ESTERN
ONSTRUCTION

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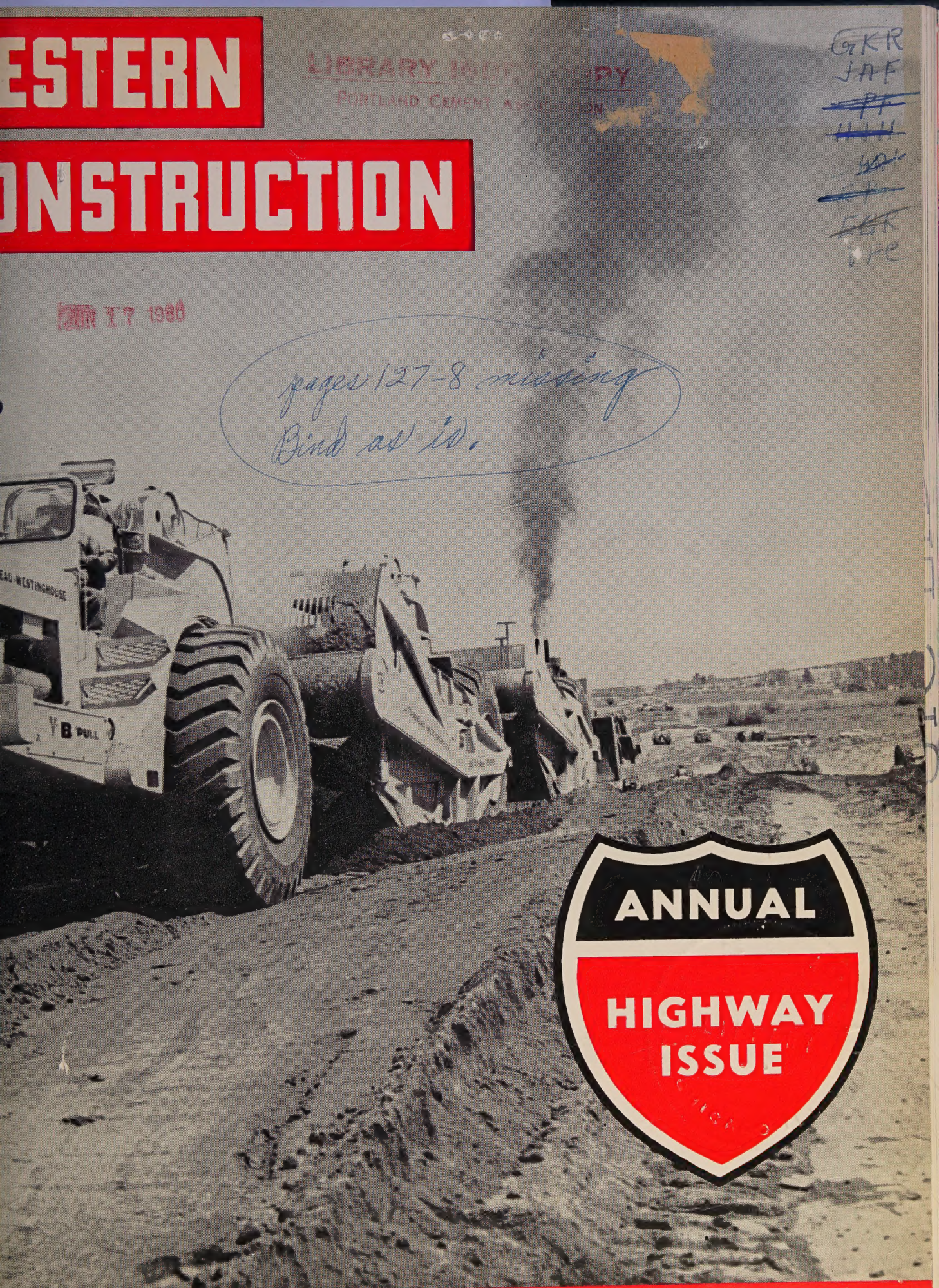

Tandems hit the road . . . p 93

JUNE 1960

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Don't conclude that you know *all about* Northwest. here is much in advanced design that advertising pace precludes telling you about. Let a Northwest an discuss your crane problem with you.

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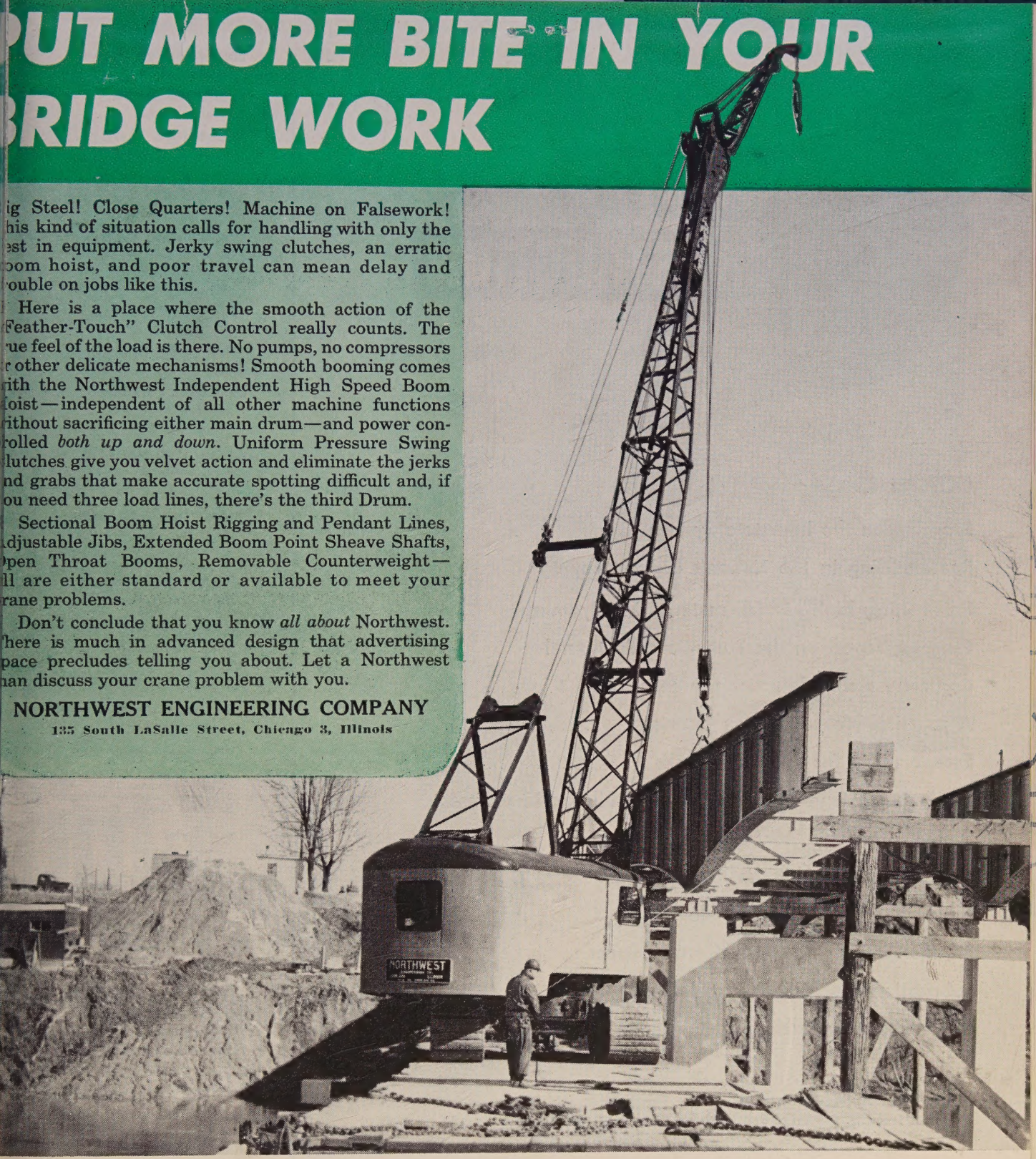

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WESTERN CONSTRUCTION

JUNE
1960
Vol. 35 No. 6

CONTENTS

COVER—Production model tandem scrapers make their first appearance on a Western highway job at Susanville, Calif., where Fredrickson and Watson is building nearly 12 mi. of freeway. For more details on the new 46-yd. scrapers see page 93.

Published monthly by
KING PUBLICATIONS
609 Mission Street
San Francisco 5, California
Phone: YUkon 2-4343

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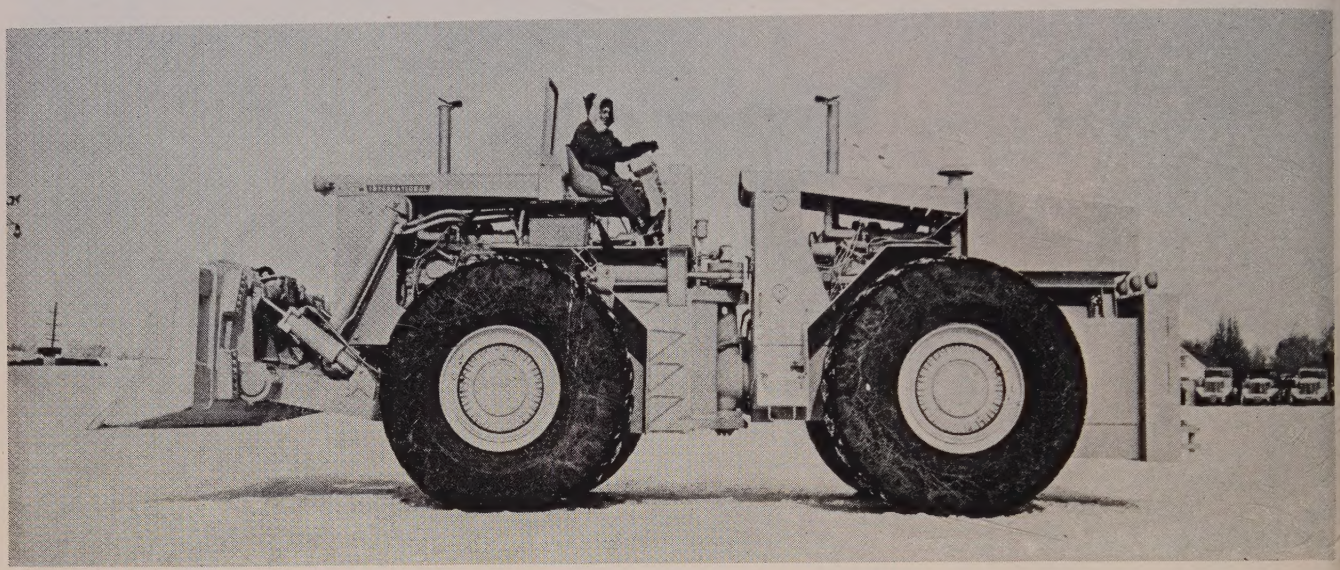
NEW EQUIPMENT

Obtain more information on these new developments in construction equipment by writing the corresponding numbers on reply postcard.



Giant Pusher-Dozer of IH has 750 hp.

A mammoth, 75-ton, twin-engine earthmover, designed and built by **International Harvester's** Construction Equipment Engineering Department and believed to be the biggest vehicle of its kind yet produced, went into action for the first time this spring on a road-building project.

Powered by two 375-hp. International diesel engines, the huge earthmover is a combination of two two-wheeled tractors, joined back to back. Designed to operate either forward or backward, it wields a 14¼-ft., 8-ton dozer blade on the front unit and mounts a foot-thick pusher plates on the rear unit for pushing during scraping and loading operations. Designated the PD-105 Pusher Dozer, it's the first of its kind the company has built, although the tractors, as individual units, are already in production. Considered experimental, the company is placing it in an actual work situation this spring for testing purposes.

With a top speed of better than 21 mph. (25 with optional high speed gearing), the unit is fast for its size, and as a pusher for other construction equipment is expected to speed up earth-moving operations which today's contractors already figure in seconds.

The PD-105 is also remarkably maneuverable. According to IH engineers, it can turn in the same circle with an Oldsmobile. Thirty feet long with blade, the Pusher Dozer's maneuverability stems, in part, from its frame steer feature. With axles rigid to frame side members, the PD-105, on turns, literally bends in the middle where the two tractor units are joined. Double-acting hydraulic cylinders on either side of the vehicle push in opposite directions to jackknife the rig, which has a maximum 45-deg. turning angle and can turn inside a 24-ft. radius. It steers with a standard wheel which actuates the hydraulic steering system. So an operator accustomed to power steering on any other heavy construction vehicle would feel at home on the Pusher Dozer. Though frame steering isn't new in the industry, IH engineers believe theirs is the biggest application of it to date.

Seat, steering wheel, accelerators and brakes are mounted on a turret which turns easily on roller bearings. In order to change directions the operator merely kicks a release and spins the turret around. Tripped by the turning turret, a switch reverses oil flow in the steering system so the vehicle steers the same forward or backward. The operator's position, nearly 13 ft. above the ground, is high enough to make it an excellent vantage point for work in either direction.

Each set of wheels in the articulated rig is powered by a six-cylinder International diesel, the biggest currently manufactured by the company. Together, the two engines give a total of 750 hp. Twin accelerators on the control turret permit single or dual acceleration with one foot.

Transmissions are single stage, torque converter driven, power shift systems, providing four speeds forward and reverse. A single lever serves both transmissions as a range selector. Another controls forward and reverse for both systems.

The Pusher Dozer's weight is well balanced between its two axles. Under favorable traction conditions, it can push or pull about 90,000 lb., the equivalent of about 65% of its gross weight.

. . . Write No. 150

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A-D Machinery Company, Inc.—Elko, Las Vegas, Nevada; **Construction Machinery Company** — San Diego, California; **Industrial Tractor Sales**—No. Sacramento, California; **Neil B. McGinnis Equipment Company**—Phoenix, Arizona; **Reno Equipment Sales Company** — Reno, Nevada; **San Joaquin Tractor Company**—Bakersfield, California; **Shasta Truck & Equipment Sales**—Redding, California; **Shaw Sales & Service Company**—Los Angeles, California; **Trinity Tractor Company**—Eureka, California; **West Coast Engine & Equipment Company**—Berkeley, San Jose, Ukiah, California

New power package for Fordson Major Diesel

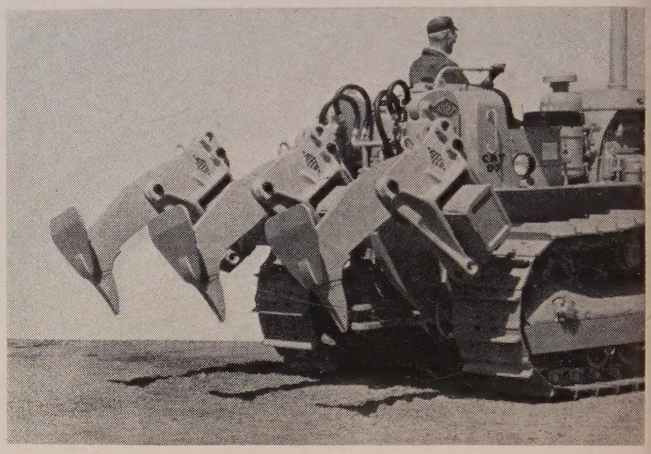
A new subframe and equipment hydraulic package now enables a contractor to mount any combination of **Ford** accessories on the Fordson Major Diesel Tractor. The "Super-Duty" loader for the Fordson Major Tractors is new in the Ford line and is being made available at this time. It has a capacity of more than 1 ton and supplies a higher capacity loader than

previously available from Ford for these tractors. The loader has a lift capacity of 2,500 lb. and a breakaway capacity of 5,500 lb. It lifts a capacity load to a height of more than 11 ft. The operator has unobstructed vision forward because of the loader's diagonal side bracing. An indicator enables the operator to know the position of the bucket without guessing. Power for the loader comes from the independent hydraulic power package. Contractors can obtain buckets with capacities of 5/8 and 3/4 yd.

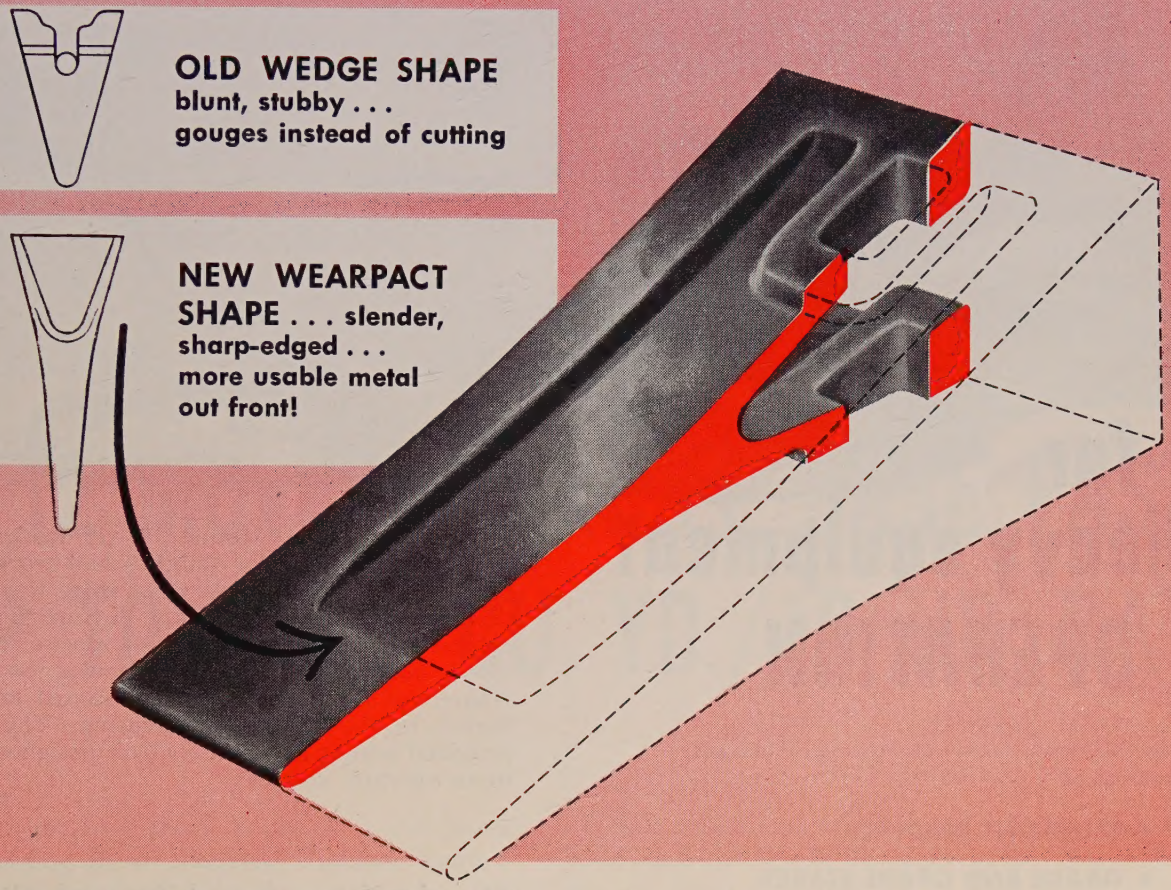
. . . Write No. 151

New Ateco Ripper for D7

Designed to match the performance of the Caterpillar D7, **American Tractor Equipment Corp.** announces a new heavy, extra-duty model of its Ateco Rock Ripper. The unit includes larger cylinders, a heavier tool beam, and swing brackets with 6 in. more ground clearance of the tool beam. Special heat treated alloy steels are used extensively for extra ruggedness. The new ripper retains the other features of the Mack Wooldridge design. Maximum ripping depth is 42 in. and a complete line of replaceable boots and points is available. These include the popular wingfoot attachment for greater lifting action. *. . . Write No. 152*



From WEARPACT... a new Dipper Tooth



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The best test for steel teeth is in the taconite mines. It's real punishment for any type of dipper tooth.

Most teeth just can't provide the combination of high-hardness and toughness that's required for month-in, month-out heavy duty service. They don't come up to the high standards of longer-wearing Wearpact cast-alloy, self-sharpening steel.

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It needs less power to slice through rock, slag, ore, taconite than any stubby, wedge-type tooth. *It cuts instead of gouging.* It digs faster . . . and easier . . . with much less wear and tear on the power shovel.

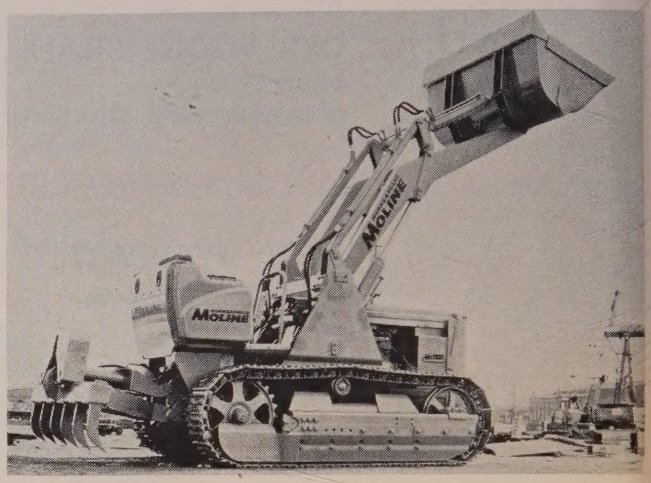
There's a Wearpact tooth to fit almost every standard shank. Try 'em for proof on your toughest jobs. See your Wearpact distributor for a demonstration, or write us today for full information.

Cut your costs with **WEARPACT**® *Cast Alloy steel*

. . . for more details, write No. 13 on Reader Service Postcard

New crawler announced by Minneapolis-Moline

With a design that has been directed toward lowest operator fatigue and highest operator comfort, **Minneapolis-Moline** has announced a 59-hp. crawler tractor with torque converter and instantaneous reversing shuttle. Designated the MoTrac, it is called "the general contractor's ideal machine". It is available with both diesel or gasoline engines and is provided with a 5-speed transmission having a range from 1.3 to



7.25 mph. With a Moline 1¼-yd. loader mounted on the cross shafts for stability and work visibility, the machine is said to carry out more work than any crawler in its horsepower class. The machine has been designed for easy attachment of accessories. A dozer blade has simple 4-point mounting on the track frame and a scarifier is easily mounted on two arms bolted to the differential housing. The tractor is provided with a seat and controls designed for maximum operator comfort.

. . . Write No. 153

Cleveland trencher shifts and tilts

With instant lateral positioning and tilting of its digging wheel, the new **Cleveland** JS-30 will dig a trench behind either crawler track or at any point within its 6-ft. width. It can also be tilted to cut a vertical trench on side slopes and under other conditions where one crawler track is higher than the other. This eliminates the usual requirements for blocking or cribbing under one track. The lateral shifting arrangement of the digging wheel moves it 5 in. outside of either track, permitting a 24 in. wide trench to be dug flush with parallel pavement, curbs or sidewalks. The hydraulic power tilting of the wheel, 7 deg. to either side of the vertical, when combined with the lateral shift permits trenches to be dug virtually flush with fences, walls, or pole lines.

. . . Write No. 154

(Turn to page 164 for more New Equipment.

New Literature can be found on page 174.)

NO. 12 MOVES FLEXIBLE BASE FAST —UP TO 3800 CU. YD./10 HR. DAY

The No. 12 pictured above is one of 4 Cat Motor Graders working on an Interstate Highway improvement contract being handled by T. L. James & Co., Inc. and R. W. McKinney of Corsicana, Texas. The 7-mile paving job is near Richmond, Texas, and calls for 62,178 cu. yd. of concrete plus 98,740 cu. yd. of gravel and 95,420 cu. yd. of flexible base.

To keep production high and on schedule, these contractors rely on the No. 12's superior performance and operating efficiency to move flexible base fast. Equipped with a 14-ft. blade, this unit spreads 3600 to 3800 cu. yd. per 10 hr. day.

This is the kind of production and dependability you can expect from the 115 HP Cat No. 12 . . . now, more than ever, with the many improvements incorporated in the *new* Series E model.

The most notable improvement is the new compact engine which provides greater lugging ability in tough going, long life and easier servicing. Horsepower remains the same (115) but this new engine develops higher torque and gives the No. 12 greater load-handling capacity. Besides a new compact engine, the No. 12 Motor Grader now has the dry-type air cleaner as standard. Removing 99.8% of all dirt from intake air this cleaner can be serviced in 5 minutes . . . cuts maintenance time by as much as 70% and substantially reduces cost . . . extends engine life.

Still retained are the many important features that have made the No. 12 the leader in its class. There's the oil clutch, providing up to 2000 hours without adjustment . . . the equivalent to 12 months of operation. Ample clearance between the top of the moldboard and the bottom of the circle drawbar provides greater rolling action . . . allows more material to move across the blade. Improved mechanical controls make engagement easier. Blade controls have a mechanical lock to insure positive blade position. When control is in neutral, the power shaft is locked by a set of gear teeth to prevent creeping.

These are just a few of the reasons why the NEW Cat No. 12E Motor Grader is out front. To get the complete picture, see your Caterpillar Dealer. He'll show you proof of top performance with an on-the-job demonstration!

Caterpillar Tractor Co., General Offices, Peoria, Ill., U.S.A.

CATERPILLAR

STEP UP PRODUCTION WITH THE IMPROVED NO. 12

The WEST from WASHINGTON

By E. E. HALMOS, JR., Washington, D. C.

Taking everybody—including the bill's sponsors—by surprise, the House Rules Committee early in May granted an unexpected new lease on life to California's hopes for the $2 billion San Luis project (S.44).

As you know, the bill went through the Senate exactly a year ago, then went to the House, where the Interior and Insular Affairs and the powerful Rules committees bottled it up. Main point of contention has been the traditional 160-acre limitation on individual landholdings to be served by the project. Western sponsors wanted this limitation eliminated from the bill, on ground that a good part of the water to be supplied to arid Southern California would be state-owned, thus not subject to limitation. Eastern and Midwestern delegations, however, forced inclusion of the limitation in the bill passed by the Senate.

The House Interior committee, however, promptly took the limitation out of the bill again.

Rules committee action in "granting a rule" to the bill means that it now goes on the legislative calendar for floor action—although whether it actually comes up on the floor in the less than two months remaining of the session still remains in doubt. Failure to complete action will kill the measure, since when this Congress adjourns, all legislation not enacted dies with it, and a new bill would have to be introduced next January.

* * *

With this background—and intent on getting the best bargain possible under the circumstances—Western Congressional delegations have been pushing on other fronts.

For example, California's Senator Kuchel appeared before the Senate Public Works Committee (and added a speech on the Senate floor as well) to support changes in HR 7634 (the omnibus public works appropriations bill) that would add three navigation projects to those already included: Noyo Harbor, Los Angeles Harbor and Monterey Harbor; a beach erosion project in Orange County; and four flood control projects, on the Sacramento, Merced, and Mokelumne rivers and Tachevah Creek. Total Federal expenditures of some $30 million would be involved.

Wyoming's Senator Joseph C. O'Mahoney pushed for revisions he favors in proposed "wilderness" legislation (S. 1123). Key points: Give statutory designation to 5.8 million acres of National Forest lands (most of it in Western states). and authority for the Secretary of Agriculture to ascertain the wilderness characteristics of some 8.3 million additional acres now classified as "primitive"; makes provision for administering lands declared to be "wilderness". (As you know, the legislation in general has been opposed by Westerners, on grounds it would place vast areas out of the range of needed future development for any purpose.)

And Rep. Jeffrey Cohelan, of California, pushed Congress and the Defense Department to "do something" about raw sewage dumped into San Francisco Bay from bases at Benicia, and Treasure and Yerba Buena Islands. He reminded Congress that it had authorized sewage treatment facilities at these stations in the military construction appropriations for 1959 and 1960—now must make appropriations for this work.

* * *

The tenor and direction of that investigation into the Interstate Highway program got clearer early in May, as Minnesota's John A. Blatnik and his special House public works subcommittee got back to work.

Earlier hearings—into the reasons for raising Interstate bridge minimum clearances — got nowhere in particular, and got practically no headlines.

This time, however, the committee counsel had gotten hold of what seemed to be a real scandal: A grand-jury investigation into the construction of the 9-odd mile "Skelly bypass" around the southeast side of Tulsa, Okla. Irregularities in inspection formed the basis of the committee's check into procedures of the Bureau of Public Roads, and the whole investigation had all the good headline attributes: A district engineer who admitted he'd relied on reports from the state highway department (normal procedure, of course), had made no independent checks of the accuracy of state reports; a rather fulsome memorandum from Washington BPR headquarters, praising the district engineer's "investigation"; a disgruntled former state highway department inspector who charged that certain tests were never made; and a county prosecutor and his grand jury, with an independent engineering investigator, who seemed to corroborate the reports. Added to this were newspaper charges that the new road "broke up" shortly after it was opened to traffic in 1958.

Although BPR stuck to its official opinion that the problem may have been caused by some "sloppy" work by the state, but wasn't too serious or far out of line, nobody in Washington minimized the headline mileage the committee could get out of the charges, and probably others it could find. Certainly, the charge did appear to leave the BPR in a weak position—Congressmen, sharply questioning witnesses, brought out the fact that Federal inspection could break down because of sloppy or dishonest action at the state level.

Obviously, there won't be any legislation this session — but the foundation is being laid for a thorough-going checkup, next time.

* * *

As indicated in these columns months ago, the Bureau of Reclamation has had the last word in that labor dispute at Glen Canyon Dam —and has refused to pay 85% of the cost of pay raises granted to construction workers by Merritt-Chapman & Scott.

Following reasoning that was made clear late last year (see issue of November 1959, p. 80) BuRec told the contractor that it considered the 50-cent wage increase to be "subsistence" pay—and that the government wouldn't pay for that. It doesn't consider Page, Ariz., (where the government has built roads, schools, housing) as a "remote" area justifying such pay.

* * *

The U. S. Chamber of Commerce, holding its annual meeting in Washington early in May, took budget-cutting swings at two Western construction agencies.

Among others, it urged Congress to end completely public works appropriations for the Southwestern Power Administration and the Bonneville Power Administration (to pay for new transmission lines and substations). Private industry,

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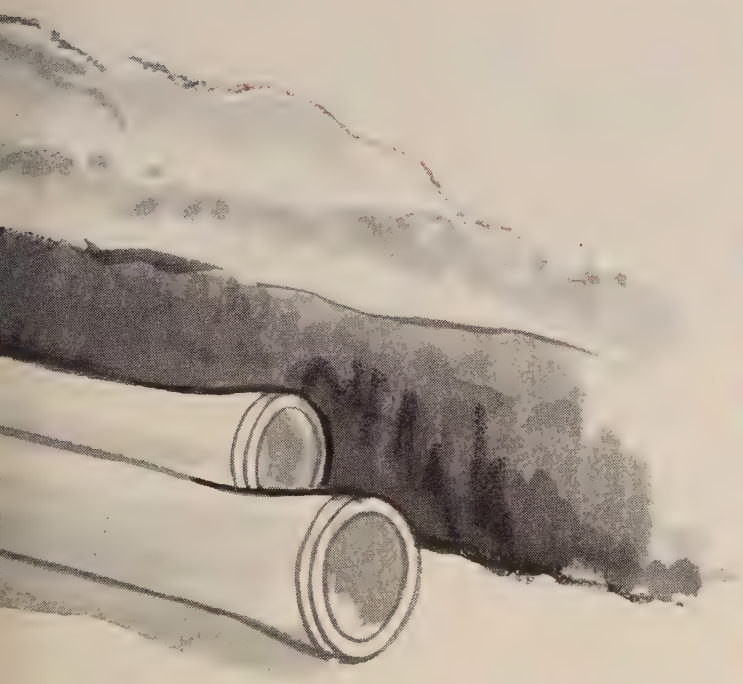

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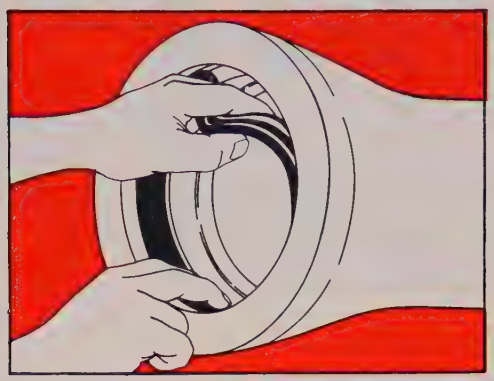
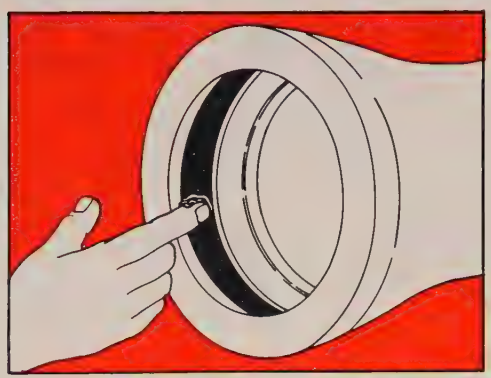
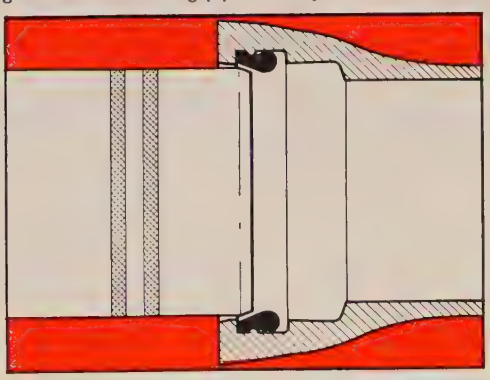


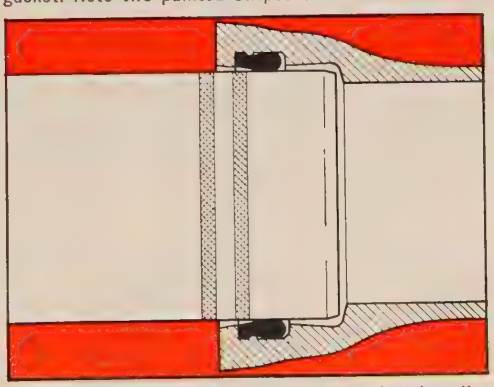
Insert gasket with groove over bead in gasket seat . . . a simple hand operation.



Wipe film of Tyton Joint® lubricant over inside of gasket. Your receiving pipe is ready.



Insert plain end of entering pipe until it touches gasket. Note two painted stripes on end.



Push entering pipe until the first painted stripe disappears and the second stripe is approximately flush with bell face. The joint is sealed . . . bottle-tight, permanently! The job's done . . . . fast, efficiently, economically. Could anything be simpler?

. . . for more details, write No. 19 on Reader Service Postcard

said the Chamber, can do these jobs withoct cost to the Federal government.

* * *

A major West Coast contractor joint-venture was one of the partners (with a British and a French firm) in submitting proposals for that long-planned tunnel under the English Channel. A three-plan proposal, to cost up to $269.3 million, was submitted by Hyperion Constructors, Enterprises Campenon Bernard of France, and Richard Costain Ltd., of England.

All proposals called for sunk-in-place twin tubes, to carry railway trains at high speeds, through the 113,500-ft. length of the underwater passageway. The most elaborate of the proposals called for a two-level tube, with standard sized railway trains operating at the lower level, and specially-built lightweight trains to carry automobiles operating on the upper level.

The huge tunnel tubes (largest would be 53 ft. 3 in. in outside diameter) would be placed by a version of the DeLong barges that were used on the Hyperion outfall.

Final decision on the tunnel won't be made before the end of this year.

* * *

Waterways operators, seriously concerned over what they regard as a continuing attack on their operations by highway interests, have reached agreement on what they consider absolute minimum bridge clearances over navigable waterways.

The clearance they want, vertically, is 55 ft., to be available "98% of the navigation season". The decision was taken over proposed bridges in the Midwest—but waterways operators made it clear they would fight for similar clearance requirements everywhere.

* * *

At least $30 million of the appropriations for the Atomic Energy Commission will go for construction work in Western states, according to terms of the bill (S3084) that has been okayed by the Senate.

Bigger projects that are identifiable from the carefully-worded language of the measure include: $2.9 million for a plutonium reclamation plant at Hanford, Wash.; $2.1 million for a high velocity test track at Sandia Base, N. M.; $1.9 million for work on the Tonopah Test Range, Nev.; $2 million for a contaminated waste plant at Los

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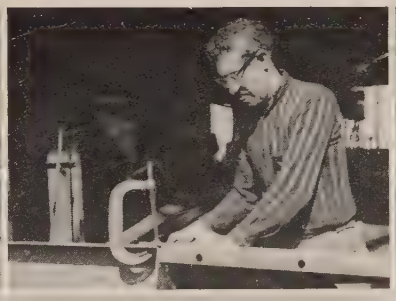

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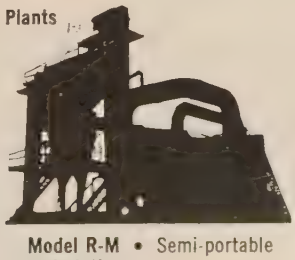
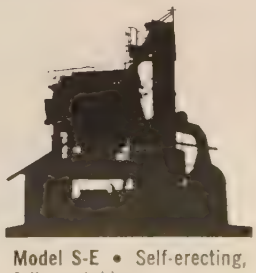
Model T-M • Trailer-mounted, self-contained.



Model R-M • Semi-portable and stationary



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Alamos, N. M.; $6.9 million for a fast reactor test core installation at Los Alamos; $600,000 for "real estate developments" and an elementary school addition at Los Alamos.

* * *

Extension of the payment period —but not a moratorium on payments—is the proper answer to getting Western reclamation projects built without undue burden on water users, according to the Bureau of Reclamation.

Case in point involves three Columbia Basin irrigation projects, whose directors have refused to sign agreements to pay drainage construction costs as part of the annual operation and maintenance charges. House and Senate joint resolutions first proposed a two-year moratorium on such payments. Department of Interior objected—but supported a House bill (HR 10602) that would extend time for such payments from 40 to 50 years, in order to spread out costs to irrigators.

* * *

There's no chance of passage this session—but engineers will be greatly interested in terms of a bill (HR 11916) "to establish a system of public and legal recognition of engineers and scientific personnel engaged in the practice of their arts on projects sponsored by the Federal government."

Introduced by Maryland's Rep. Foley, the bill would, in effect, set up a new registration classification —that of "Federal Engineer"—and a new registration group in Washington that could well upset long-established state registration groups, despite the provision that requirements should conform — where advisable—to existing registration laws.

Although the bill makes a bow to other engineering regimens, it is specifically concerned with civil engineers. It declares that "the practice of engineering on Federal projects . . . is declared to be subject to regulation in the public interest." Anyone "engaged in, or offering to engage in" . . . engineering, would be required to submit evidence that he is qualified to practice, and must be registered as provided by the bill. A 7-member registration board, to include civil, mechanical, chemical and electrical engineers, would pass on prospective registrants.

Prospective registrants would have to be 25 years of age or more;

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Interstate 65 (Atmore to Evergreen)

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Interstate 40
Interstate 55

CALIFORNIA
Golden State Freeway (Los Angeles to Bakersfield)
Interstate 5 (San Francisco to Reno)
Interstate 15 (Los Angeles to Las Vegas)
Interstate 80 (San Francisco to Reno)
Nimitz Freeway (Oakland to San Jose)
San Bernardino Freeway (Los Angeles to San Bernardino)
San Diego Freeway (Los Angeles to San Diego)
U. S. 50 (Oakland to Carson City)
U. S. 101 (Los Angeles to San Francisco)

COLORADO
Denver-Boulder Turnpike
Interstate 25 (Pueblo to Denver; Denver North; Trinidad)
Interstate 70 (Idaho Springs)
Interstate 80S (Fort Morgan-Brush; Denver to Barr Lake)
Valley Highway (Denver)

CONNECTICUT
Connecticut Turnpike (Interstate 95)
Interstate 84 (New York-Conn. Line in Danbury. East to Hartford)
Interstate 91 (Hartford to Mass. Line at Longmeadow)

FLORIDA
Sunshine State Parkway

GEORGIA
Interstate 75 (Adel to Ashburn)
Interstate 85 (Fulton County)
U. S. 41 (Atlanta to Cartersville; Atlanta to Griffin)

IDAHO
Interstate 15 (Monida to Humphrey; Hamer to Roberts; Blackfoot to Pocatello)
Interstate 80N (American Falls to Pocatello; Mountain Home to Boise; Payette to Caldwell)

ILLINOIS
Congress Expressway (Interstate 90)
Edens Expressway (Interstate 94)
Illinois Toll Road
Interstate 55
Interstate 57
Interstate 80
Interstate 255 & 270
Northwest Expressway & Calumet Skyway (Interstate 94)
Tri-State Toll Road (Interstate 294)

INDIANA
Indiana Toll Road (Interstate 80 and 90)
Interstate 65
Interstate 70
Interstate 74
Interstate 465
Tri-State Highway (Interstate 94)

IOWA
Interstate 29
Interstate 35
Interstate 80 (Davenport to Council Bluffs)

KANSAS
Kansas Turnpike (Interstate 35; Interstate 70 Kansas City to Topeka)
Muncie Expressway (Interstate 70, Kansas City)
U. S. 50 (Turkey Creek)

KENTUCKY
Interstate 75 (Covington)

MAINE
Interstate 95 (Portland to Brunswick)

MASSACHUSETTS
Interstate 91 (Conn.-Mass. Line North through Longmeadow-Springfield to Vermont Line)
Interstate 93 (Boston to N. H. Line via Woburn-Andover-Methuen)
Massachusetts Turnpike (Interstate 90)

MICHIGAN
Interstate 75
Interstate 94
Interstate 96

MINNESOTA
Interstate 35 (Mission Creek to Sandstone)
Interstate 35W (Owatonna, north)
Interstate 90 (Austin to Dexter; So. Dakota Line to Beaver Creek)
Interstate 94 (Moorhead, north)
Minneapolis Freeway (Interstate 35W & 694)
St. Paul Freeway (Interstate 35E & 494)

MISSOURI
Interstate 3 (Kansas City, north)
Interstate 35

MONTANA
Interstate 15 (Cascade to Ulm)
Interstate 90 (Tarkio; Drummond; Springdale; Glendive East)
Interstate 94 (Crow Agency to Hardin)

NEBRASKA
Interstate 80 (Omaha to Lincoln)

NEVADA
Interstate 15 (Los Angeles to Las Vegas)
Interstate 80 (Sacramento to Reno)
U. S. 50

NEW HAMPSHIRE
Interstate 89 (Bow-Concord to Lebanon)
Interstate 93 (Franconia-Littleton)

NEW JERSEY
Garden State Parkway (Cape May to Spring Valley)
New Jersey Turnpike (Ridgefield Park to Deepwater)

NEW MEXICO
Interstate 10 (Lordsburg to West Arizona Line)
Interstate 25 (Las Cruces to Radium Springs; Socorro to Belen; Las Vegas, north; Glorieta, north and south)
Interstate 40 (Gallup, west; Ft. Wingate to Thoreau; Grants to San Fidel; Laguna to Correo; Albuquerque, etc.; Moriarity to Clines Corner; Guadalupe County Line to Santa Rosa)

NEW YORK
Cross Westchester Expressway (Interstate 487)
Empire Stateway (Interstate 81, Binghamton to Ogdensburg)
Heckscher State Parkway
Long Island Expressway (Interstate 78, Queens only)
New York State Northway (Interstate 87, Albany to Plattsburgh)
New York State Thruway and Extensions (Interstate 90, Pa. to Mass.; Interstate 87, Selkirk to New York City)
Palisades Interstate Parkway
Sunrise Highway (State Route 25)
Taconic State Parkway (New York City to Albany)
Throggs Neck Bridge(Interstate 78)

NORTH CAROLINA
Interstate 95 (Fayetteville to Dunn)
U. S. 1 (Sanford to Raleigh)
U. S. 29 (Greenville to Gastonia)
U. S. 70 (Salisbury to Raleigh)

NORTH DAKOTA
Interstate 29
Interstate 94

OHIO
Interstate 70 (Springfield to Englewood)
Interstate 71
Interstate 75 (Dayton to Piqua; Wapak to Findlay)
Interstate 90

OKLAHOMA
Interstate 35
Interstate 40
Interstate 44
U. S. 69

OREGON
Interstate 30 (Banfield Expressway; Columbia River Highway)
Interstate 99 (Baldock Freeway)
Sunset Highway (Portland, west)

PENNSYLVANIA
Interstate 70S (Washington to Pennsylvania Turnpike)
Interstate 83 (New Cumberland to Maryland line)
Pennsylvania Turnpike (Interstate 80S to Valley Forge)
Schuylkill Expressway (Interstate 80S)

SOUTH CAROLINA
U. S. 29 (Greenville to Gastonia)

SOUTH DAKOTA
Interstate 90 (Black Hawk to Rapid City)
Interstate 93 (Sioux Falls to Iowa State Line)
Interstate 95 (Sioux Falls Bypass)

TEXAS
Interstate 10
Interstate 20
Interstate 35
Interstate 45

UTAH
Interstate 15 (Beaver to Paragonah; Harrisburg Bench; St. George, north; Levan to Scipio)
Interstate 70 (Cat Canyon to Emery Gy Line)
Interstate 80 (W. Tremonton to Bl. Creek; Henefer to Echo, Parley's Canyon)
U. S. 40 (Heber to Silver Creek Junction)
U. S. 89 (Mt. Pleasant to Manti; Hatch, south; Kanab to Glen Canyon)
U. S. 160 (Moab, north)

VERMONT
Interstate 91 (Mass. Vt. Line North through Guilford-Brattleboro-Dummerston-Putney)
Interstate (White River Jt. to Montpelier-Burlington-St. Albans)

WASHINGTON
Interstate 10 (Renton and Shore Cutoff; Seattle-Spokane-Coeur d'Alene)
Interstate 99 (Olympia Bypass; Vancouver to Olympia; Tacoma-Everett Freeway; Vancouver Bypass; Auburn-Echo Lake Bypass)

WEST VIRGINIA
Interstate 64
Interstate 77

WISCONSIN
Janesville Bypass
Interstate 90
Interstate 94
Interstate 894 (Bypass around Milwaukee)
Milwaukee County Expressway

WYOMING
Interstate 25 (Cheyenne to Casper)
Interstate 80 (Rawlings to Evanston)
Interstate 90 (Buffalo to Newcastle)

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hold a license or certificate of registration from a state or territory; must hold a certificate of qualification from the National Bureau of Engineering Registration or the National Council of State Boards of Engineering Examiners; have four or more years of engineering work; must submit evidence of his experience and standing. The board would prescribe and give examinations for applicants.

It is interesting that Foley's bill was introduced "by request"—which is a nice Congressional way of saying that the Congressman in doing a favor for a constituent, and doesn't necessarily know the subject well, or care too much about the details.

* * *

Another of those perennial bills relating to naming of mechanical subcontractors was dropped into Congressional hoppers recently — and is no subject of joy to the Associated General Contractors.

Despite an eminently lucky number—the bill is officially HR 11711—it has no chance of action this session.

Its provisions, however, could mean jail terms for general contractors. Introduced by Michigan's Rep. E. A. Cederberg, it would require that the general accompany his bid with a list of the names, addresses, amounts involved and other details of contracts he intends to make with subs. If he fails to utilize the listed subs, makes a subcontract at a lower price than quoted, or doesn't pay the subs as he himself is paid, the general may be penalized under the original contract, and will also be subject to a fine of $10,000 or two years in jail, or both.

The idea of naming subs and using those named where possible isn't new of course—it was part of a "package" offered by AGC to the mechanical contractors some years ago, as you may remember. But AGC doesn't want it to be compulsory, with heavy penalties attached, and also wants the mechanical trades to give up their demands for separate contracts in return for such an agreement.

* * *

Brief: The booster rocket that will power the Saturn space probe will move, via a Texas-built barge, over 2,200 mi. of inland waterways from Huntsville, Ala., to Cape Canaveral, Fla. Reason: The assembly will be too big and heavy for transport by railroad or highway.

WESTERN CONSTRUCTION

Why Those Specs Just Won't Standardize

WHAT are the reasons that delay further standardization of specifications for highway construction? Two basic reasons are: people and things. Obviously, people are too changeable, while things are stubbornly consistent. The reverse is true.

People tend to resist change and the forces that push them out of accustomed channels. On the other hand, things are never the same. If people would accept change more readily, and things were to become uniform, then highway specifications and highway building would be able to develop further standardization, and secure resulting savings in public funds.

From the clean-up demands of a habit-rigid resident engineer to the laboratory man sticking to sieve sizes he is accustomed to, there is a sense of stubborn sameness.

On the other hand, a material as carefully controlled as cement or asphalt may exhibit unexplainable results without apparent cause. These are man-made and carefully controlled products. When it comes to the products supplied by nature the changes are as frequent as they are unpredictable. Such materials vary widely from state to state, and even from job to job. Specifications must account for such changes, and local project requirements take precedence over the general regulations, again emphasizing the difficulty in standardization.

Climate is an equally important factor in highway building, and probably more variable. Predicted pouring temperature, the run-off at the bridge site, the wind on the falsework are all subject to wide variation and again prove that things are changeable compared to people.

Engineers, by temperament, training, and responsibility lean decidedly toward the conservative. This is another aspect of resisting change. When their experience and that of associates have demonstrated that a process works successfully, they find good reasons for maintaining it. Any changes from such a fixed pattern might possibly produce an inadequate result, and is hard work.

Applied to highway engineering this tendency accounts for the variation in design of many elements that could well be standardized. Small drainage structures, lighting, guard rails, traffic marking, signing, fencing, are just a few. Possibly the tangible results in ultimate cost savings might be relatively small, but the advantages favor uniformity, bidding should be closer, and the highways made safer for the user.

Contractors, being equally human, like to talk about their interest in any new process or machine, but exhibit equal characteristics of resistance to change. Try and introduce a new form of bidding procedure, a modification in cost keeping, organizational set-up, or simply the make of his equipment units. Competitive demands, however, give contractors a much greater urge toward trying something new than their engineering counterpart.

It will remain necessary to continue examining and testing things because they are constantly changing. It is equally necessary to examine men who don't change. Between the two, specifications that are a product of one to control the other find tough going in developing uniformity.

Jim Ballard

A. J. Chinn, Superintendent, Kirkland Construction Co., Prineville, Oregon

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KING PUBLICATION

WESTERN CONSTRUCTION

JUNE, 1960

HIGHWAYS — Key to Western growth

- *THE WEST is more dependent on highways than any other region.*
- *Highways are more costly to build.*
- *Engineering and construction problems are more severe.*
- *New equipment and methods most frequently develop in the West.*

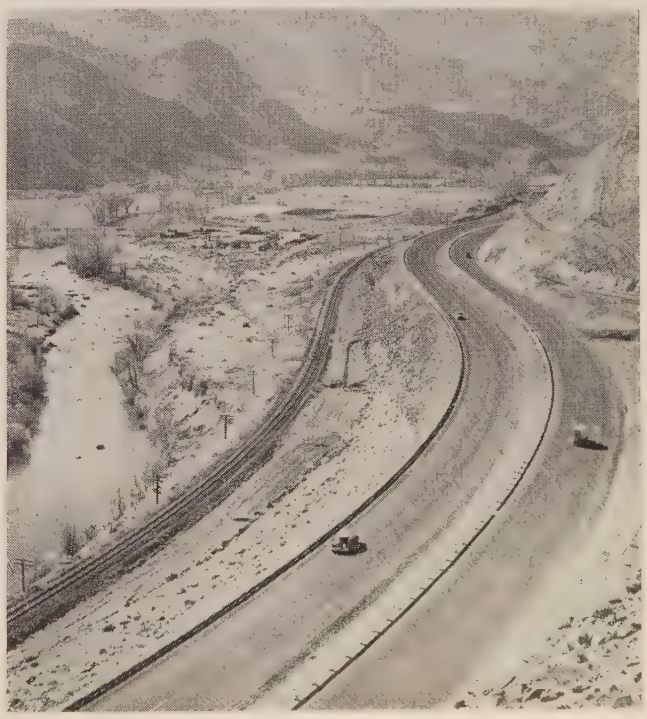
SINCE THE DAYS of the continuous mud-hole, the West has boomed in population, commerce and industry. This growth has required the building of our highway system and, in turn, the development of a highway system in the West has made possible its growth.

More than 40 years ago, highway engineers of the West realized their common, regional problems and initiated the Western Association of State Highway Officials. This original regional conference has subsequently been copied in other parts of the country. Corresponding conferences among contracting groups and equipment distributors re-emphasize the regional aspect of highway construction work and problems.

In this issue, following long established practice, we are presenting a group of articles that review some of these peculiar characteristics of Western highway engineering and contracting. Naturally, such a selection of articles and subjects cannot possibly cover all differences, but they do emphasize some outstanding situations. We are repeating the established feature which brings to date by a state-by-state summary the current status of work on the Interstate System in the West.

YESTERDAY . . .

TODAY . . .



Progress on the Interstate system

State by state survey shows effects of compromised financing legislation. Volume of contracts is below last year but healthy increase is in store for next 12 months.

FOR THE FIRST TIME in the short history of the Interstate construction program in the 11 Western states, the amount of work under way is less than 12 months earlier. Since the highway building program was authorized by Congress in 1956, the Western states have seen about 30% more construction underway each year. The high was reached a year ago when $450 million in construction was under contract. Then came the debate at the national level about how to make up for the extra funds spent in 1958 to combat the recession.

The political maneuvering and factional warring threw a great scare into the construction industry. It looked for a time that a stalemate had developed which couldn't be broken. Without extra funds, the vast construction program would languish and great hardships would be worked on contractors and suppliers, who were geared for a big effort. At the last minute, a compromise financing bill was agreed upon calling for a 1½-cent gas tax increase. This was far better than some of the stingy plans which were proposed, but still fell short of what the construction industry hoped for. It averted drastic cut-backs in most states, but caused a very definite slow-down. The picture emerges clearly from a canvass made by *Western Construction* of each Western state highway department.

There is $409 million in Interstate highway construction now under contract in the 11 Western states. This represents a 9% decrease from the figure reported 12 months ago.

However, the picture for the coming year is much brighter. The states estimate the volume of work under contract a year from now will be about $518 million, which is 26.7% more than today's figure and is 15% higher than last year's record level. (The prediction for Colorado was made by *Western Construction* in the absence of last-minute data. A 50% error in the figure used for Colorado in the accompanying table would affect the total by only 1%.)

Perhaps the hardest hit of the Western states is Colorado, which started its Interstate highway construction program very quickly and whose 168.7 completed miles still rank with the nation's leaders. The fast start was possible by using $35 million from an anticipation warrant bond issue. With the reduction in the Federal financing rate, Colorado now must cut down on new awards in order to keep current jobs going.

The brightest spot in the West is Wyoming, which reported $26.9 million under contract a year ago and $59 million now. Wyoming hopes to have $86 million under contract a year from now which could put it second only to California in the West for the amount of field work under way.

There is 11,065.9 mi. of Interstate network in the 11 Western states. There are 1,300.2 mi. completed now compared to 834 mi. a year ago. There are 810 project miles under contract at the present time. (The term "project mile" is used by the Bureau of Public Roads and is merely a measure of length and does not indicate whether the project being measured will complete the highway. If a section of highway is divided into two contracts, one for grading and one for paving, the project miles will be double the total length of the project.)

Where must contractors bidding on Interstate jobs have the sharpest pencils? This is an impossible question to answer but some interesting clues are given in figures just released from the Bureau of Public Roads. If the average number of bids received per project can be taken as an indication of competitiveness, then it is hardest to be low bidder in Idaho where (calendar year 1959) 12.4 bids on the average were received for every Interstate project. Montana is next with a 11.9, Arizona next with 11.2, followed by Wyoming with a 10.3. Nevada had the fewest bidders per job with 7, followed by New Mexico with 8.2. Another indication of competiveness is the amount the low bidder was below the engineer's estimate. On this basis, the situation is toughest on contractors in Utah, with the low bidder an average of 23.6% below the engineer's estimate, followed by Montana at 20.8%. At the other end of the scale, the low bidder in Arizona during 1959 was an average of 3.8% below the engineer's estimate followed by Nevada at 3.9%.

Nationally, the 41,000-mi. Interstate system will link 90% of all cities of 50,000 population or more. It is designed to handle 1975 traffic volumes, when 50% more cars, buses and trucks are anticipated. The system includes about 1% of the nation's total mileage of roads and streets, but it will carry 20% of all traffic.

Following is a brief look at the Interstate situation in each Western state. (Alaska and Hawaii are not included in the Interstate system.)

Arizona

There are 1,161 mi. of Interstate in Arizona, of which 85.9 are completed to standard and another 105.2 are under construction. The dollar value of work under contract at the present time is $26.4 million. A year from now, it is estimated that $27 million will be under contract. The significant development in 1960 will be the awarding and completion of two paving contracts which will finish the 49-mi. alignment between McGuireville and Flagstaff.

California

The Interstate system in California contains 2,183 mi. There are 332 mi. completed, adequate for present traffic, and 96 project miles under contract at the present time. There is about $157 million of work under contract now. A year from now the total is

expected to be about $175 million. Two very large projects are in the current budget and will probably come up for bid this year, both in Los Angeles County. One of the longest single freeway projects in history was awarded in April to a joint venture of Gordon H. Ball, Inc., Ball & Simpson, and E. L. Yeager for $4.88 million. The project involves 25.2 mi. of freeway and 13 bridges east of Baker in San Bernardino County. The traffic lanes in each direction will be separated by a median strip 100 ft. wide to cut headlight glare.

Colorado

About 963.1 mi. of Interstate highway system are in Colorado, of which 211 are completed. About $17 million is under contract right now, compared to $22 million a year ago. Although an official estimate of contract levels for the next 12 months was not available at press time, it seems likely that the current volume will decrease still further before it begins to increase again. On March 14 the Colorado Department of Highways revealed that 21 Interstate highway projects had been deleted from the budget because of a shortage of Federal Aid funds. The reduction amounted to $10.78 million in Federal money and $2.08 million in matching state funds. It was known a year ago that if Congress didn't enact a full financing bill, Colorado would have to curtail awards on its Interstate system this spring. Despite current difficulties, Colorado ranks 14th nationally in miles of completed Interstate projects. One interesting project which now now under way is in Clear Creek Canyon at Idaho Springs with twin tunnels 800 ft. long.

Idaho

Idaho has 612 mi. of the Interstate system, of which 46 mi. are complete. About 78 project miles are under contract at the present time representing a total contract cost of $14.5 million. The Department of Highways estimates that $22 million will be under contract a year from now. Construction work will soon be in full swing on three connecting highway projects covering about 30 mi. of new alignment in southern Idaho near the towns of Paul and Burley. The new route will replace an extremely dangerous section of U. S. 30 North presently in use between Raft River and Rupert. Originally the Department of Highways planned to provide four lanes of surfacing this year. However, the cut-back of Federal Aid funds has made it necessary for the work to be carried forward on a stage basis in which two lanes will be built now and two more lanes later. An 8.2-mi. contract which was to be built in May, will require extensive and unusual dredging operations to obtain needed surfacing materials from sources in the Snake River Canyon.

Montana

There are 1,180 mi. of Interstate system in Montana. About 49 mi. have been completed to Interstate standards and about 74 mi. are under contract at the present time. The total value of the work under contract now is $23 million. The estimated total value of work which will be under contract a year from now is $40.6 million.

Nevada

As designated today the Interstate system in Nevada totals 534 mi. The routes are Interstate 80 (U.S. 40) through northern Nevada and Interstate 15 (U.S. 91) through southern Nevada. As of June 1, 1960, Nevada will have 54.2 mi. of Interstate freeway completed—18.3 on Interstate 80 and 35.9 on Interstate 15. Under contract at the present time are 12.7 mi. on Interstate 80. This is a single contract at a dollar value of $4.5

(Progress map of Interstate on next page.

Text is continued on page 56.)

The Interstate Highway Program in the West

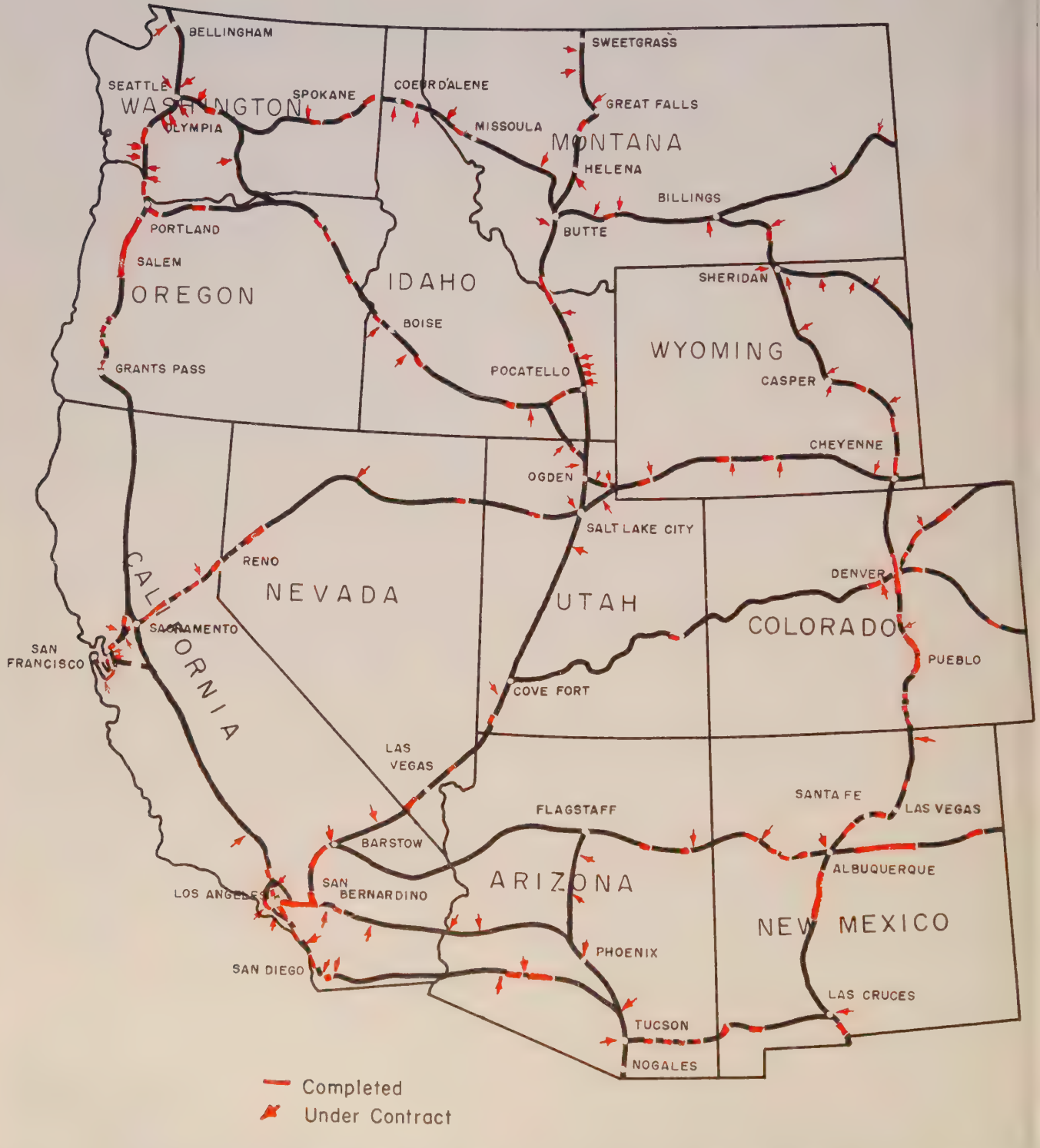
	TOTAL (miles)	COMPLETED (miles) May 1959	COMPLETED (miles) May 1960	UNDER CONTRACT (millions) May 1959	UNDER CONTRACT (millions) May 1960	UNDER CONTRACT (millions) May 1961 (est.)	UNDER CONTRACT (Project miles) May 1960
Arizona	1,161.0	50.0	85.9	$ 26.0	$ 26.4	$ 27	105.2
California	2,183.0	226.0	332.0	204.0	157.0	175	96.0
Colorado	963.1	168.7	211.0*	21.9	17.3*	12**	77.0*
Idaho	612.0	23.0	46.0	18.0	14.5	22	78.0
Montana	1,180.0	6.5	49.0	18.0	23.0	41	74.0
Nevada	534.0	15.0	54.2	7.8	4.5	17	12.7
New Mexico	1,003.0	151.0	199.0	20.1	8.0	16	24.0
Oregon	731.0	94.0	162.0	50.0	46.5	55	112.0
Utah	965.0	2.3	40.0	21.0	18.0	22	62
Washington	726.9	28.9	47.8	36.5	35.0	45	42.4
Wyoming	1,006.9	68.7	73.3	26.9	59.0	86	127.2
TOTALS	11,065.9	834.1	1,300.2	$450.2	$409.2	$518	810.5

* Last minute data was not available for Colorado. Figures marked with asterisks were taken from Highway Department release dated April 18. All other figures in table were obtained by direct communication.

** Arbitrary estimate made by Western Construction, not by Colorado Highway Department. Figure is less than current contract volume to conform with recent announcement of deletions of previously budgeted projects.

Other figures in columns are rough estimates made by qualified officials in each state.

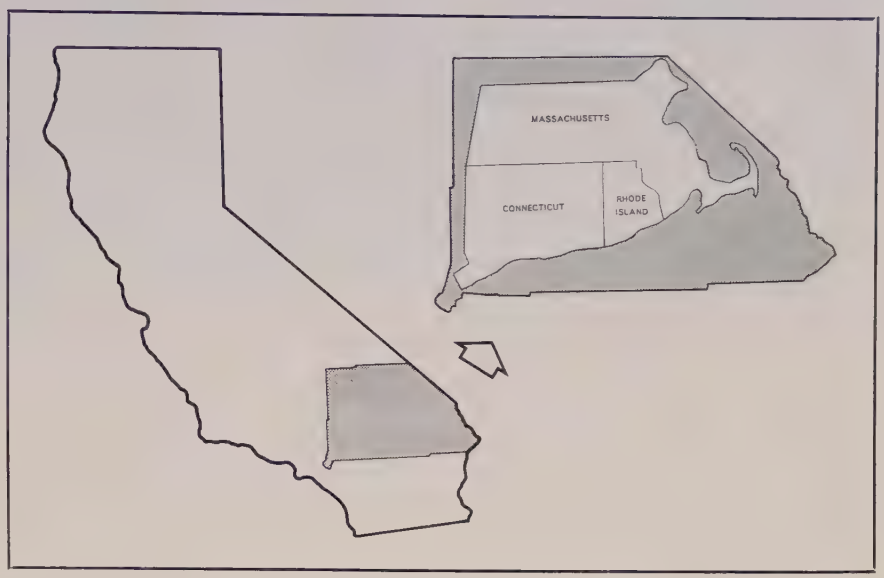
Progress and project locations on the Western Interstate System



EACH RED ARROW points to the approximate location of a project under active construction on the Interstate System. Red lines where work has been completed. Information for map and table (page 43) was obtained by a special survey made by WESTERN CONSTRUCTION of each of the 11 Western state highway departments. Progress should be at a faster pace next year.

Roadbuilding in the biggest county

San Bernardino County leads the nation's counties in area, road mileage, and rate of population growth. Here's how the Road Department keeps ahead of its problems.



SAN BERNARDINO COUNTY'S 20,000 sq. mi. take up a sizeable share of Southern California, as shown on outline map, left, above. On the right is a larger map of the county with three Eastern states at the same scale placed inside as a comparison. County has 4,411 mi. of roads.

SAN BERNARDINO COUNTY in Southern California displays nearly all the characteristics which typify the West as a region and which make its road building problems different from the rest of the country. It is the West in miniature. It has great distances between centers of population and distribution, it has extremes of climate and topography, and it is growing at a rate which far exceeds the national average and is high even for the West.

The County's borders enclose an area of 20,000 sq. mi. From Trona in the northwest corner to Parker Dam in the southeast, is a distance of 200 mi. in a straight line and 340 by road. In area, San Bernardino County is half as large as the entire state of Ohio.

It is a land of dramatic contrasts. In the east is the Mojave Desert, a thinly populated wasteland of dust, sand, heat and wind, with an annual rainfall of less than 3 in. Man has had little effect on the Mojave, and travelling through it is like turning the pages of a text book on geology.

In the west the mountains form an 8,000-ft. high barrier against moist air moving inland from the ocean. Rainfall in the mountains runs as high as 60 in. a year with an average snowfall of 3 ft. In the Big Bear Lake and Lake Arrowhead district, which is highly developed as a mountain recreational area, snowfalls as high as 8 ft. have been recorded in a single winter season.

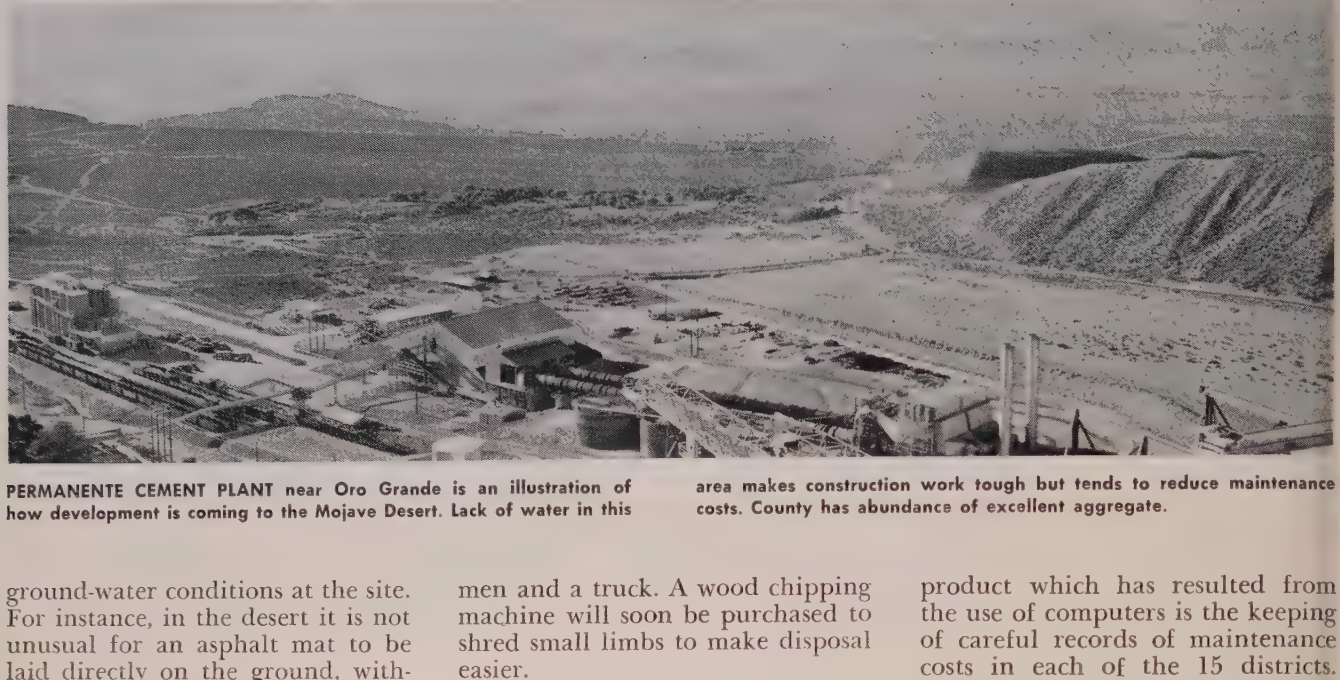
Most of the county's population of 500,000 is concentrated in the southwest corner, in and around the city of San Bernardino. The population is growing at the steep annual rate of 5%, which will bring the total number of people to 1,300,000 by 1980. The modern buildings and residential developments which are advancing across the countryside might well be a preview of civilization in the future, just as the Mojave Desert behind the mountains to the east is a reminder of the distant past.

San Bernardino County has long been the largest in area in the nation, but it was just last year that it took over the number one spot in miles of maintained roads. During the 1959 fiscal year, 163 mi. were added to the system making a total of 4,411 mi. Neighboring Los Angeles County, the previous leader, is now second with 4,267 mi. The county has a total of 300 on its payroll, which results in the very high ratio of nearly 15 mi. of road per employee. The county's total annual revenue for road purposes is slightly over $4,000,000, putting it in seventh place among counties in California. (The figure for Los Angeles County is $33,000,000).

The efficiency of the San Bernardino County Road Department is indicated by the maintenance expenditures per mile on its vast road network. The average for all California counties last year was $574 spent on maintenance per mile. San Bernardino County spent a total of $1,187,668, for an average expenditure per mile of $269. How is this figure kept so low? Part of the reason lies in the physical nature of the county itself, and part lies in the way the Department is organized and operates. The scarcity of water, which is a problem during construction, tends to reduce road repair costs. Most problems of road deterioration are caused by the action of water in one way or another, action which is absent in an arid region. Also, the county is blessed with a profusion of top-quality aggregate and base materials. This permits the economical construction of bases and wearing surfaces of the highest quality, which naturally require less to maintain. Relative low traffic volumes is another contributing factor.

It is interesting to note that the county uses very little slurry seal, which is widely used in certain other parts of the West. The availability of good material and the lack of heavy traffic congestion make it feasible to use a harder to apply but more substantial coating. The usual procedure is to lay down a topping consisting of well-graded material and 4½ to 5% of asphalt by weight, with a maximum size of aggregate one-half the thickness of the mat. This coating is placed with central mixing plants and pavers, or road mixers and motor graders. Compaction is carried out with a combination of pneumatic and steel wheel rollers.

One way the original construction costs are held down is to diminish the thickness of the subbase depending on the rainfall and



PERMANENTE CEMENT PLANT near Oro Grande is an illustration of how development is coming to the Mojave Desert. Lack of water in this area makes construction work tough but tends to reduce maintenance costs. County has abundance of excellent aggregate.

ground-water conditions at the site. For instance, in the desert it is not unusual for an asphalt mat to be laid directly on the ground, without any sub-base at all! A wearing surface placed directly on hard dry clay makes a perfectly good road—as long as it doesn't rain. But even if another wet season comes like that of 1950, when most of the desert was covered by snow, it would only take a week or two of the hot desert sun to make the road suitable again.

The changing character of the southwest corner of the county has had some unusual side effects on the Road Department. Before the extensive urban developments took place in the San Bernardino Valley Area, it was common for County maintenance crews to be called on for removal of sand drifts. High winds sometimes created piles 4 ft. deep on the travelled way. That particular maintenance problem hasn't occurred for years and seems now to be a thing of the past.

But a new problem has arisen—trees falling across roads and blocking traffic. The western part of the county was once a center for vineyards, orange groves and orchards, which are rapidly being displaced by housing tracts. The growers are leaving behind them hundreds of rows of tall eucalyptus trees which were planted years ago for windbreaks. Without irrigation water the trees are dying at a great rate. Sixteen years of below normal precipitation is aggravating the problem. Two years ago to diminish the hazard of dead and falling trees the county removed nearly 1,000 in one 2-mi. square area. A recent survey showed that 800 more are dead and need removal in the same area. The county keeps two tree crews working full time, each with four men and a truck. A wood chipping machine will soon be purchased to shred small limbs to make disposal easier.

County specifications

Last year the county began using its own book of standard specifications. Most counties simply use the State standard specifications, with their own appropriate special provisions. But San Bernardino County finds that its own book of standard specifications, which goes into great detail on lower standard roads not covered in State specs, makes the supervision of construction projects much easier.

For communications the county has 45 mobile units equipped with two-way FM radio sets. A transmitter is located on Strawberry Peak, with a repeater in the desert. During emergencies the Road Department has the use of a county owned monoplane and helicopter. The aircraft are normally used for desert and mountain rescue work.

Competitive maintenance

To simplify construction and maintenance, the county's vast area is divided into 15 districts. In each district is an equipment yard and a foreman responsible for his share of road system. Although the district boundaries were established with careful consideration given to natural divisions of population, topography and climate, they are quite flexible. It is common for equipment and personnel for one district to be used in an adjoining district when needed.

In 1955 the business and accounting department of the county switched from manual methods to IBM machines. One valuable by-product which has resulted from the use of computers is the keeping of careful records of maintenance costs in each of the 15 districts. Costs are computed each month for the month, for the year to date, and for the average of the previous 48 months. Maintenance costs are usually difficult to control, but the business machines have made it possible to locate quickly those areas in which costs appear to be different from what experience indicates they should be. The circulation of the cost figures has created a healthy competitive spirit among the 15 district foremen, which is an important factor in keeping costs low. The maintenance expense per mile for the last 12 months, for example, is a very low $131 (not counting traffic maintenance and emergency maintenance which are kept separate).

Road sufficiency rating

To make sure that every dollar is being spent where it will do the most good, the Road Department in 1957 devised a rating program to select roads for improvement. (Point rating has been adopted by 22 state highway departments across the nation, as well as the Bureau of Public Roads). The system is considered a guide only, because some things, like route continuity or public opinion, cannot be reduced to a formula. But it puts construction and maintenance on as objective a basis as possible. Not only can the engineers make more accurate and impartial decisions, they can justify them to officials and civic groups.

The San Bernardino County Board of Supervisors now requires an annual itemized report on deficiencies in the road system, cost of

their elimination, and a financing plan. The availability of machine computation in the county enabled the Road Department to develop a continuous road rating plan.

The rating system includes all roads and sections individually, the average of all roads in each district, the average of all roads in the Valley Area, the Desert Area, and the Mountain Area, and the average of all roads in the county.

The system requires the full time services of one engineer and an assistant. Because of machine computation they are able to spend 90% of their time in the field gathering data.

The structural condition of the road is assigned 370 points, the safety record 300, and the service rendered relative to traffic carrying efficiency 330, making a total of 1,000 points. Below is a breakdown of these three general divisions showing the items that are rated and the maximum number of points possible under each item.

CONDITIONS	
Pavement width	120
Type	20
Shoulder width	50
Drainage	40
Remaining life	50
Maintenance economy	90
SAFETY	
Accident rate	200
Consistency (Absence of surprises or obstructions within 4 ft. of the highway)	50
Width	50
SERVICE	
Alignment	50
Passing opportunity	80
Surface width	80
Sway in cross-section	50
Roughness (measured by personal judgment)	70

Financing

Contrary to public opinion, the Road Department is not financed by local property taxes. The main source of revenue comes from the 1⅜ cents highway users tax levied by the State of California on each gallon of gasoline. The money is collected by the State and apportioned to each county, according to vehicle registration. In 1958-59, the total from this fund to the county was $2,722,137.

The second major source of revenue is traffic fines which, in the current year, amounted to $875,547. The county does not have a road tax, but the general fund does contribute toward F.A.S. construction.

The total revenue received during the year amounted to $4,165,671.

Incidentally, the county has adopted an ordinance by which charges are made for permits and for overweight and oversize loads. Permits can be obtained on a specific section of the road for periods up to one year.

Federal Aid Secondary

The Federal Aid Secondary program was initiated in 1944 by the Federal Aid Highway Act and has been continued since then by legislation at the Federal level. Funds are turned over to the states which in turn distribute money to counties on a formula based on area, rural population, and mileage of certain classes of rural mail routes. The funds can be used to defray about 54% of the cost of construction. The remainder is furnished by the county or the state with the county providing right-of-way and engineering. Since 1953 California has made available to San Bernardino County sums varying from $50,000 to $200,000. The FAS program since its inception and up to June 30, 1959 has provided for construction of 83.390 mi. of road at a total cost for contract construction of $5,472,524. The program now, including right-of-way and engineering, is running about $1,250,000 per year.

Planning

One of the functions of the County Highway Planning Section is to study freeway routes made by the State Division of Highways. Through the combined efforts of the Road Department Engineering Staff and the Planning Department, recommendations and changes or adoptions are made. To insure the maximum in future service to adjacent areas, it is necessary to study proposed interchanges and grade separation structures with great care. Future land use trends and traffic increases must be estimated and evaluated to arrive at proper recommendations for changes or approval. During each stage, maps and overlays are prepared and maintained, which provide a visual record to indicate routes and facilities both proposed and approved. The use of transparent overlays has been found to be particularly economical. The overlays are used with various symbols to indicate land use, population trends, city and urban limits, and many other factors.

Traffic research

To properly evaluate the operation of a county road system, it is necessary to accumulate large quantities of data such as traffic volumes, traffic accidents, and inventories of traffic controls. This information is maintained on IBM punch cards so that it is readily available.

The traffic volume data is derived from the annual counting

EXTREMES OF TOPOGRAPHY and climate mean the Road Department has to be prepared for everything from sandstorms to snow drifts. Rainfall varies from 3 in. per year in desert to 60 in. per year in mountains. Peak in background of photo is 10,080-ft. Mount Baldy.

program. This program uses a master station system in which the county is divided into areas with a master count station in each area. The master stations enable adjustments to be made on individual counts for seasonal and daily fluctuations. The data is extremely useful for determining growth trends and predicting future traffic volumes as well as establishing design standards for construction projects.

The information on accidents is received from the California Highway Patrol in the form of individual accident reports. This data is coded on IBM punch cards for automatic machine tabulating. Machine procedures provide a relatively simple method for extraction of pertinent information such as location, time, apparent cause of the accident, as well as collision pattern and driver, vehicle, and road condition. This system eliminates the necessity of maintaining an accident spot map for high accident frequency locations.

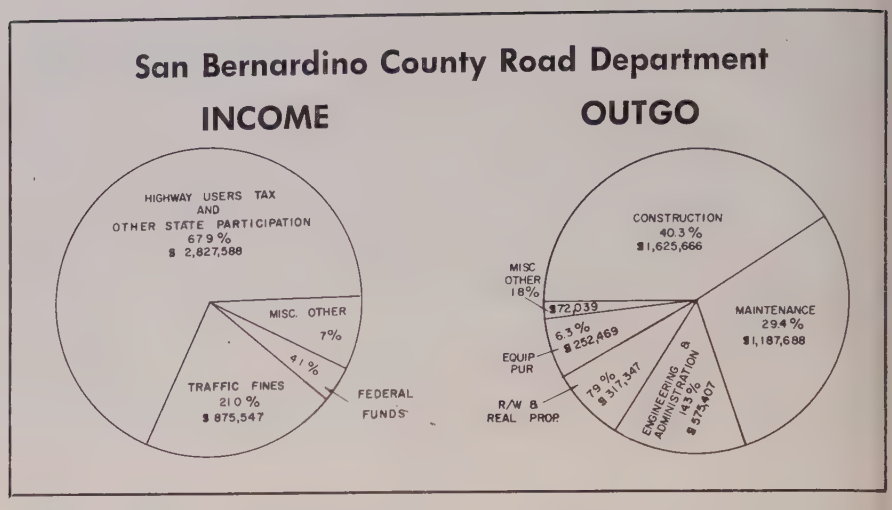
Traffic signs, striping and pavement markings are handled by the traffic engineer through the sign foreman and his crew. San Bernardino County maintains about 775 mi. of center line stripe per year.

An index of all county roads as required by state laws is maintained by the department. This index is called the Road Book and shows the road name, location, type of pavement, length and width. In addition, a set of 57 maps is kept current in conjunction with the Road Book. Each individual road has a code number which is used in keeping cost records, in compiling traffic statistics, and as a convenient way of organizing and filing all types of data.

San Bernardino County Road Department

Equipment List

Automobiles	50
Station Wagons	16
Pickups	109
TOTAL	175
Flat Rack Trucks	11
Hoist Trucks	4
Ladder Trucks	2
Spray Rig Trucks	4
Oil Spreader Truck	1
Compressor Trucks	3
Snow Plow Truck (Not Blower)	1
Maintainer Truck	1
Welder Trucks	3
Dump Trucks	102
Semi Tractors & Trailers	3
Shovels	5
Loaders	19
Bulldozers	15
Motorgraders	39
Oil Mixers	3
Tractors	13
Pile Drivers	2
Carryall Scrapers	5
Rollers	16
Tractor Brooms	8
Power Brooms	2
Striping Machines	2
Power Mower	1
Oil Heaters	7
Snow Plows (Blower)	8
Cranes	2
TOTAL	282



FINANCIAL PICTURE of Road Department operations is given in these two pie charts. No income is derived from property taxes. Segment labeled "misc. other" breaks down into 1.9% for reimbursements, permits, fees, etc., and 5.1% for general county funds.

Prison camp and farm

The operation of the County Industrial Road Camp has been the responsibility of the county engineer since 1940, with the sheriff being in technical charge of their security. Prisoners assigned to the Road Camp are those committed to the County Jail for nonviolent crimes. The prisoners work primarily on shoulder and drainage clean-up, flood control channel clean-up, material handling in the highway garage, maintenance on roadside parks and fire breaks, and on the Glen Helen Farm.

Subdivision engineering

Last year more than $1,000,000 worth of construction work was processed through the Subdivision Engineering Section of the County. Final maps of 79 subdivisions were accepted which contained 62 mi. of graded roads and 52 mi. of paved roads. All subdivision improvement plans are submitted to this office, field studies are made, road design, drainage facilities and structures are checked with the Flood Control District, and final approval is given by the County Road Department. Field inspection is carried out during construction.

Each subdivider is required to file with the County a bond of the amount of the road improvements planned. Progress is reviewed at the end of each one year bond period to determine whether the bond should be renewed or the work finished immediately. The amount of the bond can be increased or decreased depending on percent complete or changed construction costs. When improvements are finished the bond is released.

An outstanding recent accomplishment of the Subdivision Section was the creation of the Standard Specifications and Drawings which are now in use for all construction work in the County.

Personnel

San Bernardino county engineer is M. A. Nicholas. Willard Carris is assistant road commissioner (Operations), George P. Zimmerman is assistant road commissioner (Engineering), and John N. Tillman is executive assistant.

Top men in the Engineering Department are N. C. Williams, Planning; DeWolfe Murdock, F.A.S.; Anton J. Mormann, Local Roads; James G. Galanis, Traffic; and Felix M. Mosso, Subdivision.

Division operations superintendents are Horace F. Sutt, West End, Earl Freeman, East End and Mountains, and Walter C. Campbell, Desert.

Harvey D. Axley is superintendent of equipment.

Wyoming describes the principle and process of—

Pre-wetting highway fill material

A typical Western highway construction problem of processing dry soils to secure proper compaction is being solved most successfully by controlled pre-irrigation. At the request of Western Construction this article has been prepared for highway engineers and contractors of the entire West.

Material for this valuable article was prepared at our request by James Desmond, assistant materials engineer, and Jack Russell, public information assistant.

I. E. Russell is chief materials engineer, and J. R. Bromley is superintendent and chief engineer of the Wyoming State Highway Department.

THE PROCESS of pre-wetting of embankment soil has been used in several states, but the real pioneer in use of this highly beneficial system in highway construction has been the State of Wyoming.

The Wyoming Highway Department Materials Laboratory has naturally been most closely tied to the process and its development for use on the state's highway construction jobs. Laboratory personnel state: "It is a gratifying sight on our construction projects to see an increasing amount of sprinkler setups working away on our borrow areas and cut sections to bring up our moisture contents. This is gratifying from the soil laboratory standpoint because of the high degree of uniformity in moisture content and compaction and the increased densities we are obtaining on our pre-watered projects."

The laboratory's enthusiasm for the process is well substantiated with reports and records from the field. The majority of the contractors working on Wyoming's highways now use the pre-wetting process, and their favorable response to the process has been almost unanimous.

Basic principle and specs

As already stated, the basic idea of pre-wetting is not new, for embankment material had been prewet in the past by working water trucks in the cut areas prior to excavation operations. But the use of sprinkling systems in highway prewetting work is fairly new.

With the advent of economical light-weight aluminum pipe, featuring quick couplings and providing highly portable large diameter pipe, irrigation companies developed. As these companies built up large inventories of equipment and acquired more knowledge about the action of water applied in this manner, they began to look to highway work as a market for their services.

The Wyoming State Highway Department became interested in the pre-wetting operation and decided to place it in the specifications. This was on Aug. 29, 1957, and under the heading "Special Provisions for Pre-Irrigation of Embankment Material" the specifications were introduced. The pertinent sections appear as a part of this article.

The department leaves the method of watering to the discretion of the prime grading contractor, and he may elect to either pre-wet the cut areas with sprinkling systems, or use water trucks on the fills. The majority of contractors do not operate their own sprinkling units; they choose to employ one of the irrigation companies to handle prewetting. However, some of the construction companies have acquired their own equipment for the prewetting process, and do their own.

Advantages of pre-wetting are many. All jobs on which pre-wetting has been used report an overall compaction of 95 to 100%, and a water content (percent of optimum) in the material of an average of 90%. These averages were tabulated from jobs with varying cut depths, averaging 20 ft.

It is much easier to obtain a uniform distribution using the prewetting method, and one that is very close to the optimum amount needed for compaction of the fill. Also, pre-wetting eliminates dust, thereby improving working conditions, reducing wear on equipment, and pre-wet material is much easier to work and load.

One of the main advantages in point of view of contractors is the elimination of tank trucks and mixing equipment on a fill—a process that often slowed construction operations and made it difficut to obtain uniform moisture content.

Wyoming's first project to be prewet was a new Interstate just north of Cheyenne. The prime contractor, Platte Valley Construction Co. had the Industrial Pipe Lines Co. of Grand Island, Neb. perform the pre-wetting operation. This particular job involved 943,000 cu. yd. of excavation, was started March 1957, and grading was completed October the same year. The estimated

PRE-WETTING MATERIAL with a 2-line layout, using 60-ft. spacing and sprinklers at 20-ft. intervals. Aluminum pipe is 6-in size. Operating pressure is 35 to 45 psi.

LOCATED on a U. S. 40 project near Bosler, this pre-irrigation job required 16,640,000 gal. of water, bid at a price of $1.40 per thousand.

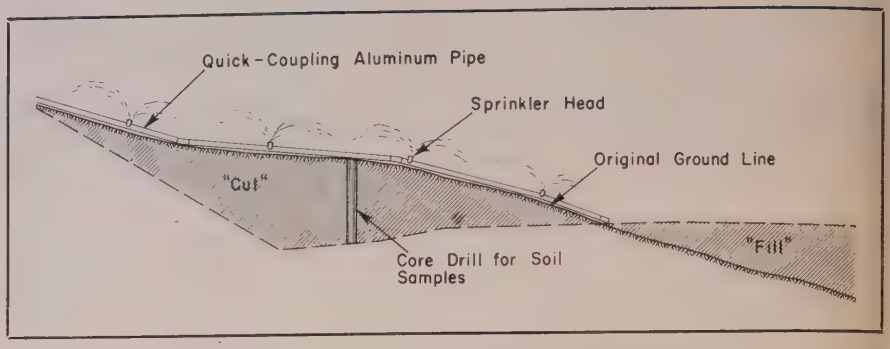


DIAGRAM OF PRE-WETTING OF SIDE-HILL EXCAVATION.

number of gallons of water the job would require was set at 32,800,000 and the actual number used was 26,884,000 at a bid price of $1.50 per thousand.

Since then, pre-wetting operations have been used on approximately 40 completed projects with outstanding results, and is being used on 30 to 40 projects now under construction.

The water used in pre-wetting is obtained either from a nearby lake or stream, or from special wells drilled by the watering contractor. As it is transported to the job site through the pipe, it is metered as explained in the specifications.

Principle of wetting soil

Technically, the pre-wetting of embankment soils, when executed properly, is based upon the following theories and is accomplished by the following methods of operation. The relationship of water movement in the soil is the prime factor in the operation of pre-wetting embankments. Soil water is divided into three main groups: hydroscopic, capillary, and gravital.

Hydroscopic water does not concern the pre-wetting operation, other than knowledge it is present. Capillary water constitutes the difference between hydroscopic water and the field carrying capacity of the soil. This field moisture carrying capacity is, in most cases, very near to the optimum moisture content as fixed by density determinations. Capillary water is the determining factor of the number of gallons of water per yard required to bring the soil to optimum moisture.

Each soil type has its own level of water carrying capacity dependent upon the particle size and the amount of voids between particles. The soil particle size determines the adhesive properties of the soil,

SPECIFICATIONS FOR THE PRE-IRRIGATION OF EMBANKMENT MATERIALS

"In lieu of the method of applying water to embankment material as specified in Section 202 of the 1956 Standard Specifications, the contractor may pre-irrigate the material in excavation areas prior to placing same in the embankment in accordance with the following procedure.

"Excavation areas shall be watered by means of a sprinkler irrigation method so controlled and regulated that the material to be taken from the excavation area and placed in embankment shall have a sufficient moisture content that it can be compacted to the specified density by means of compaction equipment specified.

"As the excavation area is irrigated, the soil layers become moistened to their capacity to hold water. This is known as field carrying capacity. The water then moves on down to the next layer until the entire area is moistened to its field carrying capacity for the full depth of the area. The water capacity of soil material is very close to the optimum moisture content of the soil.

"In carrying out the above irrigation procedure it is essential that a sufficient curing period be required to permit the movement of the water downward after all necessary water has been applied so that the soil shall have a uniform moisture content approaching optimum for the full depth to be excavated. Excavation of the material from the area will not be permitted until the percolation of the water is such that the excavation area for its full depth has reached its field carrying capacity. This is necessary in order to give sufficient time for proper percolation of the water and prevent removal of the upper layers that are still too wet.

"In order to insure effective downward movement of the water and to minimize run-off, the natural growth on the excavation area shall not be removed until all watering of the area has been completed, otherwise the contractor will be required to rip the area on the contour of the ground to a depth of 2 ft. on approximately 4-ft. centers.

"Stripping of the vegetation from any given excavation area shall be done within a reasonable time after all watering of the area has been completed. The time limit for such stripping shall be subject to the control of the engineer. Excessive evaporation can occur if vegetation is left in place for an extended time, and this requirement thus prevents loss of moisture through evaporation.

"The placing of the sprinkler system, the regulation of the pressure on water lines, and the use of proper orifices on the sprinklers shall be such as to adequately water the excavation area only and to minimize any wastage of water.

"The amount of water applied to the excavation areas shall be that necessary to bring the material to optimum for the full depth of the excavation and any water used in excess of this amount shall be determined by the engineer and deducted from the metered quantity. In the event the material placed in the embankment is too wet and requires drying before compaction, such drying shall be done at the contractor's expense.

"Contractor shall provide adequate drilling equipment to check the penetration of moisture for the full depth of the excavation area.

"Water shall be metered and payment shall be made at the contract unit price bid per thousand gallons as measured by the meter. The contractor shall furnish a certificate showing the accuracy of the meter. Such certificate shall show that the meter has been calibrated just prior to use on the project. Any water that is necessary to be used in the grading operations and that has not been metered shall be measured and paid for as stipulated under section 202 of the 1956 Standard Specifications.*

"Payment for the water measured as provided above, at the contract unit price bid, shall be full compensation for furnishing all irrigating equipment, labor, tools and incidentals necessary for pre-wetting or irrigating of the excavation areas including the source of supply of the water."

Comparison study of Cat DW21G Tractor with SynchroTouch Transmission Control shows

DW21 SERIES G HAULING COSTS ...32% lower than Tractor X ...16% lower than DW21 Series C

Results on the job are the only true measure of a machine's ability to produce *profitably*. Competing on an actual job under identical conditions against Tractor X and a DW21 Series C, the new Caterpillar DW21 Series G-470B team hauled dirt at lowest cost per cu. yd. The combination of SynchroTouch Transmission Control on the tractor and LOWBOWL design of the scraper is unbeatable—note the results below. Your Caterpillar Dealer has a complete report on this job as well as other revealing time-and-cost studies. Ask him to show them to you. See for yourself how the DW21G-470B can step up your profits!

Caterpillar Tractor Co., General Offices, Peoria, Ill., U.S.A.

. . . .

PROJECT: South End Shopping Center, Tukwila, Wash. **PURPOSE OF STUDY:** To compare production and cost per yard of equipment observed. **EQUIPMENT:** One DW21G with SynchroTouch Transmission Control; two Tractor X (24-yd. struck, plus 36-inch sideboards); and three DW21C (18 yd. struck). **JOB CONDITIONS: Material**—slightly damp clay with some sand. **Density**—3425 lb./bank cu. yd., average of three tests, oil method. **Haul length**—1300 ft. (one way), return same route. **Haul road conditions**—soft, not maintained during study. **Weight test**—loads weighed with Streeter-Amet Electronic Scales. **Pusher**—all units pushloaded by D9 with Torque Converter Drive.

JOB DATA:	Cat DW21G w/SynchroTouch	Cat DW21C	Tractor X
Average Load Time	.73	.75	1.20
Average Haul, Dump and Return Time	4.14	4.67	4.25
Average Wait Time	.44	.44	.44
Average Cycle Time	5.31	5.86	5.89
Average Payload in Bank Yards	20.0	17.5	23.9
Trips per Hour	11.3	10.0	10.0
Average Hourly Prod. (bank cu. yd.)	226	175	239
Owning and Operating Costs per Hour*	$20.37	$18.87	$31.84
Cost per Yard	9¢	10.8¢	13.3¢

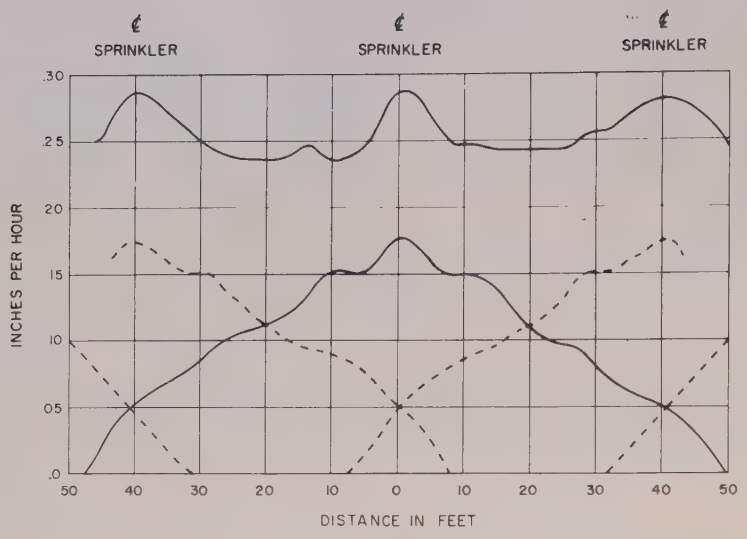
*Hauling costs only—does not include pusher costs

FIELD ENGINEERS WEIGHED LOAD AFTER LOAD as the competing units passed over the portable Streeter-Amet Electronic Scale. By subtracting average empty weight from average gross weight, they determined the average net load weight. This and other job studies prove that the new DW21G-470B hauls dirt at lowest cost per cu. yd., regardless of capacity of competing scrapers.

NEW CAT DW21G TRACTOR-470B LOWBOWL SCRAPER. New Turbocharged 345 HP Cat Engine delivers 12% higher rimpull giving up to 20% faster travel speeds under similar haul conditions than the previous model. With SynchroTouch Transmission Control (optional), operator simply dials desired gear for automatic, split-second, touch-and-go response. New 470B LOWBOWL Scraper is rated at 19.5 cu. yd. struck; 27 cu. yd. heaped. LOWBOWL design loads more material faster because of less loading resistance. Result: DW21G-470B moves dirt at lowest cost per cu. yd.

CATERPILLAR

HAUL AT LOW COST PER CU. YD. WITH A DW21G-470B



COVERAGE from sprinklers spaced at 40 ft. The wetting pattern of the individual sprinklers is shown by the lower curves, and the resultant pattern by the upper curve.

which directly affects the cohesive property of the water that adheres to the soil particle.

The larger the soil particle, the less surface area for water to adhere to; the smaller the particle, the more surface area is available. Therefore, the soil particle size determines the water capacity for a given soil, and the volume of voids determines the rate of percolation.

One important characteristic of soil which enables us to predetermine to what depth the water will penetrate is the fact that the water will not pass through any given layer of soil until the field moisture layer has been reached. This has been proved by drilling into pre-wet soil and finding a definite break between the wet dirt and the dry dirt. The importance of this fact is readily discernable for uniformity of moisture content.

The following procedures are observed when setting up pre-wetting operations:

1—Determination of required amount of water to penetrate to a given depth.

The core samples furnish the information as to the different stratas which will be watered. A lab analysis supplies the moisture content present in the soil, and the compaction test gives the required optimum moisture content. This information is used in a formula which gives the amount of water required in inches per foot. This amount is multiplied by the depth of a given strata, then the total for the different stratas is compiled, giving the depth of water which must be added in each area.

2—Control of the application of water.

Proper application of pre-irrigation water depends on three factors:

(a) Intake rate of surface conditions

(b) Percolation rate of the soil

(c) Application rate, which is conditioned by the first two factors.

First, the intake rate depends upon the slope of the ground, surface texture, and soil type. If a quantity of vegetation is present, the roots will improve porosity and the leaves will break up water droplets, thereby increasing efficiency and the rate of application may be increased.

If no vegetation is present, the ground can be ripped for 3-ft. depth and effect somewhat the same condition. The rate of application will vary from approximately 0.2 in. per hr. for silts and clays, up to 0.5 in. per hr. for clean silts and sands.

Second, the percolation rate of the soil is considered. This percolation rate varies with the size of the soil particle, the pores spaces, and the percent difference between natural moisture and the optimum moisture. Generally, this percolation rate is approximately 2/3 of the application rate, and this fact is used as a check upon the pre-wetting progress in the field.

The third consideration is upon the rate of application of the water. This is dependent not only on the last two items, but also upon three mechanical factors:

(a) Spacing of lines

(b) Operating pressure

(c) Nozzle characteristics

The line spacing is generally set at 60 ft. by 40 ft., which is the most practical. However, where the cut section is of a width where this spacing will not cover, or will waste water by over-extension, a 40-ft. by 40-ft. spacing is used. This spacing will increase the application rate by approximately 0.10 in. per hr., but the difference in operating time of these sprinklers is calculated, and the sprinklers are shut off sooner than on the wider spacing. If the rate is too high for the soil to take, then the sprinklers are run for a while, and shut off for a period to allow percolation.

The operating pressure and the size of orifices will determine the amount of water and the size of droplet produced. It is best not to use too high an operating pressure because this forms smaller droplets and produces a mist which causes excessive evaporation losses. The best operating pressures are 35 to 45 psi. This provides 10 lb. of range through which pressure can be reduced during high winds to increase droplet size and combat the effect of the wind.

The 3/16-in. diameter nozzle is quite common and will deliver about 6 gpm. at 35 psi., and 6.8 gpm. at 45 psi.

At 40 to 45-psi. operating pressure at the sprinklers, each sprinkler will have a coverage of approximately 45-ft. radius. The amount of water distributed by each sprinkler will have a conical pattern and will depend upon the overlap from neighboring sprinklers to provide the same amount of moisture in the gap between sprinklers as there is under the sprinkling head. This decrease in water at the outer fringe of the sprinkler radius fits in very well with back slopes of cuts.

A plan for each job

Using the foregoing information as to the inches of water required for each soil strata, and the calculated intake rate and rate of application, then a detailed plan should be made to follow on the job. Area cross-sections provide information as to the different depths to be watered. This information can be plotted, and the lines arranged for the best coverage. Scaling the lines on the plan, the depth below each sprinkler can be figured and length of time each sprinkler is to run can be calculated. The job foreman can use these plans and lay his system out in the field.

Periodic checks are made of the operation by use of a core drill or

(Continued on page 56)

verpass at Albany—Steel girders will be placed on top of these steel-reinforced concrete olumns to form an overpass at Albany, California. USS *Di-Lok* Concrete Reinforcing ars are used for all types of concrete work; and Universal Atlas Cement Division of nited States Steel, offers a wide variety of portland cements. *Tiger Brand* Wire Rope is sed in cranes, pavers, shovels, ditchers, trenchers, derricks, mixers and road scrapers.

Steel Bridges at Magra—The USS *Di-Lok* Bars in the right-hand side of these bridges at Magra near Gold Run, California, are ready for concrete. The next step in the construction of the left-hand bridge is to place the decking on top of the continuous girder span.

# of 2,194 miles of Interstate Highways

with products from United States Steel

California's Highway Commission has planned 2,194 miles of Interstate Highways to be completed by 1975. 1,453 miles have already been located; 73 miles have been completed, and 170 miles are under construction. Several hundred miles of California's own Freeways are near to meeting the rigid requirements for the Interstate System; when they do, the number of *completed* miles will rise rapidly.

Steel is high on the list of products being used to speed construction on the eighteen highways in California's Interstate System: 3,186 bridges, overpasses, underpasses, and traffic-controlling clover-leafs will be built; 123 bridges are already completed and 194 are now under construction.

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hand probe, and the downward progress of the water is cross-checked against the plans. The progress of the water is measured only by use of the contractor's drills, which he is required to provide. The highway department's drill is used only to make preliminary checks before a job is let. This allows the department to prepare more accurate profiles of soil conditions in the deep cut zones. Also, the department takes moisture samples at these depths and measures rock stratas and impervious beds to give the water contractor better information to prepare his bids on watering.

The materials laboratory now looks over the soils profile thoroughly prior to each letting, and estimates a period of time which will be required for soils to cure for pre-wetting. This information is shown on the plans by the design department, and the contract working days are extended by this amount of time for pre-wetting operations only. With this operation, and based on the fact that water will not penetrate any one layer of soil until its optimum has been reached, all the water required can be applied at one time, providing there is no impervious layer present.

The curing period required is dependent upon the same factors as the percolation rate, therefore, the curing is variable for each area. The term "cured soil" refers to soil at optimum moisture, or capillary moisture present in soil with no gravital moisture.

As a general rule of thumb for curing, cuts up to 10 ft. in depth require two weeks; cuts 10 to 15 ft., three weeks; and cuts over 15 ft. in depth require one month to six weeks, depending upon the type of soil and the various layers encountered.

Since the free water ratio is about 50% of the total water being held, one can see that before all of this water has passed to the lower limits, there will be uncured soil above.

One important point is the fact that the contractor must always have adequate drills on the job to furnish frequent samples for determination of penetration.

The Wyoming Highway Department feels that the pre-wetting of embankment soils has worked out extremely well, and the majority of contractors heartily echo these sentiments.

To sum up use of the pre-wetting system, the Wyoming Highway Department has benefited greatly, and so has the contractor.

PROGRESS ON THE INTERSTATE IN THE WEST

(Continued from page 43)

million contract was being advertised but not yet awarded at press time. It is expected to be the largest highway project ever awarded in the state. It involves construction of 12.7 mi. over Golconda Summit beginning 18 mi. east of Winnemucca. There will be over 1,800,000 cu. yd. of roadway excavation and 1,000,000 tons of base material.

New Mexico

There are 1,300 mi. of Interstate system in New Mexico. Complete to Interstate standards are 199 mi., and there are 24 mi. under contract now. Current contract value is $8 million. It is estimated that there will be $16 million under contract one year from now.

Oregon

There are 731 mi. of Interstate freeway in Oregon. There are 162 mi. completed and 112 mi. under contract, valued at $46.5 million. A year from now, there should be about $55 million under contract. In January of this year the McKenzie River-Willamette River section of Interstate No. 5 was awarded to Roy L. Houck Sons' Corp. This contract in the amount of $1.39 million is for a portland cement concrete paving project 4.9 mi. long. It is a divided, 4-lane, limited access type of construction and will provide a continuous freeway between Portland and Eugene, a distance of 104.54 mi. The project connects on the northerly end to a similar contract of 6.08 mi. in length awarded to the same contractor in December of 1959. Both contracts have to be completed in 125 working days with the count beginning on March 1.

Utah

In Utah there are 965 mi. of Interstate highway. To date 40 mi. have been completed to Interstate's standards and are in use by the travelling public. There are now 62 project miles under contract at a dollar value of $18 million. A tentative estimate of the contract value a year from now is $22 million. The largest project to be undertaken this year on the Interstate system will be a section east of Salt Lake City from Silver Creek Junction to Wanship. This is an 8-mi. stretch that will involve 1,400,000 cu. yd. of excavation and reconstruction of five structures. It will be a difficult project for the alignment is located in a narrow winding canyon with a small creek and railroad competing for the available space. Estimated cost of the job will be about $2 million and involve 300 working days.

Washington

In the state of Washington there are 726.9 mi. of the Interstate system, of which 47.8 mi. have been fully completed to 1975 standards. There are 42.4 project miles under contract at the present time at a total value of $35 million. If all the contracts tentatively set for awarding in 1960 go through, there will be about $45 million worth of contracts under way a year from now. One of the longest stretches of Interstate construction was awarded in January to Northwest Construction Co. of Seattle for $1.4 million. It is a 5.024-mi. section of the Tacoma-Seattle-Everett freeway. The job involves two parallel prestressed concrete girder bridges.

Wyoming

At the present time Wyoming has 1,006.9 mi. of travelled way on the Interstate. Upon completion of the entire system to standard, the total will be about 915 miles due to improved alignments. Constructed and completed to Interstate's standards at the present time are 73.3 mi. There are 127.2 mi. under contract at a value of $59 million. The estimated total dollar value of work which will be under contract a year from now is $86 million, an increase of more than 45%.

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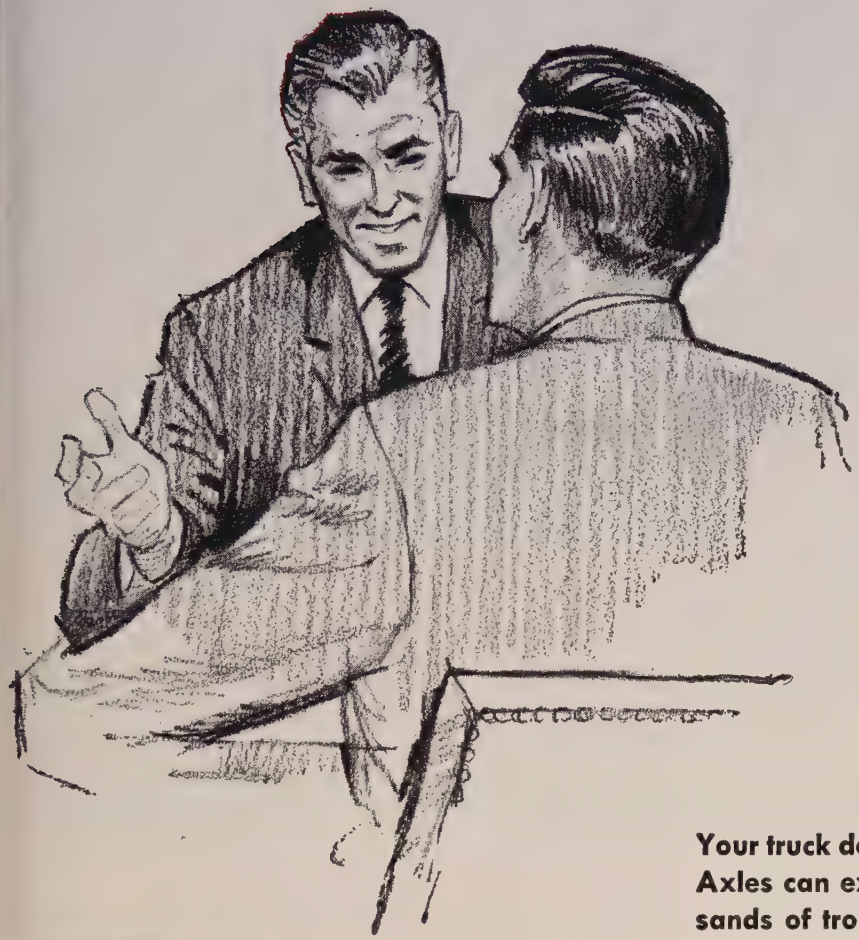

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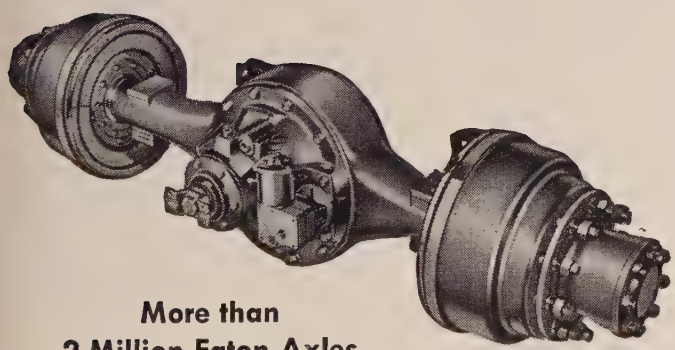

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A progress report on the Trans-Cascade tunnel

Studies continue for a low-level highway bore under Naches Pass, providing another route east from the Puget Sound metropolitan area.

HISTORICAL Naches Pass, one of the earliest cross-Cascade routes the early settlers took to reach the northwestern Pacific Coast region, is again in the limelight. A study of the feasibility of an all-weather cross-Cascade toll tunnel at the site of the first Cascade mountain crossing in 1853 is under way in Washington state.

Washington's Naches Pass, or the "citizens' road," as it was called by the early settlers traveling it from Walla Walla to the Puget Sound area, is a spot steeped in historical lore. Here, in Washington's vast Cascade mountain range, at an elevation of 4,998 ft., lies the path of the first crossing, by settlers, of the greatest obstacle in the settling of the Puget Sound country . . . the Cascades.

Throughout the state of Washington's Cascade range there are today twelve main passes though roads haven't been built through all of them. The Cascades were such a barrier, prior to the first Naches crossing in 1853, that many early settlers preferred the long, arduous voyage around Cape Horn. Other wary emigrants crossed the plains until they reached the Columbia, then traveled by boat down the river and up one of its tributaries until they could travel overland, up the coast to Puget Sound.

Today there are four other mountain passes that are lower than Naches. The two lowest, Snoqualmie and Stevens, have become integral parts of the state's two most important east-west highways. Other passes that are much higher have also been developed. But Naches, the territory's first pass, remains undeveloped.

Ironically enough, the pass carried the name of the man who failed to recognize it until 1921, when the State Legislature officially changed the name from McClellan to Naches Pass.

Today the Naches Pass route is in the news again. This time, however, the talk is not of a pass route, but a tunnel. Governor Albert D. Rosellini announced in March that consulting engineers studying the feasibility of a highway tunnel through the Cascade Mountains at Naches Pass will have a preliminary report ready in July. A complete report is scheduled for December.

A year-round snow-free mountain pass route in this area has long been a dream of cross-state motorists in Washington. As long ago as 1909, a plan was suggested for the building of a 32-mi. tunnel through the Cascade Mountains at the 1,000-ft. level, to be used by both railroad and highway traffic. The idea proved unsound, however, for two reasons: (1) a long tunnel was not economically feasible and (2) there is no heavy snow until a much higher elevation is reached.

A Cascade Mountains Low Level Tunnel Survey, made in 1946 by Ole Singstad, pointed out that there were very few spots in the main Cascade Range where it is possible to locate a vehicular tunnel. The survey pointed out the value of such a venture because of the fact that the lowest portion of the range is almost in a direct easterly direction from the two great cities on Puget Sound, Seattle and Tacoma. The conclusion of this survey was that there were only two places in the Cascade Range where it would be economically feasible to provide, by means of a tunnel, an east-west, all-winter commercial highway route free from the hazards of winter interruptions.

These two places, the survey pointed out, were near Snoqualmie Pass and Stampede Pass. The area near Stampede Pass would include the Naches Pass route, which is just a few miles to the south.

Again, in 1958, another report on the feasibility of financing and constructing a Naches Pass Toll Tunnel in Pierce, King and Kittitas counties was undertaken. The up-to-date facts and figures in the report substantiated the value for such a project. According to the report's figures, in 1958, a total of 54% of the trips across the Cascades had Seattle as either an origin or destination. Tacoma and Everett accounted for another 14% of the traffic. In the eastern portion of the state, Yakima accounted for 25% of the traffic and Spokane 19%.

Approximately 30% of all trips across the Cascades have a desire line of travel roughly in direction with the proposed Naches route, the report found. Travel between Seattle and Yakima would save over 11 mi. in comparison to Snoqualmie Pass, and travel between Tacoma and Yakima would save over 15 mi. in comparison to Chinook Pass and almost 40 mi. in comparison to Snoqualmie Pass.

The proposed tunnel itself, along with the highway approaches, would total nearly 32 mi. The Naches tunnel would be 1.85 mi. long, and would cost $20,255,699. The western approach highway would measure 12.4 mi.; the east approach highway 17.6 mi. The total highway construction cost for the 30 mi. of approaches was estimated in the report at $10,809,250. An additional $2,247,300 appropriation would be made for a tunnel power plant.

The western terminus of the approach highway would be on State Highway 5, where it meets the Greenwater River, about 20 mi. east of Enumclaw. The eastern terminus of the approach highway would also be on State Highway 5, about 30 mi. west of Ellensburg. The lined tunnel would be 33 ft. wide. The two-lane pavement, measuring 26 ft., would be bordered on each side by a 3½-ft. walkway.

Proponents of the tunnel route point out that at one time during the winter of 1959 all routes between Seattle and eastern Washington were closed. This could not be the case, they point out, if there were a Trans-Cascade tunnel at Naches. These proponents say that economically speaking, the tunnel would be a greater asset to the Puget Sound area today than it was over 100 years ago. Seattle's seaport trade, they say, is suffering today because truckers from eastern Washington prefer the highways to Portland, rather than the mountainous routes to Puget Sound.

To date, four legislative reports have been prepared in Washington state on the feasibility of such a Naches route.

Perhaps now the bright promise of a Naches-Cascade route, so determinedly started by the pioneers in 1853, may be fulfilled. Progress is not always a rapid accomplishment.

SCENE of the new road is this remote section of the Oregon coast. Construction included deep cuts and high fills. Crews encountered numerous slide areas including one of 250 ac. area, and heavy winter rains threatened fills. (Oregon Highway Dept. Photos.)

Contractors fight slides to complete highway along rugged Oregon coast

EXCAVATION and grading of the new $9,000,000 scenic shoreline highway along Oregon's rugged south coast between Brookings and Gold Coast is now substantially completed, but it hasn't been easy.

The main project is a 15-mi. stretch from Brookings north to Pistol River over a new alignment which crosses the jagged, heavily forested coastal hills with alternating sharp ridges and deep ravines. Geology of the region is an unpredictable mixture marked by underground water courses and numerous slide areas. The work is further complicated by the climate, which ranges from damp to wet and causes heavy stream run-off during the winter.

The three contractors have encountered double portions of slides and floods, including one in early 1959 which put right-angle bends in three 96-in. multiplate culverts and sent their upstream ends up through the nearly completed roadway fill (*Western Construction*, May 1959).

Drainage problem

Railway construction over the entire 15-mi. route involved deep excavation in the canyons and installation of literally miles of perforated pipe to insure adequate drainage. Canyons were stripped to the point that firm material, unsaturated, could be used as a base for the embankment. Foundations were benched, and benches were used on some of the higher fills.

At three points beach protection was required where the ocean was invaded in the coves by fills taking up large chunks of geography.

Only one contractor used sheepsfoot rollers, and then only part of the time. Specified compaction has been attained and exceeded by rubber tired equipment.

Project is divided into four contracts of 3 to 4 mi. each. From north to south, these are:

Burnt Hill-Hooskanaden Creek, by Peter Kiewit Sons' Co.

Length	mi.	3.55
Drainage Excavation	cu. yd.	11,000
Embankment Foundation Excavation	cu. yd.	63,000
General Excavation	cu. yd.	1,423,000
Tractor and Dozer Time	hr.	4,000
Power Shovel and Dragline	hr.	190
8" Perf. Metal Drain Pipe	lin. ft.	38,000
12" Perf. Metal Drain Pipe	lin. ft.	2,000
Structural Plate Pipe	lin. ft.	2,665
Class "A" Concrete	cu. yd.	300
TOTAL COST		$1,560,359

This section included the three upthrust plate culverts as well as the 250-ac. Hooskanaden slide area which at one point sent the proposed roadway skidding 100 ft. downhill without disturbing the alignment of the grade stakes. The moving mountainside was combed over by men with power saws felling timber and skinning off the shrubbery. They were followed by dozers, carryalls, draglines digging

ditches and excavating swamps in order to bring to the surface the underground water which goes through the area in torrents. The roadway was built across the hourglass-shaped slide area at its narrowest point after the slide had been stabilized.

The bent culverts were corrected by changing the slopes and adding more weight at the end. The contract, which covered excavation and grading, has been completed.

Hooskanaden Creek-Thomas Creek, by Morrison-Knudsen Co.

Length	mi.	3.21
Drainage Excavation	cu. yd.	24,600
Embankment Foundation Excavation	cu. yd.	206,000
General Excavation	cu. yd.	4,115,000
8" Perf. Metal Drain Pipe	lin. ft.	41,500
12" Perf. Metal Drain Pipe	lin. ft.	3,300
18" Perf. Metal Drain Pipe	lin. ft.	14,100
Structural Plate Pipe	lin. ft.	2,840
Class "A" Concrete	cu. yd.	700
Slide Removal		$300,000
ESTIMATED TOTAL COST		$3,265,588

The contractor has about 400,000 cu. yd. of excavation to complete following winter shutdown. Most of this work is slide removal and repair. This section is distinguished by having the deepest cuts and highest fills on the route. Contract covers excavation and grading. Canyons are so deep and close together that only double-engine scrapers could negotiate the steep haul roads uphill travelling empty. This job also involved numerous multiplate culvert installations to carry streams through the roadway fills.

Culvert installations included construction of a bench in the canyon, its level top extending upstream to the canyon walls. Culverts are placed on this broad fill which acts as a settling basin for stream before entering the culvert. Concrete spillways studded with "dragons' teeth" are constructed at the outlet end to protect the fill.

There are some large slides on this project and the adjoining Darkenwald and Harms section to the south. These jobs are divided by the deep Thomas Creek Ravine, which is the final link in the new road project.

Thomas Creek Bridge, by Bethlehem Steel Co.

Length	ft.	957
Width (Roadway)	ft.	30
Height (Towers)	ft.	330
Structural Steel	tons	1,600
COST		$1,114,951

Contract for this steel deck-truss bridge was awarded a few weeks ago, and construction is scheduled to begin shortly. The structure will be supported on two steel towers rising approximately 330 ft. from the bottom of the canyon.

MULTIPLE culvert installation includes three 96-in. pipes to carry stream through the fill. Two of these installations were damaged by floods which bent culverts upright.

Thomas Creek-Cape Ferrelo, by Darkenwald & Harms Co.

Length	mi.	3.93
Drainage Excavation	cu. yd.	11,700
Embankment Foundation Excavation	cu. yd.	110,200
General Excavation	cu. yd.	2,891,000
8" Perf. Metal Drain Pipe	lin. ft.	25,500
12" Perf. Metal Drain Pipe	lin. ft.	7,700
Structural Plate Pipe	lin. ft.	3,200
TOTAL COST		$2,044,362

This section is also noted for deep cuts and high fills requiring large tractors, scrapers, dozers, carryalls, logging donkeys and skilled operators. The contractor also encountered slides in the cut areas. Repair work on these has consisted of going back and benching in order to stiffen up and support the slope, involving considerable extra excavation. The contract, which covered excavation, grading, and selected roadbed reinforcement has been completed.

Cape Ferrelo-Brookings, by Peter Kiewit Sons' Co.

Length	mi.	4.16
Drainage Excavation	cu. yd.	7,500
General Excavation	cu. yd.	1,676,000
6" Perf. Metal Drain Pipe	lin. ft.	7,800
8" Perf. Metal Drain Pipe	lin. ft.	15,600
12" Perf. Metal Drain Pipe	lin. ft.	3,800
Class "A" Concrete	cu. yd.	1,600
TOTAL COST		$1,369,390

This southernmost leg of the project has been completed. For the two southern sections a $363,070 contract for crushed rock surfacing, the crushing of asphaltic concrete paving aggregate, and the prime coat has been awarded to J. C. Compton Co., McMinnville, Ore., and has just been started.

A fifth contract, a few miles north of the main project at Gold Beach is also part of the coast road project.

Hunter Creek-Buena Vista Wayside, by Peter Kiewit Sons' Co.

Length	mi.	1.30
General Excavation	cu. yd.	376,000
8" Perf. Metal Drain Pipe	lin. ft.	4,300
Asphaltic Concrete	tons	8,500
TOTAL COST		$483,903

Excavation and grading as well as paving was completed by Kiewit last fall. Following construction of a bridge over Hunter Creek at one end of the job by Tom Lillebo Construction Co. this section was placed in service.

Personnel

For Peter Kiewit Sons' Co., Rod Miller is area manager; Jack Scott, superintendent, Cape Ferrelo-Brookings; and Fred Nieman, superintendent of the Hunter Creek section.

Morrison-Knudsen project manager is Jack Coons, with Mitchell Humphreys as superintendent.

For Darkenwald-Harms Co., superintendents were George Coons and Gus Oberg.

Oregon Highway Department resident engineers were: G. A. "Buck" Barnhart, Bob Lammert, Larry "Lars" Rulien, and Howard "Si" Cox. Roy Norton and John Quiner handled structures, bridges and box culverts. F. D. Morgan is division engineer, and L. R. "Pop" Chandler is assistant division engineer.

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A practical look at dry air cleaners

Dry-type air cleaners are rapidly taking over as the best way to shield engines from Western desert dust. Here are the facts on how they work, what they cost, and what you need to know about installation and servicing.

By R. E. JOHNSON
Service Manager
Southwest Division
Caterpillar Tractor Co.

SINCE THE INTRODUCTION of the dry-type air cleaner to the construction industry in November 1958 it has become apparent that a new era in air induction is here. In this time the unparalleled efficiency of the dry air cleaner has been proven in every kind of job from coast to coast, and especially in Western applications where extremely dusty conditions often prevail.

After the initial breakthrough with the cyclone-tube-type cleaner, other heavy-duty dry air cleaner designs were perfected that used no cyclone tubes, yet which equaled the extremely high efficiency of the cyclone-tube type. Among these are the double-element cleaner now standard on some motor graders and smaller wheel and track-type tractors, and the single-element cleaner now used on some industrial diesel engines. With smaller space requirements and greater design flexibility, these newer cleaners point the way to even greater air cleaning economy and convenience.

These developments mean real benefit for all contractors in two very important areas: increased efficiency and reduced costs. Let's consider efficiency first.

The dirt and dust common to earthmoving jobs pose the biggest single threat to long engine service life. Research by Caterpillar engineers shows it takes only about 10 oz. of dirt inside a 1,250-cu. in. displacement diesel engine to give cause for an overhaul.

These findings are based on extensive experiments carried out with what is known as "Arizona Air-Floated Dust." Particle size of this dust is carefully controlled so that the individual particles are finer than those likely to be found on the average earthmoving job, yet coarser than the dirt particles that ordinarily pass through properly functioning oil-bath or dry air cleaners.

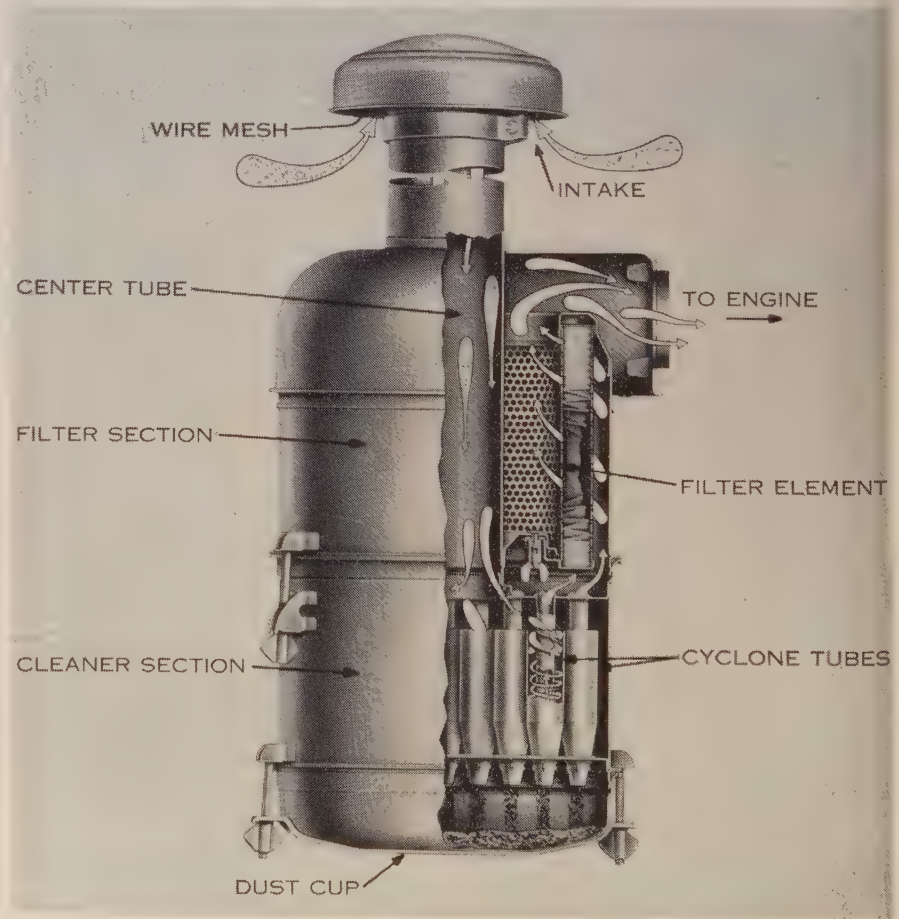
A diesel engine needs about 3 cu. ft. of air for each horsepower developed per minute, which means that a 350-hp. engine will breathe more than 1,000 cu. ft. of air each minute it operates. Research and testing show that the "heavy dust" common to construction jobs has a ratio of about four grains of dust per 1,000 cu. ft. of air. On an hourly basis, this amounts to nearly ½ oz. of dust per hr. or a total of as much as 56 lb. during 1,800 hr. of operation per year.

Or, looking at it another way, it indicates that severe damage would be done to liners, pistons and rings if completely unfiltered air entered the engine for two days.

The oil-bath air cleaner, the best cleaner we had before the dry air cleaner was developed, was generally considered to be 95% efficient. It was therefore capable of reducing to 44.8 oz. the 56 lb. of dirt breathed in by an unfiltered engine during 1,800 hr. of operation.

Now Caterpillar's dry-type air cleaners go well beyond this. Exhaustive testing shows them to be 99.8% efficient. This cuts the 56 lb. of dirt down to a mere 1.79 oz. per 1,800 operating hours.

This then is the major advantage the dry-type cleaner has over the oil bath: a higher efficiency *that is maintained at all times,* at all engine speeds and under the most severe conditions. In contrast, the oil-bath efficiency of 95% happens to be *peak* efficiency that can be obtained only at rated engine speed. When the engine lugs down or slows for any other reason, the



CUTAWAY DIAGRAM shows how dry air cleaner works. Air enters stack cap at top, flows down through center tube and enters multi-cyclone precleaner, where centrifugal action drops 95% of the dirt particles into the dust cup. The air then travels upward to the resin-impregnated cellulose filter element where the rest of the dirt is removed.

ENGINEER'S FIELD REPORT

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FIRM JAMES BOND TRUCKING CO. Phoenix, Arizona

No chassis lubricant failure in 5,550,000 miles

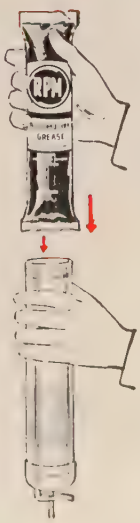
Despite extreme dust conditions, James Bond Trucking Company has had no lubricant-caused failures of chassis bearings or fifth wheels since changing to RPM Automotive Grease three years ago. Firm's 60 units (including trucks, trailers, and other vehicles) travel more than 1,850,000 miles per year hauling sand, gravel, crushed rock and paving materials, but regular lubrication with this all-purpose grease has eliminated premature wear.

"We have to keep our equipment running," says Bond Trucking Company's Operations Manager, Frank Crandall, "there's no leeway for breakdowns caused by improper lubrication. That's why we continue to use RPM Automotive Grease. We know from experience it keeps chassis parts and fifth wheel assemblies working smoothly in spite of heavy loads, high temperatures, dust and grit."

Firm's entire fleet is lubricated with RPM Automotive Grease regularly every Saturday. Vehicles include Fruehauf dump trailers (left), International (above), GMC, White, and Kenworth trucks (below).

RPM Automotive Grease in exclusive new package simplifies lubrication

- Handy 12-oz. plastic cartridges fit right into your grease gun...speed loading, end waste... also available in usual containers
- One grease fully protects wheel and chassis bearings, universal joints, water pumps, fifth wheels
- Stays in bearings, maintains proper consistency even when units operate in mud, water, extreme heat or cold
- Provides a tough lubricant film that protects against shock and overload pressures



For More Information about this or other petroleum products, or the name of your nearest distributor, write or call any of the companies listed below.

TRADEMARK "RPM" AND CHEVRON DESIGN REG. U.S. PAT. OFF.

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. . . for more details, write No. 33 on Reader Service Postcard

efficiency of the oil bath drops off sharply. The curtain of cleansing spray that normally is suspended up in the screens disappears because there is not enough air passing through the cleaner to whip up the oil.

Another shortcoming of the oil bath in regard to efficiency is the oil carry-over into the engine that often occurs at high speeds. Wheel tractors (with their higher engine speeds) and the larger track-type tractors suffer particularly from such carry-over.

But now with the dry-type air cleaner, no such carry-over is possible, for with all the advantages of a filter it may be literally covered with dust but will never pass that dust into the engine. Even with an inexperienced operator, it's almost impossible to get engine damage if the cleaner is properly installed. The filter will plug up and the engine give reduced performance—an automatic warning to service the air cleaner.

Cost advantage

The other major advantage of the dry air cleaner is its economy. Let's compare costs of both the oil-bath and the dry-type cleaners on the Caterpillar D9 Tractor (cyclone-tube cleaner) and on the D6 Tractor (double-element cleaner).

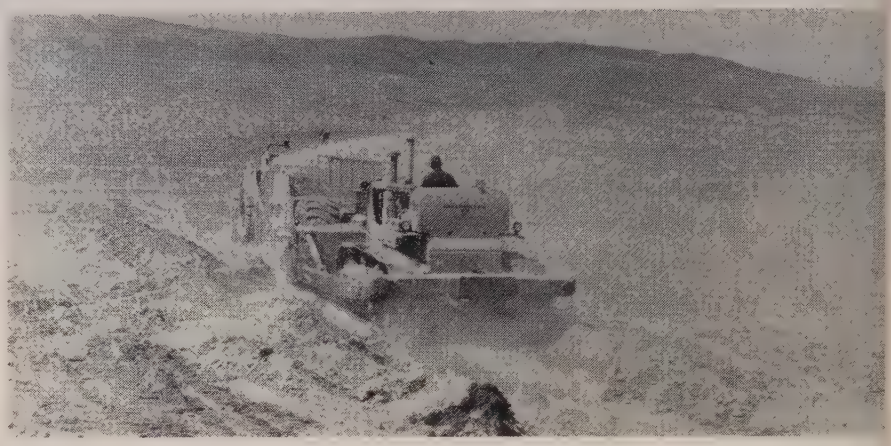
DRY AIR CLEANER COSTS
Assume: Severe conditions.
Element replacement at 250 service hr. or every 25 days.
Labor—5 min. per day @ $2.40 per hr.

	D9 TRACTOR	D6 TRACTOR
Element Cost		
Two elements @ $13.70 each		$12.31
Element Cost per day	$1.10	$ 0.49
Labor	0.20	0.20
Total Daily Cost	$1.30	$ 0.69

OIL-BATH AIR CLEANER COSTS
Assume: Same conditions.
Labor—20 min. per day @ $2.40 per hr.
Oil—$0.28 per quart.

	D9 TRACTOR	D6 TRACTOR
Oil Cost	6½ qts.—$1.82	3 qts.—$0.84
Labor	$0.80	$0.80
Total Daily Cost	$2.62	$1.64

It is clear from this analysis that on the D9 Tractor the use of a dry air cleaner results in a savings of 50%, while its use on the D6 produces a 58% savings. This, in each case, can be a sizable amount when considered over a period of time, as follows:



WHEN IT'S SPRINGTIME IN THE MOJAVE, it's as dusty as any other time. These photos were taken in April in Southern California's Mojave desert region. Such dust conditions would make short work of any engine if it weren't properly protected with air cleaners. Upper photo is a highway project near Barstow; lower photo an earthfill dam job near Riverside.

DRY AIR CLEANER SAVINGS

	D9 TRACTOR	D6 TRACTOR
Daily Cost—Oil Bath	$ 2.62	$ 1.64
Daily Cost—Dry Type	1.30	0.69
Daily Savings	1.32	0.95
Savings—150 days	$198.00	$142.50

Notice that this analysis assumes replacement of the element every 250 service hours. Actually the element can be cleaned 5 or 6 times before replacement becomes necessary, thus reducing even further the cost of the dry-type air cleaner. Incidentally, some machine owners fail to understand the extent of the tremendous savings afforded them by the dry air cleaner. This is because the cost of many days of operation hits them all at once to the tune of $10 to $15 for a single replacement element. It's not like draining a few quarts of oil each day out of a barrel already paid for. But the cost of that oil climbs a lot higher and faster than dry air cleaner elements.

Even the owner whose machine uses an oil-bath cleaner can realize savings if he installs a dry-type air cleaner field change-over group. This assumes no salvage value for the oil bath; it is thrown away. The new dry air cleaner soon pays for itself and its installation through operational savings.

Other advantages

Besides these major advantages of efficiency and economy, dry air cleaners have other positive features. For one thing, the dry air cleaner is not temperature sensitive. With the oil-bath cleaner, there was a real need to watch the weight of the oil used in the cleaner. A given weight of oil that was suitable for tractor operation in moderate temperatures would thicken in cold weather and retard the action of the oil. In hot weather, the same oil would tend to carry over into the engine. But the dry air cleaner is effective in all seasons at all temperatures.

The dry-type air cleaner is also a boon to the trouble-shooting mechanic. This is in cases where the air cleaner is suspected of being at fault in loss of tractor power. In the past with the oil-bath cleaner, there was no easy way to learn the condition of the cleaner. The most important part of the cleaner—the screen — could not be examined thoroughly unless it was cut into, which rendered it worthless for

future use. But with the dry air cleaner, the element can be replaced, the cyclone tubes cleaned until they sparkle (if the cleaner is of this type), and you have a new cleaner. Then if engine power loss does not clear up immediately, you know you have to look elsewhere.

The dry-type air cleaner really pays off in extreme dust. With the oil bath, the operator could only guess at the proper service interval and then hope for the best. He had no way of knowing whether he was right or wrong. If the interval was too frequent, it was wasteful of oil and man-hours. If not frequent enough, cleaner efficiency would drop, allowing more dirt than usual to enter the engine. But with the dry air cleaner, the engine gets positive, complete protection. Loss of engine power is an automatic signal for servicing.

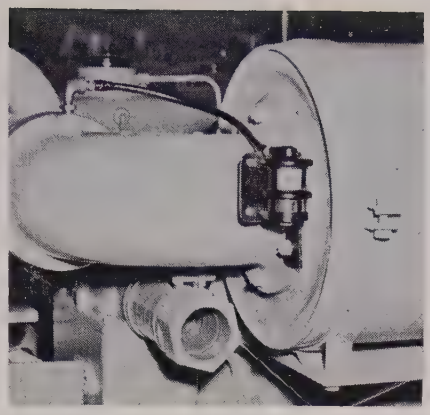
Adding to the efficiency of the dry air cleaner in this respect, Caterpillar will begin offering in June of this year a Service Indicator that will pinpoint for the operator the optimum service interval. The indicator is a small vacuum gauge that mounts on the clean air side of the cleaner. It measures the degree of restriction in the filter element. As dirt piles up on the filter, the filter's restriction increases. Air pressure drops off in the cleaner. The vacuum gauge responds with a red cylinder that rises into view in a glass window. When this cylinder reaches its extreme position, it locks into place. The operator is thus warned visually that the air filter should be serviced.

The great advantage to such an indicator is that it will eliminate too frequent cleaning of the filter and cut down on the opportunity for damage to the filter. In the past, some owners and operators, having had little experience with dry air cleaners, would grow apprehensive after the cleaner had accumulated a hundred hours or so. They would service the filter even though all indications were that the filter was functioning properly and well.

Now, with the service indicator, the machine owner will know exactly the condition of the filter element. This will enable him to get maximum service intervals and maximum usable life out of the element. Lowest possible service costs will be attained regularly and with precision.

Servicing tips

Air cleaner service time is cut 75% by dry air cleaners. And with the mess and misery of the oil bath gone, the operator is much more inclined to give the cleaner the attention it deserves. Although service intervals naturally will vary because of different dust conditions, the general procedure is as follows:



INDICATOR for showing when cleaner needs servicing will be marketed by Caterpillar this June. It is a vacuum gauge that responds to drop of pressure in cleaner when dirt piles up, thus eliminating useless inspection and servicing.

On *cyclone-tube-type* air cleaners, the dust collector cup should be removed and emptied at 10 to 50 service hours. Experience will soon indicate to the operator the proper interval. In extreme dust, begin by emptying the dust cup twice a day until the proper interval becomes apparent.

When the dust cup is emptied, the cyclone tubes should also be inspected for dust accumulation. If the tubes are dirty, they should be cleaned by running a round bottle brush through them from the bottom. It is not necessary to remove the lower body of the cleaner (of which the tubes are a part) except when filter element inspection and cleaning are desired.

The filter element in the upper body will normally require cleaning between 125-250 service hours. But this period is entirely dependent on dust conditions and may often extend beyond 300 hr. in clean atmosphere. This is perfectly all right. In fact, the longer the cleaning interval the better, as pointed out earlier. Again, unless a Service Indicator is in use, experience must determine the proper interval. Excessive engine exhaust smoke and/or loss of power are the usual indications.

On *double-element* dry air cleaners, the full-view precleaner should be emptied when the dirt reaches an indicator line about three-fourths of the way up the collector. The fins in the precleaner should also be inspected at this time. If they are dirty, remove the entire precleaner and wash it in water.

As with the cyclone-tube cleaner, the primary filter element on the double-element cleaner may require servicing between 125 and 250 hr, but will often go beyond 300 hr. The safety filter element should be removed and serviced every 1,000 service hours. It should be noted here that the safety filter is not intended to be a secondary element. It is a safety element only. Certainly over a period of time some dirt will pile up on the safety filter. But its main function is to be there, should the primary filter rupture. If this happens the safety filter will plug up quickly and choke the engine down. That is the way it is designed.

If inspection of the cyclone-tube or double-element cleaners reveals that a filter element is damaged by cuts or breaks, or that the sponge-rubber seals are damaged, the entire element should be replaced. If no damage is evident, the element can be reused after a cleaning. Elements may be cleaned as many as six times, but should be replaced at least once a year. This includes the safety element on the double-element cleaner.

Elements can be cleaned in one of several ways. One is by using clean, dry air under pressure of no more than 100 psi., and preferably less. Under no circumstances should air for this purpose be taken off the exhaust of an engine because it will contain damaging oil and soot. The air should be directed against the inside surface of the element to remove embedded dirt. Best results can be obtained by moving the air stream lengthwise along each pleat. When the inside is clean, the outside should be cleaned in the same manner. The procedure should be repeated until the element is thoroughly cleaned.

Clean water can also be used. Pressure should not exceed 40 psi. Nor should a nozzle be used on the hose; a high velocity stream of water could damage the element. Again, each pleat should be cleaned lengthwise, first inside, then out.

Washing of the element with warm water and a low sudsing household detergent is also possible. This is needed primarily when oily or sooty deposits have accumulated on the element. After cleaning, rinse the element in clear water. Incidentally, though soot quickly plugs the filter element,

this does not mean that the element cannot be cleaned and used again. Although the element may be permanently blackened, it is still generally as efficient as unblackened filters, nor is filter life shortened.

At *no* time, either during inspection or cleaning, should the element be beaten against a solid object to dislodge dirt.

When the element has been cleaned, it should again be inspected thoroughly for damage. Breaks in the paper can best be detected by holding a light bulb inside the element and turning the element slowly. If neither the filter nor the seals are harmed, the element can be installed again. Before reassembly, it is a good practice to clean all the parts.

In reassembly, special care must be taken to fit gaskets and seals properly. This cannot be emphasized too much. If dust bypasses the filter elements through a faulty gasket, permanent damage may be caused to the diesel engine. Therefore, if the condition of the gaskets is questionable, replace them. If the sponge-rubber seals on the filter element are damaged, replace the element. When installing a new element, put in all new gaskets and seals. Check all wing nuts periodically for tightness to ensure proper seating of gaskets and elements.

It goes almost without saying that oil should never be placed in the dust cup of the cyclone cleaner or in the precleaner of the double-element unit. These are truly *dry* air cleaners that require no oil whatsoever.

If cleaning the air cleaner and the filter element does not reduce the exhaust smoke or correct the loss of power, a new element should be installed.

Here are some other tips on dry air cleaners:

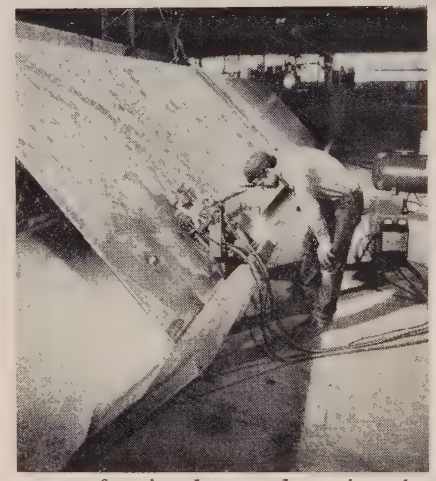
Keep the air cleaner inlet below the exhaust stack height. To extend it above, in an attempt to get it above the dust, does more harm than good. Carbon from the exhaust will plug the filter element in nothing flat.

Nor is there any need to put a precleaner ahead of the cyclone-tube cleaner. Such a precleaner, besides removing only a portion of the dust, would break up the remaining dust into finer particles. Fewer of these particles entering the cyclone tubes would drop into the dust cup through centrifugal action. More particles would be deposited on the filter element itself. This is not to say that this would put dirt in the engine; rather, less dirt would collect in the dust cup and more dirt would pile up on the element. The result: more frequent servicing of the filter element and higher air cleaning costs, with no increase in cleaner efficiency.

Always shut down the engine when servicing the air cleaner. This becomes especially important in some applications such as rock crushing where dust may hang in the air even when operations have temporarily ceased.

Special rig welds huge bridge girders

GIGANTIC 225-ton, 375-ft main span girders for the new Nisqually Glacier Bridge at Mt. Rainier National Park in Washington are submerged arc welded. Low fixture costs resulting with the development of a simple travel carriage by the West Coast Steel Works of Portland, Oregon, make it economically practical to take advantage of the high deposition rates and excellent weld quality characteristics.



The carriage, designed to travel along the inclined web of the girder section, carries the welding gun of Lincoln Electric Company's ML-2 Squirt Welder and an acytelene torch. The torch, operating during the first pass, drives out any moisture that may be present in the joint. A two-pass welding procedure is used to insure deep root penetration and sound weld quality in the continuous ½-in. fillets that connect the ¾-in. web to the 4-in. thick, 29-in. wide flange.

To facilitate shop handling and transportation to the job site, the 16-ft. 8-in. webs are split in half and later joined together by field welding. Each girder is made up of 16 of these half sections ranging in length from 40 to 61 ft.

An escape ramp for runaway trucks

A report on the experience of the California Division of Highways on one possible solution to a typical Western problem. Five miles of downgrade averaging 5.6% and carrying 3,000 trucks a day was the problem. The ramp, after three years of service, presents non-conclusive results, but the information is valuable.

THE "RUNAWAY-TRUCK" problem is one of long standing. The terrain of California is such that some steep highway grades cannot be avoided. There are the Cuesta Grade, the Meyers Grade, the Donner Grade, the Dunsmuir Grade—in fact there are some 40 locations on California State highways where warning signs to truckers have been erected. These warning signs advise of long downhill grades ahead and advise the use of low gears. Many of these grades are also posted with restricted speeds for trucks on the downgrade.

Over the years, some runaway truck accidents have occurred at various locations throughout the state. The greatest single concentration is on U. S. Route 99 at the Five-Mile Grade in Los Angeles County just north of Castaic Junction. For about 5 mi. the gradient averages 5.6%. An average of 16,000 vehicles per day traverse the grade, including an average of 3,000 trucks, 1,800 of which have five or more axles.

Over the years there have been many runaway truck accidents on this long downgrade. Due to the spectacular type of accidents that have resulted involving runaway trucks, a great deal of interest has been given to this section of highway by the California Truckers Association, Automobile Club of Southern California, California Highway Patrol, Division of Highways and many interested citizens and local newspapers.

A study of the accident records on this route during the period from Jan. 1, 1955, to Oct. 10, 1956, reveals that there were 20 persons killed per 100 million downhill vehicle miles because of runaway trucks. The statewide average for all types of vehicles was 8.4 persons killed per 100 million vehicle miles for all rural highways and 2.5 for full freeways during the same period.

On July 31, 1956, a meeting was held in the office of the California Highway Patrol for the purpose of exploring methods of reducing the runaway truck accidents on the Five-Mile Grade. This meeting was attended by representatives of the Public Utilities Commission, California Truckers Association, and the Division of Highways. All present agreed that the problem of prevention was primarily a social one: Education of drivers and truck companies to require drivers to frequently check their vehicles. The discussion, nevertheless, shifted to means of stopping runaway trucks and reducing the severity of this type of accident. The meeting closed with the conclusion that the following corrective measures be investigated:

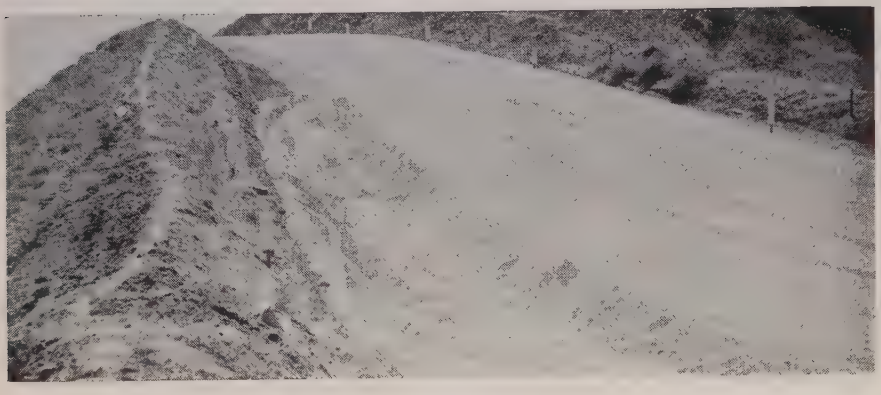
1. At a point about 0.75 mi. south from the summit a flat area exists which could be developed as a parking area, permitting equipment checks.

2. An area exists about 3.5 mi. below the summit of the grade which has been used as an escape ramp and may be improved for easier operation by runaway trucks. This area was a waste-fill area used by the maintenance department for storage of equipment and material. It was used occasionally by runaway trucks, but was not signed as an escape ramp.

On a trial basis, minor grading was done along the edge of the highway to provide a means of pulling off the road onto a sharp upgrade that might dissipate the speed of the truck. The approach of this so-called safety ramp was rather indirect and existing terrain was such that the visibility of the entrance was somewhat limited. This ramp was put into operation on August 31, 1956, at a cost of about $5,000, which included $2,350 for advance signs.

During the first six weeks of op-

FIRST view of the ramp for the runaway truck.



LOOKING UP the 17% rise of the escape ramp.

RETARDING element is heavy depth of pea-gravel.

GRAVEL DIKES across the top of the ramp.

eration between August 31 and October 10, six runaway trucks used the ramp. Of the six vehicles using the ramp, only one involved minor personal injury to a driver and four incurred vehicle damage. As a consequence of this unexpected amount of usage, funds totaling $15,000 were allocated to improve the ramp entrance, revise the grade line of the sharp upgrade to minimize damage to vehicles using the ramp at high speed and place gravel dikes on the top of the ramp.

The cost of improving the ramp totaled about $9,000, to which were added $1,233 for signing improvements and $1,329 for additional pea gravel placed in the ramp in November 1957. The remainder of the allotment was used in minor revisions from time to time and for the installation of a radar speed meter, as will be explained later in this report. In July 1959, further funds totaling $3,000 were approved to place 1,000 tons of pea gravel at an additional depth of 18 in., bringing the total cost to date to $18,096.

In arriving at an annual maintenance cost figure, all the expenditures charged to loss reports pertaining to trucks using the ramp have been compiled for the twelve month period beginning July 1, 1958, and ending June 30, 1959. These reports indicated ramp maintenance was required in 14 truck accidents on the ramp during this period. Maintenance costs, including removal of spilled loads, etc., ran from $29.58 to $264.20 per accident. The total maintenance cost for this period was $1,192.19, or an average of $85.16 per accident.

To evaluate the effectiveness of the ramp design, a radar speed meter was installed and placed in operation July 13, 1957, to obtain inlet speeds. The approximate installation cost of $3,000 was obtained from the original $15,000 allotment. The meter was put on a 24-hr.-per-day schedule. The maximum speed recorded by the speed meter for any truck entering the ramp has been 70 mph. with driver-claimed speeds consistently 5 to 20 mph. higher.

The maximum required stopping distance has been 750 ft. from the entrance or 300 ft. from the end of ramp. (Prior to the increased depth of pea gravel installed in July 1959.) Tabulation of typical stopping distances required by trucks of maximum gross weights (78,000 lb.) versus runaway speeds on entering the

RECORD OF THE ACCIDENTS INVOLVING DOWNHILL TRUCKS

(November 1953 through October 1959)

	RUNAWAY TRUCK ACCIDENTS[1]						ALL ACCIDENTS INVOLVING TRUCKS					
	Fatal		Injury		Total		Fatal		Injury		Total	
	No.	Rate[2]	No.	Rate	No.	Rate	No.	Rate	No.	Rate	No.	Rate
BEFORE: On Roadway	3	2.7	15	13.3	31	27.6	6	5.3	41	36.4	85	75.6
On Improvised Ramp	0	..	3	2.7	7	6.2	0	..	3	2.7	7	6.2
TOTAL	3	2.7	18	16.0	38	33.8	6	5.3	44	39.1	92	81.8
AFTER: On Roadway	2	1.5	13	9.9	26	19.8	9	6.8	51	38.8	90	68.4
On Escape Ramp	0	..	10	7.6	[3]79	60.1	0	..	10	7.6	79	60.1
											79	[3]60.1
TOTAL	2	1.5	23	17.5	[3]105	79.9	9	6.8	61	45.4	169	128.5

[1]Runaway truck was defined as one in which the brakes were ineffective or the vehicle was unable to avoid accelerating.

[2]Rate per one million downhill trucks.

[3]Does not include 20 trucks which used the ramp but were not classed as runaway accidents.

ramp is shown in the following table, compiled from data taken from the graphic recorder, and supplemented by related information from other sources:

RUNAWAY SPEED —MPH.		STOPPING DISTANCE —FT.
Recorder	Driver Estimate	Measured from Entrance
20-30	25-40	100-300
30-40	35-50	300-500
40-50	45-65	500-650
50-65	60-80	650-700
65-70	75-90	700-750

In most instances, runaway trucks entering the ramp have come to a stop just short of the rise, approximately 400 ft. from the ramp entrance. In such cases, stopping action has been solely the result of the 10-in. layer of 3/8-in. pea gravel. This was recently increased to 2½-3 ft. in depth, and has become more effective.

The approach to the rise has a minus 4% grade and the rise has an abrupt plus grade of 17%, to a height of about 40 ft. The speeds of trucks entering the ramp, as recorded by the speed meter, indicate that those stopping at or near the rise entered the ramp between 35 and 50 mph., depending on the gross tonnage weight of the truck between 40 and 20 tons, respectively, and driver behavior.

Trucks traveling to the top of the 40-ft. rise were recorded at entrance speeds of from 45 to 60 mph., again depending on the gross tonnage weight of the truck. The greatest distance any runaway truck has traveled into the ramp before stopping has been to the third berm, approximately 800 ft. from the beginning of the pea gravel.

Drivers using the ramp have a tendency to veer to the right and up along the cut slope apparently due to the 35-ft. drop off on the left. The lack of sight distance as the driver crests the top of the ramp has also reduced the effectiveness of the ramp to some degree.

In an effort to increase the confidence of the user, sight markers were placed along both sides of the ramp to the top of the rise and continued along the left side on top of the ramp to give some indication of the clearance and end limits.

To evaluate the effect of the ramp on the safety of the grade, a detailed analysis was made of all reported accidents involving trucks during a period of three years before construction of the ramp, during which time 1,125,000 trucks traversed the grade in a downhill direction.

The accompanying table is a summary of these accidents. After the ramp was put in operation, accidents classed as the runaway truck type increased from 38 to 105, or 175%; the number of these accidents resulting in non-fatal injuries increased from 18 to 23, or 28%.

The total number of accidents involving trucks increased from 92 to 169, or 83%; the number resulting in non-fatal injuries increased from 44 to 61, or 39%; and the number resulting in fatal injuries increased from 6 to 9, or 50%.

A review of the accidents reveals one favorable statistic. During the period before the ramp, there were a total of 31 runaway truck accidents occurring on the roadway itself, 7 of which involved other vehicles. After construction of the ramp, these accidents were reduced to 26, with only 4 involving other vehicles.

Thus, there are favorable and unfavorable indications. At the present time, the Division of Highways has reached no positive conclusions as to the merits of the truck escape ramp as a complement to highway safety, and no additional escape ramps are contemplated at this time. It is hoped that further experience with the existing ramp, together with the experience on the new 8-lane freeway soon to be completed on the Grapevine Grade on U. S. Route 99 south of Bakersfield and the results of the current program of truck inspection at the summit of this grade, will provide the answer to the problem of runaway trucks.

New model contract published by AGC

A newly revised edition of the "Suggested Form of Contract for Use in Connection with Engineering Construction Projects" is now available. This 1960 edition, prepared jointly by the Associated General Contractors of America and by the American Society of Civil Engineers, includes the following new sections:

Changed Conditions, Extension of Time, Responsibility for Work, Partial Completion and Acceptance, Damage Claims, and Acceptance and Final Payment.

There are substantial revisions in the sections on Progress Payments, and Contractor's Liability Insurance. Several outmoded sections were dropped.

Most Federal agencies already have established standard forms of contracts in close agreement with the document's provisions.

Copies may be obtained for 25¢ each from either organization. The AGC address is 1957 E Street, N.W., Washington 6, D. C.

SLIPPERY when wet. "Convertible" hits the ditch on a muddy coast road in Southern California, and its driver walks back toward a second stranded vehicle. Note tool box on running board of the car, and cylinder containing acetylene gas for the headlights.

PAVING project in Amador County, Calif., in 1927. Here a crawler-drawn grader windrows road mix. Operator works 8 hand controls and has no power steering.

Mud, Muscle and Mules

A look at roadbuilding of about 40 years ago at the dawn of the modern highway era. Supremacy of the horseless carriage was still in doubt when these spreads took the field to build hard roads for it. Photos from California Division of Highways collection.

MOUNTAIN road in Trinity County, built with shovel and "iron mules," early version of end-dump trucks. Photo about 1925.

REAL mules led the spread in this 1915 photo. Scene is believed to be Eldorado County. Note early steam roller in background.

LOS ANGELES aqueduct project visited in 1912 by a touring group of motorists.

FORERUNNER of Caterpillar tractor line is this 1906 gasoline-powered vehicle, the second one built by Holt Mfg. Co., shown being tested near Stockton, Calif.

CONCRETE paving train finishes road across the Central Valley about 1914. Aggregates were fed to the mixer by wheelbarrow, and bagged cement was stacked along roadside. Note hand-operated screed which formed crown, and "official" photographer's car at right.

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- Improves many lower-quality aggregates*
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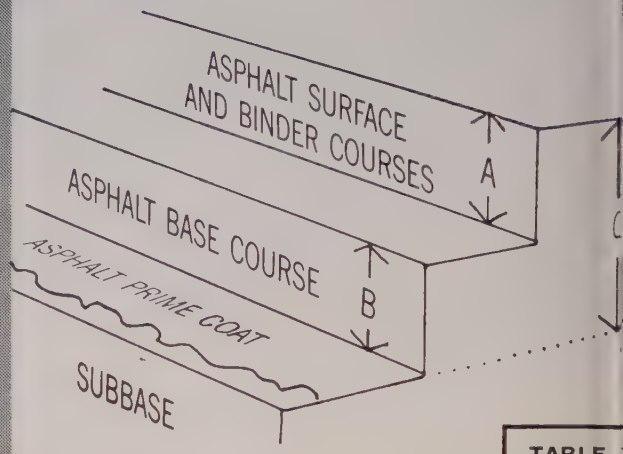
- Protects subbase from rain during construction
- Permits haul traffic on base without damage
- Eliminates subsurface moisture build-up
- Aids uniformity of pavement
- Does away with shoulder erosion
- Minimizes slope erosion
- Furnishes better drainage
- Prevents wheel-track rutting
- Provides for stage construction
- Improves surface riding qualities
- Increases driving and parking safety

**For use in areas where high-quality aggregates are in short supply.*

SUMMARY OF **ADVANC**



PAVEMENT DETAIL

TABLE 1

Recommended Minimum Thicknesses of Surface-Plus-Binder and of Base Courses (inches)*

TRAFFIC	A**	B w/ Asph base	B w/o Asph base	C w/ Asph base	C w/o As base
Very Hvy	4	4	6	8	10
Heavy	3	3½	5	6½	8
Medium	3	2	3	5	6
Light	2	2	3	4	5

**For thickness of subbase and improved subgrade courses, see Asphalt Institute Manual Series No. 1.*

***May be reduced by substitution of Asphalt base of comparable strength on inch-for-inch basis.*

"THE INCREASING STRESSES now being imposed on pavements by modern heavy traffic with average tire contact pressures as high as 100 psi or more, and the anticipated future increase in wheel coverages indicate that general improvements in design and construction must be made. To meet this need, The Asphalt Institute calls to the attention of highway designers the Advanced Design Criteria given in broad detail above and designated, 'Deep-Strength' Asphalt pavements. The Institut strongly recommends the adoption of these Ad vanced Design Criteria in the construction of a future heavy-duty Asphalt pavements. For de tailed data, you are urged to contact The Asphal Institute District Engineer in your area."

Irwin S. Wellborn

CHIEF ENGINEE

RECOMMENDED MINIMUM COMPACTION CRITERIA* (summary)

TABLE 2

Non-Asphalt Courses

COURSE	MINIMUM (% modified AASHO Density)
Subgrades (layers not to exceed 6 inches)	
Cohesive	95%; top 12 inches 90%; balance of fill (When optimum moisture is near plastic limit, compact at moisture content approximately 1% below theoretical optimum).
Cohesionless	100%; top 12 inches 95%; balance of fill
BASES, SUBBASES AND IMPROVED SUBGRADES (Layers not to exceed 6 inches)	
All (*proof roll with heavy rubber-tire rollers*).	Compaction load and contact pressures as high as material will support without undue rutting or displacement.

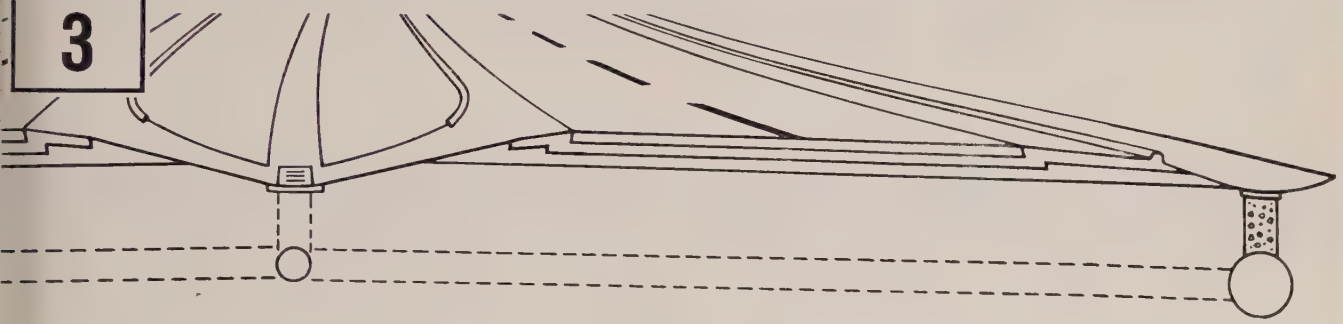
ASPHALT COURSES (base, binder, surface)

COURSE	MINIMUM CRITERIA
SUPPORTING COURSES	Flat steel-wheel rollers to be supplemented with pneumatic tire rollers having average tire contact pressures of 85-110 psi
SURFACE COURSES	Same as for Supporting Courses.

**For detailed information see The Asphalt Handbook, Manual Series No. 4.*

TABLE 3

FULL-WIDTH DRAINAGE (Typical Cut Section)



The new Advanced Design Criteria recommend better surface and subsurface drainage. For better *surface* drainage full-width paving is recommended. On elevated grades the water should be directed to Asphalt spillways by means of Asphalt dykes or curbs constructed on the extreme outside edge of the shoulder.

For better *subsurface* drainage a depressed median is recommended wherever possible. If conditions make it mandatory to construct an elevated median, transverse drains should be connected with a longitudinal drain in the median deep enough to collect all ground water before it can find its way into the pavement structure.

A year after the Montana quake

—A look at highway damage and reconstruction

Obscured by human-interest aspects of the disaster, what happened to the state highways during the Montana earthquake of last August has never been reported in proper perspective. This is particularly true of the rebuilding during the year, and the long-range planning. At the request of WESTERN CONSTRUCTION, the Montana Highway Department presents in this article an official story of its work since the earthquake struck. Editor

SUNDAY, August 16, 1959, had been a big day for the Montana Highway Department. It participated in the dedication of a new bridge across the Missouri River between Billings and Malta, opening a new, shorter route between southern and northern Montana. Over 15,000 people had been in attendance. They had come to the isolated bridge site from all over the state by boat, car and plane to see the governor formally dedicate the bridge.

This day had marked the culmination of years of planning and work and of untiring efforts on the part of many people to complete this new link in the state's highway system.

In other parts of Montana, the rugged mountain scenery and its thousands of miles of trout fishing streams were providing enjoyment to thousands of families on their vacation. Yellowstone and Glacier parks were crammed with tourists and the highway commission's state park system was also filled to capacity. Southwestern Montana, particularly with its famed Madison and Gallatin rivers being among the world's most famous trout streams, was crowded with campers and fishermen. The Forest Service camping areas were filled to capacity along the Madison River and continued full the next day, with an influx of more campers the next day, trying to find a place to pitch their tents or park their trailers. Two Boy Scout troops were camped near Hebgen Lake.

Monday, August 16, was a normal day to the highway maintenance men at Bozeman, Duck

THE SLIDE in Madison Canyon taken from the plane of the Montana Highway Department two days after the earthquake. The upper edge of the slide is at elevation 8,400, and the floor of the canyon is about 5,700. The dry bed of the Madison River and Highway 287 appear at the lower right. An estimate placed the volume of the slide at 80,000,000 cu. yd.

FOUR MONTHS after the picture on the opposite page this air view of the canyon shows "Quake Lake" frozen over in the background, and the Madison River flowing in a channel cut through the slide.

Creek, Red Cliff and Ennis, doing patching work and keeping a close check on the highways so that tourists could enjoy the spectacular scenery in the area. Only one construction job was active in the area, with Naranche & Konda of Butte grading and improving a section of U.S. 191 past Elkhorn Creek, Taylor's Fork, in the heart of Montana's dude ranch country.

Little did any of these people know that within hours they would be witnesses to, or take part in a change so great in the earth's surface that no man has ever seen a greater performance in geologic evolution in so short a time.

A bright moon was shining at 11:30 p.m. that night, and the recreational areas along the Madison River, on Montana 287, were filled to capacity. At 11:37 the earth convulsed and trailers and cars rocked and pitched and tents swayed. Those people who happened to glance across the canyon saw a whole mountainside give way and start to slide.

It moved so rapidly and with such force that it continued up the opposite side of the canyon and the forefront then curled back on itself like a giant wave of water. Thousands of fir trees varying in height from 20 to 80 ft., which had covered the mountainside, in accompanying the slide, created such a wind that it literally blew the clothes off people in the immediate vicinity.

Displacement of one mile of the Madison River also added to the confusion in the area, as tons of water were hurled through the air. Also adding to the confusion were the hundreds of rocks and boulders rolling down the mountainside on the opposite side of the canyon. The slide completely covered a small crescent-shaped camping area and the edge of the slide barely touched the very popular Rock Creek recreational area.

Dust obscured the moon and static electricity created by the friction caused a brief but severe electrical storm. The people in the immediate area were convinced that the end of the world had come and for some twenty-nine persons it did.

Estimates of the dimensions of the slide vary somewhat, but it was nearly a mile in length, one-half mile in width, and from 200 to 900 ft. in height. It came from an entire mountainside, the top of which was about 8,400 ft. in elevation, and about an estimated 2,000 ft. above the river bed. It was estimated that it contained about 80,000,000 cu. yd. of material, composed of dolomite, granite, quartz, conglomerate, and a great deal of mica, which could have acted as a lubricant to the other material.

Meanwhile, feverish activity had commenced elsewhere. The Montana Highway Department mobilized all its available men and equipment for movement into the area to repair roads and bridges they knew were severely damaged. One contractor, Naranche & Konda, was working a short distance from Duck Creek, where the highway sectionman had reported extensive damage, and his equipment was prepared for immediate movement into the area. The state highway engineer had been alerted and the highway plane was readied for flight to reach the area as soon as it was light. It was flown by "Swede" Lindgren and carried Alex Stephenson, highway patrol supervisor and

MONTANA HIGHWAY DEPARTMENT

Personnel most directly concerned with operations following the earthquake.

FRED QUINNELL, JR., State Highway Engineer
RICHARD DUNDAS, District Engineer, Butte
GEORGE BARRETT, Division Engineer, Bozeman
AUSTIN BAILEY, Section Man, Duck Creek
BERT MOORE, Division Mechanic, Bozeman
RALPH WILCOS, Section Man, Ennis
"SWEDE" LINDGREN, Pilot, Helena
ART ZION, Communications Engineer, Helena
BILL BAWDEN, Maintenance Engineer, Helena
ED VOLLMER, Ass't Maintenance Engineer, Helena
GEORGE SIME, Information Coordinator, worked with Civil Defense

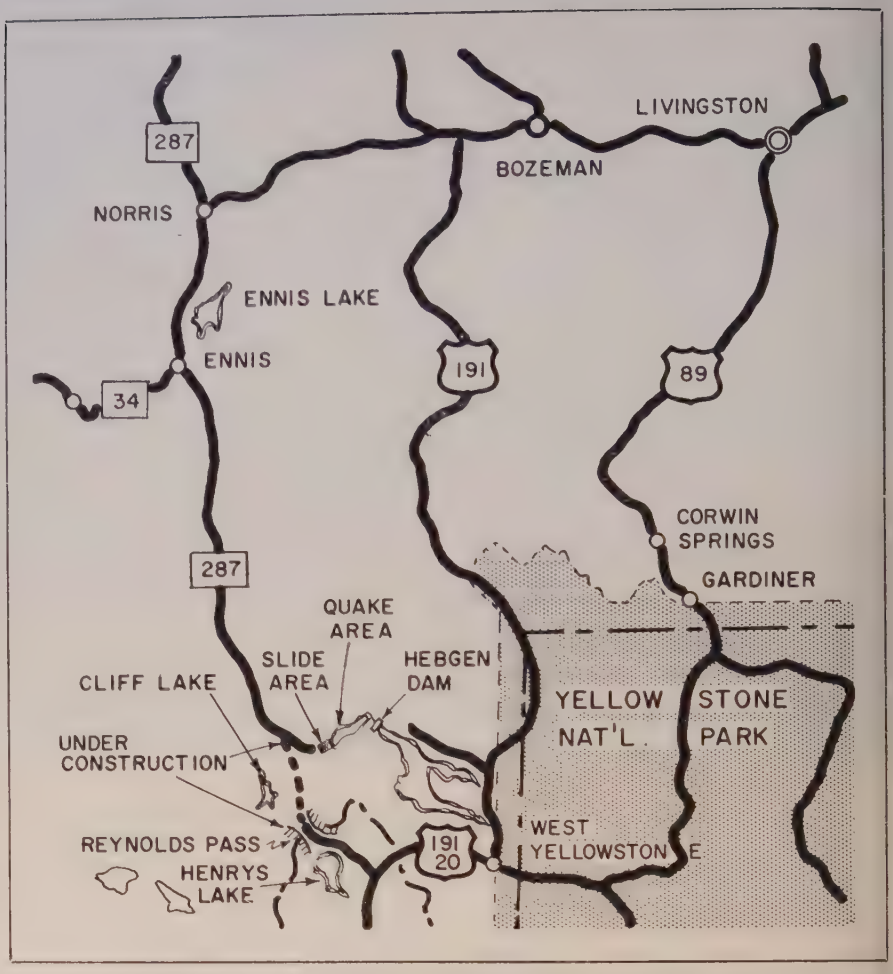
Art Zion, communications engineer.

Upon their arrival over the area, they immediately noted the plight of the people trapped between the slide and Hebgen Dam (see map). The extent of damage to the dam was unknown, and the plane radioed back to Helena for helicopters. Highway personnel working in civil defense headquarters passed the word along to Malmstrom Airforce Base. The Western region of OCDM, having the request, immediately advised that helicopters were on their way from Hill Airforce Base in Utah, Hamilton Field in California and McCloud Field in Washington. They arrived about 10:30 a.m. and immediately began evacuating the injured. They were taken to the air field in West Yellowstone where they were transferred to a DC-3 and moved to the hospital in Bozeman.

Offers of assistance from far and wide began to pour in. Sixth Army headquarters sent a representative to civil defense headquarters with offers of men and equipment. Montana National Guard, Coast Guard, Marine Corps, governors of surrounding states and premiers of neighboring provinces phoned to offer all assistance possible.

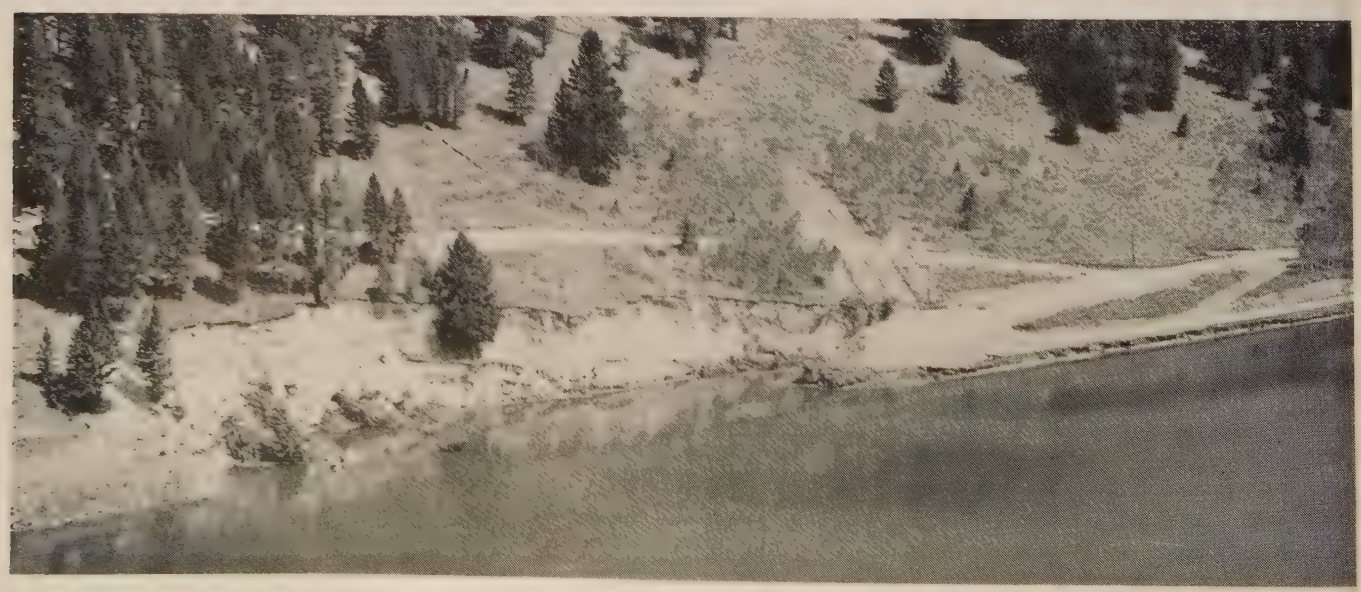
The doctors and nurses of Butte offered to go to the site; two mobile field hospitals in Wyoming were offered; saddle clubs of the state offered to go in by horseback. Smokejumpers from the Forest Service made a jump to aid the trapped people. The Montana Contractors', under their able Manager Jack Marlow, had a list of equipment available and "Plan Bulldozer" was ready to go into action.

After daylight, a rapid assessment of the damage to bridges and highways could be made from the air, and crews went to work to restore traffic. Bridges were shaken loose from their foundations, whole sections of highway were literally shaken to pieces, and several faults extended across the roads, several with displacements of 9 or 10 ft.



HIGHWAYS OF THE REGION, SHOWING NEW ALTERNATE ROUTE.

Along Hebgen Lake whole sections of highway, some as long as ¼ mi., had dropped into the lake. New pioneer roads had to be built on a steep mountainside to by-pass these areas along the north shore for a distance of about 10 mi. Below the slide, big boulders, some weighing in excess of 30 tons, had to be removed from the highway. They were too large for tractors, and had



A SECTION of Highway 287 slid into Lake Hebgen at this location. The view shows one of the emergency roads built the first day by the highway department to evacuate the 300 people marooned between Hebgen Lake and the slide.

ELDED WIRE FABRIC: CF&I-Clinton Welded ire Fabric gives concrete a thousand defense nes against the spreading of cracks, assuring nooth, trouble-free road surfaces. Installation easy. Clinton Welded Wire Fabric is also eal for reinforcing concrete pipes used for ewers, culverts and drains.

GRADER BLADES: CF&I Grader Blades and Cutting Edges are made for all types of earth moving and snow removal equipment. They are hot-rolled from special analysis, new billet open hearth steel . . . assuring extra toughness and abrasion resistance. This means longer blade life and less downtime for you.

WIRE ROPE: CF&I-Wickwire has now developed a superior, premium wire rope—Double Gray®-X. Advanced steelmaking and wire drawing techniques provide Double Gray-X with longer life for all types of construction equipment. In addition, this new rope has a 15% higher breaking strength than the catalog breaking strength of an improved plow steel rope with IWRC. Double Gray-X is available in a wide choice of constructions and sizes. CF&I-Wickwire also manufactures a complete line of slings.

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HIGHWAY 287 along the reservoir behind Hebgen Dam. Sections of highway were literally shaken to pieces, and several faults showed displacements of 9 to 10 ft.

to be shot for effective handling.

New approaches to bridges were rapidly constructed and roadways repaired. By noon traffic on U.S. No. 191 was possible on a limited scale.

Crews operating the dozers and blades in the area along Hebgen Lake finished building emergency 1-lane roads to Hebgen Dam about 6:00 p.m. It was originally estimated that the job would take 36 hr. but the men did it in 12 hr.

A caravan of some 70 cars and 250 people was then started toward Bozeman for food and rest. Montana State College made one whole dormitory available, and these refugees were advised to stay until all were rested up and ready to travel again.

After all people had been evacuated from the area, highway crews went to work to put the highways in better shape than the emergency repairs offered. A by-pass for Highway 287 through Madison Canyon was needed, and a Forest Service road over Raynolds Pass was so designated.

The Sunday following the earthquake, a delegation of senators and representatives, together with representatives of all Federal agencies involved, flew to Bozeman where they were met by Governor Aronson and Highway Engineer Quinnell, Regional Forester Tibbe, Major General Barney of the Corps of Engineers, Superintendent Lem Garrison of Yellowstone Park and Montana Power Company officials. The group was taken by helicopter over the damaged area and all briefed at a public meeting in West Yellowstone. They came to obtain an on-the-spot report and to see for themselves the extent of the damage. This was done in case Federal legislation was needed to help restore the area.

Roads, dams, parks, small businesses and Forest Service areas were all involved and possibly would need special legislation or application of seldom used emergency funds for restoration. At the meeting held in Governor Aronson's office the following week an assessment of the damage revealed the following: 40 mi. of highway either totally or partially damaged with an estimated cost of $6,000,000 to repair; 56.1 mi. of Forest Service roads and trails at $393,000; 83 campsites at $139,440; 42 schools were damaged with total damage not assessed. In addition, many farm buildings and businesses suffered extensive damage.

The Montana Highway Department was assigned the pleasant duty of escorting the Congressional delegation from West Yellowstone back to the airport at Bozeman. The highway engineers must have done a thorough job of telling the highway story to the group because shortly after the men returned to Washington the 1959 Highway Act was passed.

One of the inequities of the disaster was that states could only obtain 50-50 matching funds for the separation of highways, even though the road was on the forest highway system, and had been built by the Bureau of Public Roads at 100% use of Federal funds. If this law was to remain in effect, the repair of the quake damaged roads could have taken considerable time as Montana's highway funds are quite limited.

MAJOR EQUIPMENT

Nine contractors furnished equipment for emergency work on the big slide as Plan Bulldozer was invoked by the Corps of Engineers. Here is a list of equipment furnished by each contractor.

F & S CONSTRUCTION CO., BUTTE
- 5 Cat. D-8's with dozer blades
- 1 Bucyrus-Erie 51-B 2½-yd. shovel
- 8 Mack 20-ton rear-dump trucks

KIELY CONSTRUCTION CO., BUTTE
- 4 Cat. D-8's with dozer blades
- 1 Northwest 80-D 2½-yd. shovel
- 1 Euclid 20-ton rear-dump truck

PETER KIEWIT SONS' CO., IDAHO FALLS
- 1 Northwest 80-D 2½-yd. shovel
- 3 Euclid 20-ton rear-dump trucks

LONG CONSTRUCTION CO., BILLINGS
- 4 Cat. D-8's with dozer blades
- 1 Cat. No. 14 motor grader
- 1 Cat. front-end loader

ROBERTSON & CAVE, INC., GREAT FALLS
- 2 Cat. D-8's with dozer blades

ZOOK BROTHERS, CUT BANK
- 2 Cat. D-8's with dozer blades
- 2 Cat. D-9's with dozer blades

K. I. BREWER, HELENA
- 1 Cat. with dozer blade

GETTER TRUCKING CORP., CUT BANK
- 1 Cat. D-8 with dozer blade

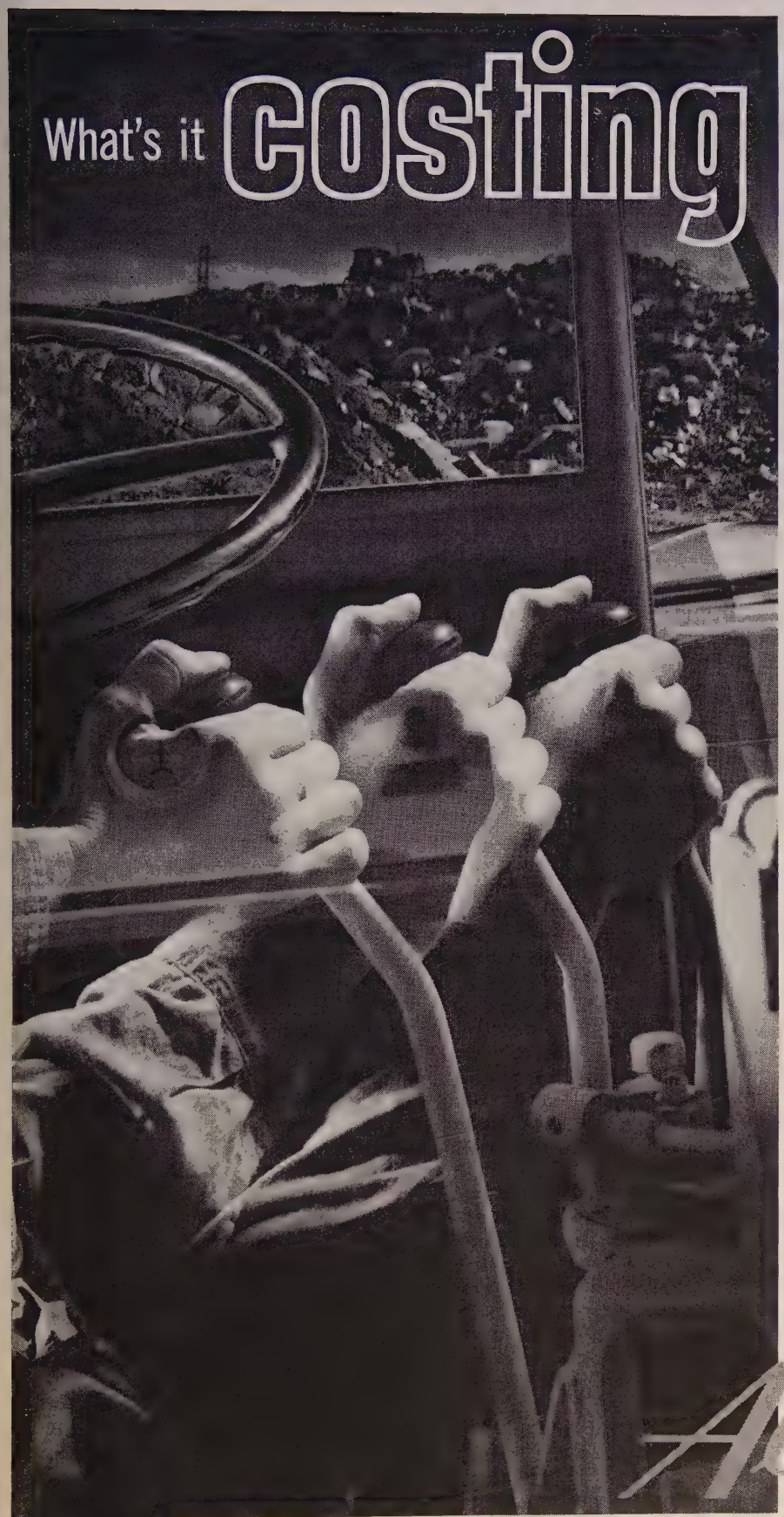
HELENA SAND & GRAVEL CO., HELENA
- 1 Allis-Chalmers HD-20 tractor with dozer blade

The Congressional delegation made the trip for two purposes: (1) to see the actual damage and (2) to be prepared to speak from firsthand knowledge if any Federal laws were to be used or should possible legislation pertaining to the situation be necessary.

One of the sections of the 1959 Highway Act corrects the inequity and specifies that roads built with 100% Federal funds shall be repaired and reconstructed with 100% Federal money.

As the water kept building up behind the slide another problem began to develop. It was feared that the new "Quake Lake" would pose a threat to towns down the Madison River if it should wash the slide out. It was decided to lower a portion of the slide to provide an emergency spillway. This would reduce the amount of water in the lake and provide a channel. Trees and fine material were removed from the proposed channel and courser rock was moved from the upper side of the slide into the channel.

The Corps of Engineers was in charge of this operation and used contractors' equipment from the surrounding area. This equipment



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The reason? TORQMATIC is controlled by a single, small shift lever. There's no leg-tiring disconnect clutch. TORQMATIC *automatically* adjusts engine power output and speed to load or terrain changes, absorbing harmful and expensive shock loads. It provides a steady, increasing torque to the wheels for a smooth standing start.

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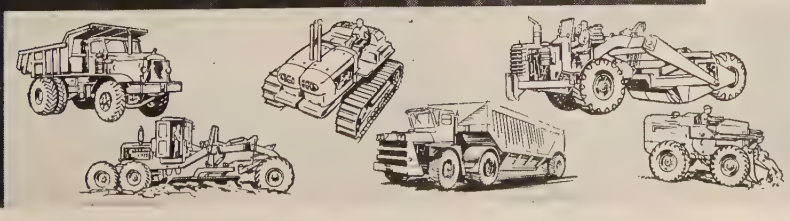
Allison TORQMATIC



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THE MODERN DRIVE FOR MODERN EQUIPMENT

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was also utilized for "Plan Bulldozer" – the first time that this emergency plan of the Associated General Contractors' has been put into effect in the United States.

As the waters from Quake Lake began to run over the slide, it became evident that the washing would be more rapid than expected, and a decision was made to lower the spillway an additional 30 ft. This job was completed in October.

"Plan Bulldozer" is a plan worked out by the Associated General Contractors of America to render aid with men and machines if and when disaster strikes. It is correlated with civil defense and an inventory of all heavy equipment is kept up-to-date with the location of each machine on file with the executive secretary of each state chapter.

Equipment moved in

Much of the equipment was pressed into service on the slide area shortly after the earthquake. When the Corps of Engineers decided to clean out the spillway, it was kept on the job. A quantity of equipment came from Butte, which was beginning to suffer from the effects of a strike in the copper mines, and the large 6-yd. dragline used in the open pit copper mine, owned by The Anaconda Co., was dismantled, moved to the slide and was operating again within 24 hr.

Altogether about fifty pieces of heavy equipment were pressed into use to deepen the spillway and to line it with heavy rock that would not be subject to washing. There were twenty D8s and D9s, three 2½-yard shovels, one 6-yard dragline, one 4-yard dragline, one 2½-yard dragline and fifteen Euclids and Mack end-dump trucks working on the spillway.

About the middle of September, the new Quake Lake had risen so that it commenced to run over the new spillway and though it was difficult to operate in the fast flowing water, both men and equipment kept on the job. It was soon apparent, however, that the lower end of the spillway would wash much more severely than desired, and it was deepened across the slide by another 30 ft. Work continued until the Madison River was pretty well channelled across the slide. This action reduced erosion on the slide and also lowered the amount of water in Quake Lake making the area at the upper end of the new lake accessible for logging operations. It also saved some resorts which would have suffered extensive damage from being inundated.

In all, the Montana contractors estimated that a total of 1,000,000 yd. of material were moved in the operation, some of it having to be moved about 10 mi. to get it to the opposite side of the Madison River, which had risen considerably from the draining of Hebgen Lake. About 6 mi. of access roads were constructed in the process. The total cost of the operation, exclusive of engineering, was $1,200,000 and was completed about the middle of October.

Planning a better alternate

In September the Bureau of Public Roads, the Forest Service and the Montana Highway Department held a joint meeting to determine their course of action in the damaged area and the following priority of reconstruction was decided upon: (1) Raynolds Pass road would be constructed to primary standards and the work should be done as quickly as possible, (2) West Yellowstone to Duck Creek on U.S. 191 should be reconstructed as soon as the work could be accomplished, and (3) the road from the Duck Creek "Y" down the side of Hebgen Lake and on through the Madison Canyon would be rebuilt, but, *after* the area is stabilized and slide damage from loose material would not be a factor.

Aerial surveys have been completed on the Raynolds Pass by-pass and from West Yellowstone to Duck Creek. The design is complete on Raynolds Pass and right-of-way maps have been turned over to the Montana and Idaho highway departments for procurement of the right-of-way. As soon as it is obtained the Bureau of Public Roads will award a contract for the full 17.4 mi. to complete the highway from the Cliff Lake turnoff on Montana 287 to a connection with U.S. 191 near Henry's Lake.

The Bureau of Public Roads plans on getting the portion of 191 from West Yellowstone to Duck Creek under construction later this year. Possibly, during the later portion of fiscal 1961, a contract can be let for a portion of the road from Duck Creek "Y" toward Hebgen Lake, to be followed in succeeding years with contracts extending on down Madison Canyon.

Extensive work was carried on during the winter months by the Montana Power Company in repairing Hebgen Dam. The dam was cracked, the spillway suffered extensive damage, and the dam itself was tilted with the entire lake bed. One side raised approximately 9 ft., while the other side dropped 9 ft. The repairs were made during the winter, while Hebgen Lake is drained as far as possible, and normal operations were scheduled for spring.

Plans for recreation

The Forest Service made extensive plans for 1960 and declared the area in Gallatin National Forest a "geologic area." They will have ready by the time the tourist season begins, a parking area on top of the slide, signs, trails, turnarounds, toilets and picnic tables so that people will be able to view this tremendous slide and the lake behind it. They also plan on constructing a parking area for trailers near the mouth of Madison Canyon so that people pulling trailers can have a place to park them and to go on up into the geologic area.

In Yellowstone Park preparations have also been made to add the changes made by the quake to the list of nature's wonders, and many new sights await the park visitor this summer.

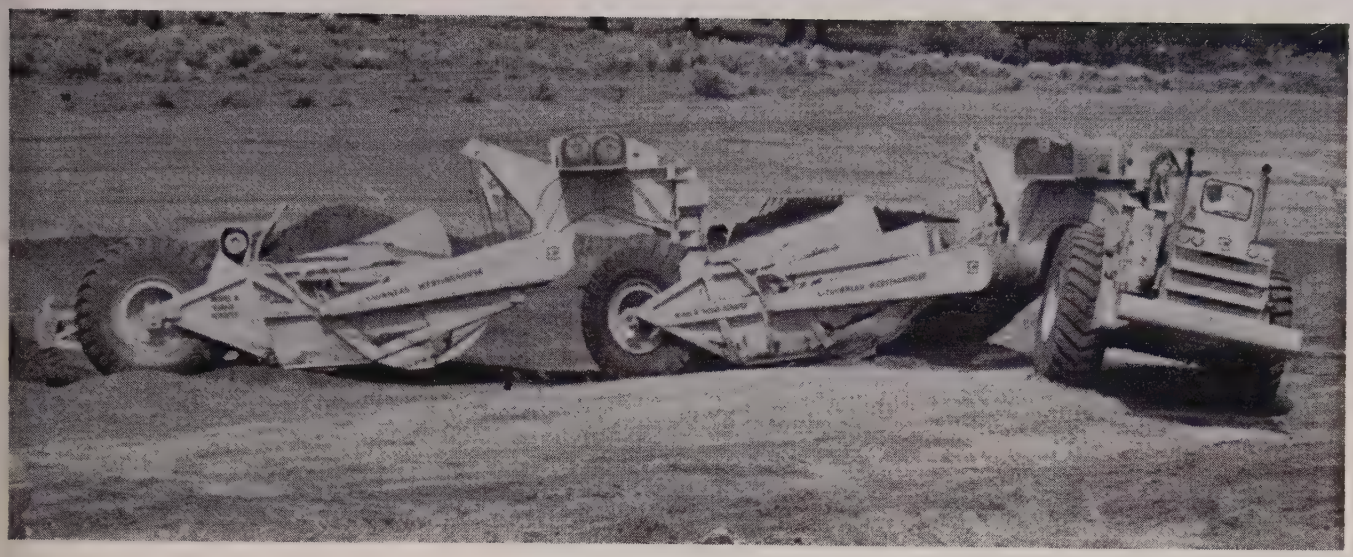
The Bureau of Public Roads and both the Idaho and Montana highway departments are going ahead at full speed to get traffic in vacationland back to normal and hope that it will be a long time before an occurrence of such a tragic and far reaching disaster happens again.

Personnel

The emergency work along the Madison River was named "Operation Earthquake" by the Corps of Engineers. It is under the general direction of Lt. Col. Walter W. Hogrefe, Garrison District Engineer. Chief of party is H. F. Michel, chief of the engineering division for the District. Construction chief is Harlan G. Hutchins, chief of the district construction division; he is assisted by Robert Parke.

Wendell McNeil of Peter Kiewit Sons' Co. helped to correlate the work at the job site and Chat Oliver of Long Construction Co. represented the Associated General Contractors in the field office at West Yellowstone.

Topping the Montana Power Co. engineering staff are: R. R. Rend, superintendent of power; Harry Cochrane, chief engineer; Glen Jones, in charge of Hebgen Dam site.



Tandem scrapers hit the road

Production model double scrapers tackle their first highway project near Susanville, Calif. Units are LeTourneau-Westinghouse Model B scrapers with a total capacity of 46 struck yards. Contractor is Fredrickson and Watson.

PRODUCTION model tandem scrapers made their bow in Western highway work this spring in the mountains of northeastern California where Fredrickson & Watson Construction Co. is building 11.9 mi. of two-lane asphalt freeway along the western edge of Honey Lake. Tandems used on the job are two LeTourneau-Westinghouse Model B Tournapull scrapers powered by 12-cylinder GM V-71 diesels of 435 hp.

The job is a California Division of Highways project realigning US395. Starting about 10 mi. south of Susanville, the new road runs through relative flat terrain at the edge of the Honey Lake basin, cutting across irrigated pastures and sagebrush flats. The contract was awarded to Fredrickson & Watson of Oakland on a bid of $938,449, low of 11 bidders. The work includes 473,000 cu. yd. roadway excavation, installation of about 9,000 ft. of culvert ranging from 8 in. to 120-in. diameter (primarily 24 in.), construction of a 32-ft. wide roadbed with a 6-in. lift of cement-treated base and 3 in. of asphaltic concrete. Contract was awarded April 1, and is set for completion in September.

Cuts and fills are relatively shallow, and the material is mainly fine decomposed granite. Earth-moving was expected to involve easy dozing and ripping, and fairly long hauls (total of 7,400,000 sta. yd. overhaul).

The contractor ordered two L-W Model B tandem rigs through Blakemore Equipment Co. of Oakland. These were assembled by the distributor, who installed the second scraper hitch, electrical connections and additional electrical control panel. The units were shipped to the job in mid-April.

The machines were operated as singles for a brief time so the contractor could study performance. Then the second scraper was attached on one machine. Following two days' testing, the second double unit was put into operation.

During their first 100 hours on the job, the two tandems got a good sample of widely divergent working conditions. During the first week, they moved about 3,400 cu. yd. at fairly low cost, according to preliminary estimate.

On the next section, however, conditions changed radically. In the first big cut of the job, the contractor encountered a hard core of blast rock beneath a deep layer of soft material. As the cut was developed, fine material sloughed downhill in the direction the units were loading, and it became necessary to reverse direction and load the tandems uphill. Using one International TD24 for push loading, the tandems were a long time filling up in the loose footing.

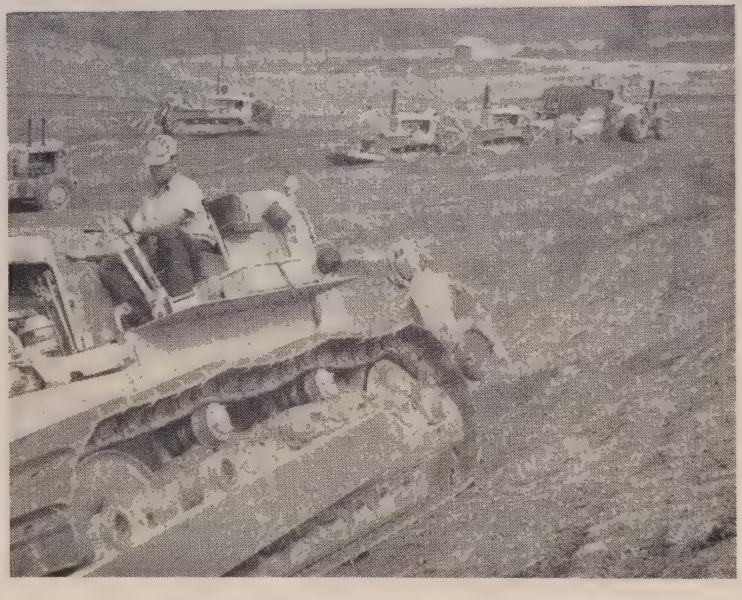
The contractor pointed out that this early experience was too limited to offer a basis of judging the machines. He noted that they are relatively easy to operate and require little in the way of special techniques. In loading, the front unit is filled first to provide additional traction for the driving wheels. Loading of the rear unit overlaps that of the first to avoid a skip in the cut. In dumping, the procedure is reversed, with the rear bowl unloaded first, followed by the forward unit which starts unloading when the rear scraper is about 70% empty.

The contractor chose the 12-mi. Honey Lake job to introduce tandem earthmovers since it is an ideal site to test their performance on long hauls. He hopes to show that the operating economies of a single driver and single power plant handling two scraper units will pay off in longer hauls. (Earlier L-W tandem rigs have been used primarily in short-haul subdivision grading.)

Pennzoil's Heavy Duty

ZOILDEEZ

SERIES 3



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Branches and Distributors to serve you in principal western state cities.

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The tandem rig is made up of an L-W two-axle Tournapull B with an identical second scraper attached by a universal joint to the push frame of the leading scraper. All scraper functions are operated by electric motors driving cable sheaves and are powered by a generator connected directly to the engine. Powering the second scraper is a relatively simple matter of providing additional electric cables with plug-in connections at the coupling. A second switch panel to control the rear scraper is installed on the dash.

Larger size tires, 33.5-33, 38 ply, compared to 27-33, 24 ply are installed on the center wheels, but there is no modification of axle or bearings. Powered by a GM 12V-71 with a torque of 1,210 ft. lb. at 1,200 rpm., the tractor has a mechanical power train through a Fuller 1-5550 transmission with L-W high and low range. Steering is electric.

The double unit is about 60 ft. long, and sells for about $80,000.

Tandem rigs use standard scraper bowls, each rated at 23-cu. yd. struck capacity. Bowl has a 10-ft. width and a 7-ft. apron opening. Scrapers are used without modifications or sideboards to preserve their easy-loading characteristics.

Original L-W tandem units were developed by Blakemore Equipmentt Co. nearly a year ago when they put two smaller Model C scrapers together for a subdivision grading contractor. (*Western Construction,* November 1959.) The prototype was so successful that the manufacturer now produces tandem rigs as a regular part of the line.

Tandems cost about 25% more than the conventional single scraper and offer double capacity. Advantages cited for the double rig include faster loading time because the push tractor does not have to move into position to load the second bowl; and economy of operation with only one driver and one power plant for two loads.

In highway operations tandems were expected to complete two cycles to three for a single unit to show significant cost reduction in earth-moving. It was believed that the double rigs could be used to best advantage on a favorable grade over fairly short hauls, since the second load would cut their haul speed. The distributor noted that early experience on the Honey Lake job, however, indicated a wider operating horizon than was originally expected.

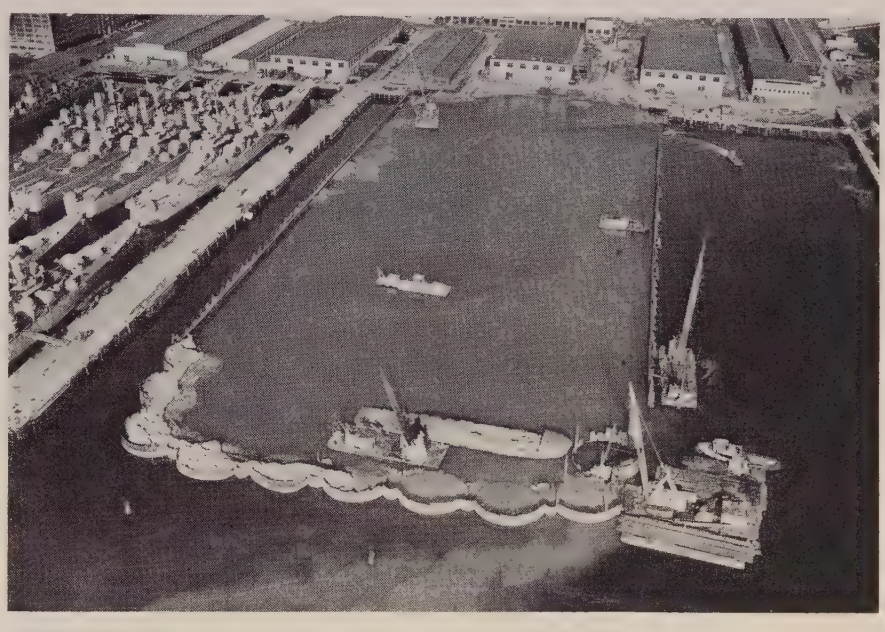
The road job is moving rapidly despite water and rock problems. The contractor is using an International TD 24 pulling a ripper frame to break the softer rock strata, while the tougher material below is blasted. Three Caterpillar DW20's are used to move the shot rock, loaded by another TD 24.

Water supply was developed by the contractor, who dug three sumps along the job's 12-mile length. Honey Lake, a brackish alkali lake, was passed over as a water source since it is only about a foot deep and local residents say a strong wind will blow half the water out of the lake. Limited stream flow in the area has long ago been claimed by local irrigation districts.

Personnel

For the contractor, Robert L. Brodie is superintendent; Jim Owen, grade foreman; M. Perry, master mechanic; and L. E. McKenzie, office manager.

California Division of Highways resident engineer is Ray Huck. H. S. Miles is District II engineer, and R. J. Felton, construction engineer.



Deep-water cofferdam built with 100-ft. piling

AN UNUSUAL deep-water cofferdam nearing completion at Puget Sound Naval Shipyard, Bremerton, Wash., requires some of the longest steel sheet piling ever used in construction. Specially fabricated and furnished on a rental basis from the Los Angeles office of L. B. Foster Co., the MP-101 sheet piles are nearly 100 ft. long.

When dewatered, the cofferdam will provide a site for construction of a new carrier-repair drydock. The contractor is Manson-Jones-Perini-Osberg, a joint venture of Manson Construction & Engineering Co.; J. A. Jones Construction Co.; Perini Corp.; and Osberg Construction Co.

The huge cofferdam extends 1,200 ft. into the Sound, terminating in 60 ft. of water. Sides of the cofferdam consist of earth dikes containing a 90-ft.-deep cut-off wall of Z-type sheet piling. The end bulkhead consists of eleven 60-ft. diameter sheet-pile cells.

Mid-welded by Foster into long lengths, piling was shipped to the site on railroad cars. It required three cars to support each 100-ft. bundle.

With a fleet of scow derricks, the contractor built the difficult cellular end section of the cofferdam by first driving H-pile spuds to position a 10-ft. deep floating steel-frame template. Two 15-ft. high half-cell extensions were placed atop the lower template to provide a total of 40 ft. of vertical support during setting and driving of the longest piling.

A NEW and DIFFEREN

The first machine ever designed for YOUR hauling problems

You can tell just by *looking* at an LW Haulpak® that it's quite unlike any other off-road hauler. Its bowl, for instance, has a distinctive "V" shape; its wheelbase is obviously shorter; it has clean lines, with none of the "hung on" tanks and cleaners so common to other haulers. Yet, these *noticeable* characteristics only *begin* to tell the story. The *fact* is that Haulpak is *completely* different from other off-road haulers!

Behind these differences are two facts: (1) Haulpak is built by a pioneer in heavy-duty *earthmoving* equipment; not by an automotive manufacturer . . . and (2) Haulpak is *designed*, from the ground up, *as an off-road hauler;* it is *not* just a beefed-up highway truck!

Haulpak differences are not "gimmicks", added on for the sake of being different. Everything you see in Haulpak has been carefully engineered with one objective in mind: to give you lower ton-mile costs on your off-road hauling.

Check the exclusive Haulpak advantages described in these pages. Then arrange with your LeTourneau-Westinghouse Distributor to personally inspect and test one of these high-production, low-cost machines. You'll see first-hand how LW Haulpak design can pay off for you.

How LW Haulpak pays off for **Utah Construction & Mining Co.**

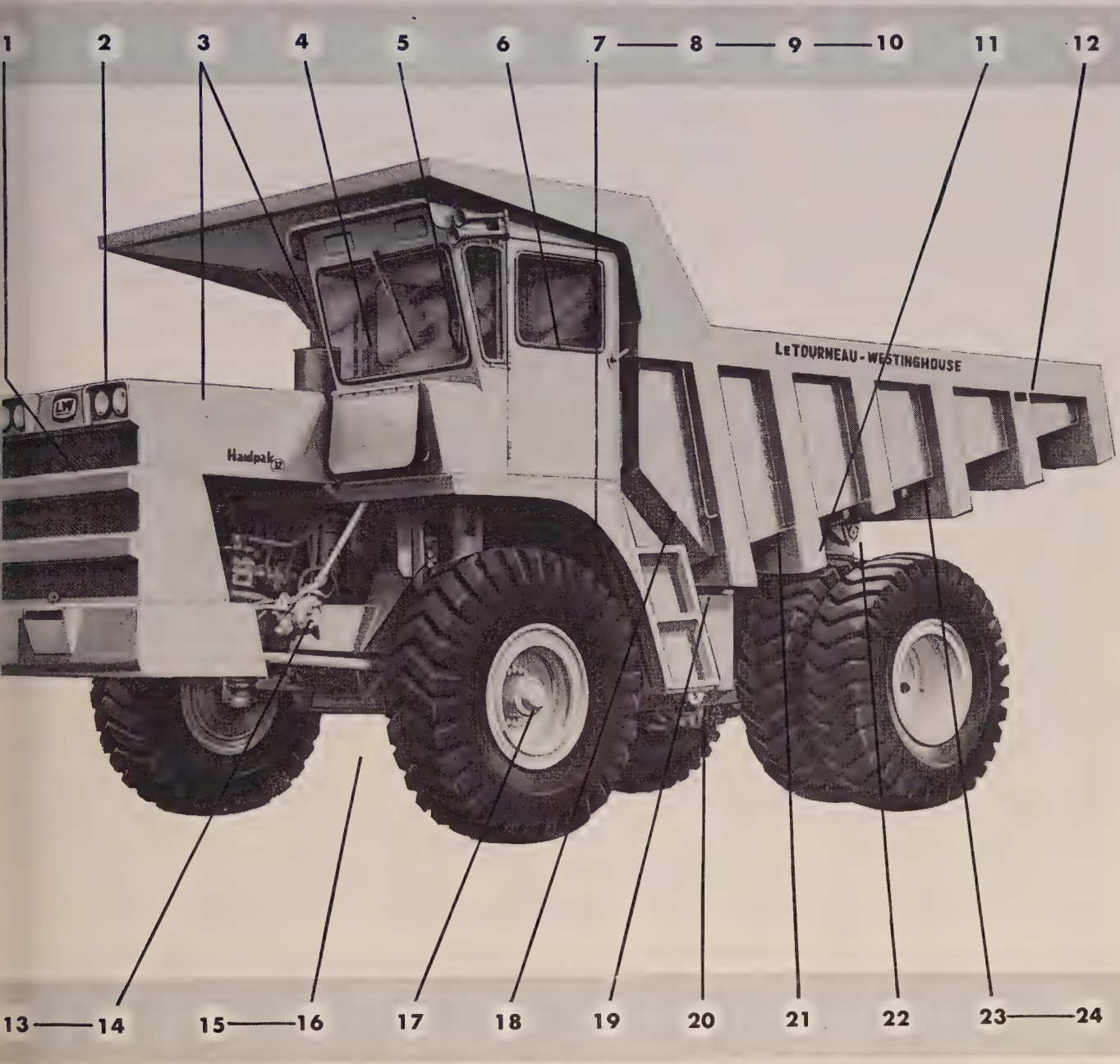
Accurate records have been kept on an LW 32 Haulpak working for Utah Construction & Mining Co., Cedar City, Utah. When these records were last tabulated, the unit had been in use 10½ months. These are the performance figures:

JOB REPORT

Scheduled hours of operation	2,681
Hours Haulpak worked	2,211
Hours lost due to Haulpak downtime	250
Hours lost for other reasons than Haulpak being down	220
Operating efficiency $\frac{2,211 + 220}{2,681}$	90.7%
Best month's operating efficiency (except Aug. '58 which was 100%) was in November, 1958	98.0%
Hours of overburden haul	approx. 1,665
Total bank cubic yards overburden hauled	206,164
Total loads hauled	13,744
Bank yards overburden hauled per load	average 15
Average loads per hour (conditions: 2,000 ft. one way, grades from + 8% to −8%)	8.25
Hours of iron ore haul	approx. 546
Total tons, ore hauled	80,266
Total loads of ore hauled	2,112
Tons of ore hauled per load	average 38.0
Average loads hauled per hour (conditions: 10,000 ft. one way, grades from + 5% to −5%)	average 3.87

How does your availability and production compare?

t lower your costs . . . boost your output



See "Revolution on Wheels"...new color film on Haulpak...Ask your LW Distributor

As a specialist in earthmoving and off-road hauling, your LW Distributor can help solve your equipment problems. You'll find him and his staff interested in helping you in all phases of your business . . . from production problems, to machine selection, to financing. Put his experience and know-how to work for *you*. Ask for full details on LW Haulpak trucks. See his color film, "Revolution on Wheels".

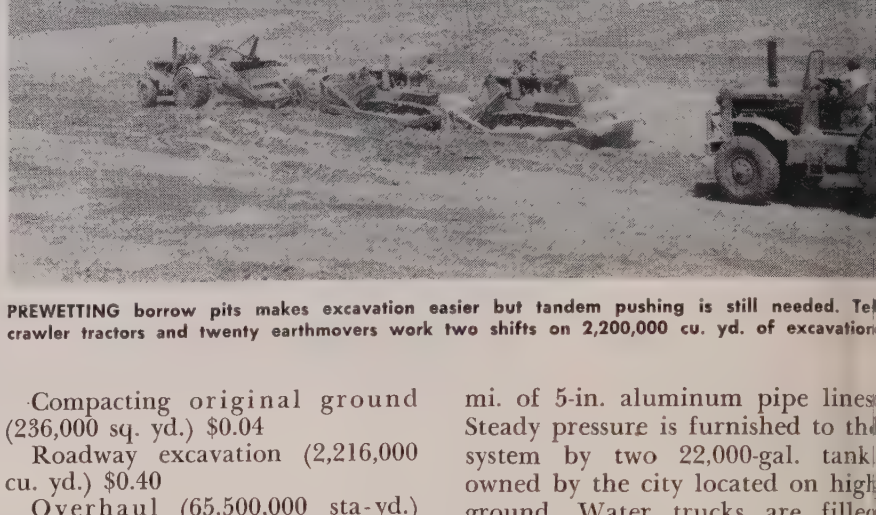
HP-2255-G-4

AVAILABLE AT YOUR LW DISTRIBUTOR:

LAKEMORE EQUIPMENT COMPANY...Oakland & Sacramento
UCKHORN EQUIPMENT COMPANY.....Cheyenne
ONTRACTORS' EQUIPMENT & SUPPLY CO......Albuquerque
ROOK COMPANY.....Los Angeles, Bakersfield & San Diego
-K MACHINERY COMPANY.....Boise
HLAND DIESEL & MACHINERY CO......Spokane
LOGGERS & CONTRACTORS MACHY. CO.....Portland & Eugene
PIONEER EQUIPMENT COMPANY OF NEVADA, INC......Reno
ROAD MACHINERY CO......Phoenix & Tucson
ROCKY MOUNTAIN MACHINERY CO......Salt Lake City
TOOLE CORPORATION.....Seattle
TUDOR EQUIPMENT CO......Denver
WESTERN CONSTRUCTION EQUIPMENT CO....Billings & Great Falls

Building a freeway in the desert

Contractor faces heat, wind, dust, and scarcity of water on 9.7-mi. Mojave Desert project.



PREWETTING borrow pits makes excavation easier but tandem pushing is still needed. Tel crawler tractors and twenty earthmovers work two shifts on 2,200,000 cu. yd. of excavation

THE MOJAVE DESERT has become a showcase for the large economy size freeway project. Last year saw the completion of Frederickson & Kasler's 29.3-mi. stretch between Victorville and Barstow and the beginning of a 9.7-mi. section past the city of Barstow, with Gordon H. Ball and Ball & Simpson as the joint venture contractor. In April of this year a contract for 25 mi. of freeway near Baker on Interstate 15 was awarded to a joint venture of Gordon H. Ball, Ball & Simpson, and E. L. Yeager Co. Not only do these three jobs rank among the longest freeway projects ever let, they are located in a region where dust, blowing sand, heat, and scarcity of water make construction work difficult.

Bids for the Barstow by-pass were opened in Los Angeles in November 1959. Low bid of $5,647,082 was submitted by Gordon H. Ball, Gordon H. Ball, Inc. and Ball & Simpson of Berkeley, Calif. The project involves building 9.7 mi. of divided 4-lane freeway with two 12-ft. driving lanes in each direction and a 10-ft. shoulder on the outside driving lane, and 14 bridges. The longest bridge crosses the Mojave River and will consist of two parallel concrete girder type structures, each 1,006 ft. long. The other 13 bridges are in the 200-300 ft. long range. Where practical a 60-ft. dividing strip will separate the eastbound and westbound roadbeds. Included in the project are illuminated signs and highway lighting at the freeway-off-ramps, and the resurfacing of existing highways in the city of Barstow.

Major work items

Below is a list of main items of work with the contractor's bid price:

Clearing and grubbing (lump sum) $300,000

Developing water and furnishing water equipment (lump sum) $100,000

Thousand gallon applying water (116,000) $1.56

Compacting original ground (236,000 sq. yd.) $0.04

Roadway excavation (2,216,000 cu. yd.) $0.40

Overhaul (65,500,000 sta-yd.) $0.002

Imported sub-base material (4,800 tons) $0.80

Imported base material (300,000 tons) $0.80

Mixing, spreading, and compacting cement-treated base (375,000 sq. yd.) $0.16

Portland cement (14,300 bbls.) $3.80

Paving asphalt (6,590 tons) $23.61

Mineral aggregate-type B plant-mixed surfacing (119,000 tons) $2.90

Mineral aggregate open-graded plant-mixed surfacing (6,600 tons) $2.90

Other major quantities on the project include 22,945 cu. yd. of Class A bridge concrete; 500 cu. yd. of airblown mortar; 230,000 lb. reinforcing bars; 4,847,000 lb. of bridge reinforcing steel; 7,900 sq. yd. mesh reinforcement; 1,491,000 lb. steel girders; and 14,485 lin. ft. concrete piling. There is roughly 10,000 lin. ft. of pipe of various sizes of both reinforced concrete and corrugated steel.

Supplying water to the project is the responsibility of the subcontractor, Water Engineering Co., Inc. of Phoenix. The water supply problem at this particular location in the desert is considerably reduced because of the nearness of the Mojave River and the city of Barstow. The east end of the project is supplied from a well in the river bed. (There rarely is surface water in the Mojave River). For the west end of the job, water is taken from the city water supply.

Water is carried to the various borrow and fill areas through 10 mi. of 5-in. aluminum pipe lines. Steady pressure is furnished to the system by two 22,000-gal. tanks owned by the city located on high ground. Water trucks are filled from two 8,000-gal. tanks. Extensive pre-wetting of the borrow pits is carried out to raise the natural moisture content of the soil from about 3% to the optimum of about 11% in the fill. Although pre-wetting involves setting and resetting sprinklers and adding weight to the material which is moved it is still an economical procedure. The material is easier to excavate, it boils into the scraper for bigger loads, rippers and cutting edges last longer, and only two water trucks are needed on the fill. These advantages far outweigh the disadvantages.

Earthmoving operations

The earthmoving is being handled by a dozen Caterpillar DW 20's. The bowls of the scraper have been lengthened about 2 ft. and raised about 18 in. by the Peterson Tractor Co. The "stretched" capacity is about 27 cu. yd. struck and 34 cu. yd. heaped. In order that this relatively small earthmoving fleet can complete the more than 65,000,000 sta. yd. of overhaul in time to complete the job in the 360 allowable working days, the contractor has gone to two shifts. Another reason for finishing the earth work as quickly as possible is that water will become progressively harder to come by as the dry summer season advances.

Most of the excavation work on the project can be handled by scrapers after ripping, but about one-fourth (500,000 cu. yd.) will

have to be shot. Drilling and blasting has been subbed to L. S. Hawley, general contractor from Azusa. Hawley is using a Joy TM 500 for 4-in. holes and an Ingersoll-Rand Crawl-IR and a Joy TM 450 for 3-in. holes. Some holes will be sunk 76 ft.

The deepest cut on the project is 88 ft. which will be drilled and blasted in two lifts.

Brunner & Lay steel with rope threads is being used by all the drilling rigs, with Joy and Ingersoll-Rand carbide insert bits. Drilling is done without water, except when the holes are begun, when water is poured from a bucket to help consolidate the material around the opening of the hole.

Ammonium nitrate blasting

A prepared ammonium nitrate (Hercules Dynatex) is used as a blasting agent and is about one-third more powerful than straight fertilizer grade nitrate. Hawley's superintendent, "Chuck" Hunt, prefers this more powerful nitrate over fertilizer grade because it permits more power to be placed at the bottom of the hole, where it does the most good. By using 10-12 ft. of stemming, throw is held to a minimum. About 1.0 lb. of nitrate per cu. yd. is being used. The nitrate is stored on the project in portable magazines.

Drilling is done for 5 or 6 weeks without shooting, in order that powder men need not be kept on the job at all times. Shots with up to 30 tons of explosives are planned.

In loading, dynamite is tied to Primacord and lowered into the hole, after which nitrate is poured in. The dynamite sticks are spaced on the Primacord so that the total load consists of about 90% Dynatex and 10% dynamite. Primacord is used rather than electric blasting caps because the desert country is notorious for its high level of static electricity.

Dust problem

Dust, sand, and constant winds of 20-40 mph. make life miserable for everyone on the project, especially the mechanics. Dry air filters are used extensively and all filters and breathers must be checked frequently. Whenever any dismantling is necessary the removed parts must be wrapped in canvas or they would quickly become covered with grit. The dust and wind conditions have several times become so bad that visibility was cut to less than 50 yd. and the entire project had to shut down.

TWIN BRIDGES 1,006 ft. long carry roadway across Mojave River, which flows underground most of the time. Steel forms for piers were originally built for channel lining work.

VERSATILE RIG is this Michigan 175A front-end loader, shown on structural backfill clean-up. Wide bucket permits it to work flush against reinforced concrete cast-in-place culvert.

Major equipment

- 1 P&H 25-ton truck crane
- 1 Michigan 175A loader
- 5 Caterpillar No. 12 graders
- 4 Caterpillar D8H tractors
- 3 Caterpillar D8 tractors
- 3 Caterpillar D9 tractors
- 12 Caterpillar DW20 scrapers
- 1 Southwest 5,000-gal. water truck
- 3 Euclid 6,000-gal. water wagons
- 1 Ingersoll-Rand drill
- 1 Joy TM 500 drill
- 1 Joy TM 450 drill
- 3 Ingersoll-Rand 600 compressors
- 8 Caterpiller DW15 bottom-dumps

Personnel

Resident engineer on the project for the Division of Highways is Kent Stone. Resident bridge engineer is D. W. Alden, assisted by Stan Griffith. Structures and grade inspectors are W. DeLamere and R. L. Bocanegra.

For the contractor, Merrill Dubach is superintendent, Al Banducci is bridge superintendent, Clarence Murphrey is master mechanic, and Bob Ferguson is job engineer.

Reviewing the background that accounts for —

Some variations in highway specs

With appreciation of the many differences in local materials, the variations in climate and the department personalities in each Western state, there are sound reasons for developing more uniformity in the requirements that govern materials and construction procedures. Lower highway costs could result. Contractor-engineer relations will be improved, particularly as they cross state lines. Tables are presented to show some typical items in specs and the existing non-uniformity.

STANDARDIZATION is one of the keys to cost reduction. The wider the variations from standard procedures and requirements the greater the tendency for costs to increase.

In the field of highway building there is a gradual and rather informal move toward uniformity in specifications and field practices among the states. National agencies and organizations foster this principle, and individual states recognize its logic. Here in the West, there are good reasons why our highway specifications should be different from those in other regions, and show variations from state to state. There are physical differences which have definite effect on highway design and construction. There are marked differences in climate, and a certain rugged individuality among state departments.

However, within this Western region, there are similarities which could provide a base for further standardization. Of course, there will need to be "special provisions" where local materials and other physical characteristics require deviations from the "standard." But there could be a progressive move toward reducing some of the variations that exist today.

Drawn by engineers

The problem is complicated by the fact that specifications are drawn by engineers, but carried out by contractors. Much has been done to bring understanding between these two groups on common problems. This cooperative effort was reviewed in some detail in our Annual Highway Issue two years ago (June 1958). It would be illogical for engineers to get together and bring uniformity to state highway specifications, unless there was agreement among contractors that this direction was leading toward more field economy, with corresponding reduction in construction costs.

In an effort to point up this particular situation on a region-wide basis, some aspects of the non-standard specifications are being reviewed. No effort is made to indicate the direction of any logical compromises for standardization. The purpose is principally to point out examples where variations exist, as an indication that there could be further progress.

The tabular material is take from the latest available standar specifications of the various sta highway departments. The data i the tables must not be used fo more than comparative purpose since there could be variations pr vided in special provisions and r visions in new specs. The factua information covers some of th more obvious specs showing tha there may be uniformity in som directions and variations in other

It is evident that complete stan ardization can only apply broadl

MAXIMUM DENSITY REQUIRED IN PERCENT (Determined by AASHO Laboratory Test T-99)

STATE	TEST METHOD USED	DEPTH BELOW SUBGRADE 0 to 1 ft.	1 to 2 ft.	2 to 3 ft.	3 to 20 ft.	Over 20 ft.
ARIZONA	T-99	95	95	95	95	95
CALIFORNIA	California Impact	95	95	90	90	90
COLORADO	T-99	100*- 95*	100 - 95*	100*- 95*	100*- 95*	100*- 95
IDAHO	T-99	100	95*-100	95*-100*	95*-100*	95*-100*
MONTANA	T-99	90*-100	90*-100*	90*-100*	90*-100*	90*-100*
NEVADA	Rel. Compaction	90	90	90	90	90
NEW MEXICO	T-99	100[1]	95	95	95	95
OREGON	T-99	95	95	95	90	90
UTAH	T-99	[2]	[2]	[2]	[2]	[2]
WASHINGTON	T-99	95	95	90 - 95	90 - 95	90 - 95
WYOMING	T-99	95	95	95	95	95

*Compaction specified based on soil type: First figure indicates compaction required on coarse-grained soils; second figure indicates compaction required on fine-grained soils.

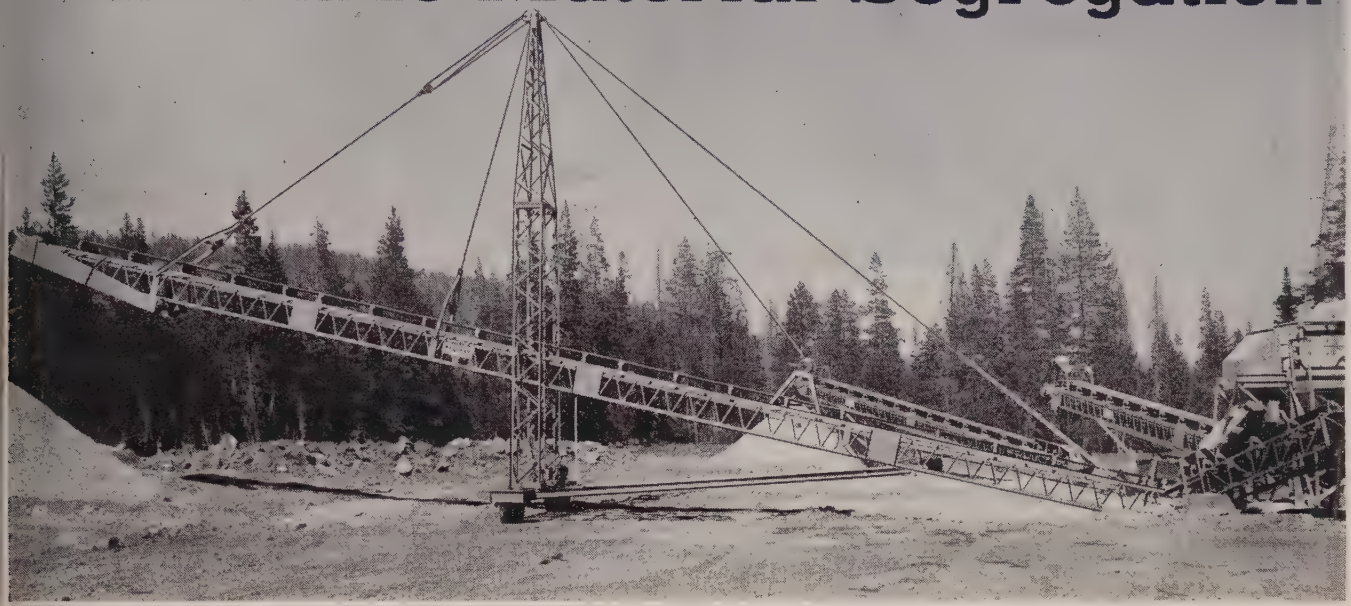
[1] Applies to top 6 inches only.

[2] Each layer shall be rolled with rollers, until compacted to the minimum field compaction requirements of the AASHO Specification M-57. The density of compacted material in an embankment shall not be less than the percentage of the maximum density shown in the following table:

NOTE: All specifications call for material to be placed in 8-in. loose layers.

Standard of Compaction or Maximum Density Obtained by Method T-99 Lb. per cu. ft.	Minimum Compaction Required Percent of Maximum Density
90 to 99.9	100%
100 to 119.9	95%
120 and above	90%

KOLMAN Radial Stackers Minimize Material Segregation



PNEUMATIC-TIRED STACKERS IN LENGTHS UP TO 150 FEET

Reports of outstanding performance by the Kolman Model 101-R Radial Stacker are rolling in from all parts of the country. Owners are enthusiastic about bonus features offered by the Kolman Stacker — features like cable suspension of the boom, two-position wheels, balanced electric drive on the head section, power lift, power travel, and cam hinge. Sizes up to 150 feet long build larger stockpiles with a single setting.

MINIMUM SEGREGATION

Kolman's cable suspension design eliminates the segregation encountered with stackers having fixed discharge heights. By raising the stacker as pile is built, the fall of material is kept at a minimum.

MAXIMUM PORTABILITY

Even the largest Kolman Stackers are on dual pneumatic tires that roll easily on any level surface. Wheel assembles are mounted in quick-change frames to easily shift from radial arc position for stacking to parallel position for moving from one location to another in the stockpile area.

BALANCED ELECTRIC DRIVE

A special balanced electric drive permits the installation of heavy electric motors and drives on the discharge end of the stacker, thus eliminating the additional cost and maintenance of a tail section wrap drive.

FINGER-TIP CONTROL

Use of Power Lift and Power Travel features permits the operator to pin-point the stacker discharge position up, down, or to either side at the touch of a finger.

SEE YOUR NEAREST KOLMAN DEALER

ARIZONA
PHOENIX—Arizona Cedar Rapids Co.

CALIFORNIA
LOS ANGELES, BAKERSFIELD, SAN DIEGO, RIVERSIDE, SANTA BARBARA—Brown-Bevis Industrial Equip. Co.
OAKLAND—Spears-Wells Machinery Co.

COLORADO
DENVER—Faris-Moritz Equipment Co.

IDAHO
BOISE, POCATELLO—Intermountain Equip. Co.

MONTANA
BILLINGS, GREAT FALLS, MISSOULA—Miller Machinery Co.

NEVADA
LAS VEGAS—Clark county Wholesale Mercantile Co.
RENO—Reno Equipment Sales Co.

OREGON
PORTLAND—Balzer Machinery Co.

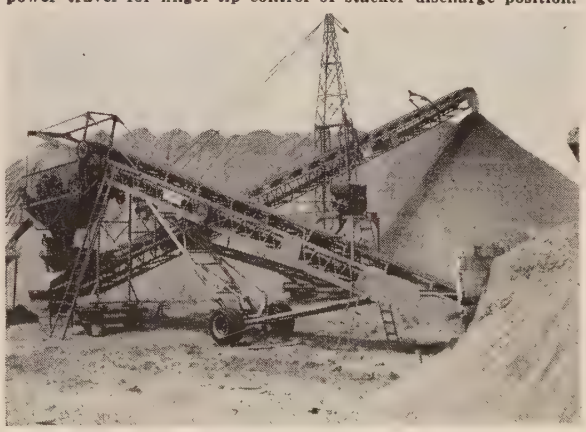
UTAH
SALT LAKE—Rasmussen Equipment & Supply Co.

WASHINGTON
SEATTLE—Sahlberg Equip., Inc.
SPOKANE—Intermountain Equip Co.

WYOMING
CHEYENNE, CASPER, ROCK SPRINGS and SHERIDAN—Wortham Machinery Co.

100'x24" Stacker is one of four Kolman Stackers used in the production of aggregate at Squaw Valley, California, in preparation of roads and site for the 1960 Winter Olympic Games. Stackers in the background are 70'x24".

150'x30" Stacker shown includes electric power lift and electric power travel for finger-tip control of stacker discharge position.



100'x24" Stacker in the background stockpiles sand produced with an 8'x48" double-deck vibrating screen on a Model 101 Kolman Portable Conveyor-Screen Plant.

WRITE FOR LITERATURE

KOLMAN MANUFACTURING CO.
5670 West Twelfth Street, Sioux Falls, S. D.

. . . for more details, write No. 44 on Reader Service Postcard

DESIGN FEATURES OF THE PAVEMENT AND SHOULDERS

STATE	TYPE OF CROSS-SECTION: THICKNESS IN INCHES	PER FT. CROWN	EDGE THICKENING	WIDTH OF TRAFFIC LANES	LANE AT-A-TIME CONSTRUCTION	PAVED SHOULDERS: TYPE AND THICKNESS OF SURFACE	TYPE AND THICKNESS OF BASE	GENERAL TYPE OF CROSS-SECTION (OTHER THAN INTERSTATE SYSTEM): Thickness in Inches	Type of Crown	Method of Edge Thickening	Width of Traffic Lanes (feet)
ARIZONA	8	1/8"[1]	Uniform	12'	O.C.	3" PM	Varies	8	1/8"[1]	Uniform	12
CALIFORNIA	8 & 9	.015"[1]	Uniform	12'	O.C.	2"-3" PMS	..	8 & 9	.015"[1]	Uniform	12
COLORADO	8	.015"[1]	Uniform	12'	P	1½"	Same as base course	8	.015"[1]	Uniform	12
IDAHO	.	.	.	.	.	.	.	9-6-9 10-7-10	A	2" Taper	12
MONTANA	A	A	A	A	O.C.	N	N	A	A	A	A
NEVADA	..	....	.	....	....	.	.	....	....	.....	..
NEW MEXICO	8	[1]	Uniform	12'	O.C.	4" P.M.	Var.	8	[1]	Uniform	12
OREGON	8	.02"[1]	Uniform	12'	R	1½" P.M.	6½" Var. Mtl.	8	[1]	Uniform	Var.
UTAH	.	.	.	.	.	.	.	B	..	Uniform	12
WASHINGTON	9	.01"[1]	Uniform	12'	R	¾" BST Min. 3" PM	Select borrow + 3" C.S.	8 & 10	.01"[1]	Uniform	11 & 12
WYOMING	8 & 9	1.56%[1]	Uniform	12'	S.P.	4" P.M.	4"-5" C.S.	.....	...	.....	..

[1] Sloped crown one way across 2 or more lanes can also be used as peaked crown.
[2] All full width surface 10' Rt., 2' Lt. (mts), 5' Lt. on 4-6 lane, 8' Lt. on 8 lanes.
O.C.—Optional with contractor.
P—Permitted by specifications under certain conditions of requirement.
A—As shown on plans.

R—Definitely required.
SP—Permitted only by "Special Provisions."
N—Not included in specifications.
PM—Penetration Macadam.
PMS—Penetration Macadam Shoulder.
BST—Bituminous Surface Treatment
C.S.—Crushed Surfacing
S—Shoulder.

TYPE OF CEMENT AND GRADING OF FINE AGGREGATE

STATE	CEMENT: TYPE USED	CONDITIONS GOVERNING USE	FINE AGGREGATE (Percent by Weight Passing Each Sieve): #4	#8	#16	#30	#50	#100	#200	ALLOWED SILT BY WT.
ARIZONA	II Low Alkali III Low Alkali	Generally Used Special Conditions	95-100	.	45-80	....	10-30	2-10	0-4	N
CALIFORNIA	II	R	92-100	65-90	45-70	25-45	10-20	2-8	0-4	N
COLORADO	I	.....	95-100	.....	45-80	....	10-30	2-10		3%
IDAHO	I, II, III	III for HES	95-100	....	45-80	....	10-30	2-10		3%
MONTANA	II	SP	N	N	N	N	N	N	N	N
NEVADA	.....	.....	.....	...	....	....	..	..		
NEW MEXICO	I, II	II in alkali soils	95-100	...	45-80		5-30	0-10		4%
OREGON	I, II, III	I w. of Cascade II e. of Cascade III HES SP	90-100		45-75	20-45	5-30	0-5		3%
UTAH	II, IIA	II + AEA — R	95-100	.....	45-80	....	10-30	2-10	..	3%
WASHINGTON	II, III	III rarely used	95-100	68-86	47-65	27-42	9-20	0-7	0-2	2-wet sieved
WYOMING	I, II, III	II L.A., I & III-SP where reactive agg. is used	90-100	.			5-30	2-10	0-3	3%

N—Not included in specification R—Definitely required SP—Permitted only by "Special Provisions"

GRADING OF THE COARSE AGGREGATE

GRADING: PERCENT BY WEIGHT PASSING EACH SIEVE

STATE	SEPARATE SIZES	SIZES	3"	2½"	2"	1½"	1¼"	1"	¾"	½"	⅜"	¼ or #4
ARIZONA	...	.....	...	100	35-100	...	....	35-70	.....	10-30	...	0-5
CALIFORNIA	3R	1	100	40-100	35-70	0-15	....	....	0-5	....	....	....
		2			100	90-100	....	20-55	0-15		0-5	....
		3				100	....	90-100	60-85		15-40	0-15
		4						100	90-100		20-55	0-15
COLORADO	2R	Combined		100				.....	.. 100	...	20-55	0-10
		Grading		100	95-100	35-70	....	0-15	.....	0-5	....	....
IDAHO	2R	Large		100	90-100	35-70	....	0-15	.....	0-5	....	....
		Small	.	.....	.	100	....	90-100	.....	25-60	...	0-10
MONTANA	1	N	N	N	N	N	N	N	N	N	N	N
NEVADA	...	....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
NEW MEXICO	N	.....	.....	100	95-100	.		35-70	.....	10-30	..	0-5
OREGON	3R	1½"	100-O.C.	...	...	50-70	....	.....	15-50	.	...	0-10
		¾, ¼		100-O.C.		55-80	....	.....	13-58	.	...	0-10
UTAH	2R	2½"-1"		100	95-100	60-90	....	0-15	0-5	....	....	....
		1½"-#4		.....	....	100	....	85-100	60-85	25-50	...	0-10
WASHINGTON	R	2½"-1¼"		98-100	92-100	72-87	58-75	.....	27-47	.	....	....
		1¼"-¼"		98-100	92-100	72-87	58-75	.....	27-47		3-14	0-1
WYOMING	N	...				100	....	.....	35-70	.	10-30	0-5

CALIFORNIA, optional with contractor: ½-in. max. size, 2", 100%; 1½", 90-100; 1", 50-86; ¾", 45-75; ⅜", 38-55; ¼", 30-45.
OREGON, Material separated on ½", ¾", ¼"; normal mix—2 parts fine, 3½ parts coarse.
R—Definitely required.

O.C.—Optional with contractor.
P—Permitted by specifications under certain conditions or requirements.
SP—Permitted only by "Special Provisions."
N—Not included in specifications
E—Where directed or authorized by the engineer

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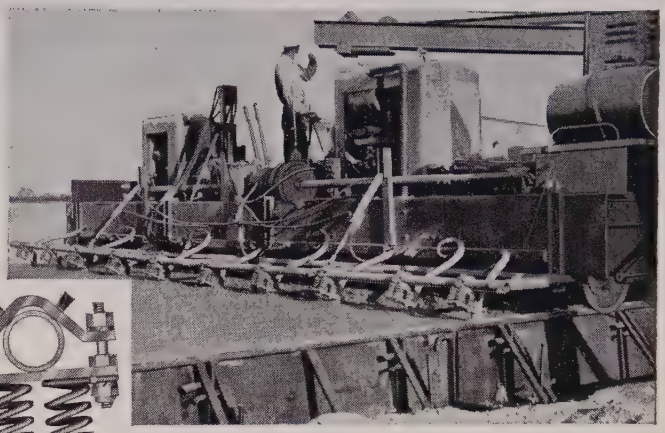

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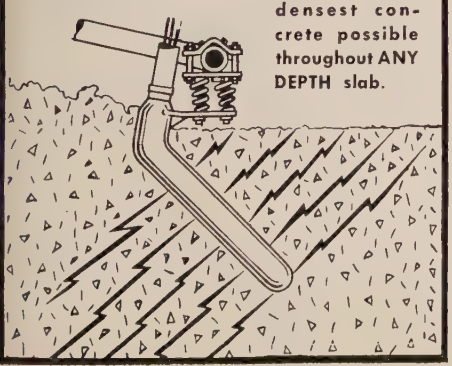

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to general provisions. These might be represented in basic design requirements and certain well recognized practices covering the end results to be secured by contractors in the field. The three most important factors which defy standardization are: (1) variation in natural materials used in highway construction, (2) variations in climatic conditions which affect construction and corresponding use of materials and (3) other factors which might include differences in financial ability and general inertia in reference to changing established practice.

Among the areas of present nonuniformity that could be investigated would be:

1. Uniform policy in reference to work days, completion dates, and liquidated damages for failure to complete.
2. Uniform method for measurement and payment to contractors.
3. Uniformity in the basis of payment for haul.
4. Uniformity in the sizes of crushed materials to be used.
5. Uniformity in the requirements for plants to produce asphalt and portland cement pavements.

To expand on the tabular information, opinions were obtained from engineers in the various state highway departments. In many cases, there are logical reasons for maintaining differences, and in other cases, it would appear that inertia represents the stumbling block.

If this presentation serves as a stimulant to further efforts toward standardization among Western state highway departments and contracting groups, it will have served a useful purpose in the possible reduction of future highway costs in the West.

Materials

"Variation in sources of aggregate in this state" appears to provide ample reason, in the minds of material engineers, why their specifications are required to be as they are. Almost every state indicated that the specifications for aggregate

REQUIRED STRENGTH AND MIX LIMITATIONS

STATE	STRENGTH COMPRESSIVE (28 DAYS)	MAXIMUM MIXING WATER GAL. PER SACK	CEMENT MIN. BARRELS PER CU. YD.	SLUMP IN INCHES	BASIC PROPORTIONS (Weight unless otherwise noted)	AIR-ENTRAINING SPECIFIED	AIR-ENTRAINING METHOD OF OBTAINING AIR ENTRAINMENT AEPC OR ADMIXTURES	AIR-ENTRAINING AIR REQUIRED MIN. AND MAX. %
ARIZONA	3,000	N	1.50	1-3	Min. 6 sacks per cu. yd. percent varies inversely with F.M. Mix designed by Lab.	R	Admix.	3-5
CALIFORNIA	N	7.2	1.25	2 Max. Kelly Ball	Job mix designed to produce dense, workable mix, using 5 or 6 sacks, as specified per cu. yd. and necessary water.	O.C. in F.T. R by S.P.	Admix.	3-5 3-6 F. T.
COLORADO	3,000	5.3	1.50	1-2	94:130; 210:400; 320 for AE Concrete	R	Admix.	3-6
IDAHO	N	Determined by design	1.50	½-1½ Vib. 2-3	Gravel 94:164:334, Stone 94:188:310	R	O.C.	3-6
MONTANA	4,000	6.0	1.625	1½-3	Designed in lab.	R	Admix.	4-7
NEVADA	....	....	....	....	.....	.....	.....	..
NEW MEXICO	S.P.	6.0	1.5	2-4 Vib. 3-5	Cement—94#, F.A.—175#, C.A.—300#	R	Both	3-6
OREGON	3,300	N	1.45	1	Contract based at C.F.=1.45. Engr. determines mix to give min. strength of 3,300 psi. at 28 days. 1.40 C.F. normal minimum.	R	Admix.	3-6
UTAH	N	NGT. 6.0	1.5-20%	2-3 ½-1½ Vib.	Proportioned by Fineness Modulus	R	O.C.	3-5
WASHINGTON	N	Controlled by slump	1.25	1.25	(2)	R	O.C.	3-6
WYOMING	3,000	Approx. 5.2	1.5 to 1.55	1-3	.....	R	Admix.	3-6

(1)—Minimum for opening to traffic.

(2)—94:212:225 (1¼-¼): 113 (2½-1¼ for 6 sacks) for bulk S.G.=9.67; 94:260:273 (1½-¼): 137 (2½-1¼ for 5 sacks) for bulk S.G.=9:67

MIXING TIMES, QUANTITIES AND FORMS REQUIRED

STATE	PAVERS 27E BATCH SIZE IN CU. FT.	27E MIXING TIME SECONDS SINGLE DRUM	27E MIXING TIME SECONDS DUAL DRUM	PAVERS 34E BATCH SIZE IN CU. FT.	34E MIXING TIME SECONDS SINGLE DRUM	34E MIXING TIME SECONDS DUAL DRUM	CONTROL MIXING MIXED IN TRANSIT	FORMS UNLESS OTHERWISE NOTED STEEL FORMS ARE REQUIRED EXCEPT ON SHARP CURVES WIDTH OF BASE	RATIO HEIGHT TO WIDTH	WEIGHT PER CU. FT. OR GAGE	SPECIAL TYPE
ARIZONA	29.7	Nlt. 50	Nlt. 50(1)	37.4	Nlt. 50	Nlt. 50(1)	Not Permitted	Nlt. 8"	1:1	N	N
CALIFORNIA	32.4	50	50	40.8	50	50	O.C.	Equal height	1:1	18#	N
COLORADO	29.7	60	60	37.4	60	60	O.C.	Nlt. 8"	N	N	slip form paver permitted
IDAHO	29.7	60	..	....	....	..	O.C.	Not less than 8" for 8"		N	N
MONTANA	29.7	N	N	37.4	N	N	O.C.	Nlt. 8"	1:1 to 8" 1:0.8 Gt. 8"	N	N
NEVADA	....	..	..	....	....	..	..	.....	.....	.....	.....
NEW MEX.	29.7	60	60(1)	37.4	60	60(1)	O.C.	Nlt. 8"	N	Nlt. 7/32"	.....
OREGON	29.7	60	60	37.4	60	60	Control	Min. 3¼" wood	N	N	..... Wood or steel O. C.
UTAH	Apvd. type and capacity	60	60	Apvd. type and capacity	60	60	E	8"	N	Adequate for 5000# machine	.....
WASH.	29.7	60	60(1)	37.4	60	60(1)	O.C. If E	Nlt. 8"	1:1	Nlt. 7/32" Nlt. 3½"	Steel, wood
WYOMING	29.7	120	120	37.4	120	120	Approved	Nlt. 8"	8" min. base	N	Flex for less than 100' R. slip form allowed

(1)—Does not include time between drums.
Nlt.—Not less than.
Ngt.—Not greater than.
N—Not included in specifications.

O.C.—Optional with contractor.
A—As shown on plans
S.P.—Permitted only by "special provisions."
E—Where directed or authorized by engineer.
Gt—Greater than.

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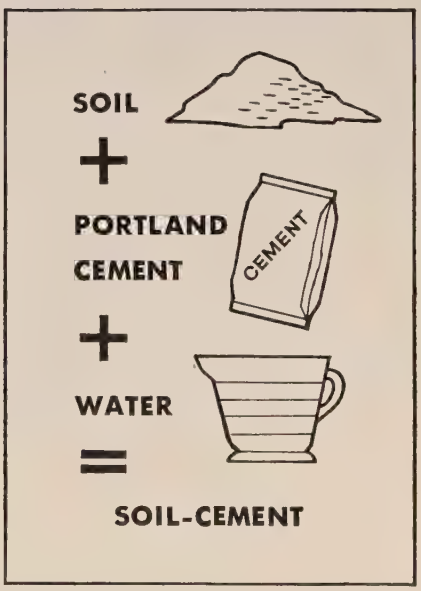

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PAVING AND FINISHING EQUIPMENT

STATE	LOCATION OF PAVER	SPREADER	VIBRATION TYPE USED	MECHANICAL FINISHER	LONGITUDINAL FLOAT	SCRAPING STRAIGHT EDGE SPECIFIED	LENGTH, WEIGHT, AND TYPE USED	TYPE OF FINAL FINISH	SURFACE VARIATION MAXIMUM ALLOWED IN 10 FT.	METHOD OF ADJUSTMENT OR PENALTY
ARIZONA	On subgrade	N	Internal along edges	R	Mechanical-R	For testing	12'	Burlap drag	1/8"	Grind down or replace
CALIFORNIA	N	R	OC	R	OC or Johnson (1)	R	16', 200 lb. steel shed	OC burlap or broom drag	1/8" (1)	Grind down
COLORADO	OC	Mech.-R	Surface vibration 3200-4200 cycles	Minimum 2 passes	R	R	12'	Broom or burlap drag	1/8" in 12'	Grind down or replace
IDAHO			Along joints and forms R		Mechanical R Manual P	R	10' wood	OC belting broom-R	1/8"	1/8" - 1/4" Grind down. More than 1/4" - replace
MONTANA	Outside	N	On screed or by hand	R	R	R	Not less than 10'	Burlap drag	1/8"	Grind down or replace
NEVADA	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
NEW MEXICO	Inside or Outside	(2)	Mechanical	(2)	(2)	R	10' swung from handles ½ w plus 3'	Broom or belt	1/8"	1/8" - 1/4" Grind down. More than 1/4" - replace
OREGON	OC may be used on slab after 3300 psi. and permission of engineer	R on forms	Mechanical 3500 cpm	R on forms	R on forms	R	Mech. ngt. 20' WB Man.-wood 10'x16"	Broom	0.07	Correct or remove and replace
UTAH	.....	.....	N	N	Hand R Mechanical R	R	10'	Burlap and broom	1/8"	Grind down
WASHINGTON	OC with Engr. permission	N	Horiz. vib. tubes	R	R Johnson float	R	10' wood special design	Broom	1/8"	Grind down or replace
WYOMING	Outside preferred	Approved mech. equip.	Vib. tampers along edge of forms	Mech.-R Screeding & travel type	Self-propelled and approved by engineer	R	Wood 10' and W + 3' / 2	Burlap drag	1/8"	Grind down unless it impairs thickness — replace

(1) On designated projects, special equipment allowed by SP and surfacing tolerances set by Profile index.

(2) Mixer capacity (sq. yd. per hour) up to 100—1 finishing machine.
100 to 350—1 finishing machine, 1 longitudinal float
351 to 550—1 finishing machine, 1 longitudinal float, 1 spreader.
551 to 750—2 finishing machines, 2 longitudinal floats, 1 spreader.

N—Not included in specifications.
R—Definitely required.
OC—Optional with contractor.
P—Permitted by specifications under certain conditions or requirements.
Ngt.—Not greater than.

were designed to conform to the materials which contractors were called upon to use. Resulting variations affect both the size of the screens, the amount of crushed rock as distinct from pit-run gravel, as well as the grading of the sand.

In most cases, the states indicated that their specifications for various types of aggregate were in general conformity with those in the neighboring states. This would obviously make it easier for contractors to bid on work outside their own state and to carry out the preparation of aggregate without costly change in their equipment.

One state indicated that its specifications for aggregate have remained essentially "unchanged for the past 10 years." This state has three grading specifications for subbase and four for base and surface courses. Although the standard specifications remain in force for a good many years, they may be modified by special provisions, particularly on projects where materials represent special problems. States indicate that their specs are adjusted generally upward as a result of higher design standards.

Several states indicated the supply of adequate aggregate sources is gradually declining and that longer hauls for adequate materials are increasing.

One state provides specifications that identify two types of aggregate: (1) an all crushed product and (2) material containing either crushed or uncrushed product. It is admitted that if the job requirements call for the first type of aggregate (all crushed) special problems might result from plants that operate normally in gravel deposits where large stones are scarce.

One state has recently stiffened its specs to secure a higher quality of rock chips for use in cover coats.

Although not specifying all-crushed materials, several states do indicate the amount of fractured stone for various sizes of aggregate. For example, a crushed gravel may be required to show at least 90% of the ¼ to ¾-in. fraction as having one fractured face. Again, to meet local conditions which influence the availability of material, the crushed gravel may be specified as having optional maximum sizes such as 2½ or 2 or 1½ in.

Field procedures

In general, compaction appears to be one phase of highway construction where end-results are now commonly accepted. The methods-type of specification that dictated

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type of roller, weight, and other characteristics, together with the number of passes that would be required, has given way gradually to the requirement by which the contractor secures a certain degree of compaction by whatever equipment and method is most economical for him.

This is a trend which has been in favor by contractors, equipment manufacturers, and the Bureau of Public Roads. It tends to make possible a maximum use of the equipment developments, as well as the units in the contractor's fleet.

In general, there have been many cases of agreement worked out between contracting groups and state highway departments in the modification of existing specifications for the benefit of both sides.

A point of disagreement for many years has been the amount of payment retained by the department, and the procedure for partial payments. In general, the amount of retainer has been found more than adequate, with some gradual reductions permitted. This is in line with the contractor's claim that the return of his capital at a faster rate will tend to lower his bid.

On the other hand, state highway departments tend to maintain their position that when they pro-

(Continued on page 114)

COARSE AGGREGATE GRADATIONS FOR CONCRETE MATERIALS

TOTAL PERCENT BY WEIGHT PASSING SQUARE OPENING SIEVES DOWN TO No. 8

STATE — TYPE OF CONCRETE	MAX. SIZE	2½"	2"	1½"	1¼"	1"	¾"	½"	⅜"	#4	#8
ARIZONA											
Structural Concrete	1"			100		95-100		25-60		0-10	0-5
Structural Concrete	1½"		100	95-100			35-70		10-30	0-5	
Structural Concrete	2½"	95-100			40-75					0-5	
Pavement Concrete	2"	100	95-100			35-70		10-30		0-5	
CALIFORNIA											
Structural and Pavement Concrete	2½"	95-100	80-95	65-87		50-75	45-66		38-55	30-45	*23-35
Structural and Pavement Concrete	1½"		100	90-100		50-86	45-75		38-55	30-45	23-35
Structural and Pavement Concrete	¾"					100	90-100		60-80	40-60	30-45
COLORADO											
Structural and Pavement Concrete	2"	100	95-100			35-70		10-30		0-5	
Structural and Pavement Concrete	1½"		100	95-100			35-70		10-30	0-5	
Structural and Pavement Concrete	¾"					100	95-100		20-55	0-10	
IDAHO											
Structural Concrete	2"	100	95-100			35-70		10-30		0-5	
Structural Concrete	1½"		100	95-100				35-70	10-30	0.5	
Structural Concrete	1"			100		95-100		25-60		0-10	0-5
MONTANA											
Structural and Pavement Concrete	2"	100	95-100	60-85		35-70		10-30		0-5	
Structural and Pavement Concrete	1½"		100	95-100	70-95		35-70		10-30	0-5	
NEVADA											
Structural and Pavement Concrete	2"	100	95-100			35-70		10-30		0-5	
Structural and Pavement Concrete	1½"		100	95-100			35-70		10-30	0-5	
Structural and Pavement Concrete	1"			100		95-100		25-60		0-10	0-5
Structural and Pavement Concrete	¾"					100	95-100		20-55	0-10	0-5
Structural and Pavement Concrete	½"						100	90-100	40-70	0-15	0-5
NEW MEXICO											
3,000 psi Structural Concrete	2"	100	95-100			35-70		10-30		0-5	
3,000 psi Structural Concrete	1"			100		95-100		25-60		0-10	0-5
2,200 psi Structural Concrete	½"						100	90-100	40-70	0-15	0-5
No P. C. Pavement specified											
OREGON											
Structural Concrete	¾"			45-65			35-45			0-12	
Structural Concrete	1½"		100	67-87			37-42			0-12	
Structural Concrete	1½"	100		55-80			22-42			0-10	
Pavement Concrete	1½"			50-70			20-35			0-10	
Pavement Concrete	1½"			55-80			22-42			0-10	
UTAH											
Structural Concrete	2"	100	95-100	35-70		15-35	0-15				
Structural Concrete	¾"					100	90-100		25-60	0-10	
Structural Concrete	1½"		100	90-100		20-55	0-15				
Pavement Concrete	2"	100	90-100	35-70		0-15					
Pavement Concrete	1"		100			90-100		25-60		0-10	
WASHINGTON											
Structural and Pavement Concrete	2½"	98-100	92-100	72-87	58-75		27-47		3-14	0-1	
Structural and Pavement Concrete	1¼"			100	95-100		40-70		5-20	0-2	
Structural and Pavement Concrete	2½"	95-100	75-100	30-60	0-15		0-1				
WYOMING											
Structural Concrete	⅜"					100			15-35	0-10	
Structural Concrete	¾"			100			35-70		10-30	0-5	
Structural Concrete	1"		100			40-75			5-25	0-5	

* California gradation continues, without interruption, down to the #200 sieve.

'Sturd-i-wall" construction on 26-unit apartment

Two relatively new time-saving techniques keyed to the use of fir plywood were credited with saving $16,000 on this apartment project. It cost some 15% less than comparable construction using other materials.

Stressed skin plywood components cut labor 75% compared with conventional roofing and flooring methods. Precisely engineered and factory fabricated under controlled conditions, panels had fir plywood top and bottom skins pressure glued to light lumber framing, with insulation sandwiched inside. Used at all three levels, they provided ceiling and underlayment or ceiling and roof decking in one unit.

Plywood stressed skin components like these offer maximum strength with minimum bulk. Their use is growing on buildings of this size and larger, for structural superiority and sharp reductions in on-site labor —in some cases as much as 85%.

"Sturd-i-wall" construction (one layer of plywood as combined siding-sheathing) was the other cost cutter, saving an estimated 15% on wall costs. Texture One-Eleven® (vertically grooved) plywood and medium density overlaid plywood were nailed directly to studs. The Sturd-i-wall system has proved its strength and economy in home building. As seen here, it offers comparable advantages in larger projects as well.

For more information about fir plywood, write (USA only):

DOUGLAS FIR PLYWOOD ASSOCIATION

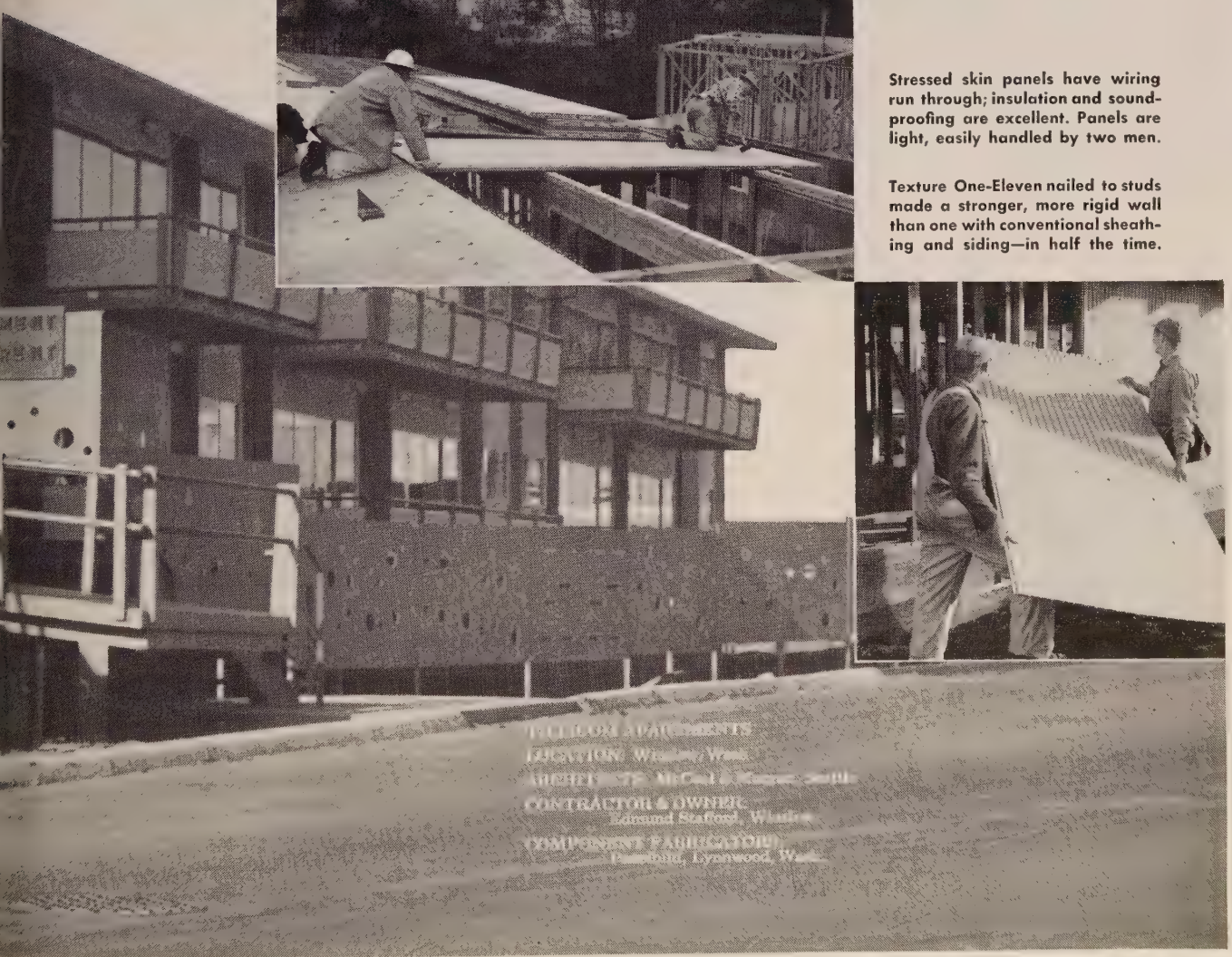
TACOMA 2, WASHINGTON

—a non-profit industry organization devoted to research, promotion and quality control

DFPA TESTED QUALITY

Stressed skin panels have wiring run through; insulation and sound-proofing are excellent. Panels are light, easily handled by two men.

Texture One-Eleven nailed to studs made a stronger, more rigid wall than one with conventional sheathing and siding—in half the time.



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EQUIPMENT SPECIFIED FOR EMBANKMENT COMPACTION

STATE	PERCENT DENSITY	STEEL WHEEL		TAMPING		PNEUMATIC		REMARKS
		TYPE	SIZE	TYPE	SIZE	TYPE	SIZE	
ARIZONA	95 T-99	Power, 3 W. tandem	10-14 T 8-T	2 section	4-13 sq. in. 1100#/tooth	2 axle 5'-7" wide	1400#/tire	Min. 35 HP tractor for towing SF roller or 55 HP when towing two SF rollers. Rubber tired tractor or truck for towing pneu. rollers. Route heavy hauling equipment over embk. or fill.
CALIFORNIA	100 Top 2' 95 Cal. impact	3 wheel	12 T 325#/I.W.	Yes	Min. 8' wide 4-12 sq. in. 250# I.W.	E		Other rollers where permitted must provide the specified density.
COLORADO	95 A-1 to A-3 100 other, T-99	A		A		A		Grading equipment to be distributed uniformly to facilitate compaction.
IDAHO	95-100 T-99	O.C.*		O.C.*		O.C.*		Class A Embkt., top 1'—100% density. Below top 1'—95-100%. Class B Embkt., top 1'—100% density. Below top 1' hauling equipment distributed over embankment.
MONTANA	90-100 AASHO in 5 steps. T-99	3-wheel Tamping	10-T 5-10T	SF or Tamping E	4-8 sq. in. 300 psi	Two axle smooth tires	48-60" wide 250#/I.T.W.	Pneumatic rollers shall be used in addition to or in lieu of tamping rollers when directed. Nominal rolling speed 2-3 mph. All rollers to be self cleaning.
NEVADA	93 Nevada Comp'n. test.	3 W. Power tandem	10-T 300# I.W.	SF-2 unit	105-250 psi Min. 5.4 sq. in.	9 tires, 2 axles	1000-2000 # WL	At least one tamping and one pneumatic roller required per 300 c.y. mtl. placed per hour, or two EA Two Unit Tamping Rollers per 400 c.y. embkt. placed per hour.
NEW MEXICO	100-95 T-180 105 top 6"	Borrow 3 W	10-T 325# I.W.	Dual drum ea. 60" diam., 60" long	5-8 sq. in. 500#sq. in.	2 axle 4-9 tires	Min. 60" wide 1000-2000#/tire	Also compaction by min. 12 c.y. scraper loaded to min. 18-T payload, 60 psi tire pressure. Detailed equipment specifications are for compaction of borrow.
OREGON	95 top 3' T-99 90 below 3'	NP		SF	4-9 sq. in. Min. 150 psi	Yes	150-350#ITW	
UTAH	95-110 Max. T-180	3 W or tandem Self-propelled	Min. 10T-14 T 300#ITW	2 drum SF, oscillating & self cleaning	60" wide, 60" long 6-8 sq. in. 325 psi.	Min. 3 W Min. 5' rolling width	Min. 6000 #W.L. 60 psi tire pr.	Tamping rollers required except embankments less than one foot high, where pneumatic, 3 W or tandem power roller may be used.
WASHINGTON	90-95 T-99	A		A		A		Partial compaction by hauling equipment permitted provided density is obtained for full width and depth.
WYOMING	95-T-99	NS	8-12 T	SF Dual drum	6-8 sq. in. 300 psi	2 axle 60" min. Must give 250# ITW		Motor grader required on fill at all times. Roller requirements shown on plans or ordered by the engineer.

NR—Not required in the specifications.
NP—Not permitted.
NS—Type not specified.
Nlt.—Not less than.
E—Where directed or authorized by the engineer.
A—Any type of equipment which will produce desired density is permitted.
O.C.—Optional with the contractor.
*—Except for Select Borrow
T—Ton
I.T.W.—Inch of tire width.
WL—Wheel load.
W—Wheel.
SF—Sheepsfoot.

vide all known information on sites for materials, they cannot guarantee the matter of quantities and other required characteristics, as usually requested by the contractor. This continues to be a normal contracting risk. In another usual item of work, the states contend that when they specify end-results, the accomplishing of these results is the contractor's responsibility and there will be no additional compensation for excessive rolling that may be required to secure these results. There appears to be some feeling that the term "end-results" is not the precise expression, although its meaning is now understood.

One situation where the end-result provision causes difficulties is the type of work where several operations are combined. For example, in the case of concrete paving where processes include the securing and preparation of aggregate, the batching, mixing, hauling, placing, and finishing, some of which may be carried out by sub-contractors. In this situation, there seems to be the feeling that more control by specifications is required so that the steps do not get too far out of line.

In one state, a new provision provides a separate pay item for the proper aeration of wet soils. Another evidence of standardization is in the requirement that cement treated base course material be processed through a central plant.

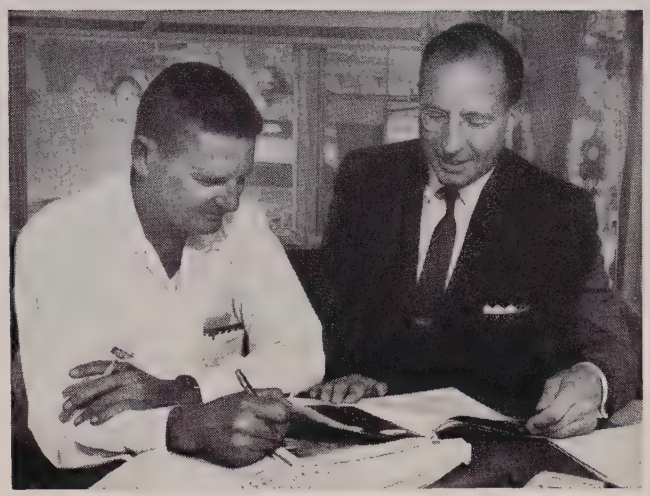
Again, the placing of surfacing material on the roadbed is now usually required to be done with spreader boxes or with trucks that have a transverse opening bottom. This tends to deposit material in true layers rather than a windrow.

Must have advantages

Several states cautioned against the trend toward standardization, merely for the purpose of standardizing. The advantages of standardization were admitted, but thoughts were expressed that local conditions sometimes demand separate treatment which must take precedence over the mere desire to be uniform. It was even noted that standardization could have adverse effects if it did not conform to local problem requirements. These local requirements relate principally to materials of unusual character and climatic conditions. Local area problems, it was agreed, must have first consideration.

As to the handling of traffic through construction areas, there

(Continued on page 118)



Jack Morris, job super, points out some of the features of the job to C.I.T. representative Jack Ebert.

shortcut through the Everglades

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Twenty-four hours a day, a giant 200-ton dragline umbers through the Florida Everglades. Scoop rock. Turn. Dump rock. Repeat the process. Over and over.

Goal: A highway shortcut that will bypass downown Miami traffic, provide a better link between two ections of southeast Florida, and, as a bonus, widen nd deepen the Krome Canal. Construction of this nusual 8½-mile highway link is by L. C. Morris, Inc.

An Everglades highway needs a firm rock bed. To nake that bed, coral lime is blasted from the canal, cooped out by dragline, and piled 9 feet above the nderlying coral lime rock. The job requires a versaile fleet of equipment.

But one high-capacity dragline was the key to the uccess of this job. As Secretary-Treasurer John P. B. Ellis says, "A machine of the size and capability of his Manitowoc, with its 6-yard bucket and 150-foot oom, was needed to carry out this contract. We couldn't do it satisfactorily with anything smaller.

"It would have been difficult, perhaps impossible, to get the necessary financing for a purchase like the Manitowoc except through C.I.T."

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In addition to equipment purchase financing, C.I.T. can help improve contractors' bid and bond capacity, meet current operating expenses or other business needs by arranging capital loans. C.I.T. representatives know how to lay out "job-engineered" finance plans carefully devised to fit the needs. Why not call or write today. No obligation, of course.

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REQUIREMENTS FOR USE OF READY-MIXED CONCRETE

	CENTRAL PLANTS (READY-MIX)			TRANSIT TRUCK (READY-MIX)				
	MIXING TIME PER BATCH IN SECONDS	MAXIMUM HAUL TIME MINUTES	BEGINNING OF MIXING CYCLE	RATED MIXING SPEED R.P.M.	MIXING REVOLUTIONS NUMBER	BATCH VOLUME IN PERCENT OF GROSS VOLUME PERCENT TRUCK	BATCH VOLUME IN PERCENT OF GROSS VOLUME PERCENT SHRINK	AGITATORS (READY-MIX) RATED MIXING SPEED R.P.M.
ARIZONA	90	90	After all material in drum	Manufacturer's designation	50-150	Not specified	Not specified	Not specified
CALIFORNIA	90	60	After all material in drum	Manufacturer's designation	Not less than 50		Manufacturer's designation	Manufacturer's designation
COLORADO	60	45	After all material in drum	Manufacturer's designation	40-60		Not specified	Not specified
IDAHO	90	90	After all material in drum	4 rpm 225 fpm peripheral speed	Not less than 50		Manufacturer's designation	Not less than 4
MONTANA	60	90	60% water in advance Rem. water 15 sec. after all material in drum	4-15	Not less than 50	57.5		2-6
NEVADA	60+15	90	Water in advance up to ¼ mixing time	Manufacturer's designation	15-100		Manufacturer's designation	Manufacturer's designation
NEW MEXICO	60+15	45	Water in advance up to ¼ mixing time	4 rpm 225 fpm peripheral speed	50-100	57.5	70	Not less than 4
OREGON	90	90	After all material in drum	4-6 rpm 225 fpm peripheral speed	50-100		Not specified	Not specified
UTAH	Not specified	30	Not specified. By perm. of Engineer	Not specified. By perm. of Engineer	Not specified		Not specified	Not specified
WASHINGTON	60	90	After all material in drum	Manufacturer's designation	50-100		Manufacturer's designation	Manufacturer's designation
WYOMING	60+15	90	Water in advance up to ¼ mixing time	Manufacturer's designation	50-100		Manufacturer's designation	Manufacturer's designation

would appear to be a trend toward having the state share at least a part of this cost. Some states are introducing this element into their specifications, based on the belief that it provides more logical control in cases where special provisions must be made in unusual traffic situations.

There is a rather narrow middle area in the philosophy behind specifications which has the most enthusiastic support from contractors. This is the area between being "too loose and too tight". If a specification is too indefinite, it follows that the work will involve interpretation by the engineering representative on the job. Such interpretation provides an indefinite factor which must be bid by the contractor. The element of uncertainty tends to raise bid figures. On the other hand, those which have too much detail may restrict the use of equipment which the contractor has readily available, and this tends to confine the bidding to those contractors who have machinery that is permitted by the specifications.

Standard but not static

There seems to be a feeling on the part of some state highway departments that moves toward standardization might lead toward specifications that become static. All express interest in keeping their specifications up to modern developments and retaining sufficient latitude so that they can be adaptable.

The comparison with municipal building codes is sufficient to justify this concern. Building codes too frequently become static and are never able to keep pace with development of modern materials and methods. Contrary to such fixed code requirements, highway specifications should set standards which are examined in the light of local conditions for every job, and modified as may be required by local materials and conditions.

Moving forward with progress in equipment and field procedures must logically be accomplished by a corresponding closing up at the rear. In other words, unless the specifications are to become too wide and loose, any modifications to admit new materials and equipment would logically require a corresponding modification to eliminate those which are the oldest and generally least acceptable.

Possibly a reversal in the matter of standard specs is the idea of eliminating such common phrases as ". . . shall be directed by the engineer", and similar matters of direction or interpretation. This is a phrase which suggests that the specification writers are not quite sure of what is desired. It tends to put the field engineer in a position of direct control. From past experience, contractors must bid on the toughest and most arbitrary resident they have encountered.

Conclusions

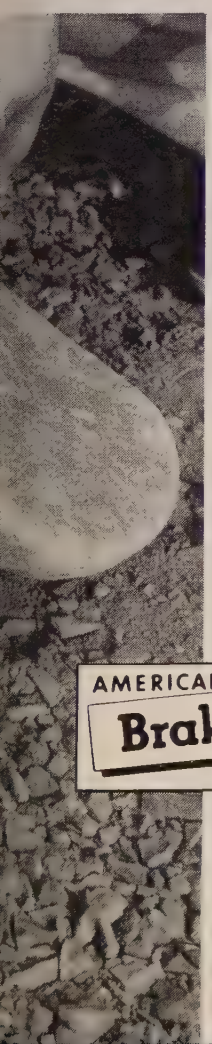
1—State highway departments and engineers are aware of standardization in specifications and the inherent advantages.

2—Uniformity, however, must give way to specifications that take account of unusual local materials, conditions, and climate.

3—A most important development in standardization is the recognition and move toward end-result specifications wherever possible. This relates primarily to the matter of compaction where contractors are being given much greater latitude in the use of equipment and methods.

4—Another trend is the growing tendency to requiring cement treated base to be processed in a central plant.

5—Specifications for materials, particularly aggregate, tend to show numerous small variations from state to state, with testing and laboratory procedures representing a hard core of resistance to a uniform specification. Again, local conditions and materials are an important factor.



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This, in the words of the quarry superintendent, sums up his experience with Amsco Manganese Steel Dippers. It's rugged work, all in rock, as you see from the pictures at the left. Shovel and dipper are used to load trap rock onto trucks for transportation to the crushing plant.

The Amsco Dipper was installed because the superintendent had used them before, and knew their reputation for long life under tough digging conditions. Experience is proving him right . . . again.

SIMPLEX TEETH HANDLE 25,000 YDS. OF ROCK BEFORE REPLACEMENT

At this same quarry, Amsco Simplex 2-Part Teeth are giving 120 hours' service . . . handling 25,000 to 30,000 yards of rock . . . before replacement is necessary. That's considerably longer service than has been obtained from competitive 2-part teeth, the quarry superintendent states.

Not only is the wear-life of these teeth exceptional, but operators like the ease of replacement, and the fact that the tips stay on without trouble.

For further information on Amsco Dippers or Simplex 2-Part Teeth, see your power shovel equipment dealer, or write to Amsco for technical bulletins showing sizes, types and application data. *Patent No. 2,904,908

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Lubrication problems in the West

Construction equipment operates under severe conditions, with corresponding demands on contractors to be familiar with properties and use of modern oils and greases.

By ELMIRE LEMIRE
Service Engineer
The Pennzoil Company

IN THE WEST a wide range of climatic conditions exist. There are abnormal high and low temperatures, sand, dust and moisture, just to mention a few. Those charged with the responsibility of lubrication must be familiar with these operating conditions, and have a knowledge of working parts of construction equipment before they can direct a servicing program.

It would be impossible to cover every phase of lubrication in a short article, especially when dealing with the variety of construction equipment. Field experience shows that certain problems predominate, however, and corrective measures can be taken to obtain maximum efficiency and extend the life of equipment.

Crankcase oils

Crankcase engine oils and their applications lead the list in importance to the general contractor. Through the years, engine oils have been classified in different ways, which confused many in the construction industry. This need not be so, since those containing additives fall into three general performance-level classifications: (1) MIL-L-2104A, (2) Supplement 1 (S-1), and (3) Superior Lubricants Series 3.

Functions of MIL-L-2104A and Supplement 1 (S-1) oils are generally quite well known, but there is still much doubt as to where Series 3 oils should be used. To understand the application of Series 3 oil, some of its development background should be known.

In 1947, Superior Lubricants (Series 2) were developed for use in heavy-duty diesel engines operating with high sulfur content fuel. They gained widespread acceptance through the years. However, as power output and engine speeds were increased in heavy-duty diesel engines, engine deposits became more pronounced, even where Series 2 oils were being used. This led to much research and engine test work on various oil additives to obtain a satisfactory oil for use in the new heavy-duty diesel engines. The answer came in the development of Superior Lubricants (Series 3) which began to be marketed in 1956.

Contrary to general thinking, these oils do not necessarily contain a larger percentage of additives but merely different types which take care of high and low temperature operations, as well as high sulfur content fuels. Although designed for use in heavy-duty diesel engines, investigations were begun on the use of Series 3 oils in heavy-duty gasoline engines. Very little information has been published but field service has shown definite advantages in the use of Series 3 oils for gasoline engines under certain conditions.

Since these oils are more costly than the Supplement I level oils, the contractor must realize benefits to compensate for the added expense. Where then should Series 3 oils be used in gasoline engines? As a general rule when extremely high engine temperatures or overloading occurs, a change over to Series 3 oil will be a help. The maintenance man himself should be in the best position to determine this. Any indication of high temperature varnish with the use of Supplement 1 oil would suggest a change to Series 3 oil, providing that some engine malfunction is not responsible for elevated temperatures. Severe service and summer heat in certain regions are governing factors in the selection of Series 3 oil for gasoline engines.

Proper oil level

Proper oil and lubricant levels must be maintained. Incorrectly marked dip-sticks or oil level indicators have been evident in recent years. Overfilling of a crankcase will cause oil splashing and overheating, with the result in loss of oil pressure and engine damage. If this is suspected, the oil should be drained with the equipment on level ground, and the crankcase filled with the amount of oil specified by the manufacturer. The dipstick should be re-marked if it does not coincide with the full level marking.

Some engines are equipped with long bayonet dip-sticks which are difficult to position in checking crankcase oil levels. Every precaution should be taken when measuring oil level with this type of indicator or overfilling will result. Needless to say, oils or lubricants in torque convertors and gear cases should be maintained at specified levels. Overfilling can result in costly repairs which are unnecessary.

Hydraulic system oils

Oils used for hydraulic systems or compressors should never contain detergents such as found in most crankcase engine oils. The general trend to reduce the number of oils and lubricants used to a minimum may prompt the "oiler" to use detergent type crankcase oil in hydraulic lifts or compressors. This practice can result in expensive down-time to men and equipment and should never be followed.

Only when sub-zero temperatures are encountered should alterations in hydraulic oils be made. The addition of refined kerosene, in amounts of 10% to 20%, can be made in such cases to increase the fluidity of the oil and speed up hydraulic controls. At the end of the cold weather season, when temperatures below −10 deg. F. are no longer expected, the mixture should be replaced with new oil of the proper grade as recommended by the manufacturer. When hydraulic systems are overhauled, every precaution in cleanliness should be taken in the re-assembly of all parts. The damage caused from traces of dirt or sand in a system cannot be under-estimated. Small amounts of water in the oil can also cause premature failure.

Gear lubrication

Many undue failures occur in gear boxes because of a lack of knowledge in lubrication and the function of the gears and bearings involved. First, the proper lubricant should be used as specified by the manufacturer. Years of experience, both in the field and in research laboratories, have proven that a certain type of lubricant works more efficiently to prevent

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wear and act as a coolant in a particular gear box. Under abnormal conditions, a change in lubricant recommendations may be made, but it is well to consult with the manufacturers as well as the lubricant supplier before making a change.

Misapplication of lubricants in worm gear sets can be very costly. Under moderate conditions, straight mineral gear lubricants should be used. For heavy-duty service gear lubricants classified as H. D. worm gear lubricants are recommended. At no time should multi-purpose or hypoid lubricants be used in worm gear sets. They become chemically active on bronze at high temperatures encountered on tooth surfaces, and will cause pronounced corrosion to the bronze ring.

In overhauling transmissions that use needle bearings on drive shafts, extra care should be taken in replacing the correct number of bearings. Ample space must be allowed for expansion on heat as well as flow of lubricant. The use of one extra bearing, even though there might be sufficient room for it, can easily cause failure. Solid lubricants such as wheel bearing or chassis lube should never be used to keep parts in place for assembly. They contain soap which, when mixed with the gear lubricant, will cause excessive foaming. We are all well aware of failures that result because of foaming, such as cavitation and gear tooth welding. A good grade of petrolatum has been found to be very satisfactory for use in keeping bearings in place during assembly. It will readily dissolve in the oil without causing foaming or other problems.

Splines and slip yokes are always subjected to fretting corrosion because of oscillating and sliding motion. In recent years, the use of moly-sulfide lubricants has been found to be very effective in alleviating this condition. The chemical structure of molybdenum-disulfide, most commonly referred to as moly-sulfide, permits a sliding action which reduces friction. In service the moly-sulfide in the lubricant will plate itself onto the moving parts, greatly reducing fretting corrosion.

How about changing oil

Many pages could be written on when oils or lubricants should be drained, or when equipment should be lubricated. To be practical about it, we might ask a simple question. When should a car be washed in order to keep it clean and appearing neat? We all know that within a few miles of driving, a certain amount of dirt collects on a car but it might still appear to be clean. In rainy weather, it takes only a short time for a car to look like it had never been washed, especially if off-highway travel is experienced.

It is the same with lubrication. Weather conditions and operations will determine what is necessary. Most men in construction work fully realize this and adjust their schedules accordingly. Some parts, however, which are only serviced at extended periods are often neglected. Wheel bearings and universal joints are typical examples. When extreme water conditions exist they should be repacked more frequently than normal. Wheel bearings should be lubricated before and after the winter season, even if the equipment has not been used constantly.

Oil and air filters

Oil filters require replacement depending on size and capacity and should not be neglected. It is poor economy to use clean oil with a clogged filter. A few extra dollars spent on filter replacements will well reward the contractor with expenses saved due to lack of premature engine wear.

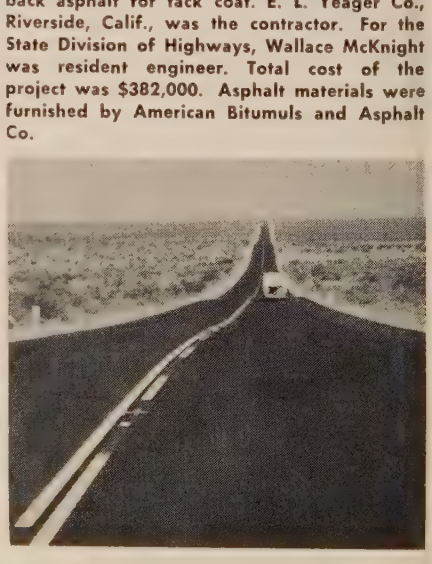
A wide variety of air cleaners are now being used in the industry. Perhaps the most troublesome one is the paper type because it is misapplied or serviced incorrectly. Every care should be exercised in the maintenance of this type of filter. If a fracture in the paper is suspected, the element should be replaced at once. A small pin hole will allow sand and dirt to be drawn through the engine with resulting damage we are all familiar with. This point is emphasized because air cleaners are usually very much neglected.

Lubrication schedules and application must then be kept flexible to match conditions. The increase in the use of automatic equipment such as torque-convertors will require lubrication and maintenance men to be kept informed on lubricant changes and general maintenance procedures.

Certain suppliers offer their laboratory facilities for testing the effectiveness of lubricants under specific conditions. Some manufacturers have had more construction industry experience than others. As a rule, the recommendations of suppliers may be considered a good guide toward minimum cost operations.

Desert highway tangent gets a retreading

A thirty-four mile two-lane stretch of road, situated near Adelanto, Calif. (Highway 395), was badly cracked and checked requiring complete re-surfacing. It was decided at the same time, to widen the entire stretch to 36 ft. Shoulders were built up using SC-4 sand mix; entire width was then overlaid with 1-in. dense-graded asphaltic concrete. The 24-ft. driving lanes were covered with ½-in. open-graded surface. In all, the project used 2,000 tons of asphalt cutback SC-4 for the shoulder work; 2,400 tons of paving asphalt for the plant mix; and 300 tons of RC-1 cutback asphalt for tack coat. E. L. Yeager Co., Riverside, Calif., was the contractor. For the State Division of Highways, Wallace McKnight was resident engineer. Total cost of the project was $382,000. Asphalt materials were furnished by American Bitumuls and Asphalt Co.



WESTERN CONSTRUCTION NEWS ®

Bid call for Trinity power plant

CONTRACTORS have been invited to bid on construction of the 100,000-kw. Trinity Powerplant and the 134,000-kw. Clear Creek Powerplant, major structures on the Central Valley Project in northern California, being built by the Bureau of Reclamation.

The powerplants are features of the Trinity River Division. Trinity Powerplant is to be built at the downstream toe of Trinity Dam, a large earthfill structure now under construction on the Trinity River, about 8 mi. north of the town of Lewiston. The Clear Creek plant will be located about 18 mi. northwest of Redding.

The indoor Trinity Powerplant, which will house two 50,000-kw. generating units, will be a 122 x 139-ft. building. It will have a reinforced concrete substructure and structural steel frame superstructure with walls of reinforced grouted masonry and metal siding.

Clear Creek Powerplant will be an indoor plant also. It will have two 67,000-kw. generating units. The 103 x 139-ft. building will have substructure, superstructure, and walls similar to the Trinity plant. Construction at the Clear Creek plant will include installation of two 2,150-ft.-long steel penstocks and construction of an afterbay control structure and tailrace channel, valve house, switchyard, access and switchyard service roads, and bridge.

Bids were to be opened June 7 in the office of the Bureau of Reclamation at Lewiston.

The Trinity River Division will ultimately make possible the average annual transbasin diversion of 865,000 ac.-ft. of surplus waters from the Trinity River watershed to the adjacent Sacramento River Basin, thus augmenting the supply of the Central Valley Basin. The more than 1,700 ft. of head to be created by the transbasin diversion will be used to develop additional power for Northern California.

Each of the two turbines in the Trinity Powerplant will be provided with removable runners. One set of runners is designed for best performance under a head of 426 ft., and the second set of runners is designed for best performance under a head of 3,304 ft. to attain optimum overall operating efficiency.

J. H. Pomeroy & Co., moves into new headquarters

J. H. POMEROY & CO., international engineering and construction firm, has completed work on its new headquarters in the Pomeroy Building at 755 Sansome St., San Francisco.

"We believe our new building serves as an example for many business and commercial firms contemplating similar projects. We will welcome all those interested, and will be pleased to show them what modern design, engineering and construction know-how can do," Robert N. Pomeroy, president, stated.

Conversion of the former Tea Garden Building took six months.

Snake River controversy moves to FPC hearing

THE controversy over power development on the Snake River, which has been active for the past several years moves into another stage with scheduled hearings by the Federal Power Commission.

The FPC has an application on file from Pacific Northwest Power Co. of Portland seeking a license for the proposed High Mountain Sheep Development on the Snake River. A hearing on this application was postponed from the original date in March following the filing of a conflicting application on March 15.

This was an application by the Washington Public Power Supply System of Kennewick, Wash. to obtain a license for the proposed Nez Perce hydraulic project in the same general area on the Snake River. This organization is composed of 13 public utility districts from the State of Washington, organized for this purpose. This most recent filing also requested that its application be considered along with the hearing of the Pacific Northwest Power Company's proposal. Postponement of the original hearing was made to enable the FPC to study the possibility of coordinating the hearings and to determine the

EVALUATING bids on defense construction projects in Alaska is the specialized job of four men whose combined Alaskan construction experience in specialized fields spans a half century. As members of the U. S. Army Engineer District, Alaska's Bids Review Board, they analyze the bids and make recommendations to the district engineer who in turn makes the final decision on awarding the contract. From left are: *Douglas L. Edwards*, Legal Branch Chief; *Carl L. Knutson*, Construction Supervision and Inspection Branch Chief; *Robert E. Lee*, Engineer Control Branch Chief; and *Gem E. Meyerhoff*, Supply Division Chief and board chairman.

proper procedure to be followed.

The proposal of the public utility districts would represent a project estimated to cost $276,500,000, exclusive of interest and would provide a 700-ft. arch-type concrete dam on the Snake River about 2½ mi. downstream from the mouth of the Salmon River. Initial installation would be 1,200,000 kw. with an ultimate capacity which would be double this output. The power would be distributed to the member public utility districts and other organizations.

The application of the private utility proposed the Mountain Sheep Development include a 690-ft. dam across the Snake River about ½ mi. upstream from its confluence with the Salmon River. This project is estimated to cost $178,000,000, and would have an initial installed capacity of 875,000 kw. with an ultimate capacity of double this output.

An important factor in the application relates to the matter of the fish, and whether the location of a high dam below or above the confluence of the Snake and Salmon River would have a material effect.

Nevada will rebuild busy section of U. S. 395

FOR THE FIRST TIME since 1931 one of Nevada's busiest and oldest sections of highway, U. S. 395 south of Steamboat Springs, will be reconstructed. The 6.5-mi. job will cost an estimated $1,000,000.

The new route will follow the highway's present alignment from Steamboat to Washoe City and the road will be kept open during the building period. To accommodate the large number of motorists using the highway, plans call for having the route paved and ready for use within six months. Rebuilding and widening the present travel lanes from 10 to 12 ft. will require over 300,000 yd. of roadway excavation and the use of nearly 17,700,000 gal. of water.

In the last decade use of this section of U. S. 395 south of Reno has more than doubled, from an average daily traffic count of less than 2,000 in 1949 to over 4,700 in 1959. Much of the increase has been due to the tremendous growth in traffic between Reno and the Carson City-Lake Tahoe area, according to studies made by the planning division of the highway department.

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ALASKA Newsletter

By CLIFFORD S. CERNICK, Fairbanks

SUPPLIES NEAR THE JOB SITE — One of the trends which seems to be developing in Alaska is the growing availability of construction materials within Alaska. This, in the long run, is going to mean a very welcome cut in the cost of construction if the savings generated by the production of basic construction materials in Alaska are not eaten up by high labor and other costs. A typical example of what is happening is the announcement recently that Alaska will have its first brick and tile factory. A plant is being set up in Anchorage and was expected to be in production by June 1. Frank Greenleaf, president of the new firm, the Atlas Brick and Tile Co., said the plant will have a capacity of 80,000 to 100,000 bricks a day. The plant also will produce building, sewer and patio tile and fire brick. Greenleaf said the tremendous growth which obviously lies ahead for the 49th state makes the future of his plant look extremely optimistic. In the cards for the future are: Alaska-produced cement and a greater supply of Alaska-produced lumber. These changes will not come about overnight—but they undoubtedly will come and will have a tremendous effect on the Alaska construction industry.

AIRFIELD WORK — Airport construction in Alaska is in full swing as the construction season heads towards its peak. The big jobs are the extension of the Anchorage and Fairbanks international airports to make them suitable for commercial jet planes. The Fairbanks contract, in the amount of $962,558, was awarded to the joint venture of B-E-C-K and McLaughlin. They are already at work constructing a 4,300-ft. runway extension and a heavy aircraft parking area addition to existing airport facilities. An indication of the size of the project is given by dirt-moving estimates: 110,300 cu. yd. of unclassified excavation and 835,200 cu. yd. of embankment construction will be required.

AIRFIELDS IN THE BUSH — There is a great deal of work going on, also, on "bush country" airfields — the real lifelines in the sparsely populated North country. Walsh and Co., Inc. of Spenard is building airfields at Kaltag ($62,-268) and Holy Cross ($56,354). Both airports are on the Yukon river. The Fairbanks firm of Williams Equipment Co. is building a $68,864 airport at Beaver about 100 miles north of Fairbanks. Though these projects are small in terms of total cost, they are considered to be among the most important in Alaska. Most of the airport work in Alaska is going forward under the Federal Aid Airport Program under which Alaska contributes to the project costs on a ratio basis.

WORKERS HEAD NORTH — Never have I seen the downtown area of Fairbanks so bustling and so thronged with such a motley crowd of persons. The construction men predominate—the city is rapidly filling up with catskinners, laborers, carpenters, plumbers — and on down the roster of construction skills. An early-season in Alaska has brought job-seekers north far earlier than usual. Many of the early arrivals were here to see the ice go out on the big rivers—the Chena, Tanana and Yukon — in the Interior. More than 80,000 dollars was distributed to the winner of the Nenana ice pool (relating to the Tanana river). The breakup of the Chena river was a very spectacular sight. Water, in a few hours, moved up several feet. Huge cakes of ice, some of them as big as bungalows, flowed swiftly down the raging stream. Timber, trash, boats and brush swept downstream in a white and yellow torrent.

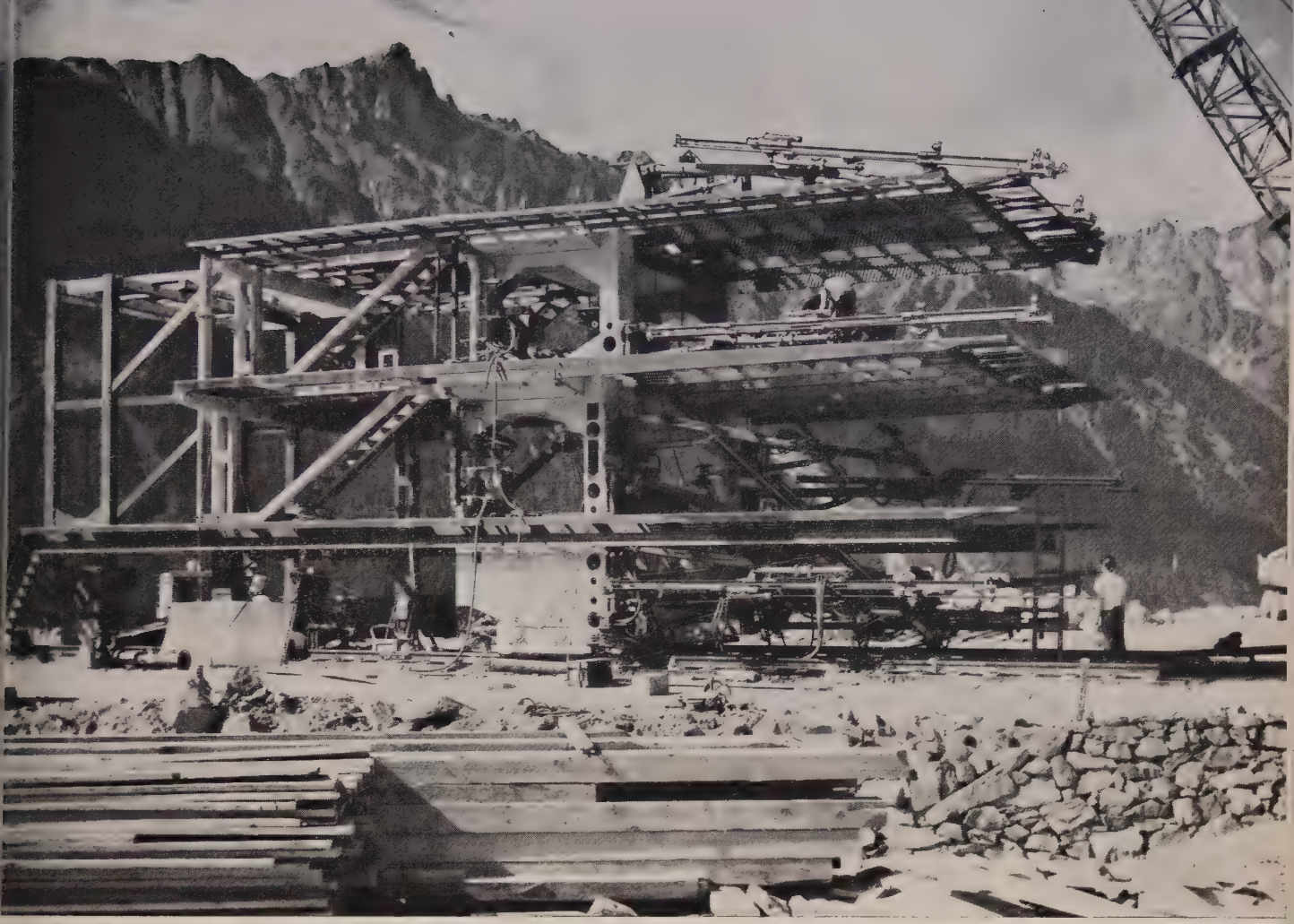
River breakup time is usually the signal for construction work to be resumed in earnest—and this was true this season. The Alaska State Employment Service reports a greater demand for construction workers than they can fill. Unions I contacted in Fairbanks tell me that placement of men on jobs is "brisk." The business agent of one of the largest unions here told me, during an informal exchange of conversation, that "we're sending 'em out on the jobs faster than any previous year. Only thing, I'm afraid to let any publicity get out about it because everybody and his brother may come flocking up here looking for work." Work on the Clear project accounts for most of the hiring to date. Still to come is hiring for the many road projects which will be opening up soon throughout Alaska.

NO DISCOURAGEMENT — For the first time in years, there is no effort being made to discourage a "job rush" to Alaska. Many of the responsible construction people I have talked to recognize that this year there is a real possibility of a labor shortage. When you superimpose the needs of the road program on the needs of defense construction, then add municipal and commercial construction's manpower requirements, you begin to see there may not be enough men to go around.

Among the factors which may prevent a serious labor shortage this year is the annual migration north of hundreds of college students from the "Lower 48" in search of jobs and adventure. These hard-working boys have an excellent record on construction projects and this year they will not have as much difficulty getting work as was true in previous seasons. Alaska unions probably will contact locals in other states for help when their own benches are emptied. Any way you look at it, though, at the peak of the season there will undoubtedly be a considerable number of jobs going begging.

UNUSUAL WALKOUT — An unusual union walkout occurred recently in the seacoast city of Seward. When a non-union electrical worker was hired by the City of Seward, electricians employed in the city power plant walked off the job. But when they did so, they turned off the power, blacking out the entire city for a total of four hours. An emergency city council meeting with heads of the union resulted in resumption of power and negotiation on the union's grievances.

PREFAB HOUSE FACTORY — Construction of a house prefabricating "factory" will begin in Anchorage some time in June — the first of its kind in Alaska. A new firm, Associated Homes, Inc., will



15-Drill Hydra-Boom Jumbo at MONT-BLANC TUNNEL

Fully mechanized I-R tunneling rig spearheads drilling from French side of new vehicular bore through the Alps

Using one of the largest and most modern boom jumbos ever built, the French side of the new Mont-Blanc tunnel got off to a fast start with workmen waging a winning battle against Europe's highest mountain. Completion by a group of French contractors, headed by Entreprises de Travaux Publics André Borie, is expected on schedule in 1962.

The huge four-level gantry-type jumbo mounts fifteen 3½″ bore I-R drifters on I-R Hydra-Booms that provide complete hydraulic positioning for all drills. It was built in Lyon, France, by Ferrand & Frantz, and Entreprises de Travaux Publics André Borie. Fourteen-foot blast holes are drilled without steel changes, using 1¾″ Carsets bits. A burn hole is put in each round by an I-R Downhole Drill with an 8″ Carset bit, to permit pulling longer rounds. The hydraulic cylinders of all 15 Hydra-Booms are operated from 5 hydraulic pumps driven by I-R air motors.

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employ 150 persons on a year-round basis according to Frank L. Vetter, president. The plant is designed to supply pre-cut homes for distribution throughout the state. Vetter said that ultimately single and multiple-dwelling units will be prefabricated at the plant. Much of the material for the plant is being hauled over the Alaska Highway by huge tractor-trailer rigs.

Vetter said he is negotiating with union officials in Anchorage to establish reasonable wage scales for year-round employes. These scales, the unions have indicated, will be set at a lower rate than those of short-term construction workers. The prefab homes turned out in Alaska will meet all FHA and city specifications and will be designed to meet the requirements imposed by Alaska's severe climate. Vetter feels the new plant will cut home building costs in Alaska by as much as one-third.

DE'S BILLION DOLLARS – During the 14 years since it was organized, the U. S. Army Engineer District, Alaska (commonly known as the DE, for District Engineers, a former designation) has spent $1,250,000,000 on Alaska construction projects. These include both military construction and civil works. At the present time, approximately 750 persons are employed by the Engineer District—540 of them in the Anchorage area. Col. William C. Gribble Jr., District Engineer, in outlining the impact of his organization on the Alaska economy, said the District has been responsible for bringing more construction firms to Alaska. He added that in the early years after it was organized in 1946, much of the time of the District was spent in getting bidders for jobs.

CONSTRUCTION NEWS NUGGETS—J. B. Warrack Co. was declared low bidder on the City of Anchorage's new public safety building. The Warrack bid was $1,576,000; plans call for groundbreaking soon at the site of a former baseball park. The new building will house the police and fire departments, the Magistrate's Court and city jail. . . . Work is being pushed on the initial phases of a new million-dollar supermarket in Fairbanks. . . . Plans for the new Ketchikan city hospital are to be drawn by the Juneau firm of Olsen and Sands as soon as the city council decides definitely on a site.

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6 "SET-UPS"

5 State jobs and 1 City job required 6 different plant "set-ups." Distances between "set-ups" varied from 8 miles to 540 miles.

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Plant was dismantled on Saturday ...moved 8 miles and was in full production again Monday morning. (Only work done on Sunday was connecting asphalt lines and changing screens.)

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HAWAII Report

By ALAN GOODFADER, Honolulu

BUSTLING ALONG — Building permits issued by the City of Honolulu in the first quarter have an estimated value of $42,386,696, nearly double the value of those issued in the same period last year, the City says. The permits are an index to civilian construction on the Island of Oahu. March was the boom month, with 1,308 permits issued for an estimated $19,397,681. About $15,000,000 of this was for housing. The quarter saw 3,359 permits issued compared to 2,280 during the first three months of 1959 with a value of $23,402,081.

FULL DINNER PAIL — The construction boom is credited with increased employment here. Takashi Kitaoka, State director of labor and industrial relations, said construction accounted for about half the 800 new job-holders counted in March throughout the state. On Oahu, construction is employing a record 13,720 persons, he said. The state found jobs for 1,081 persons during March, with most of them going as construction laborers. The squeeze will get even tighter as the result of military construction in the Pacific, according to the Bank of Hawaii. It says Honolulu will furnish much of the work force for about $70,000,000 worth of work to be done on Kwajalein, Johnston and Roi-Namur Islands. The bank also notes that bid openings here in January and February totaled $44,200,000, or more than double the $20,300,000 in the first two months of 1959.

PUBLIC WORKS PLANNED — The recently adjourned State Legislature passed and sent to Governor William Quinn a $15,000,000 pay-as-you-go public works budget for the ficsal year starting July 1. The program calls for immediate construction of roads, parks, school and University of Hawaii buildings, armories, part of a Honolulu Municipal Auditorium, water projects, State office buildings, agricultural facilities, airport improvements, small boat harbors and tourist resort developments throughout the state. Some of the larger projects include technical school additions in Oahu, $456,000; University of Hawaii construction, $2,498,600; municipal auditorium, $850,000; Waianae (Oahu) water line, $1,300,000; Maui Island water projects, $1,330,000; Hawaii County water projects, $975,000; improvements to General Lyman Airfield, Hilo, Hawaii, $333,000; Hawaii Island roads, $921,333; Kauai County water projects, $716,000, and development of Kauai's Salt Pond Beach, $200,000.

CITY BUILDING TOO—The City of Honolulu also has an ambitious $50,000,000 building plan in the works. It hopes to have more than 300 projects started by the end of this year, although the whole program will take several years. The auditorium mentioned above has number one priority, with parks, schools and sewers high on the list.

HOTELS ARE RISING — Hotel construction also is mushrooming. According to the Hawaii Hotel Assn., more than 2,000 hotel and

(Continued on page 140)

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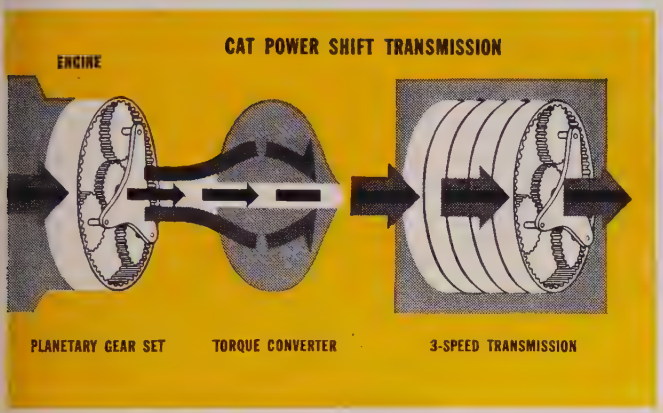

Basic design: Total power is transmitted from the engine to a planetary gear arrangement mounted on the engine flywheel. A torque divider directs the total power — part through a direct drive shaft straight to the transmission and the remainder through a torque converter to the transmission. This enables the Cat power shift transmission to combine the economy and quick response of direct drive with the anti-stall and acceleration against load of torque converter drive. Unit construction makes it easy to service, if required. It's tough—one rugged ton built with the precision of a fine watch.

50% more production! D9E, owned by Carmichael Coal Co. near Calumet, Alabama, removes overburden of shale, sandstone and clay to uncover 30" coal seam. Coal production is 9000 tons a month.

33% more production! Overburden, running to 60', is blasted and then cleared by a D9E. Owner: McCoy Coal Company, Gorgas, Alabama. 1,800,000 yards is moved to mine 150,000 tons of coal per year.

Trading in another large track-type machine for a Caterpillar D9E Tractor has brought *big* production increases to two strip mine operators—increases that prove these power shift machines are quickly paying for themselves on the very tough jobs found in overburden removal.

"We're getting half again as much production with no additional cost," says F. M. Carmichael, part owner of Carmichael Coal Co. near Calumet, Ala. "Power shift cuts operator fatigue and increases the maneuverability of the tractor." That's exactly the reason for designing a Caterpillar transmission with a one-hand control which shifts into all speed ranges, forward or reverse and on-the-go, without braking, and without a master clutch.

Earl McCoy, owner of the McCoy Coal Company, Gorgas, Alabama, has had nearly as good results. "We're getting 33⅓% more production with the D9E over the machine we traded in . . . it's more economical to operate."

The D9E, like all Caterpillar track-type Tractors, has lifetime lubricated track rollers (with the exclusive patented floating ring seals) that never need servicing. Also a dollar-saving dry-type air cleaner that can be serviced in just five minutes, yet filters the air 99.8% clean *even in the worst dust conditions*. And shifting is so easy the operator just naturally gets more work out of the tractor. What's more, he gets it on the toughest, most demanding jobs.

Besides power shift transmission, you have your choice of direct drive or torque converter in both the 335 HP D9E and the 235 HP D8H Tractors. For complete details on the new power shift transmission, see your Caterpillar Dealer. He's ready to show how it works . . . demonstrate ruggedness under complete, easy one-hand control!

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apartment-hotel units are due for completion at the famous Waikiki beach area by the end of the year. Another 330 rooms are under construction on the Neighbor Islands. Within the next two years, an additional 4,723 hotel units on Oahu and 822 on the Neighbor Islands are due for completion, the association said. The association said resort projects totaling 3,448 rooms on Oahu and 722 on Neighbor Islands have been announced in the last six weeks alone. "New hotel construction plans are being released so frequently that it is almost impossible to keep up with them," James Durham, president of the association, said. "Big resorts are coming on all of the major resort islands."

BIG HARBOR PROJECT STARTS—The State Board of Harbor Commissioners has kicked off its $6,500,000 Honolulu cargo-passenger terminal project by giving a $220,000 design contract to the firms of Law & Wilson and Tokashi Anbe. The project, in the works for 25 years, should be completed by mid-1962. Construction will start two months after architectural and engineering plans are done. The plans are expected to take eight to ten months. The project will include a new 750-ft. pier and extension of two others.

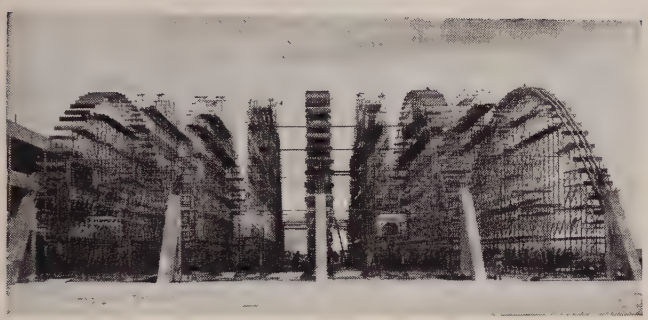
NAMES IN THE NEWS—C. M. "Buck" Sheldon of Honolulu will be project manager of a second Kuwait port development project to be built jointly by the Hawaiian Dredging & Construction Co., Ltd., and J. H. Pomeroy. The $2,500,000 will follow a $23,000,000 project under construction now.... The Magnus Corp., a new firm here, is headed by Albert E. Teller. The firm does construction clean-up and demolition work.

CONTRACTS LET—The Defense Department has awarded a $1,178,000 to James W. Glover, Ltd., for the construction of two Nike-Hercules launching sites at Oahu's Bellows Field....A. C. Chock, Ltd., has received a $1,140,000 contract to make general improvements to land in rural Oahu's Niu Valley preparatory to the construction of 225 homes there. The firm will build roads, sewers, underground wiring, sidewalks and water lines ...Oahu Construction Co. will build a $207,812 million-gallon water reservoir on Oahu's Koko Head for the Honolulu Board of Water Supply.

Scaffolding and Shoring Methods

. . . by Patent Scaffolding CO.

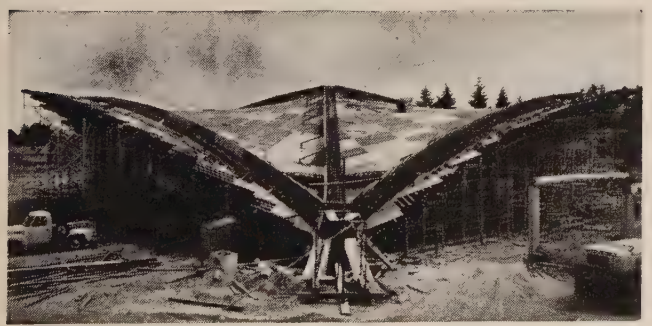
24 MILES OF SCAFFOLDING SPEEDS RADOME —A huge bowling-ball shaped structure, 140′ in diameter, is being erected at Moorestown, N. J., atop an Engineering Model Building to house and test a gigantic radar antenna system for the Ballistic Missile Early Warning System. During application of the six-sided plastic panels, 24 miles of "TubeLox" Scaffolding was erected to provide working platforms for the steel erectors, Cornell & Co. Radio Corp. of America, weapons system contractor for BMEWS under direction of the Air Force, is duplicating a part of a BMEWS installation to inspect and check radar gear.



SAME SHORING FOR RIBS AND SLAB — Standard "Trouble Saver" Shoring frames, spaced 3′7″ to 5′ apart, support formwork for new, all-concrete Swissair Hangar #15, Idlewild, N. Y. 5 arched ribs are 180′ long, 28′8″ apart and vary from 2′6″ at arch peak to 4′9″ at base. Slabs are 5″ base to 3″. Walter Kidde Constructors, Inc., contr.

REPEAT PERFORMANCE—PS Co. scaffolded Duke Memorial Chapel, Duke Univ., Durham, N. C., for construction in 1931. For renovation this year, William Muirhead Const. Co., Inc., gen. contr. uses PS Co. "Trouble Saver" Scaffolding built to 205′ high to provide platforms for workmen in anchoring 68 loose stone spires around the bell tower.

SUPPORT FOR HYPERBOLIC PARABOLOID DESIGN —On the new hyperbolic paraboloid auditorium at Edward S. Ingraham H. S., Seattle, Sound Construction Co., gen. contr., finds standard "Trouble Saver" Sectional Shoring ideal for supporting the arched beams and slabs. In effect, the building is three butterfly roofs tied together to form one complete dome, 35′ high at center point.



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Low bids and contract awards

ARIZONA

Fisher Contracting Co. of Phoenix submitted a low bid of $1,598,241 for grading, surfacing, and construction of an interchange on 1.9 mi. on U. S. Route 80, east of Mule Pass Tunnel in Cochise County. **W. W. Clyde & Co.** of Springville submitted a low bid of $673,694 for 7 mi. of grading, draining, and surfacing on U.S. Route 89, west of bridge at Glen Canyon Dam site, in Coconino County. A low bid of $167,936 was submitted by **Bentson Contracting Co.** of Phoenix, for grading and surfacing on 6 mi. on the McKellips-Power road in Maricopa County. **T. M. K. Construction Co.** of Phoenix submitted a low bid of $108,139 for grading and surfacing locations on the Quartzsite-Wickenburg highway in Yuma County. **Western Constructors, Inc.** of Phoenix submitted a low bid of $2,248,743 for grading, surfacing, and structures on various locations on the Benson-Steins Pass highway and Bowie Junction-Safford highway in Cochise County.

CALIFORNIA

Guy F. Atkinson Co., South San Francisco, received an $11,712,105 contract for grading, surfacing, and construction of 11 bridges, a composite interchange, and pumping plant to be constructed on a 6 and 8-lane freeway in city and county of Los Angeles. **Atkinson** also received a $2,393,990 contract for construction of a reinforced concrete wharf at Berths 92-93 on Main Channel, Los Angeles. **Vinnell Corp., Vinnell Constructors & A. S. Vinnell Co.,** Alhambra, received a $9,693,235 contract for construction of the Golden State-Pasadena Freeway interchange, grading, surfacing and related work, near Pasadena in Los Angeles County. A $4,883,454 contract was received by **Gordon H. Ball, Gordon H. Ball, Inc., Ball & Simpson, E. L. Yeager Co.** and **E. L. Yeager Construction Co., Inc.,** Danville, for grading and surfacing to construct 25.2 mi. of 4-lane freeway and 13 bridges to be constructed east of Baker in San Bernardino County. **Geo. M. Brewster & Son, Inc.** of Bogota, N. J., received a $4,825,808 contract for construction on the San Diego Freeway, work including grading and paving 1.3 mi. of 8 lane freeway and construction of 10 major structures, county of Los Angeles. **Gordon H. Ball and Gordon H. Ball, Inc.,** Danville, received a $3,812,194 contract for construction of 4.3 mi. of 6 and 8-lane freeway on U.S. 40 near Cordelia, and 1 mi. of 4-lane divided highway on Sign Route 21, from U.S. 40 to Cordelia in Solano County. **Peter Kiewit Sons' Co.,** Arcadia, received a $2,627,711 contract for construction of 8 two-story concrete barracks buildings, including utilities, at Camp Del Mar, Marine Corps Base, Camp Pendleton. **Diversified Builders, Inc.** of Paramount, received a $2,390,000 contract for construction of various facilities, including maintenance shop, warehouse, mess hall, fire station, warehouse and additions to other buildings and related work at the Naval Missile Center, Point Mugu. A $1,140,600 contract was received by Tumblin Co., Bakersfield, for construction of an interchange on U.S. 99 near Lerdo in Kern County. **Yuba Consolidated Industries, Inc.** of Emeryville, received a $1,313,700 contract for construction of the structural steel framing, stairs and decking for a 6-story headquarters office building for the Department of Motor Vehicles at Sacramento; metal decking work to the **R. C. Mahon Co.** of Torrance for $287,782. **Fredrickson & Watson Construction Co.** of Oakland received a $938,449 contract for grading to realign 11.9 mi. of U. S. 395, near Milford in Lassen County. **Souza & Wright Construction Co.,** Yuba City, received a $938,421 contract to realign 4.3 mi. of U. S. Highway 40 between Blairsden and Willow Creek in Plumas County.

COLORADO

Gardner Construction Co. of Littleton received a $2,091,301 contract for grading and concrete paving on 14.5 mi. of Interstate Highway 185, in Weld and Adams counties. **Pioneer Construction Co.** of Pueblo received five contracts for roadwork in Larimer, Prowers, and Las Animas counties: $486,497 for grading and surfacing on 2.8 mi. south of Virginia Dale on State Highway 123 in Larimer County; $428,699 for grading and surfacing on 9.4 mi. between Granada and Holly, State Highway 6 in Prowers County; $234,447 for 7.6 mi. of grading, structures, and surfacing on State Highway 196, between Carlton and Lamar, Prowers County; $185,323 for 6.9 mi. of structures, stabilization, and surfacing between Tobe and Kim, Las Animas County; $100,000 for asphaltic surfacing overlay on 15 mi. on U.S. 287-385 between Lamar and the Baca County line in Prowers County. **C. L. Hubner Co.** of Denver submitted a low bid of $439,593 for grading, surfacing and structures on 9.5 mi. between Granada and Holly in Prowers County. **L. H. Kilgroe Construction Co.,** Denver, received a $381,871 contract for grading, draining, and surfacing on 1.8 mi. on State Highway 121 in Jefferson County. **Pendleton Construction Co.,** Longmont, received a $302,324 contract for grading and structures on 6.3 mi. between U. S. 287 and U. S. 87 in Boulder and Weld counties. **Nielsons, Inc.,** Dolores, submitted a low bid of $223,638 for 5.9 mi. of grading, structures and surfacing in cities of Cortez and Mancos in Montezuma County. **E. J. Rippy & Sons,** New Castle, received two contracts for work in Gunnison, Routt, and Eagle counties: $249,360 for 3.9 mi. of grading, structures, and surfacing between Powderhorn and Iola in Gunnison County, and $195,325 for 5.3 mi. of grading, structures and surfacing between Toponas and McCoy in Routt and Eagle counties. **Peter Kiewit Sons' Co.** of Denver submitted a low bid of $119,246 for grading, surfacing, and structures on 4 mi. of road to the missile launching base in Elbert County; **Kiewit** also received a $137,386 contract for grading, structures and surfacing the South Interchange to the Air Academy, El Paso County. **Bailey Construction Co.,** Littleton, submitted a low bid of $103,794 for 4.7 mi. of grading, surfacing, and structures east of Kiowa in Elbert County.

IDAHO

Technical Constructors, Inc. of Dallas, Tex., received a $963,088 contract for the construction of the Special Power Excursion Reactor Test No. 4 facility at the National Reactor Testing Station. **C. F. Braun & Co.,** Alhambra, Calif., received a contract to construct the Experimental Organic Cooled Reactor at the National Reactor Testing Station at an estimated cost of

(Continued on page 146)

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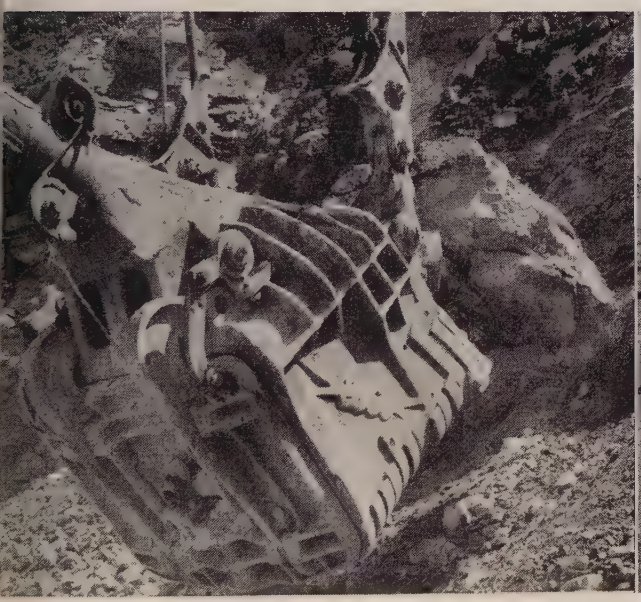

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$4,000,000. **Holmes Construction Co.** of Heyburn submitted a low bid of $744,033 for grading, surfacing, and related work on Interstate Highway 80N and 15W in Cassia County. **Earl L. McNutt Co.** of Eugene, Ore., submitted a low bid of $619,336 for construction of roadway, surfacing and railroad overpass in Bingham County. A low bid of $505,278 was submitted by **Cherf Brothers & Sandkay** of Ephrata, Wash., for grading, surfacing and related work on State Highway 88 in Jefferson County.

MONTANA

Billings Construction Co., Billings, received a $584,286 contract for 9.7 mi. of grading, surfacing and draining on the Browning-Babb (Duck Lake) road in Glacier County. A $411,081 contract was received by **Richardson Construction Co.,** Miles City, for 8.1 mi. of grading, surfacing and related work on the Nashua-Wolf Point road in Valley County. **F & S Contracting Co.,** Butte, received a $362,896 contract for grading, surfacing, and draining on 6.3 mi. of the Avon-Helmville road in Powell County. **Myrl Clark** of Yankton, S. Dak., received a $317,203 contract for 5.1 mi. of grading, surfacing, and draining on the Hardin-Sarpy road in Big Horn County. **Peter Kiewit Sons' Co.,** Billings, received a $282,759 contract for 7.6 mi. of grading, aggregate surfacing, and draining on the Meriweather Route east of Blackfoot-northerly in Glacier County. **Baltrusch Construction Co.** of Havre received a $171,337 contract for 8.8 mi. of grading and surfacing on the Harlem-Hogeland road in Blaine County.

NEW MEXICO

Wayne A. Lowdermilk and **Gardner Construction Co.** of Denver, Colo., submitted a low bid of $1,164,002 for 3.1 mi. of grading, surfacing, and structures 12 mi. east of Arizona-New Mexico State line east in McKinley County. **Skousen Construction Co.** and **Skousen-Hise Construction Co.** of Albuquerque submitted a low bid of $1,215,294 for grading, surfacing, structures, and related work on 2.6 mi. on U.S. 550, Aztec Urban, San Juan County. **Gardner Construction Co.** of Denver, Colo., submitted a low bid of $605,138 for construction of the Barcelona Bridge in Bernalillo County. A low bid of $306,071 was submitted by **Haake Construction Co., Inc.,** Santa Fe, for 8.4 mi. of grading, surfacing and related work on State Highway 10, Gran Quivera North in Torrance County. **Leslie Wheeler,** Albuquerque, submitted a low bid of $221,011 for 8.5 mi. of grading and surfacing on the Wagon Mound-Ocate highway in Mora County. A low bid of $243,672 was submitted by **Skousen-Hise Contracting Co.** of Albuquerque for 11.8 mi. of grading, surfacing, and related work on the Eunice Loop road north and south in Lea County.

NEVADA

Isbell Construction Co. of Reno received a $1,262,698 contract for construction of a portion of primary highway system in Mineral County. **Wells Cargo, Inc.,** Las Vegas, received a $433,167 contract for construction of portion of secondary highway system in Clark County. A $272,107 contract was received by **Nacon Co., Inc.** of Las Vegas for 4.2 mi. of grading and surfacing on State Route 11 in Elko County.

OREGON

Donald M. Drake of Portland submitted a low bid of $1,327,750 for repair on the south jetty at the mouth of the Columbia River. **MacGregor Triangle Co.,** Boise, Idaho, received a $1,088,970 contract for construction of the East Fork-Walker Creek section of the Eastside road at Cougar reservoir now under construction on the South Fork McKenzie River. **Bethlehem Steel Co.,** Bethlehem, Pa., submitted a low bid of $1,114,951 for construction of the Thomas Creek Bridge, north of Brookings on the Oregon Coast Highway in Curry County. **C. R. O'Neil,** Cresswell, submitted two low bids for highway work in Malheur and Hood River counties: $490,082 for grading, paving, and structures on the Central Oregon Highway in Malheur county, and $305,897 for grading, surfacing and related work on the Cascade Locks section on the Columbia River Highway in Hood River County. Two low bids were submitted by **J. C. Compton Co.,** McMinnville, for work in Curry and Hood River counties: $363,070 for stone base, binder and aggregate production on the Thomas Creek-Brookings Unit on the Oregon Coast Highway in Curry County, and $117,041 for grading and oiling on Deer Creek and Cresson roads in Hood River County. **Ham-**

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ilton & Thoms, Eugene, submitted a low bid of $349,224 for construction of 4 bridges on the Seven Oaks-Table Rock road on the Pacific Highway in Jackson County. Two low bids were submitted by **McNutt & Sons, Inc.,** Springfield, for work in Baker and Crook counties: $277,212 for grading and oiling the Sumpter-McEwen section of Sumpter Valley Highway in Baker County, and $168,041 for grading and oiling on the Middle Unit, Post-Camp Creek section of the Paulina Highway in Crook County. **Warren Northwest, Inc.,** Portland, submitted low bids for work in four counties: $228,043 for grading and paving on the Central Oregon Highway in Deschutes County, $132,330 for paving on the Corvallis-Hughes road on the Pacific West Highway in Benton County, and $167,164 for paving the Hampton-Sage Hen Hill section on the Central Oregon Highway in Deschutes, Lake and Harney counties. A low bid of $223,776 was submitted by **Mann Construction Co.** of Redmond for construction of the John Day River Bridge, grading and paving on the Wasco-Heppner highway in Sherman and Gilliam counties. **Salem Road & Driveway Co.** of Salem submitted a low bid of $222,669 for grading and paving the Chemawa road-Salem section on the North River road in Marion County. **Dorman Construction Co.,** Vancouver, Wash., submitted a low bid of $167,348 for paving at the Willow Creek-Jefferson County line on the Warm Springs Highway in Wasco County. A low bid of $152,506 was submitted by **T. C. Wildish Co.,** Eugene, for paving and related work on the Hendricks Bridge-Leaburg Dam section on McKenzie Highway in Lane County. **J. M. Arenz,** Portland, submitted a low bid of $129,114 for 3.1 mi. of grading on the Galice-Windy Gap section of the Galice Road, northwest of Grants Pass in Josephine County. **E. H. Itschner Co.** of Molalla submitted a low bid of $120,479 for 3.9 mi. of grading and oiling on the Woodell Lane Road north of Island City in Union County. A low bid of $119,134 was submitted by **Stanley Wilt** of Corvallis for 3.4 mi. of grading and oiling the Howard School section of the Ochoco Ranger Station road, east of Prineville in Crook County. **F. H. McEwen,** Eugene, submitted a low bid of $113,511 for stone base and oiling the West Unit, Siuslaw River-Walton section of the Richardson-Eugene highway in Lane County.

UTAH

W. W. Clyde of Springville submitted a low bid of $2,149,026 for grading, structures, surfacing and related work on 8.6 mi. of Interstate Highway 80, east of Silver Creek Junction in Summit County. **Morrison-Knudsen Co., Inc.,** Salt Lake City received a $1,392,490 contract for grading, surfacing, and 2 concrete structures in Utah County. A low bid of $807,946 was submitted by **LeGrand Johnson** of Logan, for grading and surfacing on Highway 15 West in Cassia County. **Stout Construction Co.,** Las Vegas, Nev., and **Hall & Hall** of Hurricane, submitted low bids on Schedule A and B: $358,507 for Schedule A and $358,506 for Schedule B, construction of surfaced road (2½-in.) in Washington County. A low bid of $151,036 was submitted by **Bettilyon Construction Co.** of Salt Lake City for construction of a bridge over the Provo River near Provo in Utah County. A low bid of $784,000 was submitted by **Alder-Child Construction Co.** of Salt Lake City for construction of Engineering Center for the University of Utah.

WASHINGTON

Lewis Hopkins Co., Pasco, received a $1,213,629 contract for earthwork, structures, and related work on Block 80 on the Columbia Basin Project. **Osberg Construction Co.,** Seattle, received a $788,711 contract for grading and surfacing in city and county of Snohomish. **Bocek Brothers** of Hoquiam received a $323,567 contract for 4.3 mi. of grading and surfacing on State Highway 9 in Grays County. **Conex, Inc.** of Portland, Ore., received a $284,977 contract for 7.1 mi. of grading and surfacing from Granger to Sunnyside in Yakima County. **J. J. Welcome Construction Co.,** Redmond, received a $253,638 contract for 1.7 mi. of grading and surfacing, Stanwood to Lindstrom road in Snohomish County. **Ostruske-Murphy, Inc.** of Tacoma received a $227,086 contract for constructing an undercrossing at Ardena Road and a concrete bridge and 2 concrete slab bridges at Hylebos Creek on State Highway 1 in Pierce County. **J. F. Konen Construction Co., Inc.,** Lewiston, Idaho, received a $200,433 contract for draining, grading and surfacing on 10.3 mi. of State Highway 6 in Pend Orielle County. A $233,128 contract was awarded to the **Baugh Co. & N. Paduano Bulldozing,** of Seattle, for constructing 1.3 mi. of highway and construction of a concrete slab bridge on State Highway 2 and 15, in King County. **P. J. Anderson & Sons** of Seattle received a $763,639 contract for constructing 3.4 mi. of new 4-lane highway on State Highway 9 from Pioneer Rock to Summit Lake Road in Thurston County. **F. R. Hewett Co.** of Spokane, (joint venture) received a $174,762 contract for constructing 1 mi. of highway in Reardan on State Highway 2, Lincoln County. **K. F. Jacobsen & Co.** of Portland, Ore., received a $149,921 contract for grading and surfacing 0.7 mi. of Clark County roads in the Hazel Dell vicinity. A contract of $130,700 was received by **Ray Weist** of Yakima for 6.5 mi. of grading and surfacing on the Branch and Larue roads in Yakima County.

WYOMING

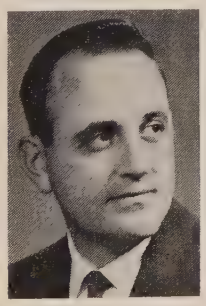
Summit Construction Co. of Rapid City, S. Dak., received a $667,471 contract for grading, surfacing, and construction of 4 structural plate culverts and related work on 6.7 mi. from U. S. 14 in Moorcroft east in Crook County. **L. H. Weber,** contractor of Rawlins, received a $523,814 contract for 5.5 mi. of grading and surfacing and 4 structures on the Kemmerer-Sage Junction road west of Kemmerer in Lincoln County. A $396,723 contract was received by **Rand Construction Co., Inc.** of Rapid City, S. Dak., for 6.7 mi. of grading and surfacing and construction of structures and miscellaneous work on 4-lane divided highway between Moorcroft and Sundance from U. S. 14 in Moorcroft east in Crook County. **D. W. Hopkins,** Wheatland, received a $132,620 contract for grading, surfacing, and related work on 7.9 mi. of highway southwest of Torrington in Goshen County. **Charles M. Smith** of Thermopolis received a $160,507 contract for construction of 5 reinforced concrete culvert extensions and miscellaneous work on 1.3 mi. west of Wamsutter in Sweetwater County. **Knisely-Moore Co.** of Douglas received a $116,367 contract for reprocessing surfacing and miscellaneous work on 11 mi. of the Cheyenne-west road in Laramie County. **LeGrand Johnson Construction Co., Inc.** of Logan, Utah, submitted a low bid of $155,121 for grading, surfacing, and miscellaneous work on the Evanston-South road in Uinta County.

ENGINEERS and CONTRACTORS

A. T. SMITH, contractor, receives congratulations from *James W. Hamilton*, center, and *Charles N. Zleisy*, engineers with the U. S. Army Engineer District, Los Angeles, following inspection of a new road. Smith had contracted with the Engineers to build a road to a Titan facility at Vandenberg AFB in Southern California, and finished the job a month ahead of schedule.

Jack Y. Barnes, Portland Cement Association district engineer at Helena, Mont., since 1952, has been named district engineer for Colorado and Wyoming. He will be replaced in Helena by **Norman D. Baumgart,** who has been soil-cement engineer for the Rocky Mountain region since August

Barnes



Baumgart

1958. In his new post Barnes fills an administrative vacancy. Previously **Edward W. Thorson** was responsible for supervising both the Denver office and the Rocky Mountain Region, but now will devote full time to serving as Rocky Mountain regional manager. Both Thorson and Barnes will maintain offices in the Boston Building in Denver.

Joe W. Kelly has been elected 1960 president of the American Concrete Institute. Kelly is professor of civil engineering at the University of California, Berkeley. The new chief executive has actively participated in ACI affairs since 1926. **Ben C. Gerwick, Jr.,** president of Ben C. Gerwick, Inc., San Francisco, is one of the new directors elected to serve a 3-year term.

* * *

From Salt Lake City announcement is made of reassignments among the resident engineers of the Utah State Road Commission. **Thomas Law** has been assigned to Interstate Highway 15 where 4.9 mi. are being constructed by Morrison-Knudsen Co., Inc. **Edward D. Kennelly** is in charge of constructing water and sewer lines and trench excavation on Interstate 15 in Salt Lake City. Wheelwright Construction Co. contracted to do this job in 160 working days. **Sherman Burton** is resident on State Road 255 near Salt Lake City where Gibbons & Reed is placing a plant-mix bituminous surface.

Robert T. Lawson has joined Harding Associates, soil and foundation engineers, with offices in San Rafael and San Francisco, Calif.

* * *

Fred Ervin, former city engineer of the city of Palos Verdes Estates, Calif., has joined the architect-engineering firm of Engineering Service Corp. of Los Angeles. He will serve as division engineer in charge of planning and design.

* * *

Denton H. Hays of Carson City has been named administrative officer for the Nevada Department of Highways. He has a record of 30 years' service with the highway organization, during which he held assignments in all parts of Nevada.

* * *

R. J. Tipton Associated Engineers, Inc., recently merged into Tipton and Kalmbach, Inc. The home office of the merged firm will be Denver, Colo.

* * *

Col. Christian Hanburger has received assignment as district engineer for the U. S. Army Engineer District, Alaska, effective in July. He will succeed **Col. William C. Gribble, Jr.** who will be leaving Anchorage to attend the National War College in Washington, D. C.

CALENDAR

Sept. 19-21—Annual National Highway Conference for County Engineers and Officials, sponsored by ARBA's County Division, Atlanta Biltmore Hotel, Atlanta, Ga.

Sept. 27-30 — Prestressed Concrete Institute, annual convention, Statler-Hilton Hotel, New York City.

Oct. 10-13—American Mining Congress Mining Show, Convention Center, Las Vegas, Nev.

Oct. 14-16 — California Association of Engineering Geologists, annual meeting, University of California, Berkeley.

Oct. 17-21 — National Safety Council, annual national safety congress, Chicago, Ill.

Nov. 28 - Dec. 2 — American Association of State Highway Officials, annual convention, Detroit, Mich.

SUPERVISING the jobs

Duke Condrey and **Von Hiatt,** general superintendent and assistant respectively, are chief supervisors on Goodfellow Bros.' $1,500,000 railroad protection job at Rocky Reach Dam, Wenatchee, Wash. Assisting as foremen are **Ben Hollister, Dean Macy** and **Mike Gillespie. Don Obert** is master mechanic. Project engineer is **Bob Hofstodt.** Appointed as structural inspectors for Stone & Webster Engineering Corp. are **Jim Tinto** and **Johnny Davies.** Work has just started and is scheduled for completion in January 1961.

* * *

Emile Ruffier, job sponsor, and **Leo Larson,** job superintendent, are key men on a $2,657,498 award to Peter Kiewit Sons' Co. for 9.1-mi. grading and surfacing work on the Miles City-east highway in Custer County, Mont. Work involves 3,000,000 cu. yd. excavation, subbase gravel, 8 in. x 24 ft. concrete paving, pipe, asphalt, and concrete structures. Office manager is **Gene Goehring,** and foremen are **Lyman Tippets,** and **Harold Huber,** while **Rollie Brumfield** is mechanic. Scheduled for completion the fall of '61, work started here in March.

IN Oakland, Calif., Guy F. Atkinson Co. is constructing about 2.1 mi. of freeway on US 50. In addition to grading and surfacing and 6 bridges, 19 retaining walls and other work are involved in the $4,109,789 contract. The principal bridge is a twin structure 1,050 ft. long over Broadway and Richmond Blvd. Shown here are some of the contractor's principal men on this project. Left to right: Top row—*Evan Millington,* grading superintendent; *William Husemann,* structures superintendent; *P. K. Mitchell,* project manager. Bottom row—*Don Kaae,* project engineer; *Brent Booth,* office engineer, and *Ed Hunt,* office manager. Atkinson expects to meet a target date of April 1962.

* * *

William A. Taylor, superintendent, was named as chief supervisor by Robertson & Cave and Sletten Construction Co., successful bidder to construct steel and concrete bridge over the Great Northern Railroad tracks in city of Great Falls, Mont. A 20-month contract, work on the $1,139,281 project has been under way since March.

* * *

M. A. Little Jr., project manager, **Bob Chapman,** project superintendent, **Ross Peterson,** project engineer, and **B. Watson,** office engineer, comprise the top personnel named by Baldwin Contracting Co., Inc., successful bidder for the construction of hangars, including utilities, paving and other work at the Naval Air Station, Lemoore, Calif. Work on the $7,145,258 contract commenced Mar. 1, earmarked for completion by July 1 next year.

* * *

Floyd Hardenbrook is project manager, **Bill King,** superintendent, and **Marion Kruse,** office manager, for the joint venture firm of Raber-Kief, Inc. and B-E-C-K Constructors which has a $3,853,000 contract for electronic aids to navigation station, buildings, tower, airport runway repairs and other work located at Sitkinak, St. Paul and Attu Islands, and Adak, Alaska. Under way since May 1, the contract will be complete in November.

* * *

Emil Forman is acting as project manager and purchasing agent for Montgomery Ross Fisher, Inc., on a contract from the Navy to construct barracks and related work at the Marine Corps Air Facility at Santa Ana, Calif. Superintending the $1,547,000 job is **Everett Hall.** A year long project, work will run to the end of this year.

* * *

Fred Michel, superintendent, aided by **Burton S. Brewer** and **Axel Malstrom,** foremen, has charge of erection of steel truss bridge and reinforced concrete box girder approach span over the Cowlitz River near Longview, Wash. The work

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is being done by Anderson Bridge Construction Co. at a $756,238 figure. Under construction since February, work will run till February next year.

* * *

Wallace D. Hughes is supervising a $313,815 job for Gibbons & Reed Co. in Multnomah County, Ore. Work covers interchanges, undercrossing structure, grading, paving and related work on the Columbia River Highway east of Troutdale. **Wallace Blom** is acting as carpenter foreman. Under way since March, the work will be finished in October.

* * *

O'Neil Jones, general superintendent for Albert LaLonde Co., is in charge of grading, draining, surfacing and plant-mix oiling, a $758,200 job west of Wolf Point-North Dakota state line in Roosevelt County, Mont. Superintendents are **Earl Fisher**, gravel, **Eldon Ulshafer**, paving and **Roy Armstrong**, pipe. With Oct. 1 the target date, work has been going since May 1.

* * *

Alvin Connerley is superintending a $569,649 contract recently awarded to W. R. Cahoon for bridge and approaches over the Snake River in Gooding and Twin Falls counties, Idaho. The piling and concrete work is being carried on using 1-yd. Insley working off barges. Roads and approaches were sub-contracted to Karl Woodall Construction Co. **Les Bally** is engineer on this project which has been under way since March and will require 240 working days.

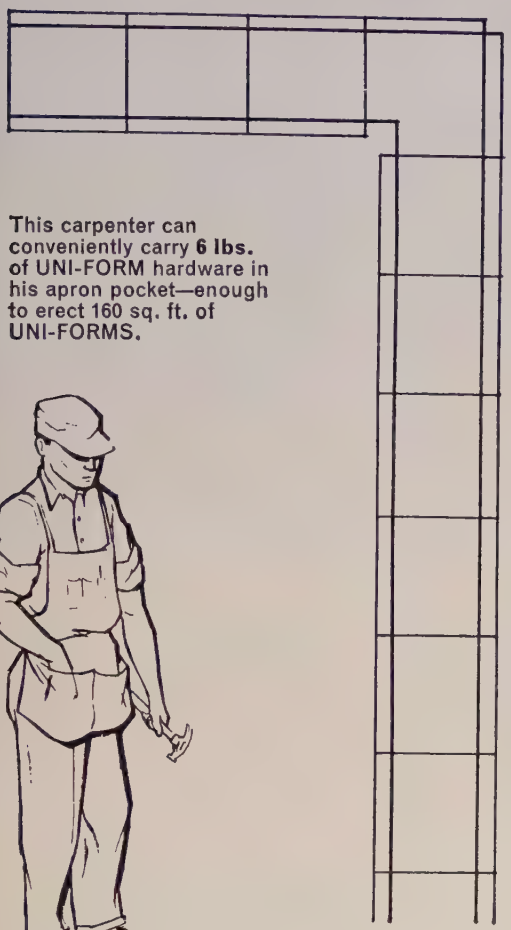
* * *

Sig Andersson is directing a $389,769 project recently awarded his firm for 6 bridges in interchange on relocated Highway 99, three miles out of Eugene, Ore. Superintending the job is **John Emmett**. Work started in February, and according to **William Coffindaffer**, estimator, it will be finished some time in October.

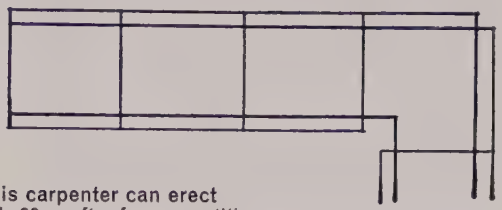
* * *

Niles Lybarger is field superintendent, and **Larry Graves**, job foreman, for Babbitt Construction Co. which has a $216,666 contract to enlarge sewage treatment plant for the city of Boise, Idaho. Babbitt started work in March and will be finished in September.

WHICH PREFAB FORM SYSTEM OFFERS MORE PRODUCTIVE FORMING TIME PER DAY?



This carpenter can conveniently carry **6 lbs.** of UNI-FORM hardware in his apron pocket—enough to erect 160 sq. ft. of UNI-FORMS.



This carpenter can erect only 60 sq. ft. of a competitive prefab system's panels with the **6 lbs.** of hardware he carries in his apron. **Extra trips for hardware means less productive forming time.**

UNI-FORM SYSTEM

Carpenters can form more contact area per hour with UNI-FORM Panels than they can with any other prefab form system. The reason? It takes less hardware—in most cases, 50% less—to form a given contact area. And UNI-FORM hardware **weighs less, costs less,** and is easier to install.

EXAMPLE: **6 lbs. of UNI-FORM hardware—128 Tie Keys—are required to install 32 UNI-FORM Ties (4 keys per tie).** 32 Ties are required to erect 160 sq. ft. of UNI-FORM Panels.

Cost of hardware required to install 1 UNI-FORM Tie: **LESS THAN 4¢.**
(Tie Keys are re-usable)

COMPETITIVE PREFAB FORM

A leading competitive prefab form system requires 2 tightening wedges and 2 connecting bolts per tie installed. **In 6 lbs. of this hardware, there are only 24 sets of wedges and bolts—enough for 12 ties.** 12 ties will assemble **only 60 sq. ft.** of this system's panels.

Cost of hardware required to install 1 competitive tie: **36¢.**
(Wedges and Bolts are re-usable)

WHICH PREFAB FORM SYSTEM GIVES YOU FASTER FORM ERECTION AND LOWER COSTS? Want more information about UNI-FORM Panels and the advantages they can bring to your concrete forming? Write today for complete details.

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Arthur W. Rogers and **Chester F. Cooper,** general superintendent and project superintendent respectively, are Tanner Bros. Contracting Co.'s top men on a highway job southeast of Ray in Pinal County, Ariz. The $469,088 contract is for grading and drain on 2.8 mi. of new alignment located in mountainous country with vertical rises and deep washes. Field office manager is **Ray Hershner.** General foreman is **Andy Telles;** concrete foreman is **Jack Willis,** and carpenter foreman is **Cecil Jacobson, Jr.**

Cooper *Rogers*

* * *

Adrian Toolson, division manager, **Roy E. Ladd,** project manager, and **Jack Griffin,** superintendent, are key men for Gibbons & Reed Co.'s recent $4,065,797 award covering grading, and surfacing to relocate 5.1 mi. of U.S. 299 west of Redding, Calif. Serving as master mechanics are **"Mick" Herndon** and **Adrian Cox,** while the foremen are **Wayne Moore, Dick Stimple, Tom Stimple** and **Forrest Hunter.**

* * *

M. G. Peterson, superintendent, assisted by **Les Terry,** is in charge of construction of 8 underground concrete filter structures at the Hanford Works, Richland, Wash. Engineer is **Jack Wells; Robert Gier** is in charge of the office. Concrete foreman is **Gordon Legurski.** Job started last November, and will probably end this October, according to R. B. Miles Construction Co. which is doing the work at a cost of $1,698,866.

* * *

Duane R. Rundle, general superintendent, with **Clyde W. Crain** and **Clarence Kite,** assistant super-

Ford Industrial Tractor, Super Duty Loader, 12' Backhoe.

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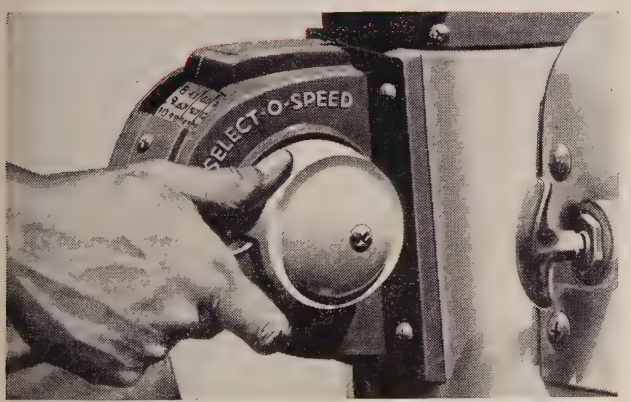

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TRACTORS AND EQUIPMENT FOR 101 INDUSTRIAL JOBS...

FORD

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intendents, and **Jollie Holzer,** culvert foreman, comprise Hopkins Construction Co.'s top personnel for $714,000 worth of grading and bituminous stabilized base on 4.1 mi. of road in Roosevelt National Forest, Colorado. Involved is a major item of 300,000 cu. yd. of unclassified excavation. Scheduled for completion in June, this work started in January.

* * *

J. G. Powers is grading superintendent, while **W. W. Waetje** is concrete superintendent on a $333,333 contract awarded to Royden Construction Co. for grading, surfacing and related work on 4¾ mi. of State Route 85 in Maricopa County, Ariz. Field office manager is **J. B. Donaldson.** Scheduled for July completion, work started in February.

* * *

Chester W. Johnson, general superintendent for Cahill-Mooney Construction Co., is in charge of a $334,588 contract, on which **Don Stanisich** is job superintendent. It covers five 4-span prestressed concrete bridges on the Butte urban road in Silver Bow County, Mont. **H. J. Carver** is equipment and pile foreman for the work which has been under way since March and will be finished about Nov. 1.

* * *

James Alderson, project manager, and **Ora Beach,** superintendent, head Allison Honer Co.'s force constructing temporary facilities at Orange County State College in Fullerton, Calif. Carpenter foreman on the $491,214 construction is **W. Stickler,** while **G. H. Brader** is labor foreman. Started in March, the job will finish in August.

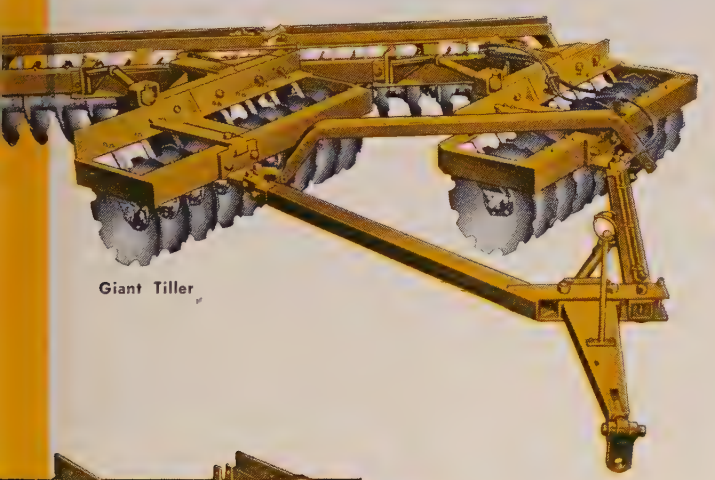
* * *

Lewis Chinn is supervising a $1,744,186 contract recently awarded to Colorado Constructors, Inc., covering 2 mi. of highway construction including two 700-ft. tunnels, 7 bridges, 360,000 yd. of rock excavation, and asphalt surface on U.S. 40 and 6 east of Idaho Springs, Colo. Other key contractor personnel are: **Ed Williams,** bridge superintendent; **Tony Jensen,** drill foreman; **Victor Karst,** timekeeper; **Arthur Kokesh,** grade foreman, and **Frank Merrick,** tunnel superintendent. Earmarked for completion in May next year, work here has been under way since early March.

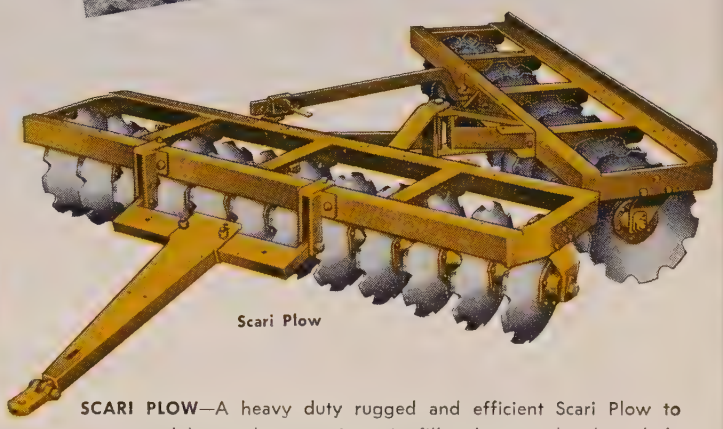
TOWNER
Contractors Tools

Two giant disc tillers working on Oahe Dam, Pierre, South Dakota.

Land clearing with Scari-plow.



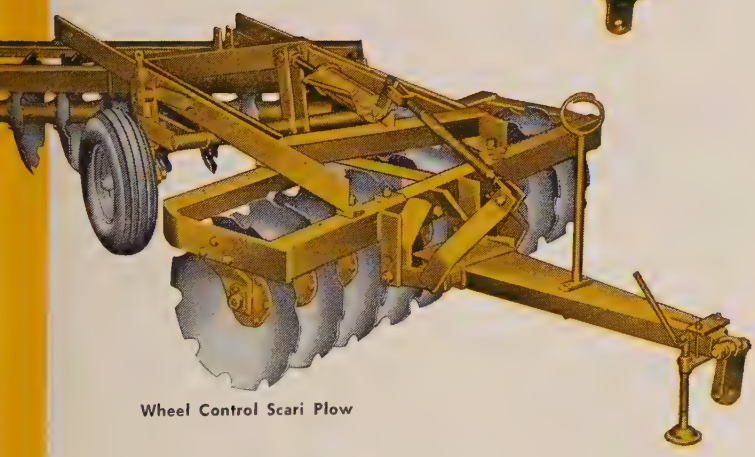
Giant Tiller



Scari Plow

SCARI PLOW—A heavy duty rugged and efficient Scari Plow to aerate and loosen borrow pits, mix fills, clear out brush and do a variety of jobs, requiring a medium weight unit 600 lbs. per foot. Entire disc gang revolves on oil bath axles assuring minimum plugging and greater under axle clearance than with stationary bearing journals and up to one-third more useable blade wear. Single units in sizes 6 to 12 feet. Squadrons, 12 to 24 feet.

GIANT TILLER—1000 lbs. per foot, truly a heavy duty disc plow designed to penetrate deep in the toughest ground conditions, to do the jobs that lighter plows cannot handle. Twenty-One foot units (pictured above), pulled by D-9's were mixing 12 inch lifts twice the depth possible with conventional Scari Plows—doing better job in half the time. Available with 12 or 16 inch disc spacing, 32, 36, or 38 inch blades. Single units in 8 to 12 foot sizes. Squadrons (as pictured) 16 to 24 foot sizes.



Wheel Control Scari Plow

WHEEL CONTROL SCARI PLOW—Wheel Control Scari Plow provides easy transport for the same heavy duty Scari-Plow which has proven so popular through the years. Depth control and maneuverability make this an ideal unit for highway shoulder maintenance as well as regular borrow pit aerating and mixing fills. Available in 8 to 12 foot sizes, cable or hydraulic control.

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CONSTRUCTION BRIEFS

RESERVOIR with plywood roof is under construction for East Bay MUD by Williams & Burrows, Inc. Shown with new air-cooled diesel compressor used on job are, from left, Les Clements, vice president, Sarki Sarkisian, site superintendent, and Joe Wolfe, project manager.

Air-cooled diesel compressors used on 19-ac. covered reservoir project

NEW AIR-COOLED diesel engine air compressors are being used by Williams & Burrows Inc., of Belmont, Calif. in construction of a 19½-ac. reservoir for East Bay Municipal Utility District.

The concrete water storage facility will be completely roofed with plywood on laminated wood beams as an evaporation deterrent, and to reduce contamination.

The contracting firm has standardized on Atlas-Copco air-cooled diesels, and now operates an 11-compressor fleet.

Substantial savings are reported on jobs requiring limited volumes of air, including an average reduction in daily fuel cost of 70% compared to conventional gasoline-powered compressors.

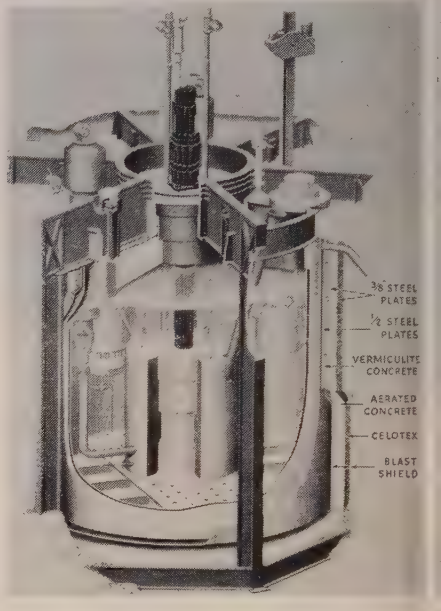
A development of European manufacturers, air-cooled diesel models have proved well adapted to Western construction use because of their versatile all-weather operating feature without special modification.

Diesel units cost 10% to 20% more than comparable gasoline models, but weight is significantly less.

Comparative fuel costs for an 8-hr. period is $1.90 for the diesel type against $6.75 for a comparable gasoline model.

Reactor blast shield uses fiberboard

UNIQUE APPLICATION of fiberboard, manufactured by The Celotex Corp., is seen in cutaway view of primary tank vessel for Idaho Experimental Breeder Reactor-II, being constructed for Argonne National Laboratory near Idaho Falls. Blast shield surrounding primary tank consists of two 8¾-in. layers



of concrete and 8-in. of fiberboard separated by ⅜-in. steel cylinders. Basic purpose of 32-ft. high, 38-ft. diameter blast shield is to absorb pressure energy and convert it into waste heat in the very unlikely event of a nuclear explosion.

Argonne engineers say that about 90% of any explosion energy released would be dissipated as waste heat within the 80,000 gal. of liquid sodium surrounding the reactor vessel itself. (Large cylinder at base of primary tank.)

AT Wanapum Dam site a large yardage of preliminary excavation is required. In the center of the photo is a Monighan dragline with 17-yd. bucket excavating in the powerhouse section. About 600 men are employed by the contractor, Grant County Constructors, and this number is expected to more than double by the end of this year. The dam is being built 6 mi. below Vantage, Wash., on the Columbia River.

MASTER MECHANIC®

ATTENDING the diesel fuel program of Bay Area EMSA were, from left, George Kent, Standard Oil; Dave Jones, speaker, of California Research Corp.; Gino Giampaoli, Piombo Construction, chapter president; C. R. McClellan, Standard Oil; and Bob Leforce, Blakemore Equipment, vice-president.

Clogged air filter main cause of engine smoke, experts say

ONE OF THE most frequent causes of excessive engine smoke on diesel rigs is a plugged air filter, Dave Jones of California Research Corp. told a recent meeting of the Bay Area Equipment Maintenance Supervisors Assn.

Bay Area

Jones, whose Richmond-based firm is the scientific arm of Standard Oil of California, presented an informative discussion of diesel fuels, covering storage, contamination, important fuel properties and engine smoke problems.

Truck operators in Southern California are collecting sizable tickets for exhaust smoke from police and state troopers armed with Ringleman charts. The chart is a circle divided into 5 segments of varying shades of gray with a hole in the center. The gendarme squints through the hole at the exhaust smoke, comparing its density with the shades around the edge, and when smoke shows 40 to 60% density the operator gets a ticket.

On trucks checked at random, common causes of smoke included overfilling, plugged spray holes, poor plunger seating, and most often plugged air filters.

It was pointed out that if the filter is in range of the exhaust, smoke will plug the filter, causing more smoke, causing even more plugging of the filter.

To keep smoke down, Jones recommended three steps: use the proper fuel, set the pump right, and maintain the engine in optimum condition. He discounted the effectiveness of proprietary additives for reducing or eliminating smoke. Some detergent additives, he said, may eventually clean up the engine, but there is no quick smoke fix.

Of the wide range of diesel fuels available, Jones recommended No. 2 diesel for most highway and construction applications. He noted that fuels are carefully prepared, and must meet as many as 15 different specifications.

Among the most important fuel properties are: Cetane number, a rating indicating the fuel's ability to ignite (opposite of octane rating in gasoline). A high cetane number indicates it will ignite quickly, start quicker and operate at lower temperatures.

Energy content (usually expressed in BTU). Heavier, cheaper fuels usually have a higher energy content, and thus supply more potential power than the lighter types.

Viscosity is particularly important. Diesel operation depends on the atomization of the fuel and its dispersal in the cylinder. Higher viscosity produces larger drops which are harder to burn, but provide better penetration.

Sulfur content must be kept as low as possible since sulfur is corrosive, and causes engine wear.

Discussing fuel storage, Jones noted that except for jets, diesel engines are most sensitive to foreign material, due tto close tolerances in the pump and plunger and small injector nozzle holes. Most common contaminants in stored fuel are water, air-borne dirt, rust, fuel gums and other petroleum products. Ten percent adulteration with other petroleum fuels is critical, he said. Effect is to cut the cetane number, reduce viscosity, and lower the flash point.

Fuel gums usually result from unstable fuels, or storage under severe heat conditions.

To keep stored fuel clean, he recommended:

1. Allow adequate settling time after filling (about 8 hours) before drawing from storage tank.
2. Never draw directly off the bottom of the tank (where rust and foreign particles collect).
3. Inspect and clean tanks at the end of each season.
4. Put filters on dispensing equipment.

Apprentice training planned

THOUGH April was dinner dance and installation month for Los Angeles' EMSA group, this did not cool the interest shown a month ago in long-range planning for a more dynamic EMSA program.

Los Angeles

Following the April Board of Directors meeting comes news of an ambitious apprenticeship and training effort on the part of EMSA for the benefit of equipment operators and the contractors. President-elect Bob Moodie of J. A. Thompson & Son says that this is not an original idea, but rather a new look at a dream en

visioned by equipment contractors and the equipment supervisors for many years.

"The AGC, the EGCA and the Operating Engineers have been trying to put together a workable apprenticeship and training program for heavy equipment men for years," explains Moodie. "So far, differences between these groups have stagnated committee work. Our hope is that our interest in the idea will help to ease the procedural difficulties that have developed."

Bob Moodie realizes this is an ambitious goal for the young group, and acknowledges it will take a lot of cooperation between themselves, the Operating Engineers and the interested contractor groups to get a universally acceptable program adopted.

"What we'd like to see come of this," explains Moodie, "is the kind of meaningful training program found among building trades people."

Envisaged by EMSA is intensive training and refresher courses in the mechanics of the equipment, the drive mechanism, electronics systems, etc. Successful completion of such courses would result in appropriate certification concerning the equipment involved.

"We have a big stake in this kind of a program," points out Bob Moodie. "A tremendous amount of the work we're called upon to do could be eliminated if the operators knew something about the equipment they use. We have no intention of making mechanics of these men through such a program. We want to make them better operators."

New chapter

An important corollary of such an effort is the challenge such a program would offer to EMSA members—both in Los Angeles and elsewhere. "Once such a program is under way," states Moodie, "our people would be up to their necks in the one thing they really know, and this is something this group badly needs."

Other good news from the board meeting: A new EMSA chapter has been started, this one in Honolulu. With guidance from L.A. EMSA vice president Ralph Currier and past president Dave Moodie, a nucleus of resident maintenance men organized the Honolulu chapter in March. Those interested should contact: Jim McKenna, Hood-Thompson Construction Co., Box 701, Honolulu.

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MODERN PAVING MACHINERY

HIGHWAY building, in a broad sense, includes the use of almost every type of construction equipment. However, the machines that belong almost exclusively to highway (and airport) work are units for placing, spreading, finishing, and later maintaining the surfacing or pavement.

A round-up of the latest models of this equipment has been prepared for this Annual Highway Issue, and appears in the following pages.

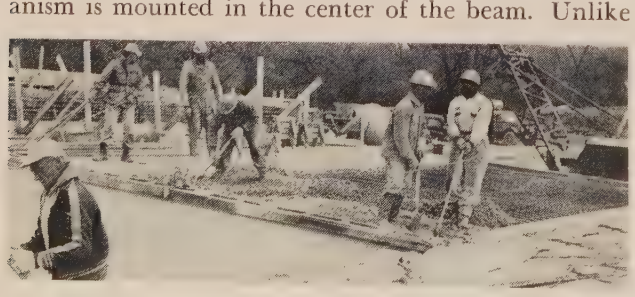
New paver mixer debut

There is a new entry in the asphalt paving sweepstakes. It's a machine manufactured in San Jose, Calif., by the **Ferguson Paver Mfg. Co.** It has been well received in California and Arizona, and is now being introduced to the other Western States. The paver is

manufactured by adding a framework and appropriate equipment to a basic Oliver gasoline crawler tractor. The standard width of 4 ft. to 8 ft. can be increased to 10 ft. with extensions. The hopper has a 3-ton capacity. Thickness of the spread varies up to 6 in. at speeds from 20 ft. per minute to 90 ft. per minute. The machine is capable of laying 1,600 tons of material .25 ft. thick in 9 hr. ... *Write No. 155*

Beam screed "slaps" slab

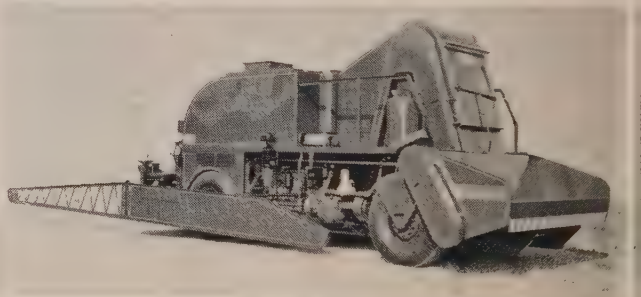
A different principle is used in the finishing screed manufactured by **Thor Power Tool Co.** The screed consists of two beams rigidly connected and is similar to others in that a gasoline engine and vibrating mechanism is mounted in the center of the beam. Unlike



other screeds, however, this one does not depend on transmiting vibration to the beams and then to the concrete. The vibration is transmitted to the beam which in turn sets in motion four steel straps fastened to the underside. A high degree of compaction is obtained from the slapping action of the straps on the concrete. The Thor screed is very light and can be used with inexpensive wood forms. The vibration mechanism remains cool after hours of operation. It is operated in oil which eliminates rusting and freezing of bearings. The company will send without charge an excellent discussion of the principles of vibrating screeds. ... *Write No. 156*

Asphalt paver for cold mixes

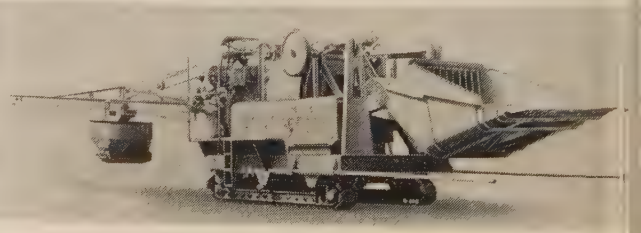
A machine which is self-contained and accomplishes complete mixing and laying of cold asphaltic mixes in one continuous operation is being manufactured by **Hetherington & Berner, Inc.** Aggregate is dumped into the front hopper and moved by a broad belt to a bucket elevator which carries it to a small bin at the top of the housing. From there it is put into a pugmill by a calibrated feed roll. Two bitumen tanks



with a total capacity of 800 gal. supply bitumen to a pump. Mixed material is ejected behind the strike-off and augered to full width. The strike-off is supported on 25-ft. runners, independent of machine, so that good leveling action is assured. Required crew is a driver, operator, and three laborers. Full information is available from the manufacturer. ... *Write No. 157*

Dual drum paver designed for speed

Controlled discharge from boom bucket, maximum boom swing and simultaneous bucket travel which permits spreading to desired thickness or pouring into forms—are some of the features of the new dual drum Model 1 34E concrete paver being manufactured by



Worthington. The new machine's speed of operation is indicated by such figures as 256 ft. per min. bucket speed, 6½ sec. for skip travel from ground to charging position, and 6½ sec. for discharge. As special equipment, the paver has a 700-gal. storage tank and 60-gal. water measuring tank mounted on the main frame. This does not increase the paver's height and supplies sufficient water for 20 batches. This tank will usually eliminate one tank and truck driver when the hauling water method is used. Extra equipment is a device designed to permit the subgrade template puller to pull the towing strike-off on any width road up to 25 ft., with the paver working inside the forms. It consists of an I-beam attached to the side of the paver acting as an outrigger carrying the necessary sheaves. All of the paver's operating features and characteristics are described in detail in a well-produced 28 page brochure available by writing the appropriate Reader's Service number.

. . . Write No. 158

Blacktop spreader attaches to tractor

A blacktop spreader attachment for the **Massey-Ferguson** Work Bull 1001 tractor shovel is now available. Easily installed or removed, the spreader can use asphalt or oil mix, hot or cold, with crushed rock or

aggregate any size up to ¾ in. It is particularly suitable for patching jobs. The spreader works off the tractor's hydraulic system through its own motor and features independent hydraulic control for each phase of the operation. It rides on its own pneumatic tires with hydraulic height adjustment and has high maneuverability for odd-shaped areas. The spreader can be adjusted to any width up to 8 ft. and any thickness up to 6 in. The hopper has a capacity of 2 cu. yd. Reversible twin augers are used to clean the hopper and assure an even spread. Standard equipment includes a screed ironing pad. A butane heater is available as optional equipment.

. . . Write No. 159

Base stabilizer plant is portable

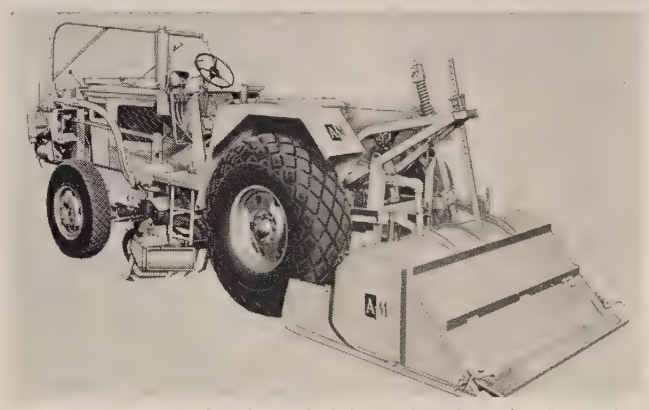
A new base stabilizer plant for highways and airports is being manufactured by **Madsen Works,** the oldest manufacturer of asphalt plants in the West. It has been designed throughout for ease of erection, dismantling and transporting. The feed can be brought into the mixer on either side or at the end. A drive-through-way in two directions is provided. The discharge and the mixing hopper is located in the center of the drive-through. An air-operated clamshell gate is used for discharge to truck. Output rating is 600 tons per hr. of stabilized base. The pugmill mixer is

a twin-shaft continuous type with replaceable liners. A new push-pull gate controls the mixing pressure by maintaining a constant and desired depth in the pugmill. Because of the frequency of start and stopping in stabilizer operations, the plant is provided with a pushbutton station on the mixer operator's platform, which permits simultaneous starting and stopping of aggregate feed, cement, and water. All the features and details of the machine are described in a 6-page 2-color brochure.

. . . Write No. 160

Rotary mixer is self-propelled

A self-propelled rotary mixer with a 7-ft. mixing width and hydraulically controlled 2-speed rotor is being manufactured by the Construction Equipment Division of **American-Marietta Co.** Called the Trav-L-Plant, the machine is powered by a 138-hp. gasoline engine. Main and auxiliary transmissions provide 10 speeds forward of 97 ft. per min. to 15 mph., and two



reverse speeds of 1.9 and 3.3 mph. Standard equipment includes power steering, underbody scarifier, auxiliary gasoline engine with 200-gpm. pump, spray bar, and meters for binder application.

. . . Write No. 161

Slip-form paver is job-proven

A slip-form paver which has met with great success wherever it has been used is the Rex, made by **Chain Belt Co.** The machine is crawler-mounted and travels directly on the subgrade. Thickness of slab is not altered while machine is in motion. Operator keeps on line by following a string line. The Rex paver is simply constructed, easy to maintain, easy to operate. In the March 1960 issue of *Western Construction* appeared an article describing this paver's successful use on a major concrete freeway project in Los Angeles. Full details are available from the manufacturer.

. . . Write No. 162

Latest Barber-Greene asphalt pavers

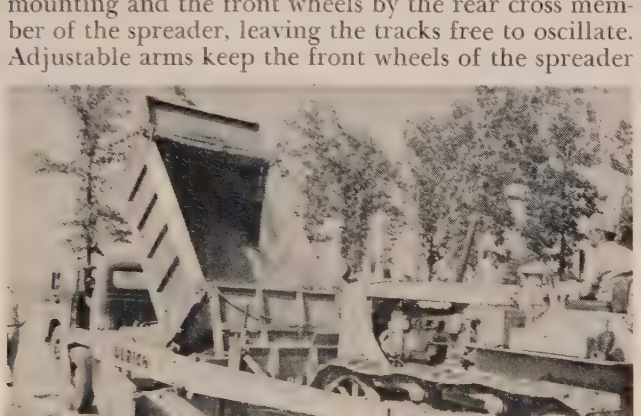
Latest models in **Barber-Greene's** full-range family of asphalt paving machines are the SA-60 (crawler mounted) and the SB-60 (pneumatic tire mounted). Other than mounting, the models are in all respects

identical. Capable of laying speeds well in excess of 100 fpm. the machines represent the highest capacity available today and can handle more than the output of the world's largest asphalt mixing plant. The paver features automatic tamping-leveling action, pre-strike-off compaction, power steering, and extensive use of hydraulic controls.

. . . Write No. 163

Spreader utilizes dozer blade

A simplified base spreader which utilizes the dozer blade in front of a tractor for strike-off is being manufactured by **Ulrich Mfg. Co.** The blade is operated in float position and is carried between the rear mounting and the front wheels by the rear cross member of the spreader, leaving the tracks free to oscillate. Adjustable arms keep the front wheels of the spreader



on the sub-base. Large wing nuts control the depth of spread. Horizontal adjustments are equally simple. The spreader is removed by lifting the blade clamps at each end of the dozer blade and pulling the pins from the trunion mountings on each side of the tractor. Spreading width varies from 10 ft. to 16 ft. and spreading depth from 1 in. to 20 in. The machine weighs 4,470 lb.

. . . Write No. 164

Finisher weighs only 3,000 lb.

A concrete bridge deck finisher with a total weight of less than 3,000 lb. is in production by **Master Vibrator Co.** It strikes off, vibrates, compacts and finishes concrete to specification in one pass. It is 5 ft. wide, 2 ft. 11 in. high and adjustable in length from 15 to 31 ft. There is little to go wrong; no complicated hydraulic or control systems to worry about. It has four 12-in. flanged wheels which ride on standard

forms. Low-geared winches on each side of the machine have 100 ft. of 3/16-in. cable. The cable is set ahead of the machine and is used by the machine to pull itself forward at the uniform rate varying from 2 to 6 ft. per min. Crank screw adjustments raise and lower the beams and introduce parabolic or circular crowns.

. . . Write No. 165

Base mixer comes in range of sizes

Mixers for mixing stabilized base materials are available in a range of sizes from 125 tons per hr. to 600 tons per hr. by the **Eagle Iron Works.** One complete

revolution of screw type flights is used at the feed end of each shaft in order to start material progressing through the tub from feed point to discharge, insuring maximum capacity. Mixing is by corrugated face paddles, which can be quickly reversed in pairs to retard material flow and increase mixing action where required in handling fine aggregate blends. Either open bevel gear drive or totally enclosed oil bath gear drives are available. Integral motor mounts are provided with either drive, for electric or internal combustion engine. When set up at the site, hydraulically-operated hoisting system raises the entire unit to provide 9 ft. under the discharge gate.

. . . Write No. 166

Subgrader digs by vibration

Controlled vibration applied to the forward edges of the cutters is one reason why the **Blaw-Knox** precision subgrader will produce a smoother, more uniform grade. Vibration disintegrates or crumbles the earth rather than mechanically shaving or cutting it. Another feature is a piece of optional equipment for deep cutting with a range of 12 to 24 in. in depth. Other features include: two ranges of widths for single or dual lane paving, fully adjustable strike-off, quick adjustable crown control, self-powered reverse travel, and finger-tip hydraulic depth controls. Optional equipment includes split-conveyor flights, extra long discharge horn, pneumatic transportation wheels, and rubber traction wheels. An 8-page bulletin just published by the manufacturer describes the machine in detail.

. . . Write No. 167

There's an Insley working near you

● Whether it's digging a trench or handling pipe, chances are you'll find an Insley on the job. One reason for this is that an Insley is designed to give the operator every advantage. The cab's a good example. Wide open vision takes the guesswork out of "picking 'em up and laying 'em down" . . . makes for greater safety too. Dependability is another reason. An Insley is built to pile up performance records, day after day, under seemingly impossible conditions.

There's an Insley working near you—any one of a complete line up to 45 tons crane capacity, up to 1½ cu. yds. bucket capacity, with crawler, self-propelled or truck mountings. There's an Insley distributor working near you too . . . with complete service facilities and 24-hour parts availability. See him today. Get all the facts on the Insley line.

Below: A heavy-duty ¾-yard Insley M owned by East Bay Municipal Utility District, Oakland, California.

THE INSLEY LINE AND CAPACITIES

Insley Type	*Excavator*	*Crawler Crane*	*Truck Crane*
K	½ yd.	8 tons	12½ tons
L	¾ yd.	10 tons	12½ tons
M	¾ yd.*	15 tons	20 tons
WT	1 yd.	25 tons	30 tons
WB	1¼-1½ yds.	30 tons	35 tons
45	—	—	40-45 tons

*Heavy duty

THERE'S AN INSLEY WORKING NEAR YOU

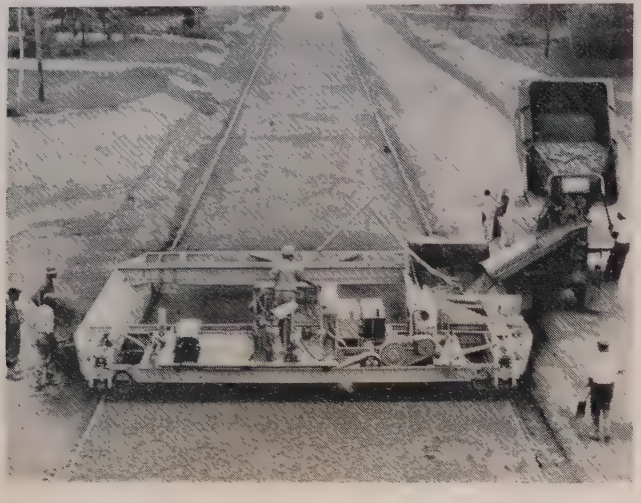
INSLEY MANUFACTURING CORPORATION

GENERAL OFFICE—Indianapolis 6, Indiana

Western Regional Office—Alhambra, Calif.

New system for concrete paving

Here's how fast you can place a full slab of concrete with the Dumpcrete Spreader made by **Maxon Construction Co.:** Chute load the spreader bucket in 60 sec. with a Dumpcrete hauling body—spread in 15 sec.—move and strike-off in 15 sec. Placing rate ranges from 180 cu. yd. per hr. to 260 cu. yd. per hr. The spreader is designed to be used with the paving method in which concrete is mixed in a central plant where consistent control and maximum production



can be attained and brought to the site in Dumpcrete non-agitated hauling bodies. When the bucket on the spreader is loaded it moves transversely across the subgrade, folding a pre-determined thickness of concrete into place. The spreader moves ahead and the adjustable strike-off levels the concrete longitudinally. Placing can be stopped and started at any point, as can all movements of the spreader. Control is hydraulic. A brochure published by the manufacturer describes in detail this new equipment and paving system.

. . . Write No. 168

Chip spreader for sealcoat work

A chip spreader which offers control, power, large capacity, and uniform material flow, is being manufactured by **Highway Equipment Co.** A central tower permits the operator to direct the power plant, conveyor, feed roll, feed augers, feed gate, and hitch. Material flow is synchronized to actual ground speed. The unit is fully self-powered and pulls dump trucks behind it as they load into its rear hopper. The

hopper has a capacity of 3.5 cu. yd. struck and has a quickly adjustable feed gate to maintain the required amount of material into the front hopper. Operating range is up to 20 mph. forward and 10 mph. in reverse. The independent main frame design makes for easier engine inspection, power train maintenance, and related overhaul, when necessary.

. . . Write No. 169

Fast paver lays compacted mat

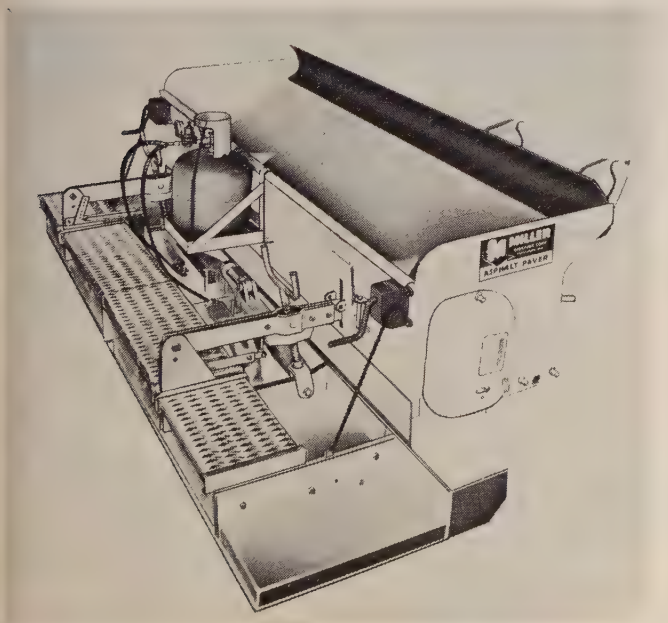
Using the patented principle of an oscillating screed and a heated vibrating compactor working together, the paver manufactured by **Pioneer Engineering** can

lay down a smooth, dense mat that is compacted from the bottom up. Traveling on crawler treads, this high-speed paver works laying bituminous mixes or stabilized soil. It is fully equipped with air-actuated controls for ease of operation. The machine has only one set of controls, which can be moved from one side to the other in a matter of seconds. The operator's platform is designed to give him full and complete visibility of the entire paving operation. Finger tip steering is easy. A fully illustrated 16-page brochure gives all the details.

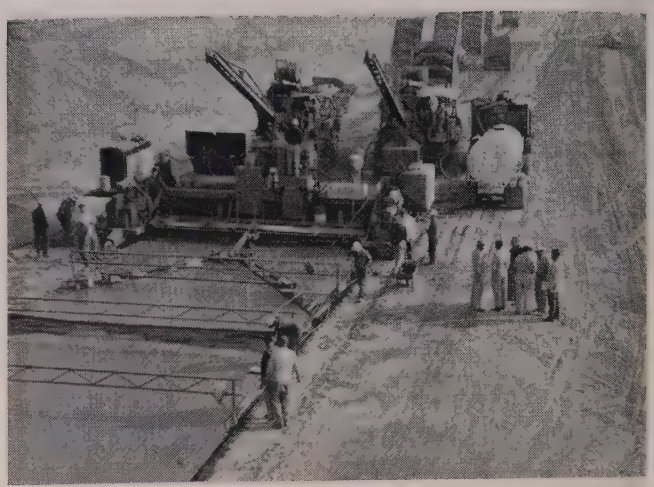
. . . Write No. 170

The Miller towed paving machine

Capable of handling bituminous concrete paving from ½ in. to 4 in. in depth, and efficiently spreading base materials up to 8 in. deep is the towed pav-



ing machine manufactured by **Miller.** It is available with standard or adjustable axle hitch and paves widths up to 10 ft. The built-in standard screed has a floating action which can lay smooth crowns up to 2½ in. Heating the screed eliminates excessive pulling on the asphalt surface, even at cool temperatures. A thickness gauge allows the operator to see at a glance the thickness setting of the paving course and can be quickly and easily adjusted. A crank hoist assembly allows fast, easy raising and lowering of the screed. The thickness gauge and the crank hoist assembly are available in kit form to fit any Miller spreader machine. ... *Write No. 171*



Slip-form paver

Successfully tested on major Western freeway projects is the slip-form concrete paver manufactured by **Guntert & Zimmerman.** The body of the heavy-duty machine is designed to be adaptable to any paving width up to 75 ft. Adapters are available for paving irregular sections. One of the chief features of the machine is its method of guidance. Grade and line is accomplished through the use of two lines of tensioned piano wire carried on special steel stakes set 25 ft. apart. The stakes and wire can easily be set with extreme accuracy. Only one side need be set to line. Sensing elements or probes are attached to the machine by small structural outriggers at the four corners, giving a longtiudinal control center of approximately 21 ft. In operation, concrete is deposited at the front of the machine in a 24-cu. ft. hopper which travels back and forth across the width of the slab depositing the concrete on the grade evenly in front of the vibrators, finishing pan, and chevron float. Full description and specifications of this highly accurate and versatile concrete paver are available. ... *Write No. 172*

Spreader for asphalt and aggregate

Operated by only two men, a tow type spreader for asphalt and aggregate laying from feather edge to 8-in. depth is being manufactured by **Good Roads Machinery Corp.** Hopper is wide and low, fits close to the

truck, and is balanced for easy hitching. Wide steel rollers support the weight of the hopper and smooth out truck tire tracks in the sub-base. The use of a strike-off bar instead of a screed eliminates build-up of material and assures smoothness of spread without long preheating. Adjustment of one bolt permits crown up to 1½ in. Side runners are full floating and do not support the weight of the hopper and the material. Depth control with adjusting handles eliminates need for wrenches or tools. Only four turns of handle are required to change spread depth 1 in. Full explanation and specifications are included in a colorful brochure. *. . . Write No. 173*

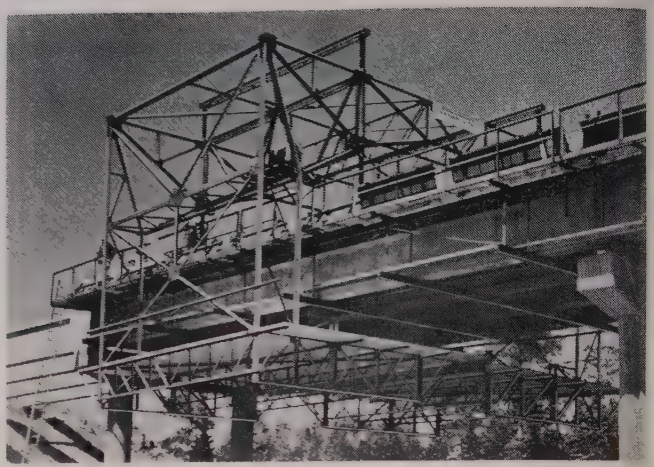
Transverse finisher has two screeds

A transverse finisher with two oscillating screeds, each of which can be operated independently of the other, is being manufactured by **Koehring Co.** They are raised and lowered by double acting hydraulic cylinders and have three speeds, 47.1, 68.4, and 112.8 strokes per min. The finisher can handle slabs up to 30 ft. wide with crowns up to 3¼ in. Transition from full crown to flat surface is controlled by a single lever

for each screed. Machine uses a Wisconsin 23-hp. engine with a Koehring transmission with chain drive on screed and travel wheels. It has four travel speeds in either direction, 8.0, 11.8, 19.5, and 81.5 ft. per min. For transporting, pneumatic-tired wheels are raised and lowered hydraulically. *. . . Write No. 174*

Bridge deck forming system

A complete system of forming bridge decks and curbs, including a form handling traveler, is available from the **Dixie Form & Steel Co.** The hydraulic traveler can move and reset a section of forms 35 ft. long in only 4 hr. From a central control panel, the operator can carry out inch by inch adjustments of platform swing and lifts. Complete details will be sent on request. *. . . Write No. 175*



Spread material with proven rig

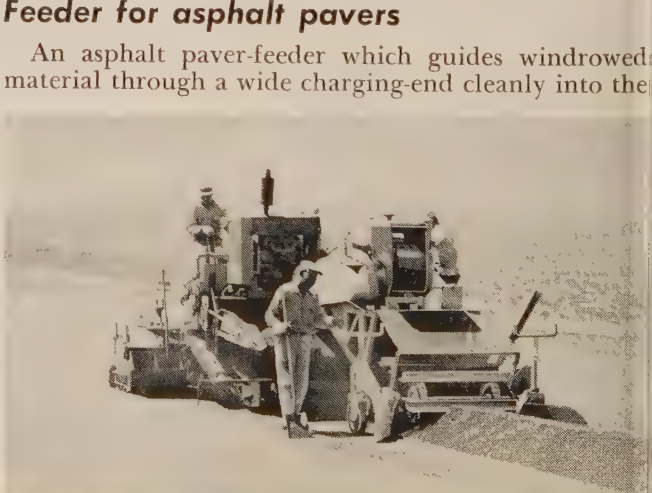
Here is a material spreader which works to controlled depth with clean-cut edges and with no access materials to be raked up later by hand labor. Materials can be regulated in a uniform or tapered spread from

a mere sprinkle up to 2½ in. in depth. Width of spread can be narrowed to 6-in. multiples. Base course spreads from 2 in. to 6 in. in depth are made with strike-off attachment. The machine is made by **Gar Wood Industries, Inc.** Drive chains to the feed roll and agitator are fully enclosed to keep out foreign material. Descriptive literature is available.

. . . Write No. 176

Feeder for asphalt pavers

An asphalt paver-feeder which guides windrowed material through a wide charging-end cleanly into the



...new ideas put this crane in a class by itself!

Reach in or up under full load or in combination with hoist. Hydraulically telescoping boom "reaches" from 37 to 50 ft. Ten-ft insert and 10- or 20-ft jibs available.

Telescoping boom rolls on anti-friction bearings.

Hydraulic outriggers (optional extra) set in seconds.

Boom retracts to 25 ft for over-all travel length of 35 ft, 9 in.

introducing the NEW Bucyrus-Erie 11-BH

New 11-BH Transit Crane, with telescoping boom, converts to dragline or clamshell (hydraulic or 2-line mechanical) . . . has 12-ton lifting capacity . . . will handle loads in tight spots you never thought possible.

The new 11-BH lets you hustle out in jig time, set up in seconds, pick up a load and thread it through tight spots you couldn't get close to with any other machine! Its telescoping boom is the big difference. You save time because you have no boom sections to remove. You save more time because hydraulic outriggers set quick and easy.

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ROAD MACHINERY COMPANY
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SANFORD TRACTOR & EQUIPMENT CO.
Reno, Nevada

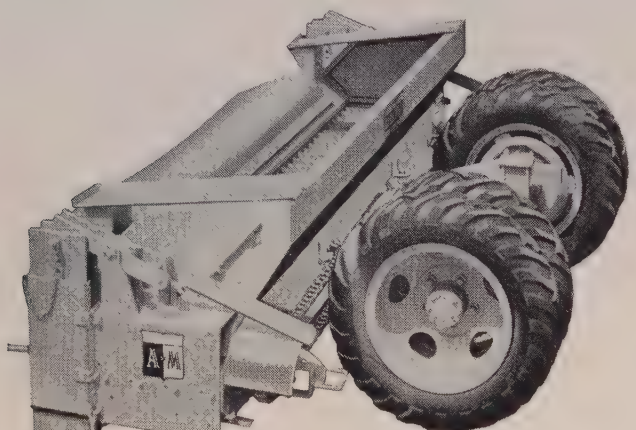
WEST COAST ENGINE & EQUIPMENT COMPANY
Berkeley & San Jose, California

CATE EQUIPMENT COMPANY
1132 South 4th West, Salt Lake City, Utah

paver at an ideal height is being manufactured by **Koehring California Co.** A wide conveyor keeps material flowing in sufficient quantities so that the paver can operate without interruption. Wheels are large, full caster type with solid rubber tires. Hand screws adjust wheels vertically to adapt to conditions. Feeder is attached to paver by pivoting a set of lugs on the feeder into position and welding them to the paver. . . . *Write No. 177*

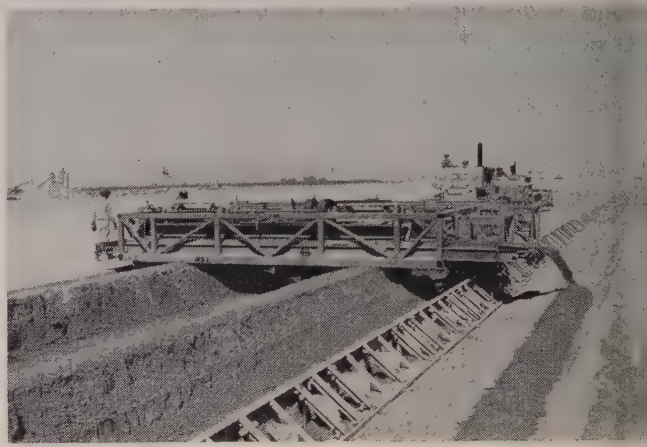
Spread cement and lime evenly

Even spreading of cement or lime with no waste is claimed for a tow-type spreader manufactured by **American-Marietta Co.**, Construction Equipment Division. Material is spread closer to the roadway to minimize blowing. Width is adjustable from zero to 10 ft. Dual pneumatic tires provide excellent flotation in loose material. . . . *Write No. 178*



Rig readies base for stabilization

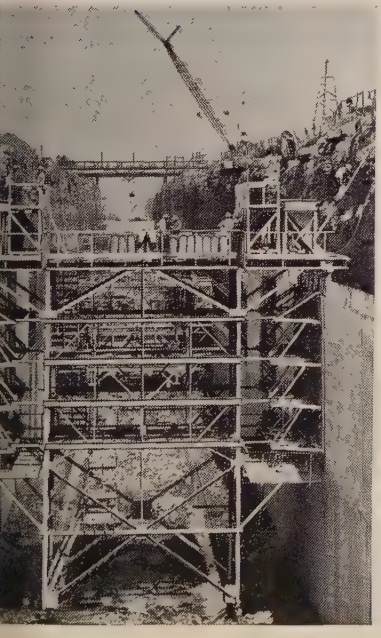
A machine for preparing base material for stabilization treatment with cement is being manufactured by



Koehring California Co. Pulled by two crawler tractors, machine rides on forms. It picks up the base material which has previously been placed inside the forms, shapes the correct amount for mixing with the cement into two windrows, and dumps the excess outside the forms. . . . *Write No. 179*

Arch-placed concrete has a 23-ft. radius, varies in thickness from 4½-ft. at crown to 6-ft. at abutments. Abutment-positioned hinges have a 15-in. radius. Crown hinge radius is 12-in. Compressible filler near hinges allows rotation and opening and closing of outside concrete faces.

Blaw-Knox Steel Forms shape five miles of twin conduits at Niagara Power Development



Three contractors are building twin conduits 22,600 feet long, 46 feet wide and 66 feet high. All three use especially designed Blaw-Knox Steel Forms to place a total of 1½ million cubic yards of concrete.

The flexible conduit will permit arch loads to carry into rock through abutments. Steel rods anchor slab and wall concrete to guard against hydraulic pressure during conduit dewatering and possible rock movement.

Saves 35% assembly time. Forms are assembled faster and at reduced labor cost, according to Balf-Savin and Winkelman, one of the contractors on the $100 million conduit project. Another, Gull-DeFelice notes that only 15% of its men are needed to erect, move, set-up, and maintain Blaw-Knox Forms. And Merritt-Chapman & Scott "can always count on Blaw-Knox for quality equipment and dependable professional service."

More and more contractors turn to Blaw-Knox Steel Forms Consulting Service for skilled assistance in building dams, tunnels, bridges, and other projects. Backed by 40 years of forms building, Blaw-Knox has complete facilities to fabricate forms to your needs, and to deliver them on time. For details, write Blaw-Knox Equipment Division, Pittsburgh 38, Pa., or call STerling 1-2700.

BLAW-KNOX

Steel Forms

. . . for more details, write No. 91 on Reader Service Postcard

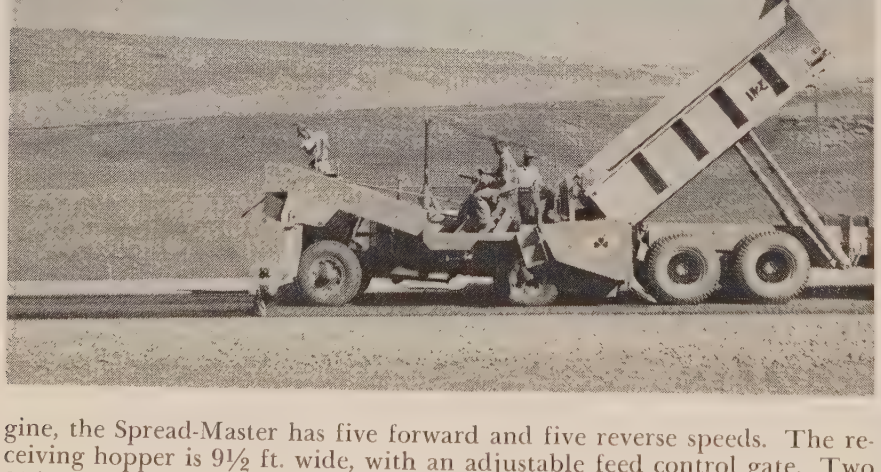
1-man machine for fine grading

One man can handle all the fine grading chores on any paving project with a **Gar-Wood** Buckeye Finegrader. Positive 4-point stroke of serrated blades insures full digging penetration in toughest conditions with an exclusive "pick axe" action. The machine is easily reversed under full power

to handle points in the grade which are too high for one pass. Hydraulic lifts elevate the machine up to 10 in., enabling it to make an initial cut before being lowered to normal position for final grading. Continuous escalator flights pick up spoil for discharge on either side. The final strike-off blades accurately trim sub-grade to the exact cross-section and are easily adjusted to leave any desired amount of fines to compensate for compaction on jobs where rolling is specified. The machine can be transported to the next job without a separate trailer or special road permits. Just slip its two big transport wheels onto the permanent stub axles and pull it away. Top speed is 10½ ft. per min. forward. ... *Write No. 180*

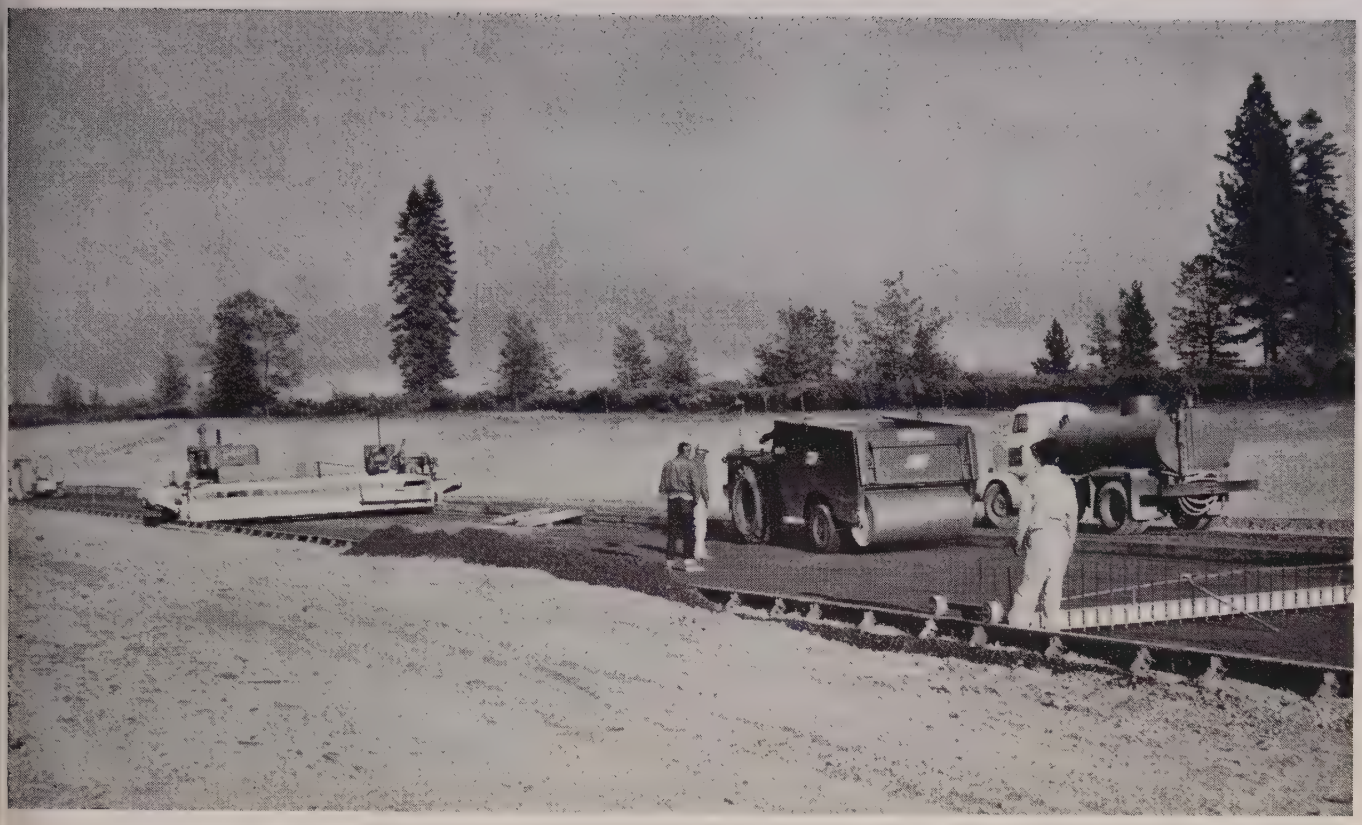
Aggregate spreader pulls unloading truck

A self-propelled aggregate spreader which pulls unloading trucks backwards out of gear is being manufactured by the **Flaherty Manufacturing Co.**, Pocatello, Idaho. Trucks are attached and released without stopping the flow of material or slowing down the spreader, thus assuring uniform and straight line materials application. Powered by a 69-hp. gasoline en-



gine, the Spread-Master has five forward and five reverse speeds. The receiving hopper is 9½ ft. wide, with an adjustable feed control gate. Two 20-in. wide belt conveyors, which operate independently of one another, carry material to a 13-ft. wide spread hopper. The large capacity storage hopper is equipped with independently operated radial cut-off gates, which permit spreads of from 6 in. to 13 ft. A rod screen in the spread hopper retains all over-size and foreign objects to eliminate streaks in the finished application. A spread roll assures uniform flow of materials and an adjustable screen at the bottom of the spread hopper places large aggregates in the asphalt first and drops the fines on top, filling the voids.

... *Write No. 181*



This Seaman-Gunnison DUO-PACTOR compacted 4-inch gravel base for a new section of U. S. 40 to Squaw Valley, Calif. Owner, A. Teichert & Son, Inc., Sacramento, averaged 2,800 ft. of paving per day.

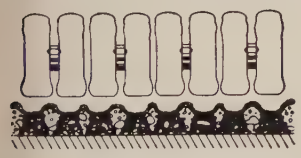
If you are thinking of COMPACTION, these DUO-PACTION facts may help you:

Contractors' cost records on scores of interstate, state, and county contracts reveal these amazing savings: Compared with previously used methods and equipment

DUO-PACTORS cut compaction time as much as 75 per cent on many jobs

DUO-PACTORS required less horsepower by one-third to one-half.

The result is compaction—meeting the most rigid density specifications—at some of the *lowest costs ever achieved!* These savings are made possible by the exclusive DUO-PACTION principle of combining high-pressure compaction tracks (pneumatic) and high pressure ridge rolling (steel) to produce uniform, high density.



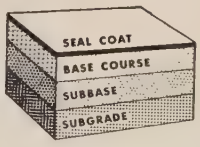
The closely spaced tires form densely compacted tracks with minimum material displacement.

Since density is a matter of compressive values, DUO-PACTION *first* of all provides greater compressive pressure than conventional pneumatic compactors, per ton of overall weight or pounds per wheel. Spring mounting of tires in pairs applies uniform surface pressure over the entire rolling width. Small tire contact area eliminates bridging.

Lowering the steel roll chokes ridged material down between the tire tracks, unifying density.

Second, close wheel spacing permits higher surface loading without material displacement, thus developing higher densities.

Third, you get selective load control—both rubber and steel rolls can be moved forward or backward, on-the-go, to vary loading.



Finally, you can handle more types of compaction and surface rolling jobs with a DUO-PACTOR than with any other compactor ever before available. You slash your investment in compaction equipment to the bone! Write or 'phone today for name of your Seaman-Gunnison DUO-PACTOR Distributor.

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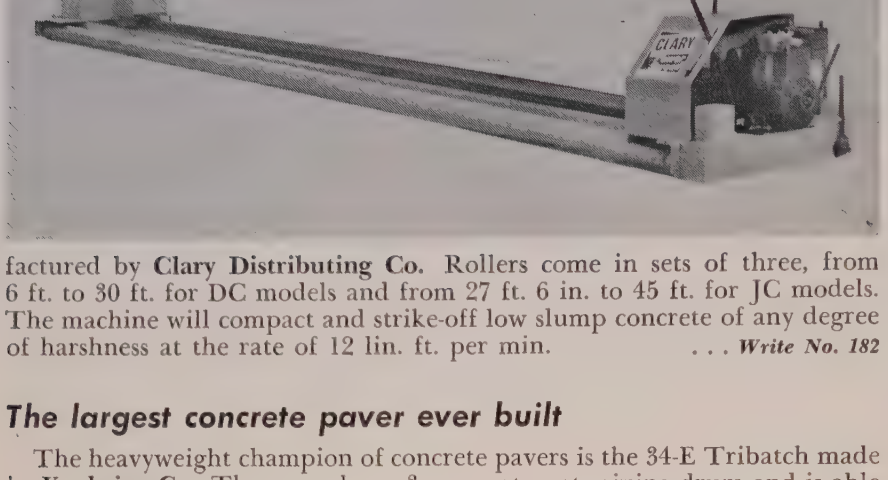
- Utility 6-yd Scraper

. . . for more details, write No. 92 on Reader Service Postcard

Vibrating roller screed is self-propelled

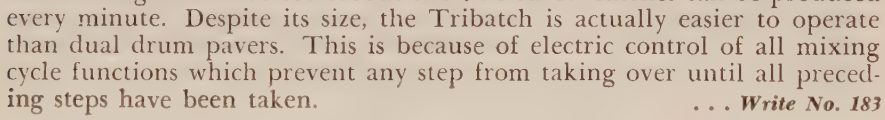
Striking off concrete slabs up to 40 ft. wide without tampers or strike-off men is a cinch with the self-propelled vibrating roller screed manu-



factured by **Clary Distributing Co.** Rollers come in sets of three, from 6 ft. to 30 ft. for DC models and from 27 ft. 6 in. to 45 ft. for JC models. The machine will compact and strike-off low slump concrete of any degree of harshness at the rate of 12 lin. ft. per min. *. . . Write No. 182*

The largest concrete paver ever built

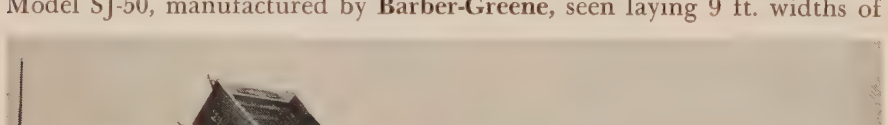
The heavyweight champion of concrete pavers is the 34-E Tribatch made by **Koehring Co.** The paver has a 3-compartment mixing drum and is able to mix and pour enough concrete in a day for about half a mile of standard 2-lane highway. Cycle time with the 3-compartment drum is 29 sec., based



on a mixing time of 60 sec. About two 74.8-cu. ft. batches can be produced every minute. Despite its size, the Tribatch is actually easier to operate than dual drum pavers. This is because of electric control of all mixing cycle functions which prevent any step from taking over until all preceding steps have been taken. *. . . Write No. 183*

Combined spreader-paver-widener

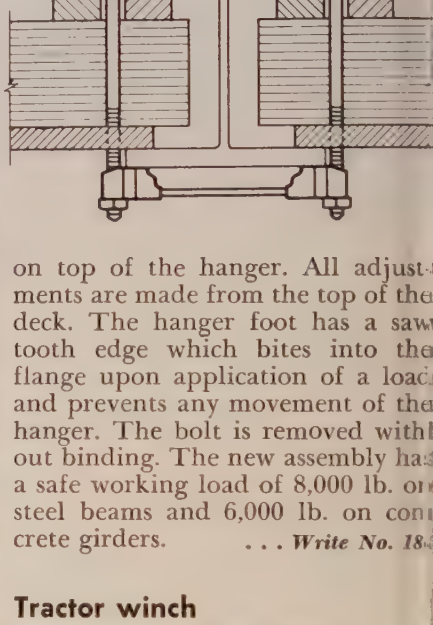
Like versatile machines? Here's one that combines the functions of aggregate spreader, shoulder paver, and road widener in one frame. It's the Model SJ-50, manufactured by **Barber-Greene,** seen laying 9 ft. widths of



aggregate for shoulder construction along an Interstate route. The SJ-50 can be equipped to handle aggregate materials, concrete, hot-mix asphalt, and stabilized mixes in a full range of widths. *. . . Write No. 184*

Non-slip steel hanger adjusted from top

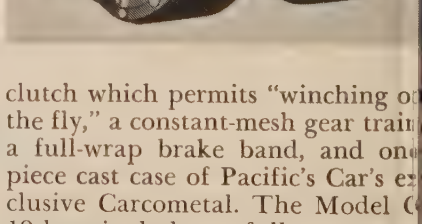
A unique steel hanger assembly for hanging forms from steel beams or concrete girders is announced by **Superior Concrete Accessories.** The new Pres-Steel hanger is made up of a hanger bar and ½-in. coil bolts. Bolts are passed up through the unthreaded holes in the hanger bar and are fastened by square nuts



on top of the hanger. All adjustments are made from the top of the deck. The hanger foot has a saw tooth edge which bites into the flange upon application of a load and prevents any movement of the hanger. The bolt is removed without binding. The new assembly has a safe working load of 8,000 lb. on steel beams and 6,000 lb. on concrete girders. *. . . Write No. 18*

Tractor winch operates independently

A 12,000-lb. capacity winch for tractors up to 40 hp. has been developed by **Pacific Car & Foundry Co.** It features a sealed friction



clutch which permits "winching on the fly," a constant-mesh gear train, a full-wrap brake band, and one-piece cast case of Pacific's Car's exclusive Carcometal. The Model C 12 has single lever, full power control and can be operated independently of the tractor's motion. Th

cable drum is driven by a hydraulically applied multiple-disc friction clutch, sealed against entry of mud and water. Hydraulic pressure is supplied by a gear-type pump mounted within the winch case which utilized regular winch lubricant in place of hydraulic fluid. The company manufactures a complete line of winches ranging up to 125,000 lb. capacity.

. . . Write No. 604

Pocket radio receiver has trouser leg antenna

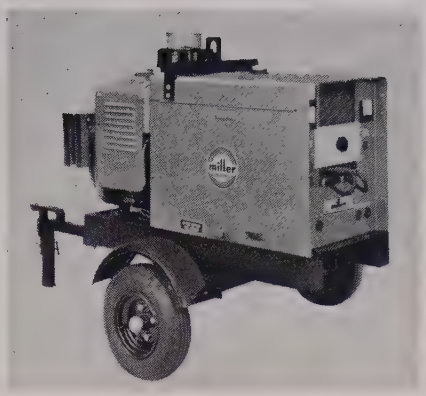
A powerful transistorized pocket receiver providing reliable voice communications even in noisy locations and weighing only 10 oz. is announced by **Motorola, Inc.** The new "Handie-Talkie" pocket receiver provides 500 milliwatts audio output, five times the power of previous units. It is available for

operation in the standard two-way mobile radio channels. The unit operates from either a rechargeable battery or from mercury cells. The battery provides up to 12½ hours operation with each charge, while the replaceable cells last up to 125 working hours. A trouser-leg antenna as well as a helmet mounting type of antenna are available in addition to the unit's built-in antenna.

. . . Write No. 605

Mobile welder does many jobs

A trailer-mounted welding power plant Model AD-225-L developed

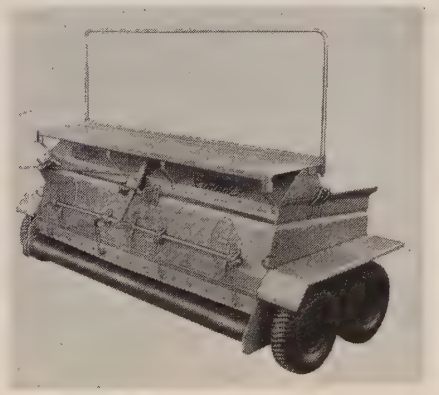


by **Miller Electric Mfg. Co., Inc.** does 7 different jobs. These are: A/C welding, D/C welding, metallic insert gas welding, generates 7 kw. of 115/230 v a/c power, supplies 1 kw. of auxiliary 115 v d/c power while welding, warms viscous fluids for pumping and charges batteries. The light-weight versatile unit delivers 300 amperes at 30 v a/c or 225 amperes at 30 v d/c welding power at 100% duty cycle. A complete range of accessories and operational equipment is available.

. . . Write No. 606

4-wheel spreader

A 4-wheel truck-towed spreading unit has been developed by **Highway Equipment Co.** The Model "TCS" spreader has a full 8-ft. spreading width and can meter materials from 5 to 70 lb. per sq. yd. It has a jack type feed gate and 3 calibrated dials for correct depth

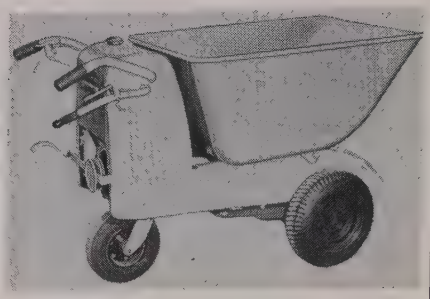


of spread. A single lever activates transmission, agitator and conveyor. The drive shaft control lever disengages either drive wheel for cornering, and an extended handle on the automatic hitch gives fast safe hook-ups. It is equipped with a 3-ply conveyor belt for uniform lateral distribution of materials across the full width of the feedgate opening.

. . . Write No. 187

Simplified transmission for concrete buggy

A transaxle incorporating transmission, differential and drive axles in one compact housing has been developed by the **Prime Mover Co.** for its powered buggies and industrial trucks. An internal chain in the new unit eliminates the need for a reverse idler, while a worm final drive replaces numerous reduction gears. Forward and reverse gears are bearing-mounted on a single shaft and actuated by two spring-loaded clutches. Power train



is incorported in the M-15B powered buggy which has 10 cu. ft. concrete bucket interchangeable with two sizes of flatbeds on the same chassis. New transmission delivers about 20% more power and the buggy will take a 20% incline with a full ¾-ton load. . . . ***Write No. 188***

Big crane features low clearance

Elimination of hook rollers in the new Manitowoc Model 3400 crawler crane reduces its overhead height by as much as 9 in. and enables the unit to work in places where a crane of this capacity could not be used before. Manufactured by **Manitowoc Engineering Corp.**, the 65-ton capacity crawler crane features a large diameter wide roller path and an extra strong king pin to eliminate the need for hook rollers. In addition the gantry can be quickly lowered without removing

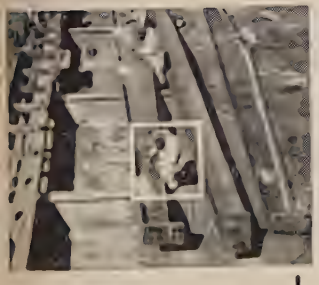
the boom to bring overhead clearance down even farther. An alloy steel drum shaft holds both drums which are cast steel with removable allow iron flanges and oversize bearings. Interchangeable steel laggings provide a wide range of line pulls and speeds. The unit has smooth disc-type clutches. Other features include torque converter drive, and independent double drum hoist. Optional features include a third drum for pile driving or similar jobs and removable counterweight. . . . ***Write No. 189***

Backhoe mounts on 2-ton truck

A self-contained backhoe unit which mounts on the 2-ton truck

For high speed welding—or any welding—it's Airco electrodes. For example, Airco's EASYARC 27, enables you to weld mild steel faster, at higher deposition rates (without undercut or double beading) than any other E-6027 type electrode. It is available in 3/16", 7/32" and 1/4", for horizontal and flat fillets, and groove welds. EASYARC 27 is the newest of 119 Airco electrodes.

For high speed welding choose AIRCO Electrodes ...backed by the *most experience*



Do you weld ships . . . missiles . . . auto bodies . . . nuclear reactors . . . earth-movers? However specialized your welding may be, you'll find an Airco electrode designed to do it better.

For any electrode: stainless, mild steel, low alloy, low hydrogen, metal powder, aluminum, bronze, cast iron and hardfacing – phone your authorized Airco Distributor. Look in your Classified Telephone Directory under "Welding Equipment and Supplies" for the nearest Airco representative.

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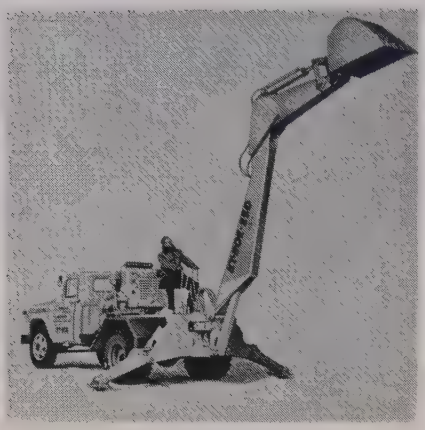


is announced by **Hydraulic Machinery Co.** The HY-HOE 250 has a ⅜-yd. struck bucket capacity. It opates with a 1,500-psi. hydraulic system with 4¼-in. ID cylinders throughout. The unit has 180 deg. wrist action at the bucket and 200 deg. boom swing. It digs 14 ft. deep, has a 20-ft. reach and 11-ft. clearance. Three independent hydraulic circuits of 25 gpm. each are used. All control valves are cast in block and all other valves are identical and interchangeable.

. . . Write No. 190

Concrete dump bucket for lift truck

A ⅜-yd. concrete dump bucket which will swing 180 deg. and can be locked in any of 5 positions is marketed by **Lull Engineering Co.** Designed to fit the Lull 7B Hi-Lifts

units, the swivel bucket permits the operator to travel parallel to the form and discharge his load to either side. Bucket is swiveled by hand. Its hydraulic dump is controlled by the machine operator.

. . . Write No. 191

Mobile hydraulic hammer works close to piers

A mobile hydraulic hammer whose tower can easily be shifted to any position along a 7 ft. track across the front of the carrier is announced by **Arrow Manufacturing Co.** The Arrow model 130-AS has a 1,000 lb. hammer mounted in leads which give up to 9 ft. vertical clearance. The carrier is a small compact rubber tired vehicle. Tower is hydraulically shifted along the track and can so be tilted hydraulically either front or back or to either side giving it a total working width of 8 ft. Hammer stroke is adjustable from a few inches up to 9 ft. The unit is designed to work close to piers and abutments. It can work from side to side across the front of the machine or work forward or in reverse. Hammer control can be set to deliver blows of uniform impact at a uniform rate or the hammer can be controlled manually. Working speeds are variable up to 32 fpm forward or reverse through a hydraulic creep gear. Tower tilts back hydraulically to horizontal position reducing the height from 13 ft., 11 in. to 6 ft., 10 in. It has forward-mounted controls and rear wheel steering.

. . . Write No. 192

Hydraulic hammer operated by tractor system

A power hammer that operates hydraulically using a backhoe loader hydraulic system for power has been introduced by **Henry Manufacturing Co., Inc.** The versatile new tool can be carried to the job in the loader bucket attached to the hydraulic system and operated at remote points. It uses all standard air hammer tools. A separate power source embodying a gasoline engine and hydraulic pump in a compact self-contained unit also

Gardner-Denver RP600 rotary portable compressors at work on sewer job.

Work 'em anywhere—in any weather Gardner-Denver rotary portables can take it

You can depend on Gardner-Denver rotary portable compressors to deliver the air you need in any weather—any climate, any altitude. They are ruggedly built, run smoothly, cost little to maintain. Six capacities from 85 to 900 cfm. Write for Bulletin RC-1. See your Gardner-Denver distributor soon.

All-weather operation—assured by efficient cooling system.

No dry starts in cold weather—clutch on RP125 and larger sizes assures full lubrication when compressor is engaged.

Thrifty—"THRIFTMETER"® fuel control regulates engine to meet air demands.

Easy to maintain—rotors and blades can be inspected and changed in minutes.

Gardner-Denver RP900 rotaries provide power for 5½" drills on Niagara power project.

EQUIPMENT TODAY FOR THE CHALLENGE OF TOMORROW

GARDNER-DENVER

Gardner-Denver Company, Quincy, Illinois

In Canada: Gardner-Denver Company (Canada), Ltd., 14 Curity Avenue, Toronto 16, Ontario

. . . for more details, write No. 97 on Reader Service Postcard

is available for operating the hammer. It can be loaded and transported in a station wagon or pickup truck. ... *Write No. 193*

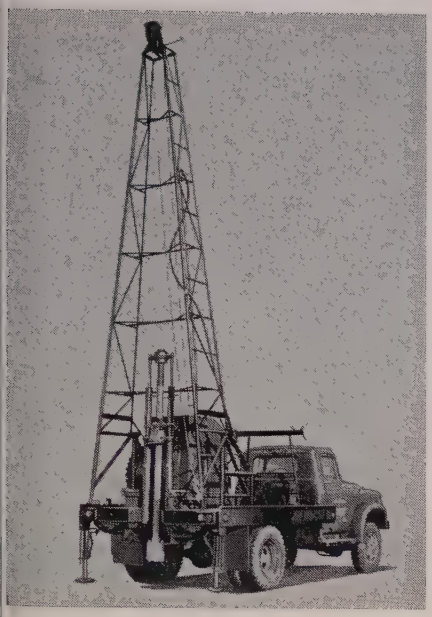
Two-ton roller for small jobs

A small maneuverable tandem roller with a gross weight of 4,000 lb. is announced by **Rolcor Division of Rosco Mfg Co.** Called Sta-Pac, the unit has a variable weight from a net of 2,100 lb. to a maximum working weight of 4,000. The

machine has 40-in. roller of 26-in. diameter and front and rear sprinkler bars. It is powered by a 9-hp. engine with a 12-volt starting system and generator. It delivers up to 74-psi. compaction pressure and is recommended for parking areas, asphalt maintenance and patching, driveways, sod rolling, tennis courts and similar jobs. The unit is fast enough for many of the bigger jobs and is easily transported from job to job. ... *Write No. 194*

Core drill unit mounts on truck

A truck-mounted core drill rig

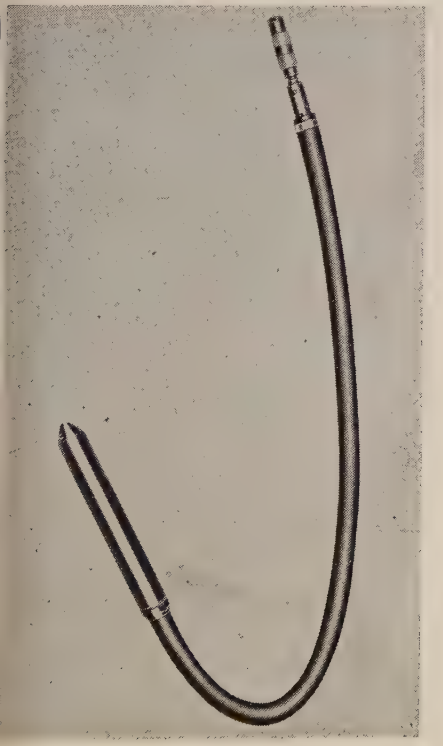


which operates from the truck's power take-off or through an independent engine system is announced by **Acker Drill Co., Inc.** Called the Presidente, the new drill rig has a 1,000-ft. capacity for core drilling, 300 ft. for auger drilling, and will produce holes up to 24 in. in diameter. Its features include hydraulic drill head, air brakes and clutch, patented automatic chuck, and a wire drum hoist with cathead.

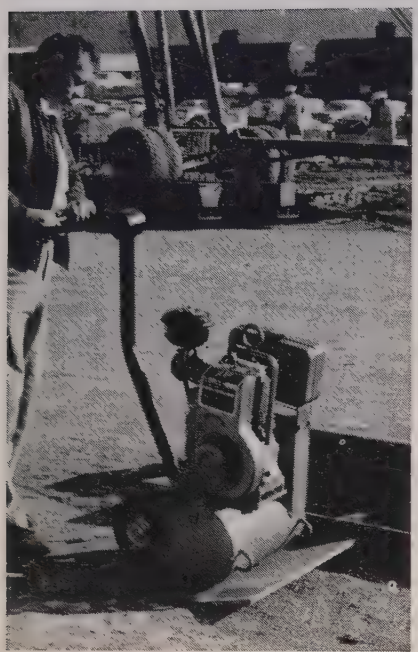
. . . Write No. 195

Concrete vibrator has one moving part

A vibrator-generator combination makes up an eccentric rotor concrete vibrator with only one



Jay Tampers provide "great savings" on Interstate Highway Construction Program



Thousands of Jay Tampers have been used coast to coast on the multi-billion-dollar Interstate Highway Construction Program. One contractor, Visintine & Co., Columbus, O., says:

"The work we did with Jay Tampers was approved by Federal, County and State Highway Inspectors, and we had great savings in time and money."

Savings on such jobs as the Niagara Power Project and the Air Force Academy are similar. In one case, compaction cost per cubic yard was cut from $2.68 to 12¢.

Even greater savings are now available with Jay's new models, which tamp harder, faster, better on all soils and blacktop. Improvements include stepped-up power, new handles, and a new trailer for easy transport.

See your Jay dealer for a free demonstration, or send for Catalog J-0. Jay Company, Division of J. Leukart Machine Co., Inc., 2222 South Third Street, Columbus 7, Ohio.

Sold and Serviced by:

Arizona—Equipment Sales Co., Phoenix

California—Rix Company, San Francisco; Construction Machinery Co., San Diego; Orange County Equipment, Santa Ana; Waco Scaffolding Co., Stockton; W & K Equipment Co., San Bernardino; Rix Central Equipment Co., Berkeley and Sacramento

Nevada—Sierra Industrial Co., Reno

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Only
D-A TORQUE FLUID
gives these SIX advantages

D·A

1. 4% to 5% more efficiency
2. More high-temperature protection
3. Better cold-weather performance
4. Eliminates sludge, varnish, corrosion
5. Exclusive D-A seal preservative . . . unretouched photo shows seal "A" destroyed by 300 hrs. service at 325° F. Seal "B," protected by D-A Torque Fluid, remains resilient and usable.
6. Longer operation between lubricant changes

DEALERS

M. W. (Bill) Cassady, Seattle, Washington, Phones: ME 2-6622—ME 2-1932; Myrl Bartmess, Boise, Idaho, Phone: 3-8196; M. G. (Mike) Ervin, Los Angeles, Calif., Phone: MA 9-2181; Robert J. Binford, Millbrae, Calif., Phone: OX 7-1839; Ralph A. Bartless, Sacramento, Calif., Phone: GI 1-0181; Clarence Knutsen, Spokane, Wash., Phone: MA 4-8924; Bob Fashbaugh, Phoenix, Arizona, Phone: AL 3-3101

D-A LUBRICANT COMPANY, INC. • Indianapolis 23, Indiana

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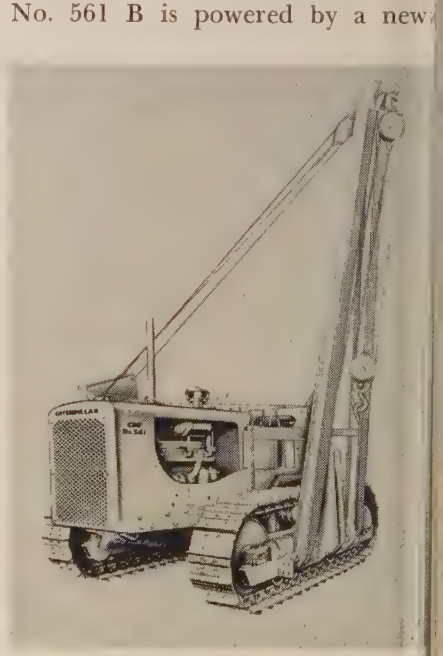
moving part; and a brushless, bearingless generator is now produced by **Master Vibrator Co.** The vibrator has an "inside-out" motor with rotor on the outside and the stator on the inside. Movement of the eccentric rotor causes the entire head to vibrate. The vibrator has a head diameter of 2⅝ in. with standard casings of 7, 14 and 21-ft. lengths. The unit has no brushes, commutator, flexible shaft, or other wearing parts. It runs on 115-v. 180-cycle current provided by an 80-lb., 1,200-watt permanent magnet generator with no wearing parts. The only moving part in the generator is a permanently magnetized armature that whirls in the air, held away from the other parts by a magnetic field. Simplicity of the generator design eliminates the need for a commutator, brushes, slip rings, bearings, or other parts that normally wear and cause trouble. Generator is powered by a small gasoline engine. Optional equipment includes a wheelbarrow mount and an 11-lb. supplementary power package which enables the generator to furnish 1,000 watts of d/c current to run lights and tools.

. . . Write No. 196

Pipe layer capacity increased 12,270 pounds

Caterpillar Tractor Co. has announced a new No. 561 Series B pipelayer replacing its old MD-6. The new model has a maximum lift capacity of 38,800 lb. at 4-ft. overhang with 5,000 lb. adjustable counterweights. Two other stationary counterweight groups of 2,500 lb. and 3,500 lb. are available. The No. 561 B is powered by a new

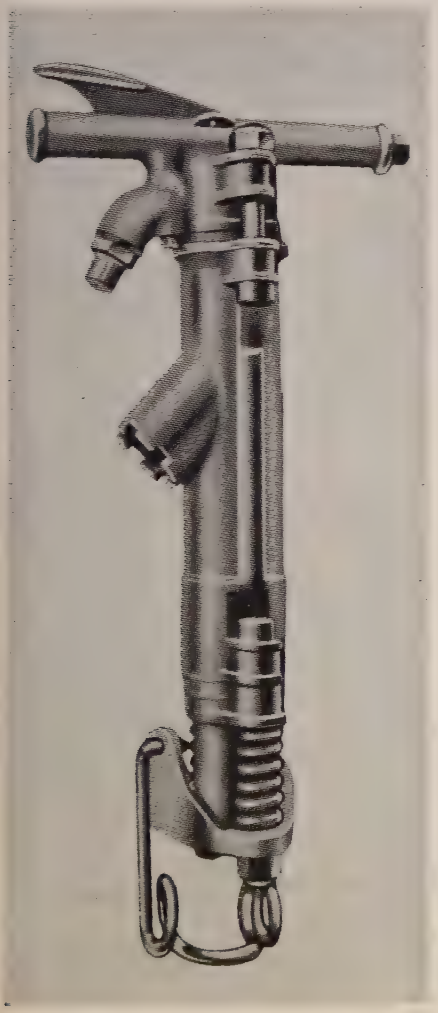


compact engine of 95 flywheel hp. Manual off-track starting with a new vertical gasoline starting engine is standard. In-seat starting of the gasoline engine with a 12-volt electric system is offered as optional equipment. A 24-volt direct electric starting system also is optionally available for the diesel engine. The controls are redesigned and steering clutches are hydraulically boosted for added operator convenience. The unit has 74-in. gauge and uses 18-in. grouser shoes. Its operating weight is 25,300 lb. Standard boom length is 15 ft. Lift speeds are 102 fpm. in first gear, 177 fpm. in second gear, and 723 fpm. in third gear.

. . . Write No. 197

Light paving breaker for awkward jobs

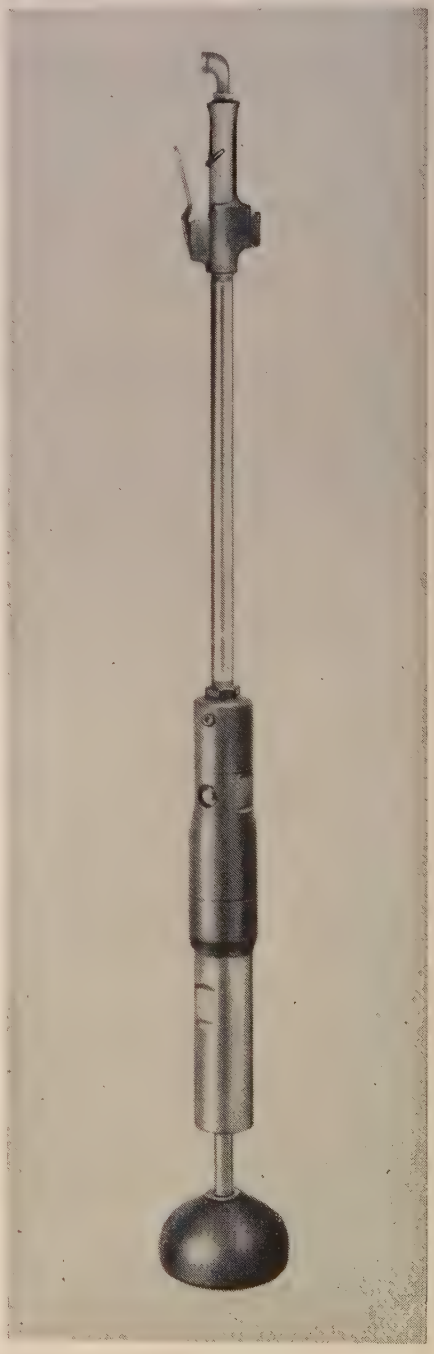
A 48-lb. class light-duty paving breaker known as the Davey-Holman Model SS-44 is announced by **Davey Compressor Co.** It is recommended for general street repair and is especially effective in awkward jobs. The tool features large alloy steel front head, bolts and



springs that can withstand severe punishment. Honed cylinder bore and reversible piston hammer and a self-seating poppet throttle valve operating in a replaceable bushing increase the new life. The tool is 22¾ in. long, 12 in. wide, and weighs 48 lb. . . . *Write No. 198*

Hand-held tamper line doubles blows per minute

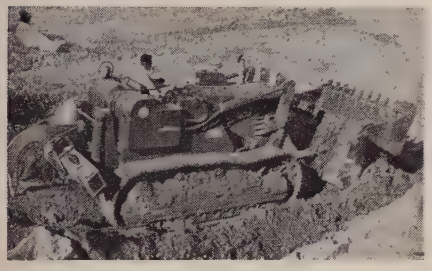
Power blows are doubled over previous design in the line of three hand-held sand wiper backfill tampers announced by **Ingersoll-Rand Co.** The air powered tools feature an especially designed front seal of neoprene felt that wipes the surface of the chrome-plated piston



rod completely clean, preventing entrance of any abrasive material into the bore of the guide or the barrel. The three units range in weight from 27 to 47 lb. and all three are equipped with lever throttles and have ⅜-in. pipe tap hose connections for use with recommended ½-in. hose. A wide selection of optional butts and peens is available for special construction field requirements. . . . ***Write No. 199***

Ripper for Drott K-3

A ripper for companion use with the Drott K-3 (four in one) loader is announced by **Greenville Steel Car Co.** The Greenville TD-20 ripper provides sufficient clearance for the crawler to tow other equipment. The unit is equipped with 24-in. penetration curved shanks. Pitch and depth controls permit the operator to place and hold points at best ripping depth.



Shanks swivel 15 deg. in either direction. Tool beam is of reinforced box-type construction equipped with bearing surfaces where swing brackets are attached. It is 102 in. wide. The hydraulic system has 44 gpm. pump operating from the rear PTO of the crawler. All shanks have replaceable, heavy-duty, heat-treated points and can be pinned up when not in use. . ***Write No. 200***

Lube oil for heavy-duty engines

A lubricating oil fortified with detergent additives, corrosion and oxidation inhibitors, and effective defoaming agent is announced by **Standard Oil Co. of California.** Called Super "RPM DELO" Special, it is intended for diesel and heavy-duty gasoline engines. Because of its wide work range under difficult to severe service, it has proven particularly effective for simplifying mixed fleet operations. The new oil is especially designed to control the bad effects of high sulfur diesel fuel. In performance, it far exceeds the requirements of API Service Classification DG and DM. . . . ***Write No. 201***

NEW LITERATURE

To obtain free copies of literature described in this section, write the corresponding numbers on reply postcard.

Emergency floodlighting

A 10-page bulletin issued by **Stonco Electric Products Co.** illustrates their complete line of lightweight, heavy-duty and vapor-tight cast aluminum portable emergency floodlights for use by contractor crews, night construction teams, public utilities and industrial emergency squads. Also illustrated are 200-500 watt power-beam portables.

. . . Write No. 202

Aggregate processing information

An illustrated brochure has been released by **Cindaco Inc.** describing services and equipment for the aggregate industry. These services include research, engineering and design of complete processing plants for aggregates, concrete and asphalt. Special sub-services also available.

. . . Write No. 203

Crawler crane-excavator

American Hoist & Derrick Co. has released a 24-page catalog on the American 300 series crawler crane-excavator. It describes and illustrates the machine's features and its versatility on many different type jobs such as crane, magnet, clamshell, dragline, shovel and backhoe.

. . . Write No. 204

Right vibrating screen

"How To Select the Right Vibrating Screen" is the title of an 8-page booklet by **Overstrom & Sons, Inc.** Estimation of screen area requirements is discussed; optional features for every application are illustrated; dimension data is given.

. . . Write No. 205

Industrial steel castings

Use of steel castings in heavy construction and in manufacturing machinery is the subject of a booklet published by the **Steel Founder's Society of America.** Entitled "Sinews of Modern Living," the 28-page brochure dramatically presents the multitude of uses for steel castings. Line drawings of more than 200 representative steel castings, selected from over 1,000 photographs and references, are contained in the book. Copies may be obtained from member companies of SFSA.

. . . Write No. 206

Natural gas engines literature

Caterpillar's complete line of natural gas engines is described in an 8-page booklet by their **Engine Division.** The booklet traces the development of the engine and shows model views, gives specifications and fuel consumption curves of current models. Photographs and job stories illustrate actual performance of the engines in drill rig, cotton gin, irrigation, gas compressor, pipeline, air conditioning, etc.

. . . Write No. 207

TD-25 diesel catalog

Illustrated with photographs and cutaway diagrams, **International Harvester Company's** TD-25 crawler tractor is described in a 24-page catalog. Highlights of the torque converter and gear drive are depicted, as well as planet-power steering, Dura-Rollers with 1,000-hr.

lubrication intervals, a lubrication oil cooler, a dry-type air cleaner, etc.

. . . Write No. 208

Pile hammer bulletin

McKiernan-Terry Corp.'s complete line of pile hammers is described in the company's new bulletin. Full information covering the operational features of the hammers, description of the operating cycle, design features, specifications, drive caps available and engineering data covering the energy rating and static load bearing capacities of the hammers are given.

. . . Write No. 209

CF&I Steel Products handbook

The Colorado Fuel and Iron Corp. has issued a 30-page booklet on the many products put out by the company for the construction industry. Detailed specifications and drawings including photographs are utilized to describe the applications and uses of grader blades, grinding rods, screens, wire rope, plus numerous construction materials. Special catalogs are available on all products listed. *. . . Write No. 210*

RECENT FILMS

"Revolution on Wheels", a 16-mm, color-sound movie about the Haulpak off-highway truck is available from **LeTourneau-Westinghouse Co.** Each L-W distributor has a copy of the film which graphically illustrates the many revolutionary features and advantages of the Haulpak line. The 15-min. film shows units working on job locations around the country. A showing can be arranged by contacting the L-W distributor nearest you.

Earthmoving methods before the machine age, and the story of earthmoving equipment from its inception to the present time, are highlighted in a 20-min. 16-mm motion picture, "Crawler Tractors in Action", available on a loan basis from **Allis-Chalmers Construction Division** branches and dealers. The movie takes the viewer to job locations and illustrates the multitude of construction, earthmoving, and material handling jobs this equipment can handle efficiently.

News of DISTRIBUTORS

Hamilton takes on tractor account

Announcement is made by Hamilton Engine Sales, Inc., Portland, Ore., of the acquisition of the Oliver industrial crawler and wheel tractor account for a portion of Oregon and southwestern Washington. Hamilton will maintain a complete stock of repair parts and a staff of factory-trained service personnel at the disposal of Oliver customers. Parts service is on a 24-hr. 7-day-a-week basis.

Empire operating as Cat dealer in Arizona

For the past several months Empire Machinery Co. has been the Caterpillar dealer in the state of Arizona, with headquarters office at Phoenix, and branches at Tucson, Flagstaff, Casa Grande, and Mesa. President Jack Whiteman continues to head the firm in the new location.

The former Empire territory in Oregon is now divided. Stone Machinery Co., Walla Walla, Wash., serves the area as Caterpillar dealer; EMCO, Inc., Pendleton, Ore., is John Deere dealer covering most of the former Empire territory; and Dalmor, Inc., at The Dalles, Ore., is the new John Deere dealer in that area.

Cate takes on Bucyrus-Erie line

Cate Equipment Co., Salt Lake City, Utah, has taken on the Bucyrus-Erie line of excavators, cranes and Hydrocranes for the entire state of Utah, plus Lincoln and Uinta counties in Wyoming and three counties in Nevada. A large parts inventory is carried by the distributor, and shop and field service expertly furnished.

Western Machinery appointed Blaw-Knox distributor

The bituminous paving products and clamshell buckets manufactured by Blaw-Knox Co. have been added to the many lines handled by Western Machinery Co. at Spokane, Wash., where this distributor has completely remodeled offices and an expanded warehouse area.

Personnel promotions

The General Tire & Rubber Co. announces the promotion of David M. Overstreet to manager of passenger tire sales for the San Francisco division, succeeding Norville Moyer who was promoted to regional manager of retail stores. At Portland, Ore., Howard B. Anderson was named to head passenger tires sales in that division.

Northwest firm adds to sales force

Air-Mac Inc. of Oregon, Portland, has added to its sales force Donald Carter who will serve primarily as a demonstrator salesman. He will work all of AirMac's lines in a small area, but make himself available to demonstrate anywhere in Oregon the Ditch Witch

AUTOCAR

– chosen for the largest over-the-road cement haul in history!

Two of Belyea Truck Company's 20 new lightweight Autocars, loaded with 145 barrels of cement each, start the run to the Glen Canyon Dam project in Northern Arizona. During a steady 3-year haul, these rugged Autocars will log 8,640,000 miles... 27,000 round trips of 376 miles between the Phoenix Cement Company plant at Clarksdale and Page, Ariz.

Imagine a super highway 20 miles wide from San Francisco to New York! That's how much cement will go into the Glen Canyon Dam project, and Autocar was chosen to haul it. Uninterrupted, around the clock for three years, Belyea's 20 new Autocars will roll through broiling desert heat, up to snow-covered 7800 foot elevations, up and down long 8-degree grades, all day long. It takes rugged construction in a truck for that kind of service, and built-in dependability to get the product there when it is needed.

The Glen Canyon Dam can't afford costly delays, and *you can't either!* Let your Autocar representative show you how this quality motor truck can help you increase the efficiency of *your* operation!

LIGHTWEIGHT AUTOCAR ALLOWS MAXIMUM PAYLOADS—Belyea's new Autocar fleet, pulling Fruehauf trailers, are A102Ts, powered with 250 hp Cummins Diesels. The lightweight trucks have aluminum frames, cabs, hoods, radiator shells, wheels and other lightweight components. They're built light to permit giant 27¾ ton payloads, yet strong enough to stand up under the grueling 3,000,000 barrel cement haul... the largest in history!

Autocar
"World's Finest"

Division of
White Motor Company
Exton, Pa.

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trencher, Clayton steam cleaner, Stow concrete vibrators and Jay tampers.

Sales additions and new accounts

Superior Equipment Co., Phoenix, Ariz., announces the addition of a new salesman to its heavy equipment division, Joseph W. Schaedler, working out of the Tucson office and covering southern Arizona. Well qualified as a heavy construction equipment salesman, Schaedler was formerly with Allied Equipment Co. in California. A new sales addition to its building construction equipment division is Donald Stinard, who formerly sold for Arizona Precast Concrete Co. He will call on the trade in the Phoenix area with Ray Spearman, Superior's building construction specialist.

Superior has taken on the Acrow (Acrow Denver, Inc.) line of shores, V-Form, and spans for the state of Arizona, and also the Spider staging line for the state.

Reports service expansion

Ed Hill, who has served Evans Engine & Equipment Co., Seattle, as service manager since 1956, has been named field service supervisor. He has a long experience in the construction industry of the area, including employment with A. H. Cox & Co. in both sales and service. Ben Brones, with Evans service department for several years, has been appointed service manager.

Promotions and new accounts

Announcement is made by Spears-Wells Machinery Co., Oakland, Calif., that Joe Wilson of 2701 Sixth Ave., Sacramento, has joined the firm as salesman in the Sacramento area. New lines added by this distributor lately are Shovel Supply Co. and Chicago Pneumatic Tool Co.

Johnnie Cox joins Rasmussen

Rasmussen Equipment & Supply Co., Salt Lake City, Utah, announces that Johnnie Cox has joined its sales force, bringing to his new employment nearly two decades of experience in the heavy equipment industry. He will manage and service the same territory in which he served his former employer. Among the Rasmussen lines he will feature are: Kolman loading conveyors; American tamping rollers; International Harvester Co. light industrial tractors and equipment; Barnes pumps; Unit Crane & Shovel Corp.; Columbia Steel Casting crusher jaws, and others.

Manages new corporation

Star Machinery Co., Seattle, announces the incorporation of Star Rentals, Inc., a subsidiary, to handle the expanded construction equipment rental operation of the company. Management of the new corporation will be in the hands of Kyle W. Hesse, vice president

Kyle W. Hesse

and general manager, who has long experience in machinery rental operations, and is well known in the construction industry. Star, with branch offices in Portland, Ore., and Spokane, Wash., distributes construction equipment, machinery and tools throughout the Pacific Northwest.

Personnel changes and addiions

Jack Sahlberg, Jr., has been appointed general manager of Sahlberg, Inc., Seattle. He has been employed by the firm since 1950, prior to which he was with International Harvester Co., Truck Division, in Portland, Ore. Announced also by Jack Sahlberg, Sr., company president, is the employment of Loren Bettes, formerly with Howard-Cooper Corp.'s Seattle office, as Sahlberg heavy equipment sales representative in King County and Alaska. A new account added by the company is Aeroil Products Co., Inc.

New line

Air Mac, Inc., of Washington has been named as exclusive distributor for the complete line of asphalt plants manufactured by Heatherington & Berner, Inc. The Seattle based firm will cover all of the state of Washington except the five southernmost counties handled by Air Mac, Inc., of Oregon. The branch at Spokane, Wash., will also service a few counties in northeastern Oregon.

Charles Brazil becomes branch manager

Charles Brazil has been elevated from sales representative to branch manager of Inland Machinery Co.'s John Day store. Brazil has been with the company since January 1955. Inland's headquarters are in La Grande, Ore.

MANUFACTURERS

Ko-Cal appoints Lee Williams

E. Lee Williams has been appointed special sales representative by Koehring California Co. (Ko-Cal), Stockton, Calif., a division of Koehring Company. He will work with Ko-Cal distributors in the eleven Western states. Williams has been connected with the construction industry since 1933. Before joining Ko-Cal he represented Yuba construction machinery for seven years, prior to which he spent three years as a representative for C & D Manufacturing Co. He was also associated in various capacities with three large Western contracting organizations: Walsh Construction Co., Utah Construction Co., and Macco Corporation.

E. Lee Williams

Essick promotes Frank Jennings

Frank Jennings has been promoted to the position of national field sales manager of Essick Manufacturing Co., Los Angeles. Jennings has been with Essick for 20 years and was Southwestern district sales manager at the time of his new assignment.

L&B acquired by Victor Equipment

Victor Equipment Co., San Francisco, has acquired L&B Welding, Inc., Berkeley, Calif., manufacturer of machines for the rebuilding of tractor track rollers, idlers and rails. To be operated as a wholly-owned subsidiary, L&B will continue manufacture at the present plant in Berkeley.

Spanall of Pacific sold

Spanall of the Pacific, Inc., Western marketing outlet for Spanall horizontal shoring, has been sold to Rex-Spanall, Inc., a subsidiary of Chain Belt Co., according to announcement by Graeme K. MacDonald, Spanall-Pacific president. A. J. Crowl, chief engineer for Spanall-Pacific, has been named to head Rex-Spanall operations in the Western states, and for the present will continue to maintain an office at 8907 Railroad Ave., Oakland, Calif.

Preco Dial-A-Slope available on L-W grader line

Preco Incorporated and LeTourneau-Westinghouse jointly announce the availability of the Preco Dial-A-Slope automatic blade-control as an addition to the list of optional equipment available for the L-W motor grader line. The unit is now being serviced and sold, for factory or field installation, by all LeTourneau-Westinghouse distributors.

Western office for A-C pipe sales

Keasbey & Mattison, Ambler, Pa., announces the opening of a Los Angeles district sales office at 5710 Manchester Ave., Los Angeles, Calif. The office will be directed by John Prechek, district sales manager. Prechek joined K&M in San Francisco as a salesman in 1955, subsequently becoming district manager there. The company has been manufacturing asbestos-cement pipe products on the West Coast since 1953 when it opened its plant at Santa Clara, Calif.

John Sproule heads Rex-Spanall

Appointment of John H. Sproule as vice president and general manager of Rex-Spanall, Inc., New York City, is announced by Chain Belt Co., the parent company. Sproule, a graduate civil engineer and former manager of current engineering in Chain Belt's construction machinery section, becomes chief executive officer of Rex-Spanall. Jerry J. Kriva, manager of general standardization at the company, has been elevated to Sproule's former post.

Marion Power appoints two

Two new executive appointments at Marion Power Shovel Co. are announced. Myron Geller, sales manager for small machines, has been named to the newly created position of administrative engineer. Anthony M. Colatrino has joined Marion as sales manager for small machines. "Mike" Geller has been with Marion since 1955, following five years in field sales with another excavator manufacturer. Colatrino, formerly sales vice president for Orton Crane & Shovel Co., also has had considerable experience in the earth-moving field.

Percy H. Batten dies

Percy H. Batten, founder and chairman of the board of Twin Disc Clutch Co., died April 8 at Racine, Wis. During his 42-year career at Twin Disc, Batten earned a reputation as one of the nation's most able and progressive industrial leaders. He built the company from a small Racine shop employing eight people into a worldwide operation with 1,200 employees.

Ray Witherill named service manager

R. H. Witherill has been appointed service manager of Austin-Western, Construction Equipment Division, Baldwin-Lima-Hamilton Corp., Aurora, Ill. He succeeds Herbert C. Wuestenberg who retired. Witherill joined Austin-Western in 1953 as district service manager covering California, Arizona, Nevada and Utah, a position he held until transferring to Aurora headquarters in 1958.

Morris Hagler moves to S.F. post

Morris E. Hagler has joined the San Francisco district staff of American Bridge Division as a contracting manager, as announced by United States Steel. He held the same position in the Chicago district since 1956.

Proposed merger

Barber-Greene Co. and Smith Engineering Works announce the approval of a proposed merger by the boards of directors of the two companies based on an exchange of common stock. Barber-Greene is a leading manufacturer of asphalt mixing, paving, ditching and materials handling equipment. The Telsmith line, including crushing and screening equipment manufactured by Smith Engineering, is universally known in the construction, aggregate producing, mining and industrial fields.

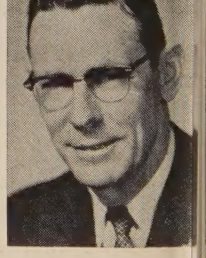
CLASSIFIED

Space is sold as advertisers inches. All advertisements in this section are ⅛ in. short of contracted space to allow for borders and composition.

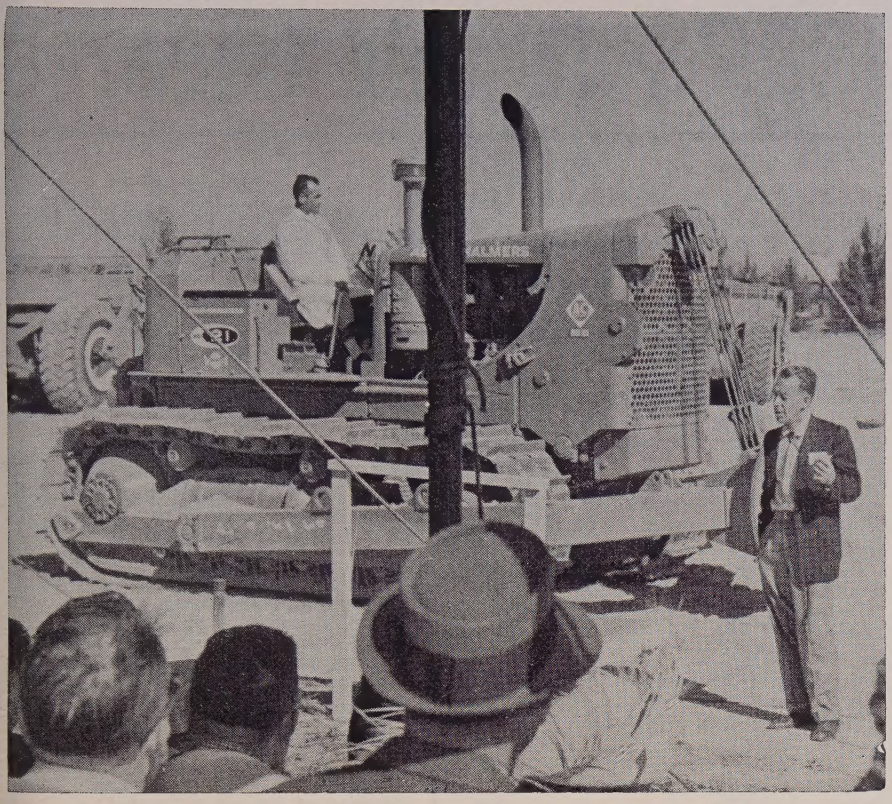
Rates are $15.50 a column inch. Copy should be sent in by the 15th of month preceding publication date.

Personnel advancements by Hyster

James L. Woodley, for the past five years manager of the Hyster Company's Danville, Ill., plant, has been placed in charge of company-wide manufacturing activities. The move brought about two other appointments. William H. Kilkenney, retail operations manager in Los Angeles, Calif., was named to Woodley's previous post. Harold Berg, sales representative at Los Angeles, was chosen to succeed Kilkenny. Woodley's appointment brings him back to Portland where he started his Hyster career in 1946.

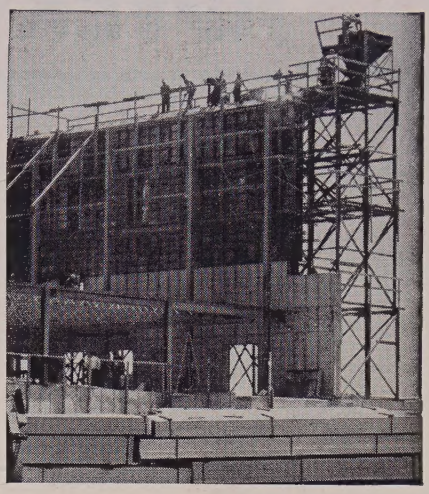


James L. Woodley



MORE THAN 700 Western contractors and distributors attended Allis-Chalmers' California Sunshine Premiere, an introductory demonstration of A-C newest and largest earthmoving machines. The visitors saw earthmoving performances under actual field conditions by the firm's all-hydraulic TS-360 motor scraper, and the HD-21 crawler tractor. Above, *H. T. Larmore*, tractor and allied equipment sales manager, describes the features of the 59,000-lb. HD-21 as a pushing unit.

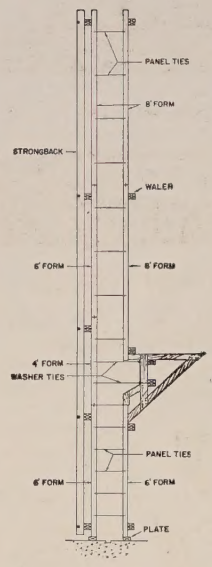
Saved! One Month



Extensive Use of Symons Steel-Ply

. . . Speeds Work on "Rush" Job

New, non-military, air route traffic control center building near Fremont, California will help control and direct aircraft, prevent collisions, and guide "lost" planes over a wide western area. J. H. Pomeroy & Co., Inc. San Francisco was the contractor.



The project was unusual because of the speed with which it had to be erected. The building is perhaps the first non-military structure in the west that has been designed to withstand atomic "fallout." The contractor gave careful study to the most time-saving methods. Symons Steel-Plys proved to be one of the principal time-savers. They were used on all major construction and were also adapted for pouring of large, reinforced concrete beams that were set between steel columns for blast protection.

Complete "Air Route Traffic Control Center" story sent *free* upon request. Symons Steel-Plys can be rented with purchase option.

ADVERTISERS in this issue