar stock, or channels to 9/16 x
 3/16 in. Shearing unit weighs 48
 lb. It is powered by a 80-lb., 1/2-hp.,
 electric hydraulic pump providing 30-
 ton thrust. Available dolly-mounted
 for mobility, this new unit can also
 be obtained with a 13-lb. manually-
 operated hydraulic pump for non-
 production applications and on-the-
 job cutting.

855

New line of hydraulic torque converters

Covering a power range of 325 to
 more than 1,000 hp., the new Na-
 tional hydraulic torque converters
 have been designed for use with high-

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FIRST CHOICE...

of contractors by a wide margin, are Mar-
 low pumps... built to meet the tough and
 exacting requirements of the job.

Marlows' have the features that contractors
 demand.

- *Simplicity of construction*, with a minimum of parts, for better operation, lower maintenance and longer life.
- *Faster, and more dependable priming* even at high suction lifts.
- *Ability to handle trash* without clogging or losing prime.
- *High efficiency and low fuel cost.*

All contractors' pumping needs are more
 dependably handled with just two types of
 Marlows — Marlow Self-Priming Centri-
 fugals for high capacity pumping — Mar-
 low Mud Hogs for muddy, sandy and trash
 laden water.

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 ing performance. For complete information
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 low Contractors Pumps" bulletin C-52.



Marlow manufactures the
 world's largest line of con-
 tractors' pumps.

313

MARLOW PUMPS

Other factories in France and England

RIDGEWOOD, NEW JERSEY

Branch Plants: DeQueen, Arkansas
 West Chicago, Illinois

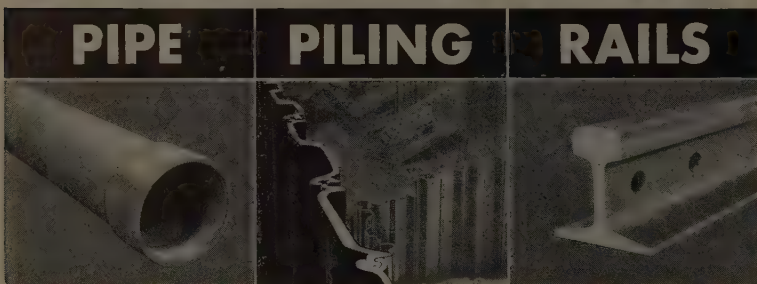
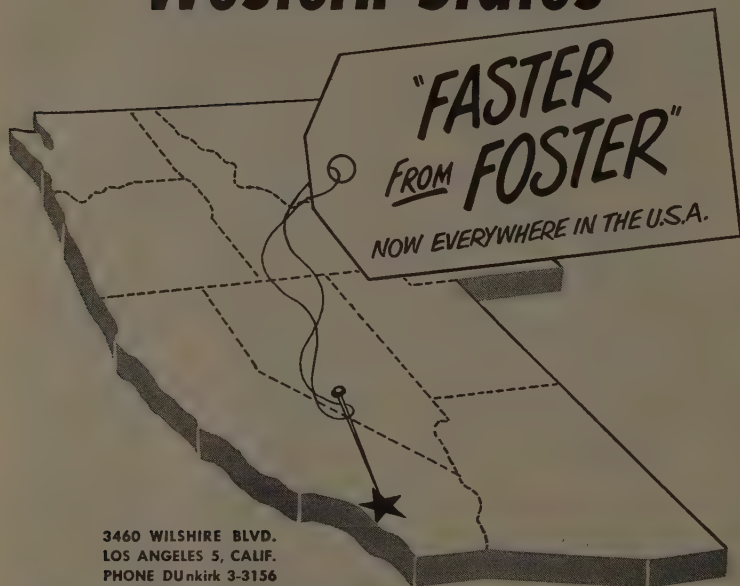
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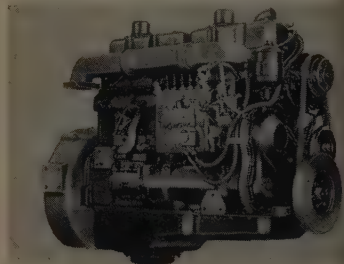
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torque, medium-speed engines. They are recommended for handling such service conditions as those encountered in power shovels, hoists, crane and well digging rigs. Both converters, the 29½ in. Type A-295-F, and the 34½-in. Type A-342-F, are mounted on a standard No. 00 fl. wheel housing and add only 36½ in. to the overall length of the engine. Manufacturer is The National Supply Co.

856

Mack diesel engine develops 170 brake hp.

Mack Thermodyne Model EN1673, a new diesel engine specifically for installation in Mack vehicles, de-



velops 170 brake hp. at 2,000 rpm. Its most outstanding feature is its combustion chamber design, which is primarily responsible for the fuel economy claimed by the manufacturer. This Thermodyne combustion chamber, which affords rapid and complete combustion, also assures more efficient injection-nozzle cooling. To assure positive starting for different operation requirements, a choice of either electrical (standard) or air-starting equipment is available. Manufacturer is Mack Trucks, Inc.

857

Belt training return idler provides automatic alignment

Rex Style No. 41 roller-bearing, belt-training return idler provides automatic alignment for the return



belt without the use of side-guide idlers. This new idler design assures positive aligning action and so greatly reduces the danger of damage from belt roving. It consists of a dead-shaft, roller-bearing return, roll mounted at each end to a toggle-like arrangement of swivel arms suspended from the conveyor framework at about a 45-deg. angle in the direction of belt

el. Acting to maintain an equi-
um with the belt in the center of
roll and the roll in normal posi-
the action is equally effective on
zontal, inclined, or declined con-
ors, and the effect of build-up of
erial on the roll is negligible. Be-
e of its principle of operation,
idler operates in one direction
r. Style No. 41 idler is furnished
a standard 5- or 6-in. diameter
l return rolls. Style No. 41RC
r, equipped with a standard 5½-in.
meter, rubber-covered, spiral re-
a roll, can be furnished. Manu-
urer is Chain Belt Co.

858

Low cost, self-powered ditching machine now offered

deal for tiling, laying gas, water,
sewage lines, and for digging
ndation trenches, the Model 6
meer Pow-R-Ditcher has been
veloped to fill the need for a rug-



1, low-cost ditching machine. The
odel 6 will dig a trench up to 18 in.
de at a regulated speed of 1, 2, or
2, per min., with maximum digging
oth of 6 ft. It may be simply hooked
for easy trailing from car, truck,
jeep: "Level-Matic" wheels allow
right up-and-down digging on
pes. Self-propelled by Wisconsin
cooled engines, this new ditcher
also available in two other models:
odel 24, with a 24-in. digging width,
l Model 6-V, with an adjustable
blade for digging drainage ditches.
anufacturer is Vermeer Manufac-
ing Co.

859

New type aggregate available for concrete production

New Basalite aggregate, a shale
aggregate expanded in huge rotary
ins at temperatures of 1,900 deg. F.,
now in production. The manufac-
r claims this new product is chemi-
cally inert, and that when used in
roduction of portland cement con-
rete it will hold curing-shrinkage to
absolute minimum. Production of
ew Basalite has made it possible for
e manufacturer to discontinue the
ee of physically weak pumiceous ag-
gregates in favor of this superior ma-
terial which can be controlled from
ew material stage to finished prod-
uct. By use of New Basalite aggregate,
is said to be possible to make con-
rete which is lighter in weight but
with no reduction in strength. Struc-
ural concrete can be made with max-

GOODALL

Waterproof

CLOTHING • FOOTWEAR



*Designed for Extra Comfort,
Made for Long, Hard Wear*

Goodall work clothing and footwear are
made to specifications assuring the ultimate
in comfort, protection and long-wear econ-
omy. Available in a wide variety of styles to
meet every Contractor's need, and fully guar-
anteed for quality and service.

SUITS • COATS • JACKETS • OVERALLS

Durable, full-cut garments in rubber, oiled and latex . . . designed
to afford maximum protection plus comfort in every kind of work.
Reinforced where extra strength is needed, without impairing com-
plete freedom of movement. Style 338 Coat is a long-time favorite
. . . double back; corduroy-lined collar; length 49". Style 80 Jacket
with Style 81 Overall makes the ideal shaft suit. Other suit combi-
nations to meet every preference or job requirement.

"HARDBOILED" FIBREGLASS SAFETY HATS Light weight and
comfortable, yet providing greatest possible head protection. Exceed
highest established requirements for strength; heat and moisture
resistance; and dielectric tests.

"TOE-SAVER"® BOOTS, SHOES

Smooth, tough, flexible jet black rubber, heavy
duck lined. Cushion insole. White cap over rein-
forced steel safety toe tested to withstand 2,000
lbs. pressure. Tire-tread soles. Hip, Style MB-346.
Storm King, Style MB-780. Short, Style MB-946.
Now with **permanently marked** size numbers.
The "Toe-Saver" feature is also available on a
variety of work shoes, and on our Contractor's
Mucker Boot.



The Goodall line also includes other styles of boots, shoes and hats;
arctics; overshoes; gloves . . . all made to the same high standards
for comfort and value.

Contact Our Nearest Branch for Details and Prices



GOODALL RUBBER COMPANY

GENERAL OFFICES, MILLS and EXPORT DIVISION, TRENTON, N. J.

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Los Angeles • San Francisco • Seattle • Spokane • Portland • Salt Lake City • Denver
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Est. 1870



USE A CARCO WINCH

TO INCREASE TRACTOR DIVIDENDS

TRACTORS pay bigger dividends when equipped with Carco winches. Mounting Carco winches on your tractors, new or old, converts them to mobile pulling and towing rigs that are useful in many ways on heavy construction jobs. By doubling tractor pulling power and increasing tractor "reach," Carco winches pay off in towing heavy equipment, rescuing mired or ditched machinery, setting poles, pulling pipe, and other jobs that would tie up more costly and less mobile equipment. Or, with Carco multiple drum models, you can rig a mobile hoist, dragline, slackline or cableway in a jiffy. Most contractors want a Carco tractor winch on their construction jobs for general utility work. See your nearest Carco dealer. PACIFIC CAR AND FOUNDRY COMPANY, Renton, Washington. Branches at Portland, Ore., and Franklin Park, Ill.



imum weights of 100 lb. per cu. ft., utilizing conventional slumps to give proper placement. Manufacturer is Basalt Rock Co., Inc.

560

New concrete cutter has high power, light weight

A powerful, light-weight concrete cutter of three-wheel design is now available. Its 13.5-hp. gasoline engine



drives a standard 12-in. diameter diamond blade which cuts to a depth of 3½ in. It can also accommodate blade diameters up to 18 in. o.d. It is equipped with guard, and blade depth is adjusted by a manually-operated screw. It has been especially designed for cutting contraction joints, curb-

ings, walks, and for trenching, patching, installation of utility poles, and street signals. Known as Model 11 Di-Met, manufactured by Felk Manufacturing Co.

841

Submersible sump pump throws 3,300 gal. per hr.

The new Model 109 is a submersible sump pump said to be ideal for use in sumps, underground vaults, in transferring liquids, as a contractor's portable pump, and for general utility use. Entirely watertight, it will fit into 12-in. cube and has a maximum capacity of 3,300 gal. per hr. at 10-ft. head. Its major improvement is the redesigned liquid level control switch which operates on the principle of water rising to trap air in the skirt of the switch. Manufacturer is Kenco Inc.

852

Drott has developed a shovel for International TD-6

Designed and built exclusively for mounting on the TD-6 International tractor, is the Drott 6K3 Skid-Shovel. Specifications are: a 7.8-yd. capacity with a digging or breaking-out force of 8,500 lb. and a lifting capacity of 3,000 lb. The 6K3 has all the features of the manufacturer's larger models, so there is now a shovel available to fit any particular

"SAVED \$800 PER MILE with my new STOW SCREED!"

Performance like that is *important on any paving job*. It's the reason why so many contractors are now using STOW screeds on all their road paving jobs!

STOW vibrating Screeds:

1. Permit placing more than 300 cubic yards in less than 8 hours

2. Strike off and impact in one operation
3. Leave surfaces true to grade
4. Work up to and around manholes and obstructions
5. Have record of proven trouble-free performance *on the job!*

Stow screeds are available in beam sizes up to 30' long. Or, if you have, or prefer to build, your own beam, ask about the STOW Screed Package!



STOW

VIBRATING SCREEDS

STOW MANUFACTURING CO.

56 Shear St., Binghamton, N. Y.

Write today for complete information on Stow Vibrating Screeds and the Stow Concrete Vibrator line.

Request Bulletin 526



requirement. A total of four of the front-end loaders are available for installation on the TD-6, TD-9, TD-14A, and TD-18A International tractor. Manufacturer is Drott Manufacturing Corp.

863

Cement handling simplified with Bazooka

The Bazooka, a portable, trailer-type, inclined-screw conveyor, is a new device for transferring cement from mill truck or railroad car to a Wood cement tanker or similar cement transport. Two-wheel mounted,



rubber tired, and powered by a gasoline engine, it is easily towed from one job to another. Manufacturer is Wood Manufacturing Co.

864

Overdrive developed for Cat DW20 tractors

Available as an attachment for the DW20 four-wheeled tractor, a compact overdrive unit has been developed by Caterpillar Tractor Co. On DW20s with 15.75 to 1 final drive reduction, the maximum speed with overdrive is now 34 mph., an increase of 8 mph. over a similar unit without overdrive. Addition of the unit to tractors with the 21 to 1 final drive reduction increases top speed from 20 mph. to 25 mph. Combined with the present standard transmission, it gives the machine a range of 10 speeds forward and 2 in reverse. Installation requires special parts, all of which are supplied as part of a special package available for field installations. Mounted between the tractor's engine and transmission, it is controlled by a manually-operated shift lever located next to the regular gear shift lever.

865

New formula for resurfacing masonry

How to resurface porous masonry surfaces attractively, while successfully combating moisture-control problems, is taken care of by a new waterproofed formula. It is now being used in the manufacturer's Bondex Cement Paint, for dampness control problems, and in Bondex Heavy Duty, for serious moisture-control problems. The Heavy Duty product is applied with an ordinary brush and gives a thick white coating which hides flaws in the finish. Manufacturer is the Reardon Co.

ESCO BUCK FORTE DOZER-ROOTER CUTS COST ON HIGHWAY JOBS...



RIPS BLACK TOP, CONCRETE AND ROCK... DOZING AS IT GOES

You no longer need to haul a cumbersome drawbar ripper on road-building jobs. The ESCO Dozer-Rooter can be easily installed on a straight or angle dozer. Costs less to own, less to operate—out-performs a conventional ripper. The Dozer-Rooter will rip through rock, asphalt and concrete. Yet, it's portable enough to carry on the tractor or in a pickup truck from job to job. You can get tractor maneuverability on narrow city streets—easy efficient operation on hillsides and other places where a drawbar ripper is impractical. Precision control of Dozer-Rooter action permits safe operation around installations such as pipes, cables and footings.

The ESCO Dozer-Rooter can increase your profits. Ask your ESCO dealer for a demonstration or write for Booklet 194-A.



Dozer-Rooter adjust easily to four footing depths — 9" - 15" - 21" - 27". No special tools are needed.

ESCO

ELECTRIC STEEL FOUNDRY CO.

2163 N. W. 25th AVENUE, PORTLAND 10, OREGON

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Offices and Warehouses: Honolulu, Hawaii; Houston, Texas; New York, New York; Los Angeles, San Francisco, California; Seattle, Spokane, Washington; Centralia, Pennsylvania; Eugene, Medford, Oregon; Salt Lake City, Utah. In Canada: Vancouver, B. C., and Toronto, Ontario.

712 PORTER ST., DANVILLE, ILL.

**Engineers, Carpenters,
Concrete Men, Foremen,
Superintendents:**

SOLVE ENGINEERING PROBLEMSat a Glance!

There is no time to waste these days on tedious figuring of routine problems! This fine, enlarged edition of **CONSTRUCTION DESIGN CHARTS**, by Consulting Engineer James R. Griffith gives countless engineering shortcuts — and answers preliminary design problems in a flash! There's a whale of value in this enlarged edition for every man engaged in construction today!

This is the fourth reprinting of **CONSTRUCTION DESIGN CHARTS**, and greatly enlarged over all previous editions. Contains 100 design charts and 215 pages filled to the brim with valuable information that is a sure-fire hit with construction men. Handsomely bound in sturdy black Fabrikoid with gold stamped letters. A special metal binding allows each page to lie flat for easy reference.

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Transmission
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Triangular Areas

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City.....State.....

Position.....Company.....

NEWS of DISTRIBUTORS AND FACTORY BRANCHES



L. E. Buran (left), president of Buran Equipment Co., congratulates Vice President **I. R. Kraemer** at the opening of Buran's new plant at Santa Clara, Calif. (see item below)

Buran Equipment Co. opens branch office

The Buran Equipment Co. of Oakland recently opened a new branch office at 2380 Lafayette St., Santa Clara, Calif., with Ellis Harris named as branch manager. The organization has erected on its 10-ac. site a fine new building with all new facilities for storing and for service. The same lines will be distributed which are handled at Buran's main offices in Oakland. These include Allis-Chalmers Manufacturing Co., Baker Manufacturing Co., Gar Wood Industries, and other well-known lines.

Cummins new Southwest dealership

Cummins Rio Grande Sales & Service, Inc., has been organized to handle the former Albuquerque, N. Mex., and El Paso, Tex., operations of Cummins & Moran, Phoenix, Ariz. Headed by A. S. Leonard, president, and J. D. Dennedy, vice president, headquarters is at 1921 No. Broadway, Albuquerque. Leonard is former regional manager of Cummins Engine

Co.'s Southwest region with headquarters in Los Angeles, and Dennedy is the firm's former manager of safety. The new office will handle territory in New Mexico and the Texas counties of El Paso, Hudspeth, and Culberson.

Euclid branch moves

According to an announcement by George Philpott, president of George M. Philpott Co., the former quarters of Euclid Road Machinery in Emeryville, Calif., will be moved to Philpott's San Francisco offices at 1060 Bryant St. Otto Heck, former office manager of the Euclid branch, will continue with Philpott and will make his headquarters in San Francisco. Philpott distributes for Euclid in California and Western Washington.

Three new salesmen for Smith-Booth-Usher

Smith-Booth-Usher Co., Los Angeles, has three new salesmen on its staff: H. C. MacIntosh, specializing in bituminous and paving equipment; C. D. Chase, specializing in earth-moving and compaction equipment, and Harold Weiss, specializing in concrete equipment.

New Trailmobile branch mgr.

Wayne Hill has been named manager of the Los Angeles factory branch of Trailmobile, Inc., manufacturers of commercial truck-trailers. One of the company's four plants is at Berkeley, Calif., the West Coast Division headquarters.

Bay-Garfield cos. join forces

The Bay Equipment Co. of Richmond, Calif., and Garfield & Co. of San Francisco have been consolidated into one construction equipment distribution company under the name of Bay Equipment Co. The firm will handle Manitowoc cranes, shovels, and draglines; Clyde hoists, derricks, and handcranes; Harris tractor loaders; Bay City shovels, cranes, draglines, and truck cranes; Industrial Brownhoist locomotive cranes; and Plymouth gasoline, diesel hy-

OUT IN FRONT of Foulger Equipment Co., 1361 South 2nd West, Salt Lake City, are six 5-ton Huber retractable rollers, recently sold to the State of Utah for smoothing out bumps in the State highway system.



Tuffy

May



Triple Service Life!



**"The Best Dragline Rope
Have Used On Any Machine"**

**Says Owner of An Ohio
Construction Company**
(Name on Request)

Tuffy Dragline went three weeks, when this construction company owner had been getting around one week's service from another brand of rope! That proved to him that Tuffy's special design pays off! Tuffy Draglines are built tough for maximum abrasive resistance and longer life . . . and they're extra flexible for easy handling at high speeds or low! Learn for yourself how Tuffy Draglines can stand up under more days of service . . . and may move far more yardage than the best previous average obtained by *your* operators! Easy to order—just give length, diameter and the name "Tuffy!"

**Tear Off and Mail Coupon
for FREE Dragline Folder**



UNION WIRE ROPE CORP.

Specialists in Wire Rope and
Braided Wire Fabric

2146 Manchester Ave., Kansas City 3, Mo.

Please send my FREE illustrated copy of
the Tuffy Dragline Folder.

Firm Name _____
By _____ Title _____
Address _____
City _____ Zone _____ State _____

draulic, and diesel electric locomotives. Both offices will remain open and officers of both firms will remain with the business, according to Ray D. Smith, president of Bay Equipment Co.

**White Motor Co.'s
regional managers**

Wilson D. Patterson, Pacific regional manager of The White Motor Co. announced that Dave Collins, formerly with the company as wholesale manager in Kansas City territory,



Collins
(upper left)

Knapp
(upper right)

Ragan
(left)



is now manager of the Portland branch. He replaces J. C. Knapp who has been assigned to a new post as Patterson's assistant at White regional headquarters in San Francisco. This newly-created position as assistant to the regional manager is part of White's program to provide expanded service and facilities to the growing trucking industry in the West. In Salt Lake City, Fred H. Ragan, sales representative at the Los Angeles branch since 1947, is now regional wholesale manager, with territory including Utah, Idaho, Eastern Washington, Western Montana, and part of Western Wyoming.

Philpott moves in Portland

George M. Philpott Co. of Portland is now located at 2353 N.W. 21st Ave., in a new building which provides increased space for the parts and service department and off-the-road parking facilities for customers. Philpott distributes for Gardner-Denver Co., Marlow Pumps, Colorado Fuel & Iron Corp., and several popular bearings manufacturers.

New line for Clark Equipment Co.

Clark Equipment Co., manufacturer of materials-handling industrial trucks, has revamped and expanded its dealer organization to handle its newly-acquired Ross straddle trucks and fork-truck lines. Robert H. Dodd Equipment Co., Portland, is a new



Tuffy

**SCRAPER ROPE
Handles Extra Yardage**



**"Can't Understand Why
Anyone Would Use
Another Brand"**

Says A Virginia Contractor
(Name on Request)

Tuffy Scraper Rope is paying off for this contractor, just the way it is for thousands of other users! And here's why: Tuffy is tailored to take the abuse that scrapers will give . . . Tuffy Scraper Rope is *specially made* for use on Scrapers! It's flexible enough to withstand more sharp bending and wind snugly and smoothly on the drums. So designed to withstand drum crushing caused by cross-overs. That's why Tuffy gives you *extra* yardage of dirt moved, *extra* days of service. Remember, all you need to order is length, diameter and "Tuffy!"

**Send Today for FREE
Scraper Rope Folder**



UNION WIRE ROPE CORP.

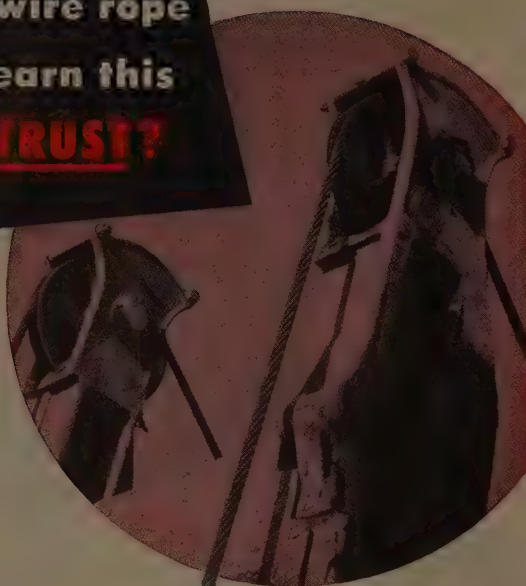
Specialists in Wire Rope and
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Please send my FREE illustrated folder on
Tuffy Scraper Rope.

Firm Name _____
By _____ Title _____
Address _____
City _____ Zone _____ State _____

Does the wire rope
you use earn this
kind of **TRUST?**



Typical of many, one master mechanic says, "We *always* use Hercules Red-Strand wire rope, because we know we can trust it for long life and safe service . . . every time." An inspector reports, "On a work test, we really abused Leschen rope. It more than satisfied our requirements."

HERCULES Red-Strand deserves it

Why is that so? Simply because *higher-than-rated quality* in Red-Strand wire rope means *greater-than-expected* safety and performance.

If you're not getting this kind of praise from your men, you should try Hercules Red-Strand. Do it, next time you need wire rope.

HERCULES®
Red-Strand wire
rope made by
A. Leschen & Sons
Rope Company,
St. Louis 12,
Missouri

*In business only to
make wire rope
... better wire
rope ... since 1857*



DISTRIBUTORS IN ALL PRINCIPAL CITIES

dealer for handling the expanded Clark line. Glen L. Codman Co., Inc., San Francisco; Robert H. Braun Co., Los Angeles, and Preston Faller, Seattle, are Clark dealers who will now handle Ross products.

Robinson heads sales at Bay

Charles G. Robinson has been appointed vice president and director of sales of Bay Equipment Co., according to Ray Smith, president. Robin-



**Charles G.
Robinson
of Bay
Equipment
Co.**

son will headquarter at Bay's San Francisco offices in the Hearst Bldg., 3rd and Market Sts. He has been with Bay Equipment Co. for several years and is well known throughout construction circles in Northern California, the territory served by the company.

AED meet in October

THE ANNUAL conference of Region 11, Associated Equipment Distributors, will be at Pebble Beach, California, October 8 to 10 inclusive. Registration and a golf tournament will be held on the afternoon of the 8th. On the 9th and 10th there will be business sessions with addresses by guest speakers. All requests for reservations should be addressed to Beal Shaw, 5100 Telegraph Rd., Los Angeles 22, California.

Cooper-Bessemer sales rep.

Todd W. Smith has been assigned as a sales and engineering representative to the Seattle, Wash., office of the Cooper-Bessemer Corp. He will devote most of his attention to the engineering application of heavy internal combustion engines, compressors, and pumps in the Northwest.

Tri-State Equipment represents Koehring

Tri-State Equipment Co., El Paso, Tex., will now handle Koehring Co.'s line of heavy-duty equipment, along with the products of three Koehring subsidiary companies, C. S. Johnson, Kwik-Mix, and Parsons, in Western Texas, and Dona Ana and Otero counties in New Mexico. J. B. Gilmer is sole owner of the new distributorship.

EWS of MANUFACTURERS

Harmon-Herrington Co., Inc.,
appoints sales promotion head

Robert V. Cummins is new head of Harmon-Herrington Co., Inc., sales promotion department, according to L. A. Campbell, vice president and general sales manager.

U. S. Steel appointment

U. S. Steel's Columbia-Geneva Steel Division has announced the appointment of James B. Black, Jr., as manager of sales in Denver, Colo. The Denver sales office is a branch of the firm's newly-consolidated Intermountain Sales District, which combines the areas formerly served by the Denver and Salt Lake City offices into one operation, with headquarters at Salt Lake City. Black previously served as assistant manager of sales at the Denver office.

National sales director for
Kelite Products, Inc.

Richard C. Martin is new national sales director of Kelite Products, Inc.,



**Richard C.
Martin**
of
**Kelite
Products,
Inc.**

manufacturer of industrial cleaning and processing chemicals, with headquarters at the main plant in Los Angeles. He was formerly in charge of the Southern division with headquarters in Dallas, Tex.

Frank G. Hough names
Northwest rep

Kenneth B. Larkin has been named district representative in sales territory No. 7 of Frank G. Hough Co., replacing H. E. (Gene) Thomas, who has been sent East. Larkin's territory embraces Washington, Oregon, Idaho, Montana, and the Canadian provinces of British Columbia, Alberta, and Saskatchewan.

Badger Machine changes

Daniel F. Przybylski, president, and Urban Shugart are sharing the sales manager duties of Badger Machine Co. since Elmer B. Mrozek left the company.

Harnischfeger award

Harnischfeger Corp., Milwaukee, has received the George Washington Medal from the 1952 National Awards Jury of Freedoms Foundation. Harnischfeger's much discussed adver-

Opportunities IN ATOMIC ENERGY PROJECT Engineers

Peter Kiewit Sons' Co. is now building a huge gaseous diffusion plant near Portsmouth, Ohio, for the Atomic Energy Commission.

We need graduate engineers with construction experience, in the following classifications:

**CIVIL • CHIEF • ELECTRICAL • DESIGN
FIELD • MECHANICAL
PROCESS PIPING • STRUCTURAL
ESTIMATORS • OFFICE • PLANNING
SUB CONTRACT • SHEET METAL**



You will have the advantage of being in

on the "ground floor" of an Atomic Energy Project.

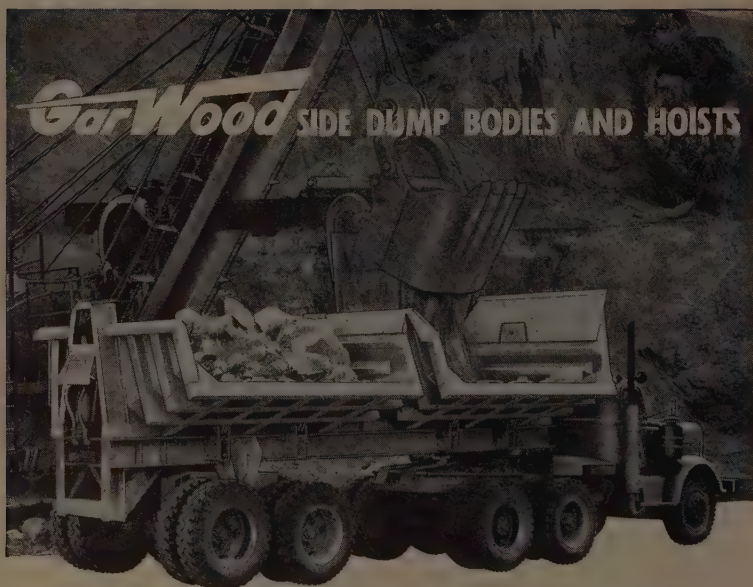
New experiences . . . new problems . . . new methods.

Here is, truly, the opportunity upon which you

may base your whole future.

**Write us and tell us about your education and experience.
Enclose a small photo if possible. All communications will
be held in strict confidence. Address Employment Division.**

**PETER  KIEWIT
SONS' CO.
BOX 268 • PORTSMOUTH, OHIO**



"LOAD ENGINEERED" TO SOLVE SPECIAL HAULING PROBLEMS

Gar Wood "Load Engineered" Side Dump Bodies and Hoists, designed and built to solve your special hauling problems, assure dependable, on-the-job performance. Where extreme dumping angles are required, Gar Wood double-acting hoist cylinders for high-angle dumping provide hydraulic cushioning at maximum dumping angle to absorb shock loads. Single or dual hoists are supplied as required, with hoist controls mounted in the truck cab for maximum driver convenience. Automatic down-folding sides are available on all Gar Wood Side Dump Bodies as optional equipment.

If you need extra strength and dependability in your hauling operation, investigate the merits of "Load Engineered" Bodies and Hoists designed and built by Gar Wood Industries, Inc.—the world's largest manufacturer of dump bodies and hoists for trucks and trailers. See your Gar Wood Distributor today!



Gar Wood medium-duty side dump bodies, with single or dual hoists, are available for truck mounting in capacities from 4 to 6 cubic yards. Double heavy-duty side dump bodies for trailer mounting are available with capacities from 11 to 25 cubic yards and dumping angles to 70 degrees.



GAR WOOD INDUSTRIES, INC.

RICHMOND DIVISION · RICHMOND, CALIFORNIA

tising campaign, a public service series, dramatized the importance of active, positive citizenship and interest in national economic and political problems of government. This is the second time the firm has been honored by the Freedoms Foundation.

Standard Steel Works appointment

Standard Steel Works announces the appointment of Arthur O. Terrel as assistant Eastern district manager at the Englewood, N. J., office. Terrel, with the company since 1929, will supervise all export functions and will assist in sales and distribution of oil and road equipment on the East Coast.

Caterpillar plans expansion

Plans for construction of a new plant, at a location not yet determined, were announced by Louis B. Neumiller, president of Caterpillar Tractor Co. The new plant, occupy-

Warren
Kinsey
will head
new
Caterpillar
plant



ing 700,000 sq. ft. of manufacturing floor space, will house the production of Caterpillar's line of motor graders and industrial wheel tractors, so enabling the firm to handle a broadened program of crawler tractor and diesel engine manufacture at the main Peoria, Ill., plant. This enlargement and gradual rearrangement of manufacturing facilities and construction of the new plant are expected to be completed by the end of 1955. Warren Kinsey, Caterpillar's employee relations manager since 1945, will be manager of the new plant. He joined Caterpillar in 1933, became personnel manager in 1937 and personnel director in 1940.

Smith Engineering Co. appointment

Smith Engineering Works, manufacturer of Telesmith crushers and other equipment for gravel pits, quarries, and mines, announces the appointment of Robert S. Bailey as representative for Southern California, covering the counties south of and including San Luis Obispo, Kern, and Inyo.

Federal-Pacific electric cos. merge

Merger of Federal Electric Products Co. and Pacific Electric Manufacturing Corp. was announced by T. M. Cole, Federal president, and J. S. Thompson, Pacific president. The consolidation forms a nation-wide electrical equipment manufacturing concern, employing 3,000, with plants in all industrial centers of the country.



ARCHITECT'S DRAWING of Plexolite Corp.'s new factory and general offices which will be located at Maple Ave. near Sepulveda in El Segundo, Calif. The building, which is scheduled for completion on October 1, will have over 30,000 sq. ft. of floor space. The grounds will contain an auto parking area and railroad siding.

Montsanto appointment

J. W. Colgan is now maintenance supervisor for Montsanto Chemical Co.'s new plant at Avon, Calif. He was formerly construction project engineer for the company's organic chemicals division. In that capacity he was in charge of construction of the Avon plant.

International Harvester takes over Bucyrus-Erie tractor business

International Harvester Co. and Bucyrus-Erie have announced an arrangement under which Bucyrus-Erie industrial tractor equipment will

be sold, distributed, and serviced by Harvester to its industrial power distributors. International will manufacture the equipment eventually.

Steel mill expands production

New annealing equipment which has been installed at Colorado Fuel & Iron Corp.'s fully-integrated steel mill at Pueblo, Colo., will double the plant's capacity for the production of pot-annealed wire, according to A. F. Franz, president of the corporation. The new annealers will supply wire to additional coiling equipment for final processing into standard 48- and 100-

lb. coils of automatic baling-machine wire. These baling-wire coils have been standardized at 14½ gauge with coil lengths of 3,150 and 6,500 ft. Addition of the new annealers and coilers at the Pueblo steel mill is part of a long-range program of expansion, modernization, and product diversification being undertaken by Colorado Fuel & Iron Corp.

F. M. Reid dies

F. M. Reid, vice president in charge of engineering for Fruehauf Trailer Co., died in Detroit on May 11.

Wayne Crane gets chief engineer

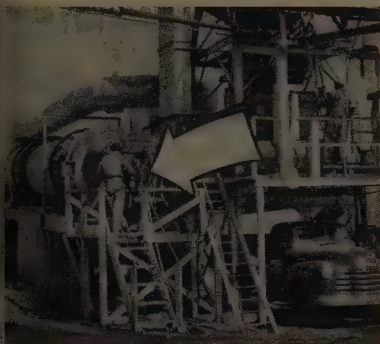
Robert Bushong, assistant chief engineer of the Inslay Manufacturing Corp. for 8 yr., has been named chief engineer of the Wayne Crane Division, American Steel Dredge Company, Inc.

New Brakeblok Division prexy

M. B. Terry, executive vice president of American Brakeblok Division, American Brake Shoe Co., has been appointed president in place of W. T. Kelly, Jr., who continues as a vice president of the parent company and president of the Kellogg Division. Kelly's additional time will be devoted to the development of the company's sintered metals operation.

Continued on page 152

At Sam Finley, Inc., Atlanta, Georgia



Finley Plant No. 1 has a Hopkins Combination Oil-Gas Dryer Unit



"We have 10 Plants using
**HOPKINS VOLCANIC
DRYER UNITS**"



● Looking for a low-cost burning system for your asphalt plant? Let Sam Finley, Inc. tell you about their experience with Hopkins equipment: "We have ten plants using Hopkins equipment, and in every case, the units have proven very satisfactory to us. We find they have increased production and lowered fuel consumption. Our first Hopkins unit was installed several years ago, and we have been installing them as fast as possible since that time. All of the Hopkins Volcanic units have given us excellent service."

Why don't **you** take advantage of Hopkins' efficient operation, as has the above contractor? A letter or phone call will bring you descriptive literature, complete details, and follow-up by a Hopkins representative.

HOPKINS VOLCANIC SPECIALTIES, INC.

ALLIANCE, OHIO

Space is sold as advertisers' inches. All advertisements in this section are 1/4 in. short of contracted space to allow for borders and composition.

CLASSIFIED SECTION

Rates are \$8.50 a column inch. Copy should be sent in by the 20th of preceding month if proofs are required; by the 23rd if no proofs are required.

For Sale CEMENT & GRAVEL EQUIPMENT

- 1—CONCRETE MIXER; Smith, 2 cu. yd. tilting type, 30-hp. elec. motor.
- 1—WEIGHT BATCHER; Blaw-Knox, 2 cu. yd., complete with 3-beam balance scales.
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- 1—HOPPER; Smith 2 cu. yd.

- 1—CEMENT BATCHER; Noble, complete with cement weighing bin, balance scales, controls, 10-hp. elec. motor.
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- 46 DODGE 4 x 4 Carryall.....\$ 600
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Cat. D4 Traxcavator Loader.....	\$ 3,750
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future. Background of manufacturing, con-
struction, mining and distribution of these
products. Married, age 33, college graduate.
Write or wire Box 80, Western Construction,
609 Mission St., San Francisco 5, California

More NEWS of MANUFACTURERS and DISTRIBUTORS

All-State Welding field mgr. named

Kenneth V. Lutz, regional field manager of All-State Welding Alloys Co., Inc., for the 11 Western states and Hawaii since 1948, has been appointed general field manager of the company. He will help the regional managers with their welding, brazing, soldering, cutting, and tinning problems through the facilities of All-State's metallurgical resources and experimental laboratory.

Fairbanks selects Kaiser

Franz F. Kaiser, chief layout engineer and chief tool engineer of the Beloit Works, Fairbanks, Morse &

Co., has been appointed chief industrial engineer of the firm. He will specialize in plant layout, plant engineering, tool engineering, processing, work standards, time study, and the like.

Asbestos mfg. gets prexy

Carl P. Brockway, vice president of Thermoid Co., has been elected president and director of Asbestos Manufacturing Co., a Thermoid subsidiary. A. K. (Ed) Runkle has been named superintendent of Thermoid's Friction Division in place of Brockway.

Link-Belt ups two

Link-Belt Co. has appointed Harvey V. Eastling, general sales manager for the Pacific Division, as Pacific Division assistant general manager, with headquarters at San Francisco. Donald E. Thal, assistant sales manager, was promoted to sales mgr.

U. S. Steel names assistant prexy

E. E. Moore, vice president of industrial relations administration for United States Steel Corp., has been appointed assistant to president and vice president of the corporation.

Keach joins Pioneer Rubber

J. R. Keach, former vice president and general manager of the Quaker Rubber Co., has joined Pioneer Rubber Mills as assistant to the executive vice president.

Lockwood Resins Co. formed

William C. Lockwood has formed the Lockwood Resins Co. with headquarters in Pasadena, Calif. The firm produces a plastic base coating for plywood forms used in concrete construction work. Warehouse stocks are available in Seattle, Portland, San Francisco, and Los Angeles.

Rockwell ups Warrick

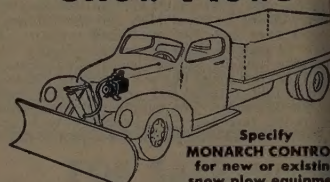
E. C. Warrick, chief engineer of the Delta Manufacturing Division, Rockwell Manufacturing Co., has been promoted to chief engineer of the firm's Power Tool Engineering Division. He will succeed Paul E. Butzin,

who will continue to serve as consultant for the division.

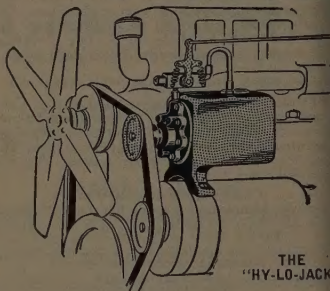
Four Baker-Lull appointees

Baker-Lull Corp., manufacturers of materials handling equipment, announced four personnel changes. William Delaney became service manager; David Hansen, former assistant sales manager, became national sales manager; Clarence J. Bornholdt, former works manager of the Little Giant Corp., became factory manager; and Charles Strauch was promoted from sales promotion manager to manager of Traveloader sales.

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BACKFILL, uncompacted

Alaska volcano versus our deadline

For a while last month, we thought we would have no Alaska Newsletter in this issue. An immediate result of the volcano eruption near Anchorage, Alaska, was grounding of all planes. The clouds of ash and dust were soon diverted by a shift of the wind, however, and the mails began to go again. Newsletter is with us, on page 102.

Cause of the trouble, according to the Air Force, was eruption of three volcanoes across Cook Inlet: Mt. Spurr, 11,050 ft., 78 mi. west of Anchorage; Mt. Torbett, 10,000 ft., 10 mi. northwest of Mt. Spurr; and an unidentified 4,500-ft. peak 4 mi. northwest of Mt. Spurr.

An eye-witness report to this office tells of pitch darkness at noon in Anchorage on July 9. Automatic actuation of street lights and signals took effect right away. Bus lines put on an extra man—one to drive and one to watch the right side of the road. Lots of auto accidents—one line of traffic wouldn't have been bad, but opposing lanes swirled a 6-in. layer of ash into dense, impenetrable clouds.

Water consumption went up rapidly as people fought infiltration of the ash in homes. Pedestrians soon became covered with ash from head to foot. Our eye-witness undertook a shampoo: "We didn't know what effect the water would have with whatever chemicals might be in the ash. Anyway, I would as soon be bald and be clean!"

Here's the ABC of why we're "nosey"

Every once in a while someone writes to us and says that we are a little too nosy with the questionnaire sent to him just after he subscribed to *Western Construction*. The questionnaire announces itself as being a requirement of the Audit Bureau of Circulations. Perhaps some of you would like to know the abc's of ABC.

ABC is a service to the manufacturers who advertise in our pages. Just as you pay for your subscription, they pay for their advertising space. And for all practical purposes, by the way, they pay for the magazine. Subscription sales alone don't nearly pay for even the mechanical production of the magazine each month.

Like you, the advertisers want their money's worth from their investment. For you, that's easy—you determine the value of *Western Construction* by the editorial content each month. The manufacturers determine the value of

Western Construction (and all trade magazines) in another way. They want to be sure that the magazine is seen by the people they want to reach. That's you, the men who buy or use equipment.

Now, by means of the questionnaires that you send in, we make up a tabulation showing how many of you are designers, how many are superintendents, how many are shovel runners or plasterers, and so on. These records are audited once a year by the Audit Bureau of Circulations. It's just like having our financial

Twenty-five years ago in *Western Construction*

An 11½-page article by J. L. Savage, chief designing engineer, and H. J. Gault, construction engineer, Bureau of Reclamation, reviewed construction of Stony Gorge Dam on California's Orland Project. The Ambursen structure was 142½ ft. high above the lowest point of its cutoff, with a crest length of 868 ft.

* * *

"Stone & Webster Engineering Corp. has been formed with a capitalization of \$9,500,000 and has taken over from Stone & Webster, Inc., its construction and engineering business and its interest in Ulen & Co. . . . C. O. Muhlfeld is president of the new company."

* * *

Fiorito Brothers of Seattle had a \$363,223 contract for improving 34th Avenue NW in Seattle. Unit bid prices included 123,800 sq. yd. of 6-in. concrete pavement @ \$1.40; 79,900 ft. of curb (new and replaced) @ \$0.20; 17 manholes @ \$90.00; 1,710 ft. of 10-in. vitrified sewer @ \$1.35; and 4,700 ft. of 8-in. "B" cast iron pipe @ \$1.34.

* * *

"Williams & Douglas of Tacoma, Washington, have practically finished grading in connection with their contract for 12 mi. of the Transmountain Highway in the Glacier National Park [Wyoming]. Project as a whole is 90% complete. . . . Equipment in use includes two power shovels, one compressor, ten trucks, and about 200 men are employed. . . . Contract price about \$900,000, involving 480,000 cu. yd. rock excavation."

books audited, but with circulation it's done to make sure the magazine is going to men who can logically make some use of the advertising messages they read.

Frankly, we think the advertisements are just as important to you as the editorial pages. They tell you what selection of equipment is available to help you do a better job. You are the men whose decisions stand to profit both yourselves and the manufacturers of the equipment you use. The manufacturers pay to reach you, and the ABC circulation breakdown is the "bill of health" that we show. That's why we are always glad to get the questionnaires back!

"Making work ... or progress"

A young engineer read our editorial page last month ("School begins at 25") and wrote to us about it. His letter began as if he had us over a barrel, pointing out that a recent article in another magazine had made much of the currently better training of young engineers, with resulting better work capacity and quality.

Our editorial, on the other hand, had cited the fact that a "common plaint of [highway] engineers was 'We're not getting as much effort from each man as we used to, especially among the younger engineers.'" We had wondered about this, posing the question whether supervisors are providing adequate training and inspiration.

The engineer's letter showed that he had done a little thinking. It may be bitter, but here it is:

"... the answer to this difference of opinion must lie with the (Civil Service) administrators and their ability to recognize capabilities and quality of training ...

"From my own experience with civil service I have found that quality and quantity of work is not recognized ... and that seniority is the only factor in advancement ... the supervisory engineers are failing in their job, primarily because they do not realize the progress—both technical and educational—that has taken place since they left school ... thus, they are still living in the days of making work instead of making progress."

Celery stalks the highway

An overturned truck spilled so much of its load of celery on the Willamette Pass highway near Eugene recently that a snow plow had to be called in to clear the road for traffic. We're glad that the truck wasn't loaded with (ugh!) tomatoes.

By THE EDITORS