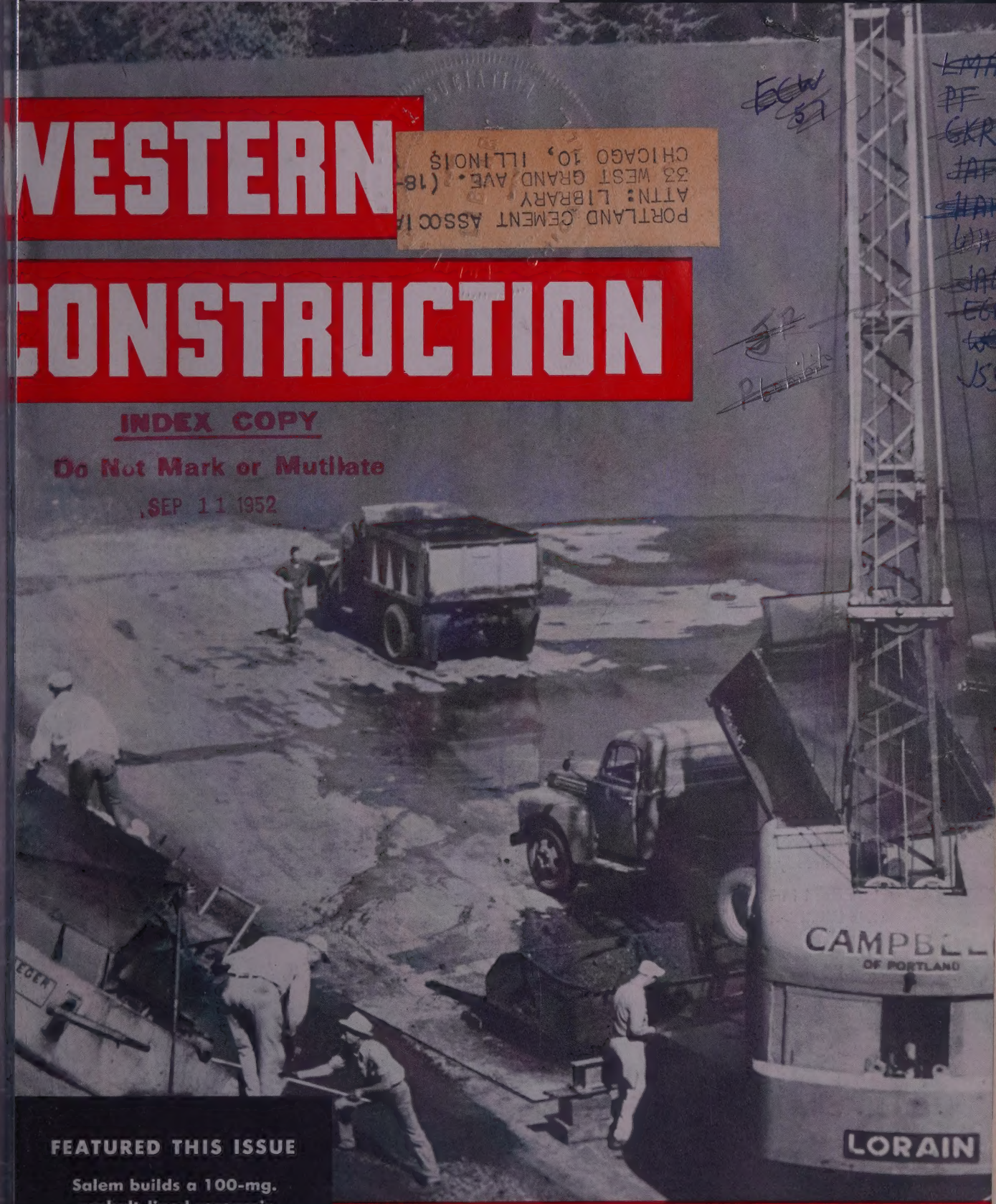
WESTERN CONSTRUCTION



FEATURED THIS ISSUE

Salem builds a 100-mg. asphalt-lined reservoir

•

Frangible construction for bomb blast protection

•

Lining heavily-reinforced 8-ft. pressure tunnel

SEPTEMBER 1952

EARTHQUAKE AT TEHACHAPI

Pages 68-75

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WESTERN CONSTRUCTION

Volume 27 **SEPTEMBER 1952** Number 9

ARTICLES

DEPARTMENTS

FRONT COVER

EQUIPMENT IS ADAPTED to work on 1½:1 slope for construction of 100-mg. asphalt-lined reservoir at Salem, Oregon. Cover view shows converted Jaeger finishing machine being used on slopes to place 3-in. layer of asphalt. Mix is dumped into buckets in front of dragline, thence emptied into spreader, which is pulled up slope by winch at top. Story on page 57.

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WESTERN CONSTRUCTION

September 1952 Vol. 27, No. 9

Tehachapi did provide useful lessons

Those familiar with earthquake destruction will be inclined to dismiss the major disturbance at Tehachapi as producing "no new information." Already the national journals have expressed this reaction. Here in the West this must be considered a superficial approach. The disaster deserves more thoughtful appraisal, and more effective use must be made of the re-emphasized lessons, before results are consigned to engineering history. Two factors are particularly worthy of attention: the impact on young engineers as they assimilate the import of the occurence, and the opportunity for the profession to renew public appreciation for sound engineering.

Engineers are impressed by events in proportion to their nearness in time and distance. Reading an engineering text describing a disastrous flood, hurricane or earthquake is one thing, but to have such a natural disturbance strike, and to read first-hand reports and see pictures of current damage have a far greater impact on the consciousness of a designer. Almost twenty years have elapsed since the last severe earthquake in California and it is reasonable to say that the majority of the structural engineers at work today started their careers during that interval. These twenty freshman classes have heard the second-hand admonitions of their superiors as to the effect of earthquakes on structures. But each year the effect has grown less and less as time dimmed the picture. This same process is going on today in the Pacific Northwest where the last three years are already dimming the impact of the 1949 earthquake on the minds of young designers. It should not be the attitude of the experienced engineers of the Pacific Coast to report "no results worth mentioning," but they should use the recurrence as an object lesson in seasoning the minds of young designers. This is an important reason for the extended report on the Tehachapi disaster.

The second worthwhile factor is the use that can be made of engineering observations and comments to re-stiffen the attitude of public agencies in demanding proper design. Regardless of what engineers would like to do about improving the structural design of public buildings, particularly schools, public support for the added cost is essential. Rather than comment with "no lesson," every engineer should carry his share of needed public relations and point out to his non-technical friends how lessons were re-emphasized.

Between its effective impact on the thinking and work of the younger designers, and its use in reactivating public support of adequate building design the recent earthquake can and should be made a lesson of extreme importance.

Turning rain on—or off

Before engineers have been able to evaluate properly the position of the professional rain-maker in the field of hydrology, the "rain-stopper" has arrived with reverse claims in regard to the control of precipitation. Thus, confusion is compounded in regard to man-made material to fill reservoirs. It would appear that with this further idea in controlling nature—from either too-much or too-little, to just enough—much engineering work will be outmoded. But, what if inter-agency conflicts develop? Suppose a flyer carrying rain-making pills for one agency to wet down a watershed, meets a flyer carrying no-rain pellets for another agency, would the results be a neutralizing effect or an atmospheric cataclysm. Speculation can run rampant as to problems and consequences. In the meantime it would appear safe for engineers to go ahead on the old fashioned basis of designing works to control run-off when it is excessive and to conserve it where deficiencies exist.

Preliminary costs—to sell or bury

Every new refinement in engineering design tends to increase preliminary costs of any project. In the years when designing was rather empirical, engineers were accustomed to work with a minimum of site exploration or study. Today, design is so refined and exact as to be influenced by seemingly minute changes in foundation-structure relationship, or the corresponding effect of disturbing a water channel. So, more investigations are demanded, and this trend is in line with increasing specialization elsewhere in the field of science. It also adds up to increasing the cost of construction.

Years ago levees were built and the regimen of rivers changed without too much concern over secondary effects, if the primary results were achieved. The science of hydraulics has now advanced to where engineers will not get involved with such work without elaborate model tests.

Such a study is being urged in the planning for the future development of San Francisco Bay. Engineering agencies are shying away from definite planning without the aid of a model to be built and studied at an estimated cost approaching $1,000,000. In many cases this type of preliminary engineering has its cost hidden in the final total figure. However, in the present case the local communities are being introduced to this preliminary cost as a separate figure, and don't like it. The reaction could well have been anticipated. It reflects a basic problem in public relations, and the weakness of the engineer's position in the confidence of the public. Medical or legal costs for such studies would not be questioned. The moral is to keep engineering preliminary costs properly buried in the total, or advance public relations.

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WESTERN CONSTRUCTION

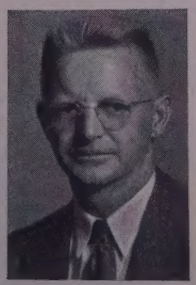
EPTEMBER 1952

Salem improves water supply system with—

100-mg. asphalt-lined reservoir

Capacity of 18-mi. delivery line increased by 2.5 mgd. with storage secured at a side-hill site requiring extensive fill—Equipment adapted to placing 3-in. asphalt lining on 1½:1 slope—Test devised for watertightness of lining

By
JOHN L. GEREN
Manager
Salem Water Department
Salem, Oregon



TO SECURE STORAGE for absorbing peak loads on an 18-mi. water delivery line, the City of Salem, Ore., is completing the construction of a 100-mg. reservoir which is provided with a lining of asphaltic concrete. This storage will result in increasing the capacity of the system by about 2.5 mgd. when the reservoir is full. Maximum advantage of this added storage capacity will not be attained, however, until a second supply line can be constructed from the reservoir to Salem.

Location of the reservoir site is near the town of Turner at a point where the line crosses a low range of hills. At this point the profile of the line reaches the hydraulic gradient. By storing water during off-peak hours and then taking advantage of the increased head produced by the reservoir, there will be a valuable increase to the capacity of the 8-mi. line into the city.

A word of history

In 1935, the City of Salem purchased the water supply system supplying the city from its private owners. The source of water at that time was a system of filter beds in the Willamette River which was producing a water much criticized for its taste and odor, and which was becoming totally inadequate in capacity for supplying the city. Studies were immediately begun for a new source of supply and for the improvement of the distribution system, which

ARRIVING AT THE TOP of the slope, the paver was pulled up onto a timber skid-rig developed and built by the contractor. The skid was then pulled forward by truck for the width of the paved strip. The winch in the skid then lowered the paver down to the bottom of the slope.

led to completion in 1938 of a 10-mg. covered reservoir, replacing an old 2-mg. open reservoir, combined with an 18-mi., 36-in. gravity supply line and a source in the North Santiam River above the town of Stayton. This source consists of a system of infiltration galleries in an island in the river, followed by fine screening and chlorination. It is capable of producing, with some later modifications, about 20 mgd. As has been true of so many cities, its adequacy was overestimated due to the rapid growth of Salem.

Site on side-hill

The site selected for the new reservoir is on a side hill, its elevation being fixed by the grade of the supply line. Its unusual shape, as shown in the accompanying sketch, was designed to take full advantage of the area available with a minimum of cut and fill. This was done by placing the center line approximately on a contour of the original ground. In dimensions, the reservoir is 2,040 ft. long on center line, 200 ft. wide in the bottom, has 1½:1 side slopes, and is 31 ft. deep to the top of the embankment. Water level at a depth of 28 ft. will provide storage of approximately 100 mg.

Soil conditions vary from a very tight clay in the east end to solid rock a few feet below the surface in the west end. The rock bottom in the west half is fissured, making a tight lining imperative to prevent high leakage loss. The north, or uphill, slope is entirely in cut. The south slope averages about 7 ft. in cut with the balance in embankment. The embankment is 113 ft. wide on top, except where it narrows at the two ends as the fill diminishes, and is a 1½:1 slope on the outer side.

Contract for the excavation was let in September 1950. Not much was accomplished during the winter, with the work begun in earnest in the early spring and completed in June 1951. Tractors and scrapers were used for earth excavation and a shovel and Tournarockers were used for rock. All rock had to be blasted. By distributing the rock with the earth, sufficient compaction was obtained from the heavy equipment, and rolling was not necessary. A total of 380,000 cu. yd. of excavation was required. After completion of excavation, some work was done during the fall and winter on underdrains and inlet and outlet connections, but the project was allowed to lie idle through the winter to allow any settling to take place. Maximum settlement observed in the deepest part of the embankment was 0.07 ft., and very little damage was done to the slopes by winter rains.

After considerable study of costs and other factors, it was decided to line the reservoir with asphaltic concrete. A watertight lining was imperative to prevent loss of water and to prevent saturation of the fill. Presence of heavy groundwater during the winter required a system of underdrains which also serve to intercept and carry away leakage water. Drainage will be measured daily to observe any sudden increase which would indicate a leak in the lining.

Clay cover on slopes

Slopes were prepared for paving, particularly in the areas of rock cut, by hauling in clay soil, spreading it on the slopes with a drag line, and then compacting with a pneumatic roller operated by a shovel at the top of the slope. After this treatment, slopes were smooth, hard, and uniform and offered a good surface for paving. Soil sterilant was applied to the upper third of the slope to prevent weed growth under the lining in the areas not continually submerged.

Contract was let in March 1952 for placing of 5 in. of base rock and topping in the bottom, paving of slopes and bottom with 3 in. of asphaltic concrete, and placing of seal coat. Slope preparation was done by city forces.

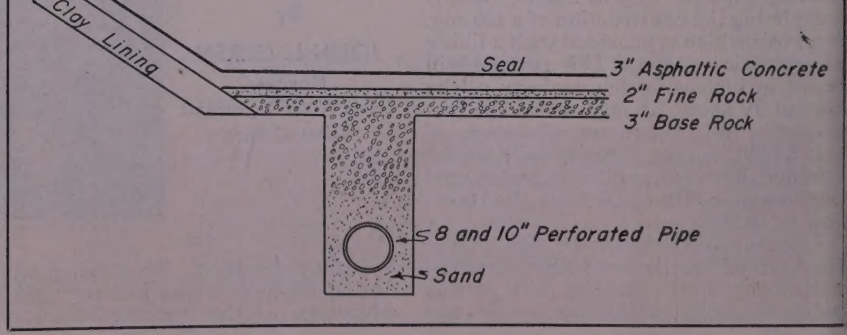
Asphaltic concrete linings for reservoirs are something new in the Northwest, although a great deal of similar work has been done with canal linings, and with reservoir linings in other parts of the country. One of the first problems faced was to re-orient the thinking of everyone connected with the project from highway pavements to the type of material required for lining a reservoir. Quite a number of paving contractors were skeptical about bidding in the light of the specifications being so foreign to their established practices in street and highway construction.

Design of asphalt mix

An asphaltic mixture was sought, and was achieved after some experimentation, which combined the properties of density and watertightness, stability, and workability, required for this purpose. The mix selected was one using crushed aggregate all passing the ½-in. screen, and much more dense than a paving mix. From 10% to 11% of 60-70 penetration asphalt was used. After setting the mix, some modifications of proportions were required to obtain the desired properties in laying. A 16-mi. haul from the plant to the job limited the amount of asphalt that could be carried without too much segregation.

The side slopes of 1½:1 created a problem in placing the hot-mix lining on slopes. Due to the unavailability of a suitable commercial slip-form for this purpose, the contractor converted a standard Jaeger spreader to a combination spreader, adding an ironing screed to compact the spread mixture. However, due to the rigidity of the machine, the ironing screed attachment could not be used, and was detached soon after be-

FOUNDATION for lining on the slopes was layer of rolled clay, while a two-lift layer of rock was used on the bottom, under the asphalt.



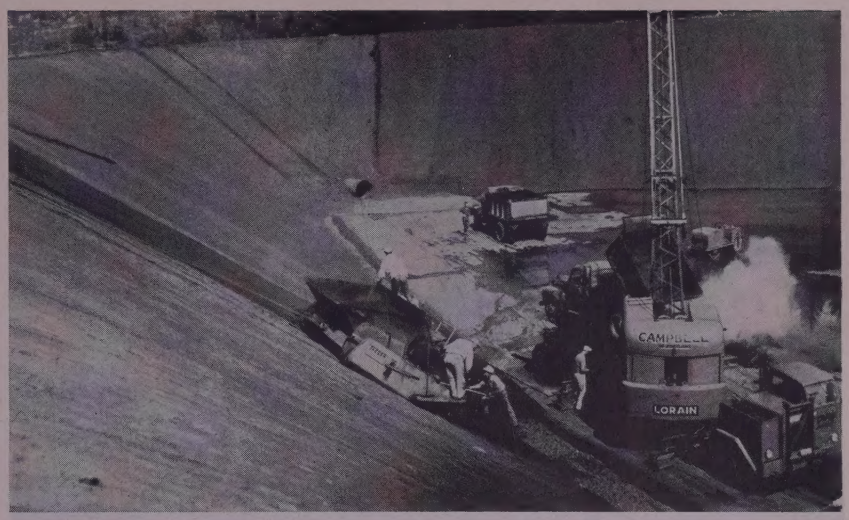
inning this phase of the work. The aeger was then used satisfactorily as a preader only, the mixture being com-acted by rollers, assisted by a cable to drag-line winch. To permit moving the preader to the next lane, an incline was onstructed as a skid-rig, and operated t the top of the reservoir. The skid-rig nounted a gasoline engine and a winch, nd a cable attached to these pulled the preader from the bottom of the slope o the top. At the top, the spreader was ulled up completely on the incline, and he skid-rig then moved forward by a ruck-mounted cable and winch, to the ext lane, where the spreader was re-eased to roll by gravity to the bottom f the slope, ready for loading with mix. Mix was loaded into the spreader by neans of two skips of 2-tons capacity ach, the spreader holding about 4 tons t one loading. The spreader was re-oaded about halfway up the slope. The rakes on the spreader were used to ssist in steering the spreader up the lopes, and to secure a tight joint in rowding the previously placed spread.

Compaction of the paving of the side lopes was accomplished by rolling im-nediately after placing with a very light 300 lb.) roller, followed in a few hours y a heavy tandem roller. The rollers vere pulled by power winches and cables rom the top of the reservoir.

The paving in the bottom of the reser-oir was placed by a Barber-Greene fin-shing machine and compacted with a 0-ton tandem roller. Due to the vibra-ion of the finishing machine screed, a ight film of asphalt was floated to the urface of the rich mix used, affecting a ight surface seal in addition to obtain-ng initial compaction.

Testing for density

Laboratory tests were made from cut amples showing densities in the range f 95% to 96%. A test was devised for vatertightness in which a 5-in. core was ealed in a section of 6-in. pipe and water ressure applied through a pressure re-lucing valve at pressures up to 60 psi. Although great care was taken in cut-ing, removing and transporting the amples cut from the lining, some doubt xisted as to the ability to obtain com-letely crack-free and non-distorted pecimens for the leakage tests. How-ver, sufficient tests were made to indi-



CONVERTED ASPHALT PAVER was loaded by skip at the bottom of the slope and pulled up the bank by winch. About halfway up the slope the paver was reloaded by skip handled by the truck crane. An enlarged view appears on the front cover of this issue.

cate that: (1) a sample that was tight at low pressures would remain tight at higher pressures, (2) that water tightness was not entirely related to density, and (3) that surface condition appeared to govern the degree of tightness. Areas of surface roughness or screed pull leaked at low pressures, even though a sample cut from the same spread might be watertight where the asphalt had flushed to the surface.

The experiments indicated that some of the areas of the completed lining might have some degree of water permeability under high pressure, due probably to the method of compaction used and to the use of a highly angular aggregate in the mix which, while giving a high stability, also tended to reduce workability sufficiently to prevent high density from being obtained under the rollers.

In view of the possibility of permeability in several areas, the decision was made to seal-coat the entire lining prior to placing in use. Two types of seal will be used. The sides will be sealed with an application of catalytically blown asphalt cement, applied at high temperature and without application of aggregate of any kind. In the bottom, where periodic cleaning will require some traffic on the floor, an asphalt emulsion and sand treatment will be used. This construction should result in a permanently water-tight, jointless and crackless lining.

With the exception of a small area in each end, there has been no evidence of slipping of the lining on the slopes. Some doubt had been expressed as to whether asphaltic concrete would stand on such steep slopes, but the lining has been exposed through temperatures as high as 101 deg. F., which is as severe a test as will ever be required of it. In the two areas mentioned in the ends, an attempt was made to add extra tightness by placing an asphalt membrane under the clay lining. This proved to be a mistake, as the heat of the asphalt paving penetrated through the clay, causing the membrane to act as a lubricant and allowing the earth cover and paving both to slide. These sections will be removed and repaved.

Certain design features of the reservoir and its appurtenances are of interest. Although the reservoir is supplied by, and discharges into, a 36-in. line, inlet and outlet connections are 48 in. in diameter. Branches have been installed in both inlet and outlet lines for 48-in. connections to future lines. A 48-in. line from Turner Reservoir to Salem is planned for the reasonably near future, with an additional line from the reservoir to the source at Stayton projected for some years later. Valves and connections are so arranged that all water may be passed through the reservoir or so that it may be by-passed at any time for cleaning or maintenance. An inclined ramp has been left for access to the bottom.

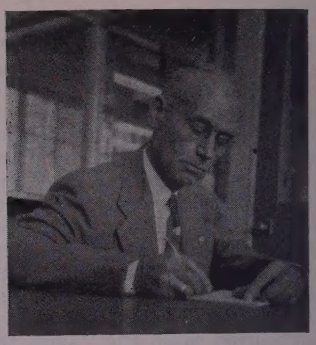
The inlet line enters the reservoir at the floor level and terminates in a header across the end with five equally spaced openings facing toward the slope. This arrangement is intended to give the entering water a rolling action in an attempt to secure fairly uniform velocity through the reservoir. Near the inlet is an overflow structure capable of taking

Continued on page 138

LOCATED along a contour, the reservoir follows the side-hill for a length of 2,040 ft. and required 180,000 cu. yd. of excavation. Bottom width is 200 ft. and water depth will be 28 ft. to overflow.

Wyoming uses scoria waste for cement-stabilized base

Lack of suitable gravel within 65 mi. of highway project prompts study resulting in use of rejects from railroad ballasting—First use of the process by highway department and the first known use of scoria for this method



By

I. E. RUSSELL

Chief Materials Engineer
Wyoming Highway Department

USE OF SCORIA waste material for a cement-stabilized base course has made it possible for the Wyoming State Highway Department to eliminate a 65-mi. haul for suitable gravel, saving about $12,000 per mile for the base course on a reconstruction job in the northeast corner of the state. Not only is this the first cement-stabilized base project to be carried out by the highway department, but it is believed to be also the first time that scoria has been used for this purpose. The general principles and procedure of the stabilizing of highway base material with cement have been reviewed in this publication in previous articles and this review will be confined to a description of the contractor's field operations. A brief article in the preceding issue outlined the background for this project.

The northern tier of counties in the state, extending eastward from the Big Horn range of mountains to within a few miles of the eastern border are predominantly Wasatch and Fort Union geological formations. Few deposits of gravel suitable for ballast or highway base course surfacing are available within the area, and even these contain material that is borderline for these purposes. The gravel contains an excess of the finer fractions with the result that the dust-ratio is near the limit or beyond the specification requirements. Usually the plasticity index is likewise near or beyond the specification limits.

A section of highway on U. S. 14 and 16, extending east from Gillette was badly in need of reconstruction and had been given high priority on this year's program. This section lies in the very center of the area devoid of suitable base materials, and accordingly the problem of gravel or an adequate substitute was

TOP TO BOTTOM AT LEFT—

(Pictures and captions with this article are presented in a sequence corresponding to job operations.)

LOADING bulk cement into tank truck by screw conveyor from railroad car.

MEASURING cement into one of three windrows for scoria.

MIXING with Wood's machine equipped with 1,400-gal. water tank.

prime importance. Good quality material was available both north and east the project but at a distance of some mi.

coria available

At Minturn, 6 mi. east of Gillette, the urlington Railroad had, for some years ast, been carrying on the production of coria ballast for their roadbed. This peration had developed a waste pile of me 300,000 cu. yd. of fine scoria rang- g in size from ¼ in. to dust. The ossibilities of using this material with ement to construct a hardened scoria- ement stabilized base were investi- ated. Samples of the scoria fines were bmitted to the Portland Cement As- ciation laboratory to determine their itability and the per cent of cement quired. Similar tests were made in our boratory. All of these tests indicated at the scoria would be satisfactory, nd that it would harden well and give tisfactory compressive strength with % cement added.

Cost estimates also indicated that a nsiderable saving could be made by

TOP TO BOTTOM AT RIGHT—

SPREADING a windrow with blade as soon as mixed.

LOOSENING material with farm cultivator before compacting with sheepsfoot.

COMPACTING to 6-in. finished thickness over the 28-ft. width of base.

SHAPING with a patrol, while a finger weeder takes out track marks.

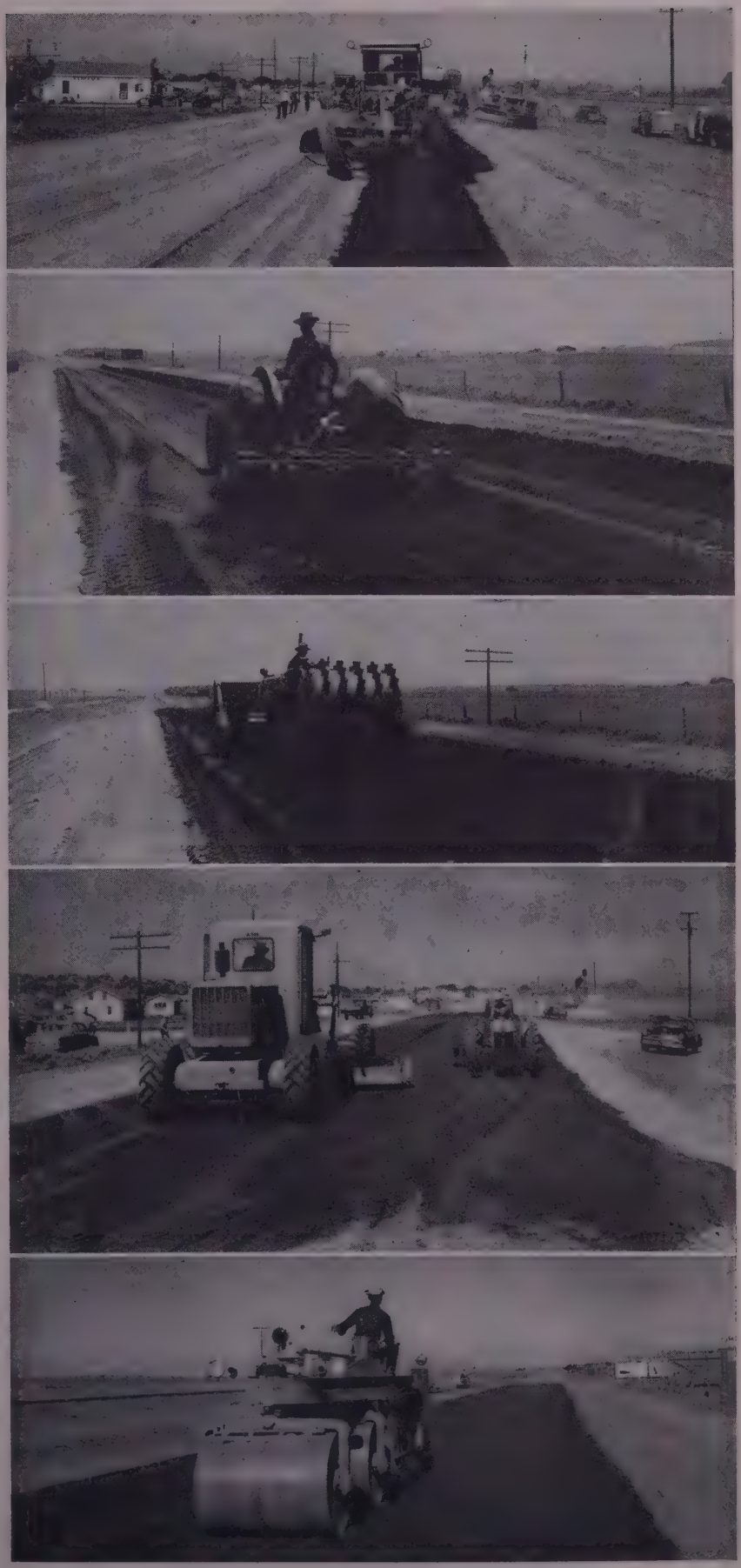
FINAL ROLLING with a 3-axle steel-wheeled roller.

tabilizing this waste material with ce- ent, rather than hauling the necessary allast gravel from 65 mi. away. Due to he variable types of soil throughout the roject it was not deemed good practice attempt the cement stabilization of he natural grade material.

tarting the first job

The first project, 10 mi. in length, was et up last winter so that a contract ould be awarded in plenty of time for he work to get under way early this pring. Our design procedure (modified BR Method) called for a sub-base of in. of selected embankment over part f the project and 8 in. over the balance xcept for approximately 2½ mi. at the illette end, where the grade material as a sand, classifying as A-2. On this ection no sub-base was placed.

Scoria fines from the waste pile were sed for this selected embankment. In etting up our design thicknesses of sub- ase, base and top surface, the 6-in. hickness of scoria-cement base was con- idered the equivalent of 8 in. of high uality crushed gravel base. The typical ross-section of the roadway is shown n the accompanying sketch. The project nvolved some 440,000 cu. yd. of excava- ion, 55,700 cu. yd. of selected embank- ent, 163,100 sq. yd. of scoria-cement ase course, 12,100 tons of plant mixed urface course, one continuous concrete



girder bridge of three spans, and the many incidental items for a contract of this magnitude.

On Dec. 6, 1951 the contract was awarded to Big Horn Construction Co. at a contract price of $707,913. Work was started early this spring and all grading has been completed, selected embankment placed, scoria-cement base placed and the plant-mixed surface course under way.

Since this was Wyoming's first project of this type, and some of our local contractors lacked experience and necessary equipment, it was decided to be as liberal as possible in setting up the equipment requirements. Accordingly, heavy duty farm type equipment, traveling plants or stationary plants were permitted for the mixing of the scoria-cement base. Other specification requirements for this part of the work followed quite closely accepted specifications of other states.

The contractor chose to use bulk cement and accordingly provided a 125-bbl. tanker equipped with a Wood's automatic feeder. A plate was mounted on this equipment just ahead of the cement feeder to cut a groove in the top of the windrow for the cement. Mixing of the scoria and cement was accomplished by a Wood's mixer on which was mounted a 1,400-gal. water tank. Tractive power for the mixer was a D8 Caterpillar.

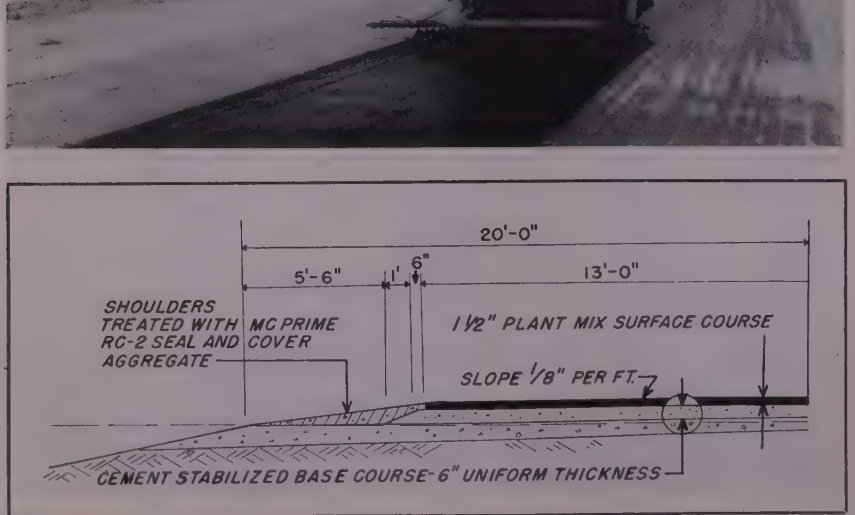
Average moisture in the scoria fines was 10% and, due to the bulking at this moisture content, a total of about 20 cu. ft. was required per lineal foot of roadway to provide the necessary 6 in. of compacted thickness for the 28-ft. average width of base. Based on the capacity of the mixer, the material was placed in three windrows of about 6⅔ cu. ft. each.

As might be expected, some difficulties were encountered at first, but these were soon ironed out and as construction procedures were corrected and a proper sequence or chain of operation adopted, the contractor was able t complete 2,500 ft. per day. This wa broken down into five sections of 50 ft. each to complete fully all operation within the required time schedule. Gu Robbins of the Portland Cement As sociation was at the job and assisted ou engineers and the contractor in settin up the schedule of processing operation for the cement-stabilized base.

The schedule adopted was as follows

1. Windrow scoria in three windrow
2. Meter cement into each windrow.
3. Mix with Wood's mixer, addin water to bring material to optimun
4. Spread material with motor patro
5. Mix with cultivator.
6. Compact with sheepsfoot roller.
7. Water surface if needed to main tain optimum moisture.
8. Loosen surface and scratch out tir marks with finger weeder.
9. Shape with patrol.
10. Follow through with finger weede
11. Roll with pneumatic roller.
12. Water surface if needed.
13. Use finger weeder lightly after op erations 11 and 12 are fully com pleted.
14. Final shaping with patrol.
15. Roll with pneumatic roller.
16. Final rolling with three-axle tan dem steel wheel roller.
17. Seal the moistened surface wit RC-2 cutback asphalt.

TOP—Fog spraying with water during final finishing to maintain moisture content.
CENTER—Applying RC2 curing seal.
BOTTOM—Cross-section showing relation of scoria cement-stabilized base to the sub-base and the asphaltic plant-mix surfacing.



Right-of-way problem

Due to limited right-of-way it wa necessary to build almost the entir project within the right-of-way of exist ing roadway. All traffic was carrie through the project and detoure around construction activities wher necessary by way of the borrow pits. T guard against undue inconvenience t the traveling public, a definite sequenc of operations was provided in the con tract as follows:

"Grading work shall be commenced a one end of the project and carried on i sections not to exceed three (3) miles however, the Contractor shall co-ordinat the sequence of his grading operations an the placing of selected embankment so tha there will not be more than a total of three fourths (¾) mile of sub-grade under traffi at any one time without at least the firs lift of selected embankment in place. At n time shall the grading operations includin the selected embankment be more tha eight (8) miles ahead of the complete cement-stabilized base course and the ce ment-stabilized base course shall not b more than three (3) miles ahead of the oi ing operation. The above schedule of wor may be changed only upon the written per mission of the Engineer.

"Construction operations on each sectio shall progress with minimum amount o inconvenience to traffic until the finishe roadbed on that section is completed."

Gravel for the plant-mixed surfac course was obtained from a satisfactor deposit about 65 mi. north of the projec hauled by rail and stockpiled at the jo site. The gravel was processed with 120 150 penetration asphalt and spread an rolled with a 14-ton three axle tande roller.

Concluded on page 138

Frangible construction for bomb blast protection

Building walls and roof designed to be blown out by shockwave, protecting structural frame—Suggested walls are of corrugated asbestos-cement, with roof sheets filled with perlite concrete to eliminate possible condensation of contaminated air.

By
JAMES R. GRIFFITH
Structural Engineer
Nucleonics Division
General Electric Co.
Richland, Wash.

A PRELIMINARY STUDY of the released (declassified) data concerning the effect of the energy liberated by the atomic bomb on personnel and structures produces a feeling of hopelessness as the first reaction. Insofar as conditions existing at ground-zero are concerned, protection of any sort seems fantastically costly, if even possible. The principal ray of hope exists in the possible accuracy by which a bomb can be placed by aircraft flying at the altitudes necessitated by modern radar-controlled anti-aircraft fire.

The Air Force is, no doubt, able to estimate the number of bomb drops necessary to place one on a specified target. I would guess that the number is considerable. In World War II, saturation bombing did not always put an industrial target out of commission. It seems highly improbable that any aggressor will be able to utilize nuclear fission for saturation bombing. Building protection from atomic bombing is therefore contingent on the improbability of an accurate pin-point drop.

Effect of the blast

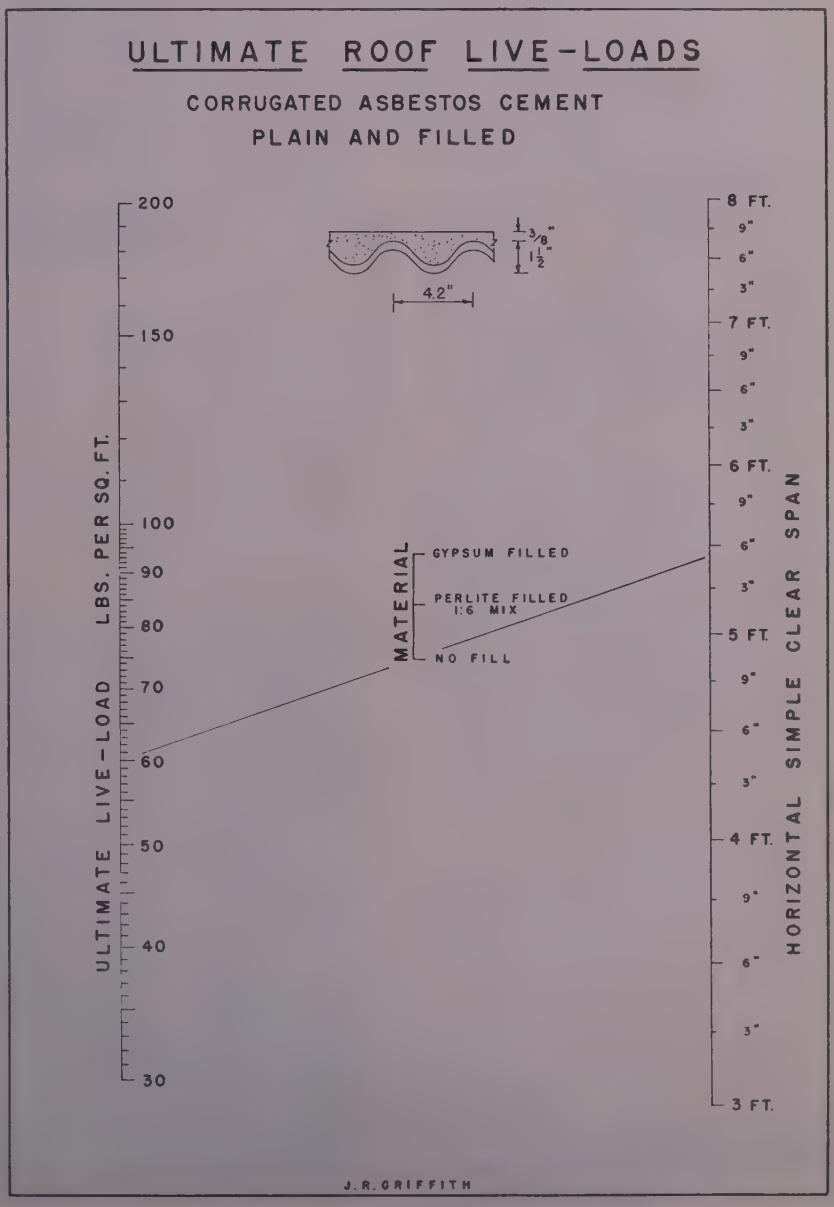
The disruptive effect to any industrial unit by an atomic air burst will in all probability be from the shockwave thereby produced. Any normal structure within a radius of several miles of ground-zero will sustain some damage. Structural design that will cause the least disruption, and permit the earliest resumption of normal operations, would be the best design within economic probabilities.

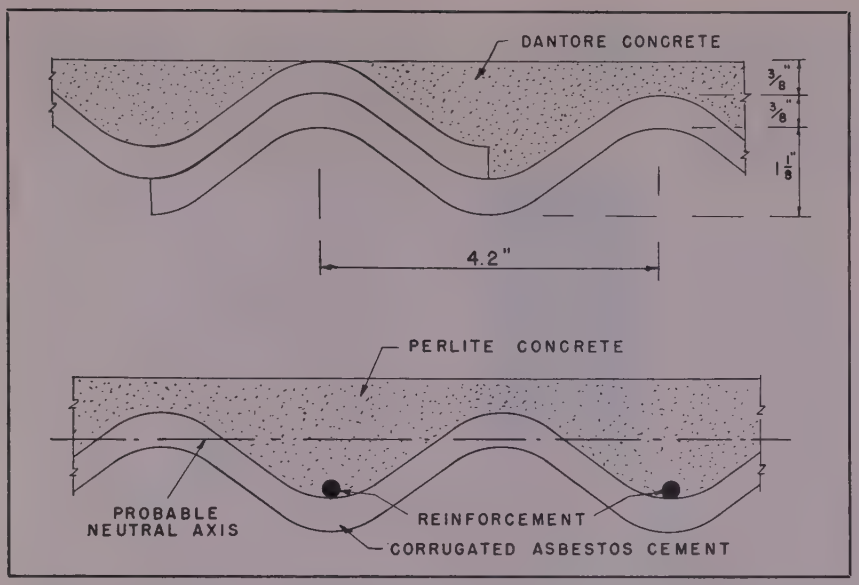
The results of air blast damage to industrial plants in the Japanese Nagasaki bomb burst are photographically recorded in "The Effect of Atomic Weapons" (Supt. of Documents, Washington, D. C., $1.25). Where frangible roofs and siding were not in use, the building frames were distorted and left leaning away from the source of the blast. The Germans during World War II solved the problem of minimizing airblast damage by the use of tarpaulins which would be ripped away by the blast without permanent damage to the structural frame, but could then be quickly replaced. Earth-filled or concrete barricades protected vital equipment from all but a direct hit.

In the design criteria for steel building frames at the Hanford Works, frangible walls and roofs were specified. Webster's Collegiate dictionary defines frangible as "breakable; brittle; fragile." The ideal frangible material would have sufficient strength to withstand normal live loads, yet disintegrate into small harmless pieces when subjected to bomb blast. In the absence of any known ideal material, corrugated asbestos-cement was selected as the best material available for the desired results.

In normal structural design we are accustomed to using either allowable maximum unit stresses, or allowable unit uniform loads in conjunction with respective spans, all of which contain a factor of safety. In frangible construction, on the other hand, we are faced with the necessity of knowing the failure loads of siding and roofing beyond all reasonable doubt. Thus, the supporting steel frame can be designed so as to prevent deflection beyond the yield point prior to failure of the siding and roofing.

In 1947 I was considering the possibility of a nomographic chart, for my series then appearing in *Western Construction*, involving allowable uniformly distributed loads on various spans of corrugated asbestos-cement. I was considering a companion chart to that published in June 1949 issue for corrugated iron. The Seattle office of Johns-Man-





PROPOSED SECTION of roof design (top) at the lapped joint of the asbestos-cement sheets. To provide more strength for roof load (bottom), a small reinforcing bar could be used as shown.

ville obtained from company headquarters the following data for me on corrugated Transite:

Tensile strength	1,000 psi.
Compressive strength	10,000 psi.
Modulus of rupture	3,000 psi.
Uniform breaking load—3 ft. span	200 psf.
Uniform breaking load—4 ft. span	120 psf.
Uniform breaking load—5 ft. span	70 psf.

"The above figures are for dry materials and should be reduced about 20% for maximum moisture content. Also, these loads are ultimate breaking loads, without any factor of safety."

How reliable these figures were, we had no idea, although they were at least a start. Two of our young rotational engineers (Cecil Hathaway and H. W. Stivers) were assigned the problem of making actual tests of the material in question. The results of their tests verified the values furnished by Johns-Manville within reasonable limits. The test results were plotted to logarithmic coordinates and averaged with a straight line. Thus we know with reasonable certainty the necessary girt spacing to cause failure of the siding for any given live load.

Roof—a complication

When it came to the roof we ran into other complications. For flat roofs, one conventional type of construction utilizes corrugated asbestos-cement on top of which insulation is attached, and then a mopped roof for weather proofing. In our case, the air space left between the corrugations and the insulation was objectionable due to possible condensation of contaminated air. A light-weight fill material was desired which would leave no objectionable air space and yet not materially increase either the dead-load or the resistance of the section to flexure. In the first tests poured gypsum, containing wood pulp to retard the rate of setting, was used and found to be reasonably satisfactory. The major objection to the use of the gypsum is its fast rate of setting. It cannot be mixed in a central plant on the ground, but must be mixed on the roof.

Perlite concrete was suggested as a possibility. Through the courtesy of Dant and Russell, Inc., of Portland, Ore., sufficient quantity of the firm's commercial perlite aggregate ("Dantore") was obtained for a test. After due consideration to strength and weight, a mixture containing one sack of portland cement, six cubic feet of this perlite aggregate and 16½ gal. of water was chosen for test purposes. On the recommendation of F. S. Burt of Dant and Russell, 1½ oz. of Darex per sack of cement was added. According to test results by the Charlton Laboratory of Portland this mixture should result in the following characteristics:

7-day compressive strength....125 psi.
28-day compressive strength....185 psi.
Oven dry density.....33 lb. per cu. ft.

In the test sections using both the gypsum and the perlite concrete fills the top surface was maintained ⅜ in. above the top of the corrugations. This was to permit striking the surface of the fill flush with the lapped joint (see illustration).

Much to our pleasure, the test specimens with the perlite concrete gave lower breaking loads for the same spans, as compared to the gypsum fill. The increased strength of the gypsum fill is probably due to the wood fibers in the gypsum which increase the tensile resistance similar to the action of the asbestos fibers in the asbestos-cement. That portion of the fill material of gypsum, below the neutral axis, would then increase the flexural resistance of the section. Contrary to normal structural design, this was a case where increased strength was objectionable.

The perlite concrete gave an excellent rough surface for adhesion of the insulation and roofing. This section resulted in a net weight of 8 lb. per sq. ft.

After the test results were averaged, I began trying to get the results into nomographic form for convenient use. This chart is herein reproduced for those readers who may run into this same problem of frangible construction. Where the reader does not want ultimate loads, the necessary factor of safety can be applied by a load factor.

Safety on such a roof

Many engineers will undoubtedly question the safety of such a roof during actual construction with workmen moving around thereon. We had many such misgivings within our own organization. To satisfy ourselves, we decided to test a full width sheet of corrugated asbestos-cement to failure with human loadings. The standard sheets are 42 in. wide. For testing, 4 x 4 timbers were carefully leveled on a concrete slab. Then, three men of known weights stood on a clear span of 6 ft. (aggregate load of 593 lb.) at the span center, producing a maximum deflection of ¾ in. The material returned to its original position on the removal of the loads.

Since we were considering purlin spacings as high as 6 ft., 9 in., it was decided to test the sheet of corrugated asbestos-cement to failure on a 7-ft. clear span. The men stepped on the sheet one at a time with care so as to not produce any impact. Three men having an aggregate weight of 493 lb. at the span center produced a maximum deflection of 1-3/16 in. with no sign of failure. In the 42-in. width of sheet there was only room for three men to stand at the span center. When the three heaviest men, having an aggregate weight of 610 lb., stood at the span center, a deflection of 1-7/16 in. was measured, and then suddenly the sheet collapsed.

This failure load of 610 lb. on the 7-ft. span was equivalent to a uniformly distributed load of 47 lb. per sq. ft. According to our previous tests, the sheet should have failed with the 493-lb. load being equivalent to a uniformly distributed load of 40.3 lb. per sq. ft. (see chart). The difference is probably explainable by the variations in moisture content of the asbestos-cement. Data obtained from Johns-Manville indicates a variation of as high as 20% from moisture content.

The thought has occurred to me that in normal construction, where higher strengths are desired, such increase might economically be obtained by laying one small reinforcing bar in the trough of each corrugation (see illustration). The flexural resistance of such composite section would still be controlled largely by the tensile strength of the asbestos-cement below the neutral axis. Since the bottom of the trough, between corrugations, is undoubtedly below the resultant neutral axis, any reinforcement in that area should materially increase the resistance of the section to flexure. I regret that our needs did not warrant any research on this possibility. Perhaps someone else will see the possibilities for flat roof construction and carry it to a conclusion.

Carter Lake tunnel on Bureau of Reclamation's Colorado-Big Thompson project designed for dynamic head of 235 ft.—Reinforcing steel (right) presents placing problem — Concrete is hauled in spring-mounted cars to reduce segregation.

LINING AN 8-FT. PRESSURE TUNNEL

By
MAX GELWIX
Engineer
Bureau of
Reclamation
Loveland, Colo.

DESIGNED TO OPERATE under one of the highest heads imposed on any tunnel built by the Bureau of Reclamation, the Carter Lake pressure tunnel of the Colorado-Big Thompson Project presented a special lining problem for the contractor with its hoops of No. 11 bars at 5-in. centers near the discharge end. With the tunnel having an 8-ft. finished diameter, equipment for placing the concrete lining was another major construction problem. Driving and lining were carried out by K. S. Mittry Construction Co. The contract was concluded last April, representing a period of 639 calendar days.

The tunnel, located about 7 mi. west and 2 mi. south of Loveland, Colorado, is one link in the chain of dams, reservoirs, canals, tunnels, siphons, penstocks, power plants, pumping plants, transmission lines, and other structures included in the Bureau's Colorado-Big Thompson Project. The overall project, which is in its fourteenth year of construction, diverts water from the headwaters of the Colorado River on the western slope of the Rocky Mountains through the Continental Divide for power and irrigation on the eastern slope. This article reviews the work on the Carter Lake tunnel, and describes in some detail the lining equipment and procedure.

TOXIC GASES from this diesel locomotive are removed by the scrubber on the engine exhaust. Test on the tunnel air indicated that the engines had to be maintained in first-class operating condition to produce effective results by this process.

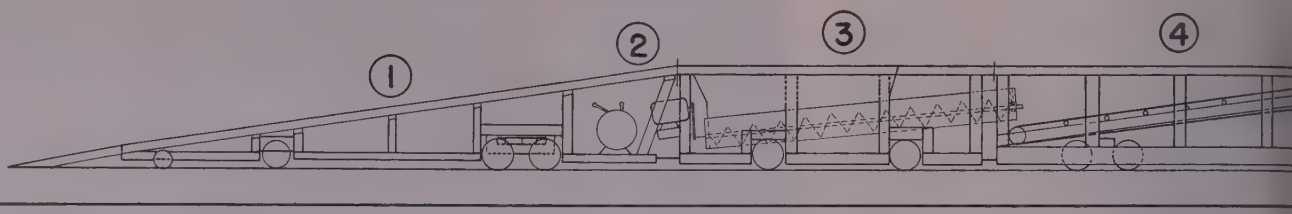
The Carter Lake pressure tunnel is an 8-ft. diameter, circular, reinforced concrete section, 5,792 ft. long. It connects a pressure conduit from a pump turbine, or by-pass in the Flatiron Power and Pumping Plant, to a submerged conduit and trashrack structure in the Carter Lake Reservoir, a feature of the Foothills Storage and Supply System of the project. The tunnel was designed to serve a dual purpose: (1) as a discharge conduit when the pump turbine unit in the Flatiron Power and Pumping Plant is pumping water into the reservoir and (2) as a penstock to the pump turbine unit, which will add to the power generating capacity of the plant during peak loads.

The following brief description of some of the design features may provide a better understanding of the construction requirements. Maximum pump discharges will vary from 220 cfs. to 480 cfs. for static heads on the pump varying from 162 ft. to 297 ft. Releases from the reservoir to the pump turbine in the plant will vary from 300 cfs. to 450 cfs. with static heads varying from 162 ft. to 301 ft. Releases up to 550 cfs. from the reservoir through the tunnel and bypassing the pump turbine to the Flatiron afterbay can also be made under a maximum static head of 301 ft. A release of 550 cfs. would result in a velocity of 10.94 ft. per sec. in the tunnel.

Heavy reinforcing for pressure

The tunnel slopes on a grade of 2.18% downward from the reservoir to the pumping plant. A surge tank was not provided; therefore, the lining was designed to resist internal pressures resulting from dynamic heads up to a maximum of 325 ft. that could result from maximum surges in the operation of the tunnel. A concrete tunnel lining having a minimum thickness of 5½ in. was provided; it was reinforced with steel hoops sized and spaced as required to resist the internal pressures. These steel hoops varied in size and spacing

LINING EQUIPMENT EXTENDS A TOTAL OF 94 FT.



1—Tracks on ramp to elevate cars of mixed concrete for dumping.

2—Concrete cars (1 cu. yd.) dumped into re-mixer.

3—Any segregation during haul was eliminated in the mixer-conveyor.

4—Belt conveyor moves remixed concrete to placer.

from No. 8 bars on 6-in. centers at the reservoir end to No. 11 bars on 5-in. centers at the pump end.

A 96-in. butterfly valve was provided in the tunnel to control the water flow between the reservoir and the power and pumping plant. The valve is located in a 13-ft. diameter reinforced concrete lined shaft 1,480 ft. from the trashrack in the reservoir. This valve shaft is 174 ft. deep to the centerline of the tunnel, and its top is on the shore of the Carter Lake Reservoir above high water surface. Controls for the valve are electrically-powered and located at the top of the shaft. The valve will be hydraulically operated.

Bids for the construction of the Carter Lake pressure tunnel were opened by the Bureau of Reclamation in Denver on June 27, 1950. The K. S. Mittry Construction Co. of Los Angeles was the successful bidder. Construction of the tunnel began on July 24, 1950.

Driving procedure

Driving operations of the contractor were conventional as to methods and equipment. One of the prime considerations was the 2.18% grade of the tunnel, and since the driving was done from the pump end toward the reservoir end, the excavation proceeded uphill.

Material through which the tunnel was excavated was entirely sedimentary and consisted mostly of sandstones and shales. This type of ground is relatively easy to drill, shoot and excavate. The contractor elected to use short rounds of from 5 to 7 ft. to hold the overbreak down to a minimum.

For locomotive power two diesels and two 9-ton storage battery motors were used. On both diesel motors a scrubber was used to remove the toxic gases from the exhaust, and continuous tests were run by Bureau personnel to check on the purity of the tunnel air. These tests showed that the diesel motors had to be kept in first class running condition to keep the toxic gases to a minimum. The contractor used the two diesels considerably more than the electric motors for the excavation work.

Compressed air for power in the tunnel was supplied by two portable air compressors, one of 500-ft. capacity and the other of 630-ft. capacity. Drilling in the heading was done with a four-machine rig, and mucking was by a compressed air-operated shovel. Mine cars were of two types: 88-cu. ft. air dump and 47-cu. ft. rocker dump.

Excavation was completed in 200 working days, representing an average advance of 29 ft. per day. The greatest footage made in any one day was 52 ft., which was in an unsupported section through the Satanka formation. None of the ground encountered was heavy or bad; however, the danger of slacking and slabbing was present throughout all or portions of the Fountain, Lyons, and Lykins formations. Because of this slabbing danger these sections were supported by steel ribs and timber lagging. A total of 4,532 ft. of the tunnel was supported and 1,260 ft. was unsupported.

If the driving operations could be considered relatively easy, the problems in lining the heavily-reinforced small-diameter tunnel were severe. In the selection of equipment for concreting the tunnel the prime consideration of the contractor was working space in the 8-ft. size of the bore (circular when finished). Minimum size and number of the pieces of equipment was essential.

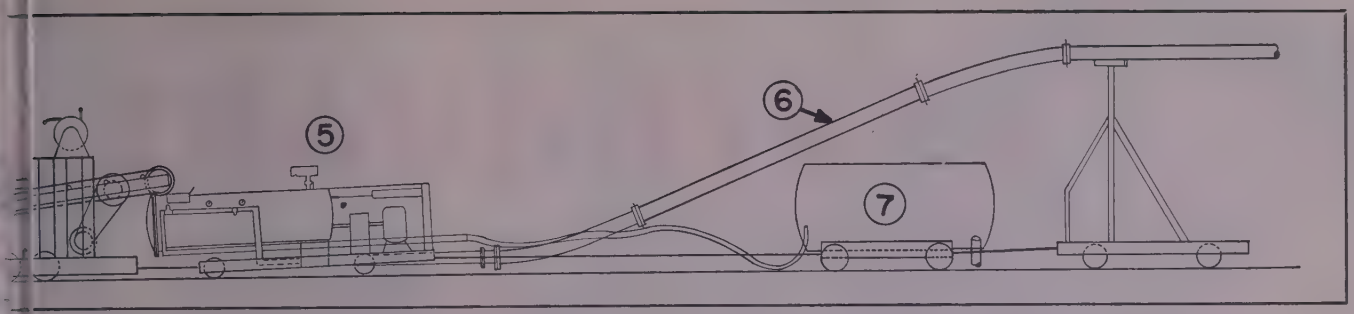
TO REDUCE the possibility of undesirable segregation in the mixed concrete, the contractor mounted the cars on coiled springs. Tests proved the effectiveness of this idea. Remixing at the placing rig was the final step in the elimination of segregation.

Concrete mixing and hauling

The contractor selected a 14-cu. ft. pneumatic placer to handle the concrete and then built the rest of his lining equipment around it. The pneumatic placer answered the requirements of minimum size and adequate capacity for the equipment. Concern was expressed by Government forces over the possible high velocity discharge of concrete, inasmuch as a low velocity was required until the slick line was buried by concrete in the forms. A demonstration of satisfactory performances was given by the contractor before the placer was used in the tunnel.

The contractor made a conscientious effort to meet the specification requirement of low velocity discharge, and, with few exceptions, did meet it throughout the tunnel. Such satisfactory operation of a pneumatic placer in the early stages of each placement is necessarily dependent upon the operator.

To reduce congestion in the tunnel the contractor elected to mix concrete outside, at the batch plant, and haul the mixed concrete into the tunnel. As a result there was concern over segregation and loss of slump due to the rough track and length of haul. The contractor overcame these objectionable aspects of the haul by spring mounting the bottom-dump batch cars (see illustration) and by installing a re-mixer at the placer. A trial run was made over the tunnel track to compare the segregation in the spring-mounted cars with that in the regular solid-mounted ones. This trial



5—Pneumatic concrete placer of 14-cu. ft. capacity was the key to the lining set up.

6—Discharge line, which was operated with special care to maintain low velocity before the end was buried.

7—Compressed air receiver to maintain an adequate supply during placing.

run showed that by the use of four coil springs on each batch car the segregation of concrete could be reduced, as compared to that experienced with solid mounts. The contractor then mounted all batch cars on coil springs.

The re-mixer was included at the placer for positive elimination of any slight segregation that might occur and to act as a receiving hopper for the concrete. Introduction of this re-mixer made it possible to dump an entire car (1 cu. yd.) at a time. A slump of 4½ to 5 in. was maintained at the mixer and numerous slump tests were made to check for loss of slump during the haul. It was found that a maximum loss of ½ in. could be expected.

Tunnel forms were built for the contractor by the K. C. Construction Co. of Denver to produce a full-circle monolithic job. The contractor adopted this full-circle, one-operation method, primarily because of the difficulties presented by the placing of the heavy reinforcing steel. Full circle reinforcing steel did not readily lend itself to a curb-arch-and-invert, or an invert-and-arch sequence without major difficulties. Since fixed forms were prohibited in the 60 deg. of the invert, removable pans were used that could be removed to permit finishing within 1 to 2 hr. after the invert was filled. A total of 80 ft. of forms was used, permitting a 60-ft. placement each day with 20 ft. of forms left in place.

Vibrations on and behind forms

Vibration to consolidate the concrete was done with two vibrators on the form and two immersion type air vibrators. The form vibrators performed well, particularly in the sections where a 5½-in. minimum lining, partially filled with No. 11 reinforcing bars on 5-in. centers, resulted in a restricted flow of the 1½-in. maximum size aggregate concrete. These form vibrators greatly reduced the work required of the men and helped to give an excellent finished product.

Groundwater in the tunnel presented a problem in securing proper concrete placement. At the start of the concreting there was a flow of 71 gpm. coming from the tunnel. This flow was not issuing from any one particular section; rather there were alternate wet and dry sections, the wet sections making water everywhere on the perimeter of the tunnel. The contractor adopted the plan of installing individual drains, as the water was encountered, bringing it to the inside of the tunnel lining. Once inside of the lining the water was pumped and piped ahead of the section of tunnel where concrete was being placed.

Each drain was provided with grout and breather pipes, and was grouted off after lining operations were completed. A survey of the tunnel after it was completed showed that in no instance was there any groundwater seeping through the tunnel lining, except at small temperature and shrinkage cracks. The original flow of 71 gpm. had been reduced to 3 gpm. on completion of concreting and grouting.

Problem in the invert

A difficult problem existed in the cleanup of the invert. The specifications required that: "In the invert, all loose excavation shall be removed to clean undisturbed surfaces before the concrete is placed." To clean up the invert was not difficult, but to keep the invert clean while reinforcing steel was being tied and forms were being set was practically impossible because of the great amount of traffic over it.

INSPECTING the progress of concrete placing in the top of the form with handy periscope. Engineer, using periscope and light, is able to see behind the closely spaced steel.

To eliminate this problem, the contractor developed the plan of placing a sub-invert up to the "B" line in the center, and up to the top of the foot blocks for the support steel in the corners. This permitted him to clean the invert and place concrete on it immediately. The sub-invert facilitated the cleanup of the side walls and arch of the tunnel prior to setting reinforcement and forms, because after placing the reinforcement the invert could be cleaned by a simple washdown operation. After this sub-invert plan was adopted the lining operation speeded up considerably.

As the tunnel lining was placed, 2-in. grout pipes were installed in the arch at points of heavy overbreak and heavy timber. In extreme cases of uniform arch with little or no overbreak these pipes were set 50 ft. apart, but nearly always they were 20 to 30 ft. apart and sometimes closer. In grouting, a 2:1 and 1:1 grout was placed under 100-psi. pressure, and the pressure was held on the hole until the grout take had gone down to 2 gpm. About 1.0 cu. ft. of grout per foot of tunnel was placed behind the lining, and in all probability a good part of this grout was forced into the many bedding planes and fractures in the rock. The low consumption of grout is indicative of the excellent performance of the pneumatic placer and of the skill of the men who operated it.

Construction under the tunnel contract was completed on April 23, 1952. A total of 639 calendar days had been spent by the contractor in completing the job. The installation of the 96-in. butterfly valve and its controls was deleted from the contract because of late delivery; however, the tunnel proper now stands ready for project use.

Personnel

Michael W. Straus is Commissioner of the Bureau of Reclamation and L. N. McClellan is Chief Engineer. A. A. Batson is Regional Director, J. H. Knights is District Manager of the South Platte River District, and G. R. Highley is construction engineer in the Loveland-Foothills area.

Personnel on the project for K. S. Mittry Construction Co. include K. S. Mittry as project manager and James H. Stewart as project engineer. Jack Stallar was excavation superintendent and Newell Pennington was concrete superintendent.

EARTHQUAKE AT TEHACHAPI

Comparable in its effects to the Long Beach 'quake of 1933, this disturbance reiterated the engineering design lessons learned then — Structural failure experienced entirely among buildings that were deficient in modern design and which had not previously been exposed to earthquake — Agricultural damage accounts for biggest loss

Editorial comment . . . . . page 55
Report on railroad damage . . . page 74

By RALPH WHITAKER, JR.
Assistant Editor

THE TOLL of only 14 lives in complete destruction of only a small town does not properly describe the seriousness of the earthquake occurring at Tehachapi, Calif., at 4:52 a. m. on July 21. Tehachapi (population 1,700) lies at the summit of the Tehachapi Range, a southwesterly trending portion of the Sierra Nevada, about 48 mi. southeast of Bakersfield. Millions of dollars in Kern County's cotton crop were lost as the tremors, which continued with occasionally destructive violence for nearly two weeks, caved wells, knocked out electric power, fractured concrete pipe irrigation laterals, and distorted irrigation flow gradients in the fields. Structural damage throughout the immediate area and in Southern California is considered severe, although there have been few instances of buildings requiring evacuation of tenants. Thorough inspection, however, is expected to reveal a need for extensive repairs to connections and other structural components of large public and private buildings.

The Southern Pacific Company's main railroad line over the Tehachapi Range was broken by varying degrees of destruction to four of its tunnels that lie almost on the fault line, finally determined to be the long-inactive Bear Mountain (or White Wolf) fault. Damage to highways was scattered, ranging from minor settlement of fills to complete obstruction of U. S. Highway 99 by a 40,000-cu. yd. landslide 9 mi. south of Gorman on the Ridge Route. State Highway 178, winding through the precipitous Kern River canyon east of Bakersfield and providing major access to the Corps of Engineers' Isabella Project, remained closed long after the initial temblor as aftershocks continued to bring down boulders at many points along the road. Isabella Dam and its auxiliary dike, both of earthfill construction, are reported undamaged.

Power quickly restored

Power facilities throughout the affected area were quickly restored by municipal utility personnel and by crews of the Pacific Gas & Electric Co. and the Southern California Edison Co. In the Los Angeles metropolitan area, this restoration involved dealing with over 100 lines that were down, some of them high-tension lines that had parted with characteristic blue flashes that alarmed residents in the dawn twilight. In Kern County, the work took longer as literally hundreds of irrigation well power transformers had been knocked down by the earthquake. In Tehachapi and in Arvin, an agricultural community of about 5,000 population lying on the valley floor just west of the foothills and 16 mi. southeast of Bakersfield, all utilities were quickly shut off until the extent of damage could be ascertained. Interconnection and bypass provisions generally enabled early municipal recovery of water, gas, and electric power.

Most roads were temporarily restored to traffic, in at least two lanes, by quick action of state and local maintenance forces, and patched to provide for safe vehicle operation. Tehachapi itself, accessible only via U. S. Highway 466, was virtually isolated for a few hours until this work was done. Actually passable, the road was badly roughed up by transverse cracking where the fault line crosses it. Patching here and inspection at other points, where fills had settled to produce a variety of crack patterns, resulted in a pronouncement of safety to emergency vehicles bound for the stricken town.

Business restored to normal

Except for the complete ruin of business properties in Tehachapi and, to a lesser extent, Arvin, most human activity was able to pick up again within a day or two and proceed on a normal basis. However, minor debris removal was not enough to bring "business as usual" back to the Southern Pacific, nor to Kern County farmers. And the continuing aftershocks affected some who were not put upon by the initial quake. In Bakersfield, the city hall, county courthouse, and county hospital re-

uired evacuation; and in at least two ther communities city halls were abanoned.

Farmers throughout the southern tip f the San Joaquin Valley swamped supply houses for water containers of every escription, both to supplant fallen storge tanks and to transport water past roken pipes to stock watering troughs. hovels and steel pipe were high on the emand list, as the county labored to ring water again to its vast irrigated creage. Even for those crops ready for arvest, the quake complicated farm perations, as combines and other mechnized equipment were hampered by racks and swales and rough ground. ern County agricultural commission stimates of loss a week later ranged to 30,000,000—mostly in cotton, which eeded about one more month of irrigaion. Wholesale desertion of the area by ransient labor forces, frightened by the ontinuing tremors, created additional roblems.

ailroad damage

The Southern Pacific quickly revised stimates of a five-day delay to rail reight and passenger traffic when it was een that repairs to the line near Bealille siding would involve about 500,000 u. yd. of earth moving. Within only ays of the disaster, all mouths were losed as to guessing the time that would e needed for Morrison-Knudsen Co., nc., to daylight two tunnels and part of third, and to open up the longest tunel (1,170 ft.), plugged as it was by a 97-lin. ft. cave-in of unknown vertical imensions. A more complete review of railroad damage and reconstruction appears on pages 74 and 75.

CRACKS and vertical displacement often occurred in series disturbing the surface of the ground for widths of 20 ft. or more.

Tourist traffic in Southern California was not abated after the earthquake, a different pattern from that experienced in earlier years after similar disasters. In particular, Bakersfield and Tehachapi received increased traffic. And among the visitors were many engineers of all specialties, learning first-hand what an earthquake can do. Generally, their confidence in present-day "earthquake design" was bolstered. Likewise, the advisability of continuing rehabilitation programs on old municipal structures in the earthquake-susceptible West was borne out by the destruction at Tehachapi.

STRUCTURAL DAMAGE

THE TEHACHAPI earthquake has this year provided a first chance for California engineers and building officials to evaluate design and legislative provisions drawn to protect structures from earthquake damage. In Los Angeles, admittedly somewhat removed from the principal disaster scene, the uniform building code adopted in 1933 (immediately after the $40,000,000 Long Beach earthquake) passed the current test with flying colors; that is, the more recent structures built to its standards survived without structural damage. Similarly, the Earthquake School Safety Act, sponsored in 1933 by the late California assemblyman C. D. Field, justified observance of its provisions over the intervening 19 years. The uniform building code includes structural provision against a lateral force equivalent to 10% of the building weight; the Field Act specifies comparable design to achieve definite safety standards. Inspection of school construction by personnel of the

LOCATION OF THE EARTHQUAKE AREA AND FAULTS

THE EARTHQUAKE which so nearly destroyed Tehachapi on July 21, and which is now (August 7) thought to have caused $75,000,000 in damage to Kern County alone, occurred along the Bear Mountain Fault. Creating a severe series of shakes for two weeks, the disturbance also resulted in conspicuous distortions on the surface.

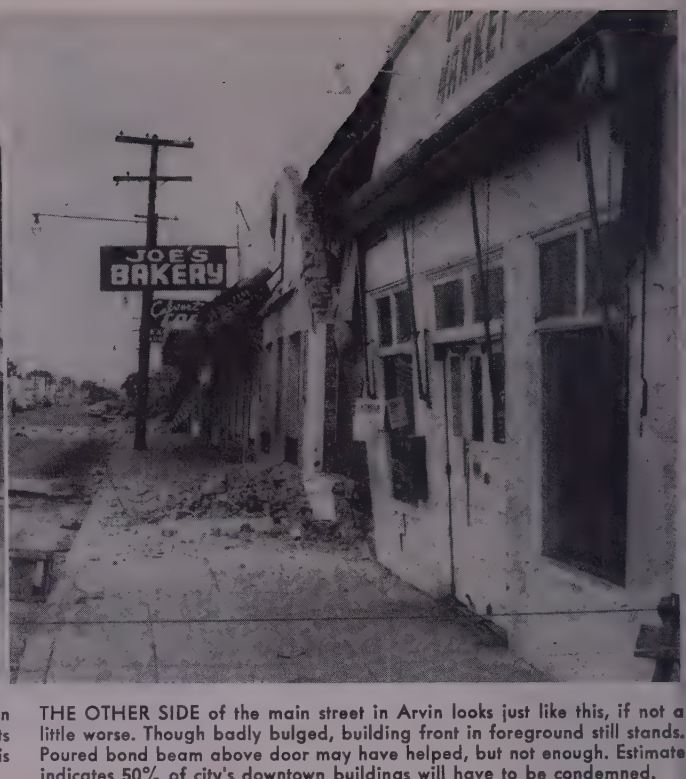
The Garlock Fault, an offshoot of California's notorious San Andreas fault, was first thought to have been the troublemaker since it passes much closer to Tehachapi. There was, therefore, some concern outside the immediate quake vicinity that the new stresses created by the Tehachapi earthquake might "trigger" the San Andreas, the fault that moved in the state's historical 1906 earthquake.

The Bear Mountain fault, prior to this earthquake, was known only by a discontinuous series of outcrops in the foothills on both sides of the San Joaquin Valley floor. Even now, it cannot definitely be said that this fault line (see map) is continuous, branching off from the San Andreas Fault as does the Garlock Fault to the southeast. Existing knowledge of the Bear Mountain Fault line has been fortified by the Tehachapi quake, however, a 12½-mi. series of cracks having been traced from the Arvin vicinity into the mountains to the northeast. This line crosses U. S. Highway 466 and the Southern Pacific route which was so effectively damaged. It passes about 8 mi. west of Tehachapi itself. The earthquake epicenter has been placed by John P. Buwalda, geologist at the California Institute of Technology, "a few miles southeast of Arvin."

Measurements of the quake intensity were recorded on seismographs all over the country. Consensus places it at a magnitude of 7.5 on a scale of 10. Subsequent aftershocks ranged as high as 6.5. By comparison, the San Francisco earthquake (1906) measured 8.25; the Santa Barbara (1925), 6.2; and the Long Beach (1933), 6.25. Greatest measured earthquake in history occurred in the Himalaya mountains of Asia and was recorded at 8.6.

The Tehachapi earthquake lasted from 45 sec. to 1 min. initially. The motion varied from place to place, structural evidence showing variously the effects of circular motion, sharp vertical jolts, and well-defined directional motion back and forth.

TYPICAL FAILURE of poor workmanship and faulty materials is shown in this bearing brick wall in Tehachapi. Weak mortar and unfilled head joints were common. This second story apparently housed a meeting hall; roof is now supported by grand piano and auditorium chairs.



THE OTHER SIDE of the main street in Arvin looks just like this, if not a little worse. Though badly bulged, building front in foreground still stands. Poured bond beam above door may have helped, but not enough. Estimate indicates 50% of city's downtown buildings will have to be condemned.

State Division of Architecture is mandatory under the Field Act.

With realistic building codes and the Field Act resulting in survival of buildings incorporating their provisions, the question then arises as to just where did occur the catastrophic damage that was so widely told by story and illustration at the time of the quake. For the answer to this question, reference must be made to the age and character of affected communities.

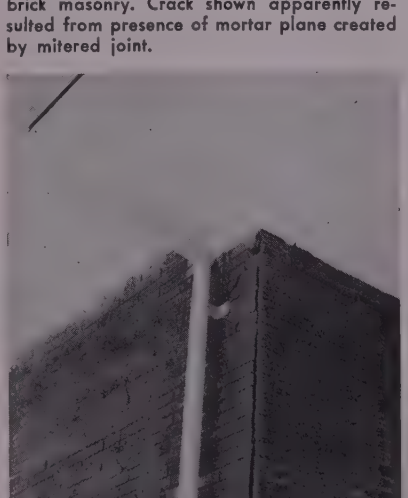
Tehachapi—what and why

Tehachapi is an old town, relying for its existence upon "strategic" location. It lies at the nominal summit of the pass followed by both U. S. Highway 466 and the Southern Pacific in penetrating the Tehachapi range. Thus, it has lived on as a likely watering place for rail and highway traffic. It is a small town, lacking the rigid formality in its government that follows upon intensive development of other, larger, still growing California communities. Structures in Tehachapi have just grown up and, without strong economic or government forces calling for radical change in the town, they have continued to be adequate in their facilities far beyond the usual expectation in years.

A summary of damage to Tehachapi buildings includes, first, the total loss of 70% of the town's business houses. This estimate was made by the Los Angeles structural engineering firm of Hillman & Nowell, principals of which were on the scene for several days after the disaster evaluating damage in Tehachapi and throughout the county as a public service. The total of affected structures being only 31, however, the number of complete losses is not great. In addition, 15 houses are listed as destroyed, while about 50 suffered severe damage and another 75 to 100 will require repairs of varying extent.

Many of the damaged or destroyed buildings were of adobe or fieldstone construction. Many others were of brick, and these were built without present-day knowledge of proper methods of unit-masonry construction. Dating from the 1890's, they most certainly lacked "earthquake design." Typical buildings were one- and two-story affairs with 13- and 17-in. bearing walls and various roof structures. Damaged masonry exhibited almost complete lack of mortared head joints where walls were over 4 in. thick (see pictures). Improper moistening during construction was evidenced by lack of bond between bricks and mortar. Much of the brick from Tehachapi will probably be re-used, and without any necessity for cleaning mortar from the brick surface. Ties were inadequate or lacking; reinforcing was haphazard from building to building and within a given building.

ISOLATED DAMAGE is shown at Arvin High School, a new building of reinforced grouted brick masonry. Crack shown apparently resulted from presence of mortar plane created by mitered joint.



Mortar at fault

In regard to materials themselves, it was not their age but their original composition that led to weakness. Much of the mortar was of the old-fashioned (and now illegal) lime variety. Some samples of mortar could be crumbled between the fingers, and more could be crumbled under foot; these appeared to be oversanded. Subjected to a very rough field test, bricks salvaged from the Tehachapi rubble had no ring of quality when struck together; instead, one heard a dull thud and, likely as not, wound up with four brickbats!

Most notable nearby loss was at the state prison for women, about 7 mi. west of Tehachapi. Many of the buildings there were relatively new, but their 1932 date of construction preceded by one year the Long Beach earthquake that changed engineering design so radically for subsequent major buildings in California. As a result, buildings costing $400,000 in 1932 have had to be abandoned and will require replacement at an estimated cost of at least $1,250,000. Among the affected structures are six 2-story reinforced concrete dormitories that exhibited major vertical and horizontal cracking.

Most notable survivals in the Tehach-

i area are the cement manufacturing cilities at Monolith, 4 mi. east, and the cific Gas & Electric Co. "super inch" s transmission line. Monolith Cement p. suspended operations due to the ntinuing hazard created by severe ershocks, but early inspection had lo- ted no significant damage. The 34-in. el pipe of P. G. & E., bringing natural s from Topock, Ariz., to the San Fran- co Bay area, has remained in service roughout the period of disturbance. ly instantaneous fluctuations of pres- re gauges at pumping stations along e line indicated the quake's occur- nce, though the pipe crosses the fault two points in its traverse of the Te- chapi range.

amage at Arvin

The town of Arvin suffered loss of arly a block of its business district, th brick and concrete block store onts coming down on every hand. One unty supervisor has estimated that 0% of the buildings in downtown rvin will have to be condemned." rvin became the nominal center of mage in aftershocks during the days mediately following July 21. It might said that Tehachapi could fall no rther; on the other hand, local reports d it that earthquake motion in Arvin ring the aftershocks actually was ore severe than during the original ake. Thus it was that more building onts came down and more windows ere broken. (Replacement window ass broke during a series of tremors days later, on July 31.)

Bakersfield, its damage becoming ore apparent day by day after the itial earthquake, is of a somewhat dif- rent character from either Tehachapi Arvin. Although an old town, it is still growing one, and damage was there- re scattered and (largely) minor. any of its earliest structures had long nce been razed as the town developed, d were not present to constitute a zard under earthquake. Significant amples to the contrary are the city hall, the county courthouse, and the county hospital.

Buildings at Bakersfield

The city hall suffered extensive and significant cracking. Partially evacuated after the original quake, it was completely abandoned and condemned as seismic motion during the succeeding week aggravated its damage. The county hospital, steel frame interior construction with exterior bearing walls in its ward wings, suffered cracking also; and patients were early moved into the halls away from wall-supported floor systems.

The county courthouse, of steel frame construction with panel walls of large clay tile, incurred relatively little damage at the outset. Still in use during the days immediately after the quake, it exhibited many large plaster cracks indicative of racking. As with the city hall and the county hospital, however, the courthouse also was eventually evacuated, its hazards increased by the recurring aftershocks. These tremors are perhaps the most distinctive thing about the Tehachapi earthquake. Although some continued motion is to be expected in the wake of a serious disturbance, it seldom persists with such damaging intensity and for so long a time. One tremor occurring on July 29, eight days later, registered a magnitude of 6.5.

Cornices and parapet walls here, as elsewhere, rise above all and are thus in position to fall the farthest and develop the most damaging kinetic energy in their flight. These examples of late Victorian gingerbread ornamentation are executed in plaster, stone, and concrete; they are laid up in mortar as free standing portions of the building. And a lot of them fell. More are now being removed.

Commercial buildings, having less tradition and more money tied up in their existence, fared better, even when of comparable age. In Bakersfield, Santa Barbara, and the Los Angeles metropolitan area there was some cracking, and there were a few typical losses of parapet walls and cornices. In Glendale, the Presbyterian church lost a 5-ton cornice. A Long Beach bank building lost some masonry. Generally, however, this type of damage was at a minimum. The superintendent of Los Angeles' Department of Building and Safety, Gilbert Morris, reported that a 2-yr. program of parapet strengthening and rebuilding had paid off in reduced hazards at this time. Over 1,000 buildings had been revised, and untold tons of masonry were thereby either eliminated or prevented from toppling into the streets.

Petroleum industry

Among the expensive losses of property were those of the petroleum interests. Damage to wells is as yet incompletely tabulated, but breakage at tank and refinery installations caused many fires. At Long Beach one man was badly burned in a refinery fire. At Paloma, Calif., some 30 mi. southwest of Bakersfield, a $10,000,000 fire raged for several days at a refinery where tanks containing 2,500 bbl. of butane originally fed the flames. The plant is jointly owned by Union Oil Co., General Petroleum, Texas Co., Sun Ray, Western Gulf, and Ohio Oil. At Oildale, on the northeast of Bakersfield, an oil tank lost its wooden top in the quake. The tank contents built up a wave motion and finally slopped out, breaking the top (which thereby acted as a sort of safety valve and prevented damage to the tank itself). The oil fell as much as 50 ft. away from the tank, indicative of the quake motion there.

Reports from various agencies constructing or maintaining water supply and reclamation works in the southern part of the state include no revelation of damage. Isabella Dam is unharmed, as mentioned earlier. Corps of Engineers geologists are aware of a fault in the Kern River canyon, but find no connection between it and the currently troublesome Bear Mountain fault to the

ELEVATED WATER TANK at Arvin (left) is of 75,000-gal. capacity. Designed only for wind loads, it survived, but with much stretching of tie rods (note sag) and twisting of columns. Repair will see heavier members and details used.

POLE TOP transformers came down all over county — more than 250 of them. This picture, taken on July 24, shows one of the few such installations remaining unrepaired by that date.

south. The indicated geologic record of there having been no significant seismic motion in the Isabella vicinity for 20,000,000 yr. remains unbroken!

Bureau of Reclamation facilities in the Central Valley are unharmed, including the many miles of canals and pipe laterals built in connection with Friant Dam. Over near Santa Barbara, Reclamation personnel report that the quake was felt at various points on the Cachuma Project. Miners working at the upstream, or inlet, end of the 6.5-mi. Tecolote Tunnel were startled when the quake caused ventilating, water drainage, and compressed air lines to swing vigorously against the steel tunnel supports. The power failure that occurred throughout the tunnel was, however, the only indication of disturbance to crews at the outlet end of the tunnel, as the bore there penetrates a relatively harder rock formation. No ill effects have been observed in the tunnel.

Report on power

The Los Angeles Department of Water and Power quickly inspected all works of its 233-mi. Owens Valley aqueduct. Two hydraulic-fill dams, Haiwee, near Lone Pine, and Dry Canyon, about 40 mi. north of Los Angeles, developed superficial cracks on their crests, but were pronounced safe by both Department personnel and engineers from the State Division of Water Resources.

In addition to at least 250 instances of pole transformer banks coming down, the Pacific Gas & Electric Co. sustained other damage to its Kern County facilities. Four substations were affected as transformers tipped over and/or developed oil leaks. At another substation an elevated water tank came down, while at the company's steam plant 5 mi. west of Bakersfield the floating tops of two oil tanks were damaged. The steam plant itself, built in recent years with a lateral force provision of 20% of the building weight, was completely unaffected. The P. G. & E. hydroelectric plant at the mouth of the Kern River canyon east of Bakersfield was likewise unharmed.

Damage to highways was restricted largely to Kern County, although one major slide occurred on U. S. Highway 99 in northern Los Angeles County. In addition, there was one news report of cracking in a Los Angeles street. The reports of highway damage summarized below were provided by A. D. Griffin, assistant district engineer of District VII (Los Angeles), and E. T. Scott, district engineer of District VI (Fresno).

The slide on the Ridge Route, U. S. Highway 99, completely blocked the four-lane roadway for 14 hr., and only two-lane travel was possible for a short time thereafter. The shock and resulting slide also ruptured a 10-in. oil pipeline and allowed oil to drain across the two northbound lanes for several hours. In the ensuing two weeks, nearly all the 40,000 cu. yd. of fallen material was cleared away. However, the cut is quite shattered, and an estimated 170,000 cu. yd. of additional material will have to be removed to stabilize the slope. The work will probably be undertaken by contract in the near future.

Aside from the above, considerable movement of through fills and the fill portion of benched sections occurred on the Ridge Route between Grapevine Station and the foot of Grapevine grade to the north. The result was lateral displacement of concrete widening slabs that were not tied to the original concrete pavement. There was also vertical movement of these slabs (see picture). It was necessary to place extensive patches of bituminous surfacing to correct these cracks and step-offs. This work continued for over two weeks due to the motion induced by aftershocks.

KERN CANYON road, State Highway 178 leading to Isabella Dam, remained closed long after quake as rain of boulders continued. Repairs here will be expensive, covering many miles involving rock slides.

About 11 mi. south of Bakersfield, still on U. S. Highway 99, a limited area was disturbed by the quake, resulting in a discharge of water and sand from underground. A somewhat circular area about 100 ft. in diameter, and including the northbound traffic lane, was involved. A settlement of 11 in. was noted at one edge of the pavement.

Cracking of pavement, slipout of fills and minor slides were experienced on the White Wolf grade about 7 mi. east of Arvin. The fault line more or less parallels the road in this vicinity and is about ½ mi. to the south. The slides occurred on cut slopes only 10 or 12 ft. high and gave the appearance of having resulted from blasting rather than normal slide movement. Such was the shattering effect of the quake at its height.

Perhaps the most costly damage in the area is a slide located in the Kern River canyon on State Highway 178. Continuing slides in the area have created a hazard, and no attempt has been mad at this time (August 6) to re-open th road. The major obstruction involve about 4,000 cu. yd. of decompose granite.

There was only minor damage t bridges, involving such items as broke anchor bolt and damaged railings. Th fills at several bridges settled and re quired bituminous surfacing ramps t render them safe for traffic. This wa particularly the case at the vehicula overhead above the railroad at Tehach api. Similar settlement of fills occurre elsewhere along U. S. Highway 46 throughout its length between the Sa Joaquin Valley and Tehachapi.

Kern County road department force have been plagued by recurring settle ments of already patched areas. Much o this delayed action is thought to be du to traffic compaction of quake-shake fills, and not a result of new motion dur ing aftershocks.

Modern construction

Evaluation of earthquake effects i aided by observations of several ex amples of similar construction. Alon this line, it is interesting to note th survival of various modern structure of brick, steel, and concrete. Brick, i its current accepted form for large pub lic or private buildings, is found as re inforced grouted brick masonry—a engineered type of construction that i essentially a pair of parallel brick wall enclosing a core of reinforced grout. Th high school at Arvin is so constructe and shows very little significant damag One of the manifested instances o earthquake effects there is pictured o these pages. Otherwise, there appears t be only some cracking where wide, fla steel column-supported porticos connec to the building. Most evident damage a the high school consists of fallen book and light diffusers.

In Bakersfield is the entirely precas concrete structure built last year by Da Sill of the Kern Rock Co. Incorporatin precast wall panels, beams, girders, an roof panels, this building was describe in *Western Construction* for Octobe 1951, pp. 70-71. Now occupied by Lock heed Aircraft Corp. as a sub-assembl plant for plane production, the buildin (and its later duplicate alongside) su fered no damage. Roof slabs workin somewhat atop their beams ground o a light dust, and more of the sam spalled out of a few panel-pilaster joint Cracks in paint along similar joints ev dence the motion and the fact th welded connections performed the function.

In the cotton country southeast Bakersfield, the Arvin Cooperative G had a new unit under construction a being housed by a structural framewor Incomplete at the time of the eart quake, the building lacked some of ties and its eventual skin of corrugat metal. But it already supported interi machinery loads, largely in the form extensive duct work necessary to cott gin operation. In this relatively unstab condition, the building racked 8 to 10 out of plumb and several diagonal rods of ⅞-in. diameter were snapp

in machinery, also incomplete and erefore not bolted down to its pads in e concrete floor, was subjected to con- ierable severe motion and resultant mage.

It is expected that a month will see pair and completion of this gin in time r the 1952 cotton crop. Not so fortu- te was the existing gin in a building xt door. Here, the building survived irly well, but the machinery, being mly bolted down, suffered much dam- e to close-fitting parts. Its extent of mage is unknown and it may not oper- e this season.

levated tanks

Inspection of steel tanks, particularly ose that are elevated, has provided uch interesting information on the ture of quake motion. They are struc- rally determinate, not generally com- ex, and their structural elements are posed. Throughout the affected areas Tehachapi, Arvin, Bakersfield, But- nwillow, Oildale, and Maricopa—there e tanks for irrigation and domestic ter supply and for oil storage.

In addition to small farm installations, 00,000-gal. riveted tank of the South- n Pacific at Tehachapi fell, adding omentary flood to the problems and nic of that community. This tank in- rporated no provision against earth- ake in its design. It was an old, flat- ttomed tank sitting unconnected on a illage base from which it simply slid . In Bakersfield and in East Bakers- ld, two elevated tanks (250,000- and),000-gal.) for domestic water supply ne down, one of them narrowly miss- g drowning a small child in an adja- nt house. Again, no earthquake design hey were built about 1928. Those nks which fell, it should be noted, did t tip over in an arc, with their col- ns acting as a radius. Typically, ele- ed tanks in failure under earthquake mmence such a pattern; but the al- st immediate transfer of their entire ight to the columns in the direction fall causes these columns to buckle. nce, the fallen tank characteristically s in a heap nearly atop its own founda- n.

A notable survival was a 75,000-gal. vated steel tank of the Arvin ater Department. This tank suffered etched tie rods (see picture) and sted columns. Its repair will see in- poration of heavier members and ails, for the original design did not lude earthquake provisions. In this ard, it is well to note that, among gineered tanks, a small one (25,000- 00 gal.) is inherently better equipped survive earthquake lateral forces than large one, even if neither is so de- ned. The reason is that both are igned to withstand certain wind load- s. Wind loads vary with the amount exposed surface, and may therefore considered a direct function of tank meter. On the other hand, tank vol- e varies as the square of the diameter. us, a tank of large volume, designed ly for lateral wind load, does not pos- s lateral stability in the same propor- n as the volumetrically smaller tank. By far the majority of elevated water tanks in the earthquake zone were built to principles of earthquake design, and they remain foursquare. The same is true of nearly every present-day struc- ture, of whatever type construction. Thus, it may be said in California that the lesson of the 1933 Long Beach earth- quake has been learned, at least so far as design is concerned. The lesson of Te- hachapi appears mainly a reminder to augment rehabilitation programs among older structures, and to submit many of the oldest to a critical review of their serviceability.

STEP-OFF between pavement slabs followed settlement of bench fill on U. S. Highway 99 near Grapevine Station. This situation continued for two weeks under influence of quake aftershocks.

WHITE WOLF GRADE ascends foothills east of Arvin, joins road to Tehachapi. Paralleling the fault, it was badly shaken, producing cracks (foreground) and many slides. Cut slopes shown did not fail extensively, but note manner in which material has broken off, shattered and cracked.

TRANSVERSE CRACKS in U. S. Highway 466 mark crossing of fault. Movement here opened up roadway and also created step-offs. Note length of roadway affected. Extensive patching is expected to make repairs to subgrade unnecessary.

FILL SETTLEMENT at bridge abutments was the rule, requiring buildup of ramps with bituminous material to restore surface to passable condition.

Engineering interest and re-construction operations focus on . . .

Railroad tunnel damage and repair

Earthquake closes Southern Pacific route over Tehachapi Range with serious damage to three bores and blockage of another — Daylighting where cover is shallow — Repair operations feature fast earthmoving — Morrison-Knudsen contracts for work of restoring important railroad line

EARTHQUAKE damage to Southern Pacific railroad property in Kern County lies wholly on the western slope of the Tehachapi range, where a tortuous 2.52% grade negotiates 18 tunnels in the course of surmounting the pass marked by the town of Tehachapi itself. Except for the loss of water tanks at Tehachapi and Caliente, and one severe settlement of a through fill near Tunnel 1, the damage is concentrated in a 1.2-mi. stretch at the head of a foothill canyon about 26 mi. southeast of Bakersfield.

Here the line proceeds generally in an easterly direction, passing through Tunnels 3 and 4. Rounding the head of the canyon on a fill 100 ft. high and built to a 10 deg. curvature, the line comes west again, piercing the hillside at two more points before rounding the northerly point at the canyon mouth and leaving the immediate area. This portion of the line was built in 1876. The timber tunnel linings were replaced with reinforced concrete in 1918, when enlargement became necessary to accommodate bigger rolling stock.

Damage and repair plans

The Tehachapi earthquake occurred just after a southbound night train had passed through the area of greatest damage to the line. Due in Tehachapi itself at 5:02 a. m., the train was still somewhat to the west at the time of the quake. Stopped at a railroad siding immediately thereafter, the train and its 178 passengers were delayed for five hours until inspection of the remaining tunnels showed them to be intact. Passing slowly through Tehachapi when travel was resumed, the passengers may have gained some idea of the disaster that had befallen the railroad tunnels they had so lately been through.

Inspection of the damaged line commenced within hours, as San Joaquin Division personnel and others from the company's San Francisco headquarters arrived in the area. Five track gangs and eight bridge and building gangs were assembled to clear the way for reconstruction operations, and by Wednesday all ties and track had been removed from the badly distorted stretches of right-of-way. Thus, it was possible for earthmoving equipment, accessory tunneling machinery—compressors, power tools, etc. —and truck loads of shoring timber to be moved in on rubber via hastily bulldozed access roads.

"Highball" project

Contract for the work went to Morrison-Knudsen Co., Inc., which grabbed men and machines from every likely place to ramrod the job. Being done for a railroad, and under disaster conditions, it is truly a "highball" project, with tractors and scrapers bearing the emblems of Vinnell, Griffith, Macco, Lee Boyd, and M-K, among others.

Tunnel 3 is 700 ft. long. With all the others it shares an arch section design, being 17 ft. wide and 22 ft. high. The easterly 250 ft. of this tunnel was badly shattered—repeated transverse cracks over the arch, and whole sections of the sidewalls cracked loose and shoved inward to hang insecurely from distorted reinforcing steel. The tunnel portal was cracked and bulged outward. This constitutes the first major point of quake damage in the canyon above Bealville siding, and it is remarkable that the remaining 450 ft. of the tunnel is undamaged. Mode of repair is to daylight the damaged portion, and to this end Morrison-Knudsen had marshalled nearly a dozen earthmoving rigs only four days after the disaster. Maximum depth of cut will be about 100 ft.

The most spectacular instance of the quake's racking effects was noted just inside and outside the east end of Tunnel 3. Here the 132-lb. rails, still firmly spiked to their ties, have been twisted into a series of tight reverse curves. Inside the tunnel this apparently happened during a sharp vertical jolt that lifted the concrete sidewalls, for one loop of track, when seen afterward, simply disappeared under the relatively undamaged curb at that point and then reappeared a few feet further on. Outside the tunnel, the longitudinal compression that bowed the track so severely also took place in conjunction with vertical movement, for the ground surface between old and new track alignment was not badly disturbed as would be expected from dragging ties and track across it. This "Toonerville trolley" curve left the remaining track, leading to Tunnel 4, completely offset from its original ballast by 22 ft. (see picture).

Tunnel 4 to be daylighted

Tunnel 4, 334 ft. long, suffered distortion of its lining similar to that of Tunnel 3. In addition, the tunnel invert was heaved up, as much as 5 ft. near the east portal. Reinforcing steel of ⅞- and 1-in. diameter was popped out of the concrete arch under the quake-imposed stresses. And this lining was characteristically 14 to 16 in. thick. There was only minor cave-in; that is, the tunnel was not completely plugged by the fallen material. However, the total of the damage was such as to dictate daylighting of the bore throughout its length. The new

RIGHT—Daylighting of Tunnel 3 began two days after the earthquake. On he third day, as shown, a dozen earthmoving rigs attack the slope, which overs 230 ft. of the east end of the tunnel. The bow in the track is 22 ft. off line.

ABOVE—Tenth day finds the tunnel almost buried and major section of illside bermed to provide for disposal of material from the new cut that is aking shape.

lignment may be offset somewhat from he old in order to minimize the depth of cut.

Beyond Tunnel 4, the line proceeds for ome 20 stations along sidehill cut and ill before swinging left to commence its weeping curve through more than 180 leg. to head west again. In this reach here was some fill settlement and at east one landslide that blocked the ight-of-way. The high fill rounding the ead of the canyon was badly shaken by he quake and the track on it was offset lmost to the edge of the fill on the outide of the curve. On the inside of the urve, the fill cracked longitudinally long the toe of the ballast and dropped s much as 5 ft., creating a sort of berm ome 150 ft. long.

Tunnel 5 presents the biggest repair problem. Its 1,170-ft. length is the greatest among the affected tunnels, and its damage is thought to be the most troublesome. It was the only tunnel completely plugged by cave-in at any point, and the volume of loosened material involved was still unknown at this writing. Its easterly, or "near", end as one proceeds up the grade suffered in the characteristic manner described for Tunnels 3 and 4—shattered lining, extensive transverse cracking. The east portal also was bulged out and its surmounting parapet, or cap, of concrete loosened and split. This latter damage occurred during a series of aftershocks on July 23 when railroad personnel had completed track removal and contractor's men were on the job. Needless to say, hard hats are the rule.

Extensive damage in Tunnel 5 carries for some 200 ft. in from the east portal and is succeeded by about 400 ft. of fairly intact tunnel. But beyond here lies a 395-ft. length that was solidly blocked by cave-in. Depressions in the hilltop far above indicated that a great cavern of loose material might have been created, and that mucking, retimbering, and relining might be a very messy business. The fallen material was thoroughly shattered, with few pieces in evidence larger than cobbles.

Beyond the cave-in, the tunnel lining again was badly shattered all the way to

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ENTER DRIFT penetrating plug in Tunnel 5, showing heavily timbered eading 230 ft. from the east portal on August 5, with the face 50 ft. into he caved material.

GUNITING sections of new lining in Tunnel 5. At this location, 480 ft. in from the west portal, the work included removal of old lining, setting new steel and guniting.

Gyro equipment in moving car provides . . .

A method of rapid road inventory

"Gyro traverse" by instrument reading taken at 5 mph. and translated by business machine methods to traditional form of survey notes — 460 mi. of California highway grade and alignment mapped in four days — Less than 1% error compares favorably with stadia traverse

By

JAMES T. McWILLIAM

Assistant Highway Engineer
Division of Highways
State of California
(Co-recipient of Dr. L. I. Hewes Award for 1952)

THE USE OF automobile-mounted gyroscopes to establish reference planes for measurement of both horizontal and vertical deflection of the automobile during its travel along a highway is not necessarily a new idea. In California the idea was translated to action in 1947 when the Bureau of Public Roads requested the cooperation of the Department of Public Works in testing a sight distance and curvature manual proposed by them. This sight distance and curvature manual outlined a method of obtaining data on curve radii, degree of central angle of curves, and per cent and length of highway grades. Since a survey of plans and profiles of state highway construction to gather the requested data would have been an almost unsurmountable task, and a very expensive one, and since on a majority of the state's highway system there is no formal survey data, thought was given to the development of a gyroscopically equipped vehicle that would make possible a rapid inventory of highway grade and alignment characteristics.

Development of equipment

Two problems here, however, still presented themselves. One was the mechanical development and refinement of gyroscopic equipment that would maintain the desired accuracy and precision when carried in a moving automobile. The other problem related to the recording, correlation, and interpretation of the data that would result. The first problem had precedent for its solution, inasmuch as gyroscopes had been commercially developed, although generally for use in the relatively more stable conditions presented by sea and air craft. The Navy, together with gyroscope manufacturers, had designed and installed highly precise gyros for navigation of its ships, and these gyros had been equipped with electronic accessories whose impulses had served to stabilize naval ordnance for the achievement of an unsurpassed excellence in naval gunnery. Now, similar equipment had to be "beefed up" to withstand the sharp shocks imposed by roadway conditions, while at the same time compressed in size to a practical dimension for mounting in an automobile.

In performance of its work for the Bureau of Public Roads, therefore, the Highway Planning Survey section of California's Division of Highways carried on considerable experimentation and research with the Sperry Gyroscope Co. with the purpose of developing appropriate equipment for the road inventory to be undertaken. The instrument that resulted, and the operational technique for its use, seem to have some promise in the field of rapid surveying of highway mileage. Both the instrument and the operational techniques were subject of a report which was prepared early this year for the Department of Public Works. The equipment is summarized as "a station wagon equipped with an odometer, reading to the thousandth mile, and two gyroscopes one horizontally and one vertically installed, that make possible the measurement of azimuths to the nearest degree and the measurement of grades and superelevations to the nearest per cent."

Accessories added

Supplementary installations in the station wagon consist of an electrical generator and a converter to provide the necessary cycles of current and a voltage regulator in connection with electrically operated registering dials. In addition, inclinometer tubes—level bubbles—were installed for checking initial setting of the vertical gyro, and an aiming device was fixed to the bumper to assist the driver in orienting the car for azimuth readings.

It has been necessary to take all the spring action out of the vehicle to get true grade and super readings. If the

vere not done, variations of loading would change the car body with respect o the axles and reading of grade and uperelevation would be appreciably in rror.

With adequate gyroscopic equipment ow at hand, or fast developing, it was ecessary to determine what informa- ion would have to be recorded and at what points it should be taken. And, most important, in what form to record t for easy correlation and interpreta- ion. In consideration of the fact that the quipment operators on a "gyro tra- erse," as the method was named, would lways be on the move—however slowly —the number of points at which read- ngs should be taken had to be held lown to a minimum. Furthermore, the umber of instantaneous values to be ecorded (simultaneously, as nearly as possible) had to be held down. My back- ground having been largely in mathe- natics, where not directly concerned with highway engineering surveys, I played with this problem of finding an operational method that would suit both the gyro traverse party in the field and the office personnel who would subsequently put the results to use.

Business machine methods have proved to be the practical key to employment of the gyro traverse, serving to make the field information more easily gained and more easily translated into useful engineering data. The description below summarizes field procedures in use today, designed especially to give results that may be correlated and interpreted by International Business Machines (IBM) equipment.

Two-man party

Two men operate the station wagon in the field. The party chief acts as driver and selects all the points at which observations are to be made. At these points he reads the various instruments and the assistant records all the data on a special form (see picture). The manner in which this field work is accomplished is roughly as follows:

The general information such as road description, date, personnel, time, etc., is recorded in the "notes" section of the form; the odometer is set to zero and movement is started forward. As each change of alignment detail is encountered, the odometer position of the change, the identifying code describing the change, and the azimuth of the new direction are recorded in the proper columns of the form. In regard to a curve, the odometer position of its beginning is noted, also the proper code indicating a right or left curve, and an entry in the superelevation column. At points of reverse or compounding, the odometer position, the proper code for the situation, and an azimuth reading are recorded.

In regard to vertical alignment, the odometer position of the estimated intersection of the grades extended is recorded, but the actual grade is not

Introducing award-winner McWilliam

CO-RECIPIENTS of the Dr. L. I. Hewes Award presented at the June 1952 meeting of the Western Association of State Highway Officials were Herbert W. Humphres of the Washington Department of Highways and James T. McWilliam of the California Division of Highways. Last month *Western Construction* presented an article by Mr. Humphres describing his award-winning work in developing a low-cost soils engineering program for the cities and counties of Washington. This month the editors present an article describing the gyroscopic road inventory method used by California.

Developing the method

Development of this method has meant a great time saving for state forces in obtaining a record, for mapping purposes and construction studies, of the alignment, grade, and superelevations of California highways. Using a pair of gyroscopes mounted in a station wagon for alignment and level data, and a precise odometer for measurement of distances, a wealth of data can rapidly be amassed. However, its translation into readily understood tabular form for study and reference by engineers and draftsmen required the addition of another step. Mr. McWilliam performed the research which led to utilization of IBM punch cards for this tabular work; and it was his effort in this field, that of rapidly translating gyroscopically derived field notes into useful office information, that won him recognition this year as a Hewes Award winner.

Mr. McWilliam is a native Californian, born in 1906, married, and the father of three children. After graduation in mathematics from the University of California in 1934 he joined the Division of Highways. Assigned in 1939 to the state-wide Highway Planning Survey section of the Division of Highways, he has remained in that activity with his work broken only by military service between 1941 and 1947.

Military service

In early 1941 Mr. McWilliam was drafted and assigned to the 29th Engineer Topographic Battalion at Portland, Oregon. In August 1942, he was commissioned a second lieutenant in the Corps of Engineers and served in the North African and Mediterranean theaters as Operations Officer of a topographic company and battalion. He achieved the rank of captain.

In addition to his immediate professional duty with the Division of Highways, Mr. McWilliam is performing work for the Automotive Safety Foundation, an organization engaged by the state legislature's Joint Fact-finding Committee on Highways, which is reviewing the state's $3,000,000,000 highway deficiency program. Important to the work of the Foundation are gyroscopic inventory data gathered and correlated by Mr. McWilliam and his colleagues. The data so far covers over 6,000 mi. of state highway and is being extended to encompass an additional 3,500 mi.—*Editor.*

JAMES T. McWILLIAM (left) was not present at the WASHO convention in Seattle in June, and is shown receiving the Dr. L. I. Hewes certificate from G. T. McCoy, State Highway Engineer of California, in an office ceremony in Sacramento.

CALIFORNIA STATEWIDE HIGHWAY PLANNING SURVEY
GRADE AND ALIGNMENT SURVEY

CHPS RA 111 SHEET 1 OF 8

ROAD DESCRIPTION Hum 1 K | CHIEF McW | RECORDER R.J.M. | TIME OF BEGINNING 1300 | DATE 23 May 51

NOTES	SEQUENCE CODE	BEGINNING ODOMETER	ENDING ODOMETER	GRADE	ALIGN CODE	AZIMUTH	CENTRAL ANGLE	SUPER ELEVATION
TRAVERSE NO 34	1							
NORTH ON HUM 1 K	2							
TIME 1300 23 MAY 51	3							
McW MARTIN	4							
COOL CLOUDY	5							
ALIGNMENT TRUE	6							
BEGIN SEC HUM 1 K	7							
AT ODOMETER 19983	8							
OF TRAVERSE NO 33	9	00.000			LL	96		
		.000		0	CL			6L
		.060			T	89		
ORICK		.618		-1				
HWY MTCE STA ON RT		.640						
		.665			CL			6L
		.790			T	40		

GYROSCOPIC EQUIPMENT - ALIGNMENT AND GRADE SURVE

TRAVERSE NOTES			
TRAVERSE NO 34			
NORTH ON HUM 1 K			
TIME 1300 23 MAY 51			
MCW MARTIN			
COOL CLOUDY			
ALIGNMENT TRUE			
BEGIN SEC HUM 1 K			
AT ODOMETER 19983			
OF TRAVERSE NO 33			
	LL	960	
	CL	925	7
60	T	890	
618 ORICK			
618	T	890	
640 HWY MTCE STA ON RT			
640			

FIELD FORM for gyro survey (top) provides entries for mileage, azimuth, and special code.

IBM FORMS (lower) retains descriptive notes, but machine operations have provided tabulations of latitudes, departures, elevations, curves and safe driving speeds.

read until the maximum or minimum grade is reached. This gives information needed to calculate roughly the elevation at any point along the route. It has been found difficult to identify beginnings and endings of vertical curves, and there is no quick way of calculating the elevation of points on them. This grade portion of the detail is sometimes left out when not considered important. It permits unshackling of the springs and makes possible a much better rate of speed.

In order to orient the traverse properly, the position of every available triangulation station is noted. In fact, special traverses are run to such positions if they are not too far out of the way. (Triangulation stations are known geodetic positions established by precise survey methods.) Locations of and data from all bench marks are also recorded. These serve to give an idea of the accuracy of the work done in a vertical sense. They, and other topographic detail noted by the gyro traverse party, serve to assist the office draftsmen in delineating the line traversed.

Tabulating field information

In order to make the gyro type survey a practical procedure, it has been necessary to devise a mass mechanical method of calculating the field notes of the traverses. The 680 mi. of traversing accomplished on a project in Humboldt County meant the taking of some 24,000 observations, and their calculation by ordinary methods would have taken quite a time. A short cut method has been devised such that roughly within a week a tabulation showing certain data can be produced. This tabulation includes a great deal of information, most of which is mechanically calculated from the notes on the field sheet form. For instance, machine processes give:

1. Azimuths of chords of curves, in degrees and half-degrees.
2. Central angles of curves, in degrees.
3. Intervening distances (lengths of tangents or curves), in thousandths of miles.
4. Lengths of chords of curves, in thousandths of miles.
5. Radii of curves, in feet.
6. Safe driving speeds on curves, in mph.
7. Progressive latitudes, in thousandths of miles.
8. Progressive departures, in thousandths of miles.
9. Grade profile or elevations, in tenths of feet.

Without going into too much technical detail of just how these calculations are done on the machines, a brief review of each one is outlined.

Azimuth of the chord

The azimuth of the chord is gotten by adding the azimuth at the end of a curve to the azimuth at the beginning, and then dividing by two. There are certain complications to the picture when the entering azimuth and the leaving azimuth are on opposite sides of 0 or 360 deg. These complications are not too great, and it is only necessary to add 360 deg. to the azimuths and then divide by two. Cases where the angular turn is greater than 180 deg. are relatively few and are handled manually.

The central angle of the curve is gotten merely by subtracting the two azimuths, the entering azimuth and the leaving azimuth. Again special consideration must be made for the central angle that embraces the transition from 360 deg. to 0 deg.

Intervening distance

Intervening distance is gotten by subtracting the beginning odometer reading from the ending odometer reading of the recorded section concerned.

Length of chord of curve

For every given central angle of curve there is a definite ratio that the length of chord bears to the arc or circular segment. By matching these ratios to the proper central angles, mass calculations are made on the previously determined curve intervening distance to establish the length of chord. This length is necessary in order to convert all points of recorded data to latitudes and departures.

Safe driving speed on curves

The formula* for estimating safe driving speeds on curves might seem to pose difficulties in the IBM calculating machines. This is not so, for the IBM "calculating punch machine" can do an unbelievable number of additions, subtractions, multiplications, and divisions, take the result and operate upon it, etc. This makes evaluation of the expression $\frac{R\,(S-0.16)}{0.067}$ a very simple one. However, though the machine can be made to do it, the operation of extracting square root is not a practical operation for the number of curves that are encountered in a project. Instead, using a matching process and a table of squares, safe driving speeds are determined and punched on the record cards.

* $V = \sqrt{\frac{R\,(S-0.16)}{0.067}}$

where V = Safe driving speed, in mph.
R = Radius of curve, in feet
S = Superelevation, in per cent
0.16 = Friction factor

Radius of curve

As in the chord length calculation, there is a definite ratio for each central angle that expresses the relationship of radius to arc length. With the central angle known, an operation is made on the arc length and the result is the radius.

Latitudes and departures

At this stage of the procedure all travel has been reduced to equivalent straight lines, their length and direction being known. Knowing these distances, all that is left to do is apply the proper trigonometric functions and reduce all distances to their respective north-south and east-west components. By tabulating a progressive total of these latitudes and departures, a scalable trace is obtained of the actual route covered. In

this respect, if the vehicle is brought back to its point of beginning, axiomatically it has gone as far east as it has west, and as far south as north. The algebraic sum of the latitudes and departures should therefore be zero. If it happens that this algebraic sum is not zero, then a factor is applied to the error to distribute it proportionately through all legs of the traverse concerned.

Elevation in feet

A machine calculation that applies grade against distance traveled gives a figure representing the elevation at all points. These results can be accumulated, and what is seen on the tabulation is a grade profile of elevations in tenths of feet.

The final phase of the series of events is that of drafting and tracing a reproducible copy. Coordinates of the trace are obtained from the furnished completed tabulation. These are plotted on 10 x 10 cross-section paper, usually at a scale of 10 in. per mi. This is a convenient scale because the coordinate alignment positions are given in thousandths of miles, which makes each inch a tenth-mile and each tenth-inch a hundredth-mile, etc. As each curve is encountered on the tabulation, the radius is scaled off on dividers and the center of the curve established. The curve is then drawn in on the "hard copy." Tangents between proper points are drawn and topographic detail shown in the "notes" section of the tabulated traverse is delineated. Grade elevations are likewise plotted and plotted points connected. The resulting hard copy is then traced to convenient sheets embodying strips of complete administrative sections or is traced on sheets of standard size, whichever is the most convenient for the intended use.

Experience gained in the operation of gyro equipment over about 2,800 mi. of roads indicates that:

1. Accuracies within 0.2% can be expected in the odometer distances recorded.
2. Accuracies within from 0.5% to 0.9% may be expected on the closure of traverses calculated. (By the application of a factor in the IBM processes the error of closure can be eliminated.)
3. Grades can be estimated to within 0.5%.
4. The field operation phase can be done at a rate of about 5 mph.
5. The combined costs of operating the equipment in the field and of processing the field notes mechanically are well under $10 per mi. of road traversed.
6. The time taken to plot the IBM tabulations and to trace a reproducible copy varies a good deal, depending on the topography and extent of detail desired. Early figures indicate that a mile can be plotted and tracings made in about three hours.

The accuracy of the results of the gyro traverse compares favorably with the accuracy that might be expected of the more formal method of stadia traverse. An experimental project comprising 460 mi. of gyro traversing in San Bernardino County showed that data could be taken in the field, delivered to the IBM section for processing, and a usable plot prepared within a period of four days. In regard to the IBM processing, the larger the project the greater the speed that can be attained on a per-mile basis as this processing lends itself to the handling of mass data.

GYRO TRAVERSE instruments are all shown installed: (A) the precise odometer; (B) the horizontal gyroscope; (C) the superelevation and grade dials (also actuated by gyroscope); (D) inclinometer tube for checking and calibrating grade and "super" dials.

For unsurveyed roads

Use of the gyro traverse technique has so far been confined to the preparation of a plan and profile plot of state highways that have never been formally surveyed, to the establishment of a key net of roads within a county as a basic net for road inventory mapping, and to the rapid furnishing of statistical data on alignment and grades of certain routes at much less expense and time than would be required for review of the existing plans.

Use of method can broaden

It is anticipated that new uses for the gyro traverse will develop when existence of the vehicle and technique is made known on a broader basis. Up to the present operation has necessarily been confined to the Planning Survey section in order to establish an operational procedure, test accuracy and determine basic costs, and, all in all, determine the practicality of the instrument and its attendant technique.

Bids taken on another underground garage

AFTER MONTHS of waiting for sound action on the construction of a garage under St. Mary's Square in San Francisco, Calif., the Parking Authority is about to make its decision.

Early in August the Authority received what it termed "sound and workable" bids, three in number, for the construction.

Each of the bids specified more parking spaces than the set minimum of 750. The first, submitted by a local firm of S. E. Onorato, Inc., and the W. & B. Reality Co. of Los Angeles, called for a 33-year lease, 4% (or not less than $1,225) of the gross monthly receipts reverting to city, and space for 933 cars.

Union Square Garage, Inc., the second bid opened, called for a 40-yr. lease, 3½% of the gross monthly receipts (or not less than $1,170) and space provided for 874 cars. Terms of this bid might require use of city funds up to $250,000, though the Authority had specified that preference would be given bidders who requested no city funds.

The third bid opened was submitted by St. Mary's Square Garage, Inc., and it specified a 50-yr. lease, 4½% (not less than $1,250) and space for 911 cars.

Revenue bonds proposed for Utah highways

D. W. WHITTENBURG, chairman of the Utah State Road Commission, has suggested the issuance of revenue bonds as a means of enabling that state to proceed with the highway construction it needs. Whittenburg's proposal is a personal one, advanced without discussion among other members of the commission, and it reflects his feeling that bonding is preferable to an outright increase of the gasoline tax. Revenue bonds, backed by gasoline and other highway tax funds, although establishing an otherwise undesirable state indebtedness, would permit the expansion and modernization of Utah's highway system in the immediate future. Whittenburg pointed out that, in its current condition, the state system presents an excessively costly maintenance problem.

Twelve years of experience standardize methods for —

MAINTAINING THE BAY BRIDGE

By LEWIS K. WOOD
Associate Bridge Engineer
Division of Highways
State of California

A review of today's operations and equipment which have been developed through long experience in preserving 370 acres of exposed steel — Methods represent refinements and no major change from the original program

MAINTENANCE procedures and methods in use today on the San Francisco-Oakland Bay Bridge have not changed radically during its years of service. Some procedures instituted at the start have been curtailed, of course, while others have had to be expanded. The great variation in atmospheric conditions throughout the length and height of the bridge has been the chief cause of procedural changes. For instance, on and near the San Francisco shore line, smoke and other industrial exhausts contribute to a much higher rate of paint deterioration than at other locations. Here also are the long horizontal drain pipes necessary to prevent indiscriminate dumping of collected rain water on city streets. These drains present a problem in prevention of stoppages.

Maintenance of the bridge is divided among four departments: painting, electrical, structural, and general. There is, of course, considerable overlapping among the departments and inter-service between them.

The total steel maintained by surface painting on this structure comes to 146,309 tons. Its surface area is 16,093,000 sq. ft., an average of 111 sq. ft. per ton. The normal maintenance sequence for this steel consists of steam cleaning to remove surface deposits, cleaning of rusted areas by sandblast, spot coating of sandblasted areas with red lead primer, second coat over sandblasted areas, an overall coat of red lead primer, and a final coat of aluminum paint.

Under the best conditions, and with operations on their most efficient cycle, it is estimated that the entire area must be gone over an average of 3½ or 4 times to complete the maintenance sequence. Thus, the labor involved is equivalent to that necessary to painting a single coat over an area of about 60,000,000 sq. ft. Experience on the bridge so far shows that a 7-yr. "round trip" constitutes a satisfactory program, although some areas will need painting every 4 or 5 yr., while others (such as the interior of towers) will probably be good for 10 or more.

TWELVE YEARS have elapsed since Ralph A. Tudor, then engineer in charge of the San Francisco-Oakland Bay Bridge, described the initial maintenance operations on the record size structure for the readers of *Western Construction* (issue of March 1940, pp. 86-89). What has happened to this maintenance program that would be of interest to bridge engineers, and all who are concerned with the preservation of exposed steel? To answer this question the present article reviews the methods now in use, including a description of the equipment, sequence of operations and materials.

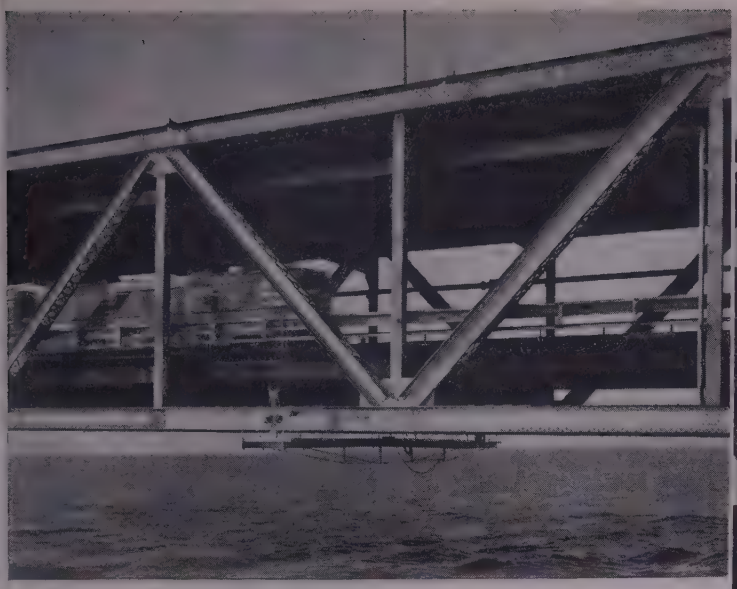
During this same period of service the bridge has been subjected to an accelerating increase in traffic load—daily average for the first year of operation was only 24,945 vehicles, as compared to the corresponding traffic load of 82,699 vehicles per day last year. Through May 1952 the bridge carried 321,303,950 vehicles for an average of 56,568 per day over the entire period.—Editor.

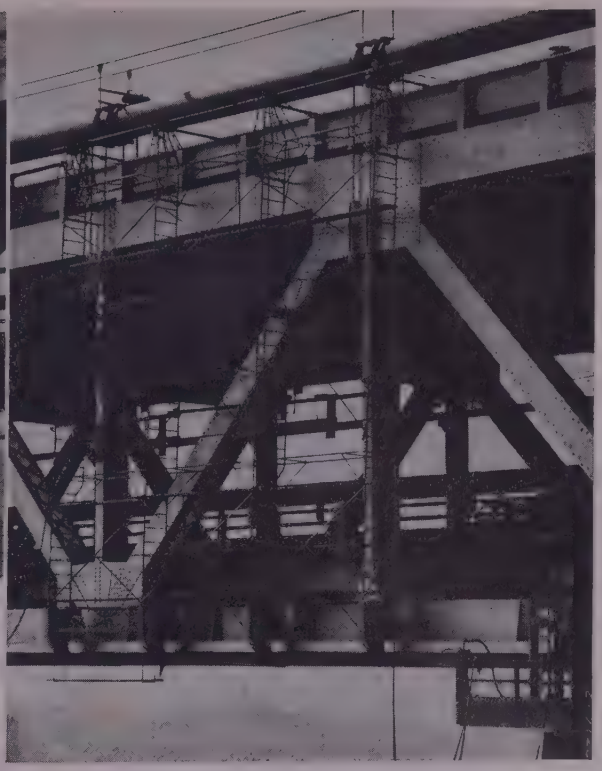
MAIN-CABLE SCAFFOLD is hung from the hand ropes on pipe frames equipped with chains for adjusting the level of the platform. Removable center section permits passing the hanger ropes. Hauling up the cable is done by air hoist. While painting is under way rules require three holding devices to be in position.

Figures for lost time

Many things conspire to delay the work and increase the costs of maintenance painting. These can be divided into two general classes, one in which little or nothing can be done to reduce costs, and the other in which coordination of activities and use of appropriate equipment can materially reduce costs.

Under the first class the greatest loss in time is due to bad weather conditions which prevail about 20% of the total working days. Actually, a 10-yr. average indicates complete loss of 6.4% of working time; during 13.6% of the bad weather days the painters can be usefully employed on other maintenance work. The next greatest loss results from the necessity for holding maintenance vehicles off the bridge deck during peak traffic hours. This amounts to 15% of total working time. Lastly, absences of personnel amount to a loss of 10% of total working time. This attendance factor takes account of payroll time legitimately expended in vacation and sick leave. Combining these lost-time percentages indicates that, in practice,





TRAVELING BRIDGE (above), used for painting the lower deck floor on the East Bay side, is 6 ft. wide by 77 ft. long, has open steel flooring, and is suspended from two lines and moved by taking up on one and slacking off the other.

"BIRD CAGE" (right) used for working on the stiffening truss members consists of a pipe frame riding on the inspection bridge rail below and fastened by outriggers at the top. Scaffold is moved forward by hand-crab.

only 61.2% of the average working day is available for painting.

In the second class of delays, where opportunities exist for saving through proper planning, an analysis of 10 yr. of operation shows that the paint crew's time on the bridge is actually spent as follows:

Rigging	12%
Cleaning surfaces	37%
Painting	51%

Obviously, the first two items are the ones to check for economy of operation. Where feasible, permanent traveling scaffolds reduce rigging time, afford better traffic protection, and accelerate actual painting coverage. For example, the use of permanent scaffold on the stiffening truss of the suspension spans (see picture) reduce rigging time from 27% to 8% of total time expended. The differential of 20%, formerly spent in handling a conventional scaffold board and falls, became available for cleaning and painting. The obvious result has been faster prosecution of the entire maintenance sequence. But since the item of cleaning time (especially sandblasting) decreases right along with reduced total time between maintenance cycles, this item has been reduced also.

Use of steam cleaning

The present use of steam cleaning on the bridge was developed in an effort to find a method less drastic than sandblasting or wire brushing to remove deposits of salt, dirt, grease, smudge and soot from the steel. Sandblasting and wire brushing was removing good paint; still, undesirable foreign matter had to be removed before effective protection of the steel could be realized. The first attempt was to wash the steel with soap and water much as a housewife washes her kitchen paint, but with the addition of rinsing with water from a hose. The inherent difficulty in this process is the cost. Also, it introduced a hazard to traffic and created difficult working conditions for painters in the vicinity. Since steam cleaners were in common use by garages and industrial plants for removal of comparable material, the trial and adoption of this equipment followed as a natural development in Bay Bridge maintenance.

Composition of paints

All paint used on the bridge is made to state specifications, with the materials sampled, tested and approved before the paint is mixed. The completed product also is sampled and tested before shipment to the bridge. This task of sampling and testing is performed by the Division of Highways materials and research department. In addition, each material must meet the standards of the ASTM. Paints in use at present are:

Red lead primer: consists of 81% pigment and 19% vehicle, by weight. The pigment is 100% red lead, and the vehicle is composed of raw linseed oil (92%), drier (4%), and turpentine (4%), all by weight.

Red lead second coat: consists of 77% pigment and 23% vehicle, by weight. The pigment here is red lead (99.8%) and carbon black (0.2%). The vehicle is composed of raw linseed oil (87%), drier (3%), and turpentine (10%), all by weight.

Aluminum finish coat: consists of 2.25 lb. aluminum paste to 1 gal. of vehicle. The vehicle is what is known as a long oil phenolic varnish.

All painting above the lower deck level is done by brush, primarily because of the heavy traffic the bridge carries. It would be impractical to try to protect vehicles from spray painting, and we have no desire to hire a crew to clean cars even if that were possible!

There are 63 men in the paint crews, of whom 2 are foremen, 6 are leadermen, 4 are truck drivers, and 21 are laborers. These men are divided into two crews, one working west and the other east of Yerba Buena Island.

Electrical maintenance

The electrical force is divided into three 8-hr. shifts, with one journeyman electrician on duty during each of the night shifts and the balance of the force on the day shift. The day shift handles all routine inspection, repairs, servicing, cleaning and adjustment of equipment. In addition, it performs all appropriate construction work in its field. The night shift provides a standby service for emergencies, such as lamp changing in illuminated traffic signs or navigation lights. Regular night shift duties include adjustment of relays returned to the shop by the day shifts, testing of lamps, and performance of necessary repairs around traffic lanes at the toll plaza.

Altogether, the electrical force is responsible for maintaining and operating the following systems:

1. 18.36 mi. of roadway lighting on bridge and approaches
2. Aerial and water navigation beacons, channel markers, and obstruction lights
3. Fog sirens and bells
4. Police telephones and call lights
5. Maintenance telephones
6. Fire alarm and tow service call system of 58 combination duplex boxes
7. Two-way shortwave radio system

8. Administration building light and power

9. Equipment for traffic count, classification and registration

10. Intercommunicating telephones and public address system

11. Direct current control and indication system.

Structural maintenance

All major structural repairs required to date have been done by contract. There have been three such projects, two the results of accidents and one the result of an expansion joint failure. Replacement of a hanger rope cut by an airplane during the war was handled by American Bridge Co., as was the job of straightening, strengthening, and revising the damaged expansion joint. Repair of a fender at one of the piers was performed by Healy Tibbitts Construction Co.

Vital points about the bridge structure, such as cable anchorages and main expansion joints, are inspected by two steel inspectors. These men program a sequence of inspections in such a manner that practically all connections on the bridge are examined at least once each year. Minor failures, such as broken rivets, pins not functioning properly, and loose bolts are discovered during these inspections and are repaired by bridge forces.

General maintenance on the Bay Bridge and parking areas is under the supervision of a maintenance superintendent, who has charge also of the fire truck and emergency tow and roadside service.

MAINTENANCE EQUIPMENT

MAJOR ITEMS of equipment used by maintenance forces on the San Francisco-Oakland Bay Bridge:

PAINTING CREW
- 3 230-cfm. electric-driven stationary compressors
- 8 160-cfm. portable compressors
- 5 steam cleaners
- 4 tank trucks
- 4 6-ton capacity low-bed trucks
- 4 ¾-ton pickup trucks
- 1 42-ft. work boat equipped with fire pump and 60-cfm. compressor

ELECTRICAL CREW
- 1 tower truck
- 1 ladder truck
- 2 utility body trucks
- 1 pickup truck

STRUCTURAL CREW
- 1 pickup truck
- 1 200-amp. welding machine

GENERAL MAINTENANCE CREW
- 4 light tow trucks
- 1 heavy-duty tow truck
- 1 fire engine
- 4 pickup trucks
- 2 dump trucks
- 1 motor sweeper

Roadway maintenance of the bridge involves slope and embankment repair and minor fills at settlement points along the approaches, correction of drainage obstructions, weekly cleaning of the bridge and adjacent areas within the right-of-way, roadway surface patching, and repairs of minor damage caused by careless drivers. Once a week the roadway is given a complete brooming with a motor sweeper.

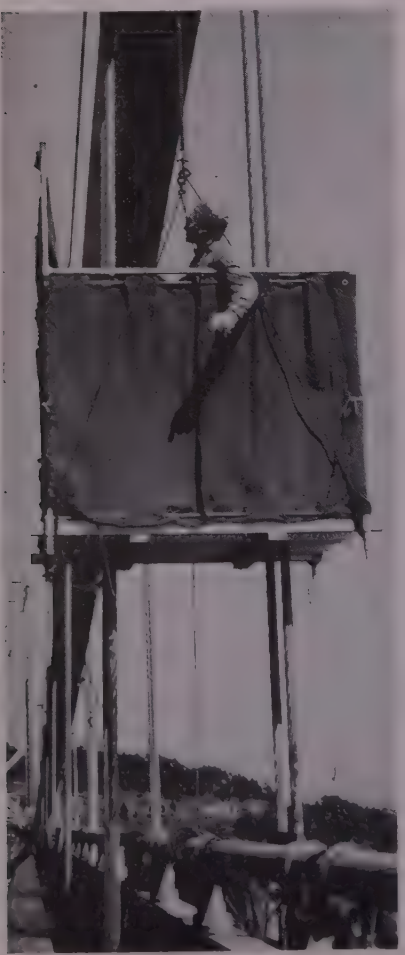
The costs

The cost of maintaining this structure, exclusive of administration and accounting, during the fiscal year 1950-1951, was as follows:

Painting	$355,968
Electrical	65,834
Structural	14,588
General	
Roadway Service	132,386
Roadway Maintenance	45,659
Shop and Garage	31,089
Total	$645,524

Personnel

The San Francisco-Oakland Bay Bridge is maintained and operated for the California Toll Bridge Authority by the Division of Highways. George T. McCoy is State Highway Engineer, F. W. Panhorst is Assistant State Highway Engineer (Bridges). Howard C. Wood is Bridge Engineer of state owned toll bridges.



HANGER ROPES are painted from this scaffold (left) held by a bridle from each corner to a shackle suspended from the main cable, and operated by a hand-crab or tugger hoist. The canvas protects the painter from the wind and the cars from paint.

STEAM CLEANING the walls of the Yerba Buena Island tunnel (below) is done at regular intervals on the night shift with traffic diverted to the lower deck. Steaming is followed by a rinse (being applied in the background).

MARSH CROSSING and BRIDGE MOVING on Montana road job

On U. S. 10 north of Butte, 25 mi. of major reconstruction requires moving the Clark Fork to a new channel, extending fills over "bottomless" marshes, and sliding a 140-ton bridge 50 ft. for a detour

NORTH OF DEER LODGE, Montana, where U. S. 10S follows the Clark Fork River through wooded, mountainous country, the Montana State Highway Commission and a group of contractors are at work on a tough 25 mi. of major highway reconstruction. They are blasting through deep rock cuts, crossing marshes—no bottom with a 30-ft. pole—and doing it so successfully that the fills are settling only a minor amount. The course of the Clark Fork channel is being changed, causing it to run beside the new highway. A 140-ton bridge was moved 50 ft. in 30 min., holding up only two cars in the process.

Contractors on the project include: Montana Engineering & Construction Co., who moved the bridge; Charles Shannon Construction Co. of Butte, making the channel changes and marsh crossings; McKinnon-Decker Co. and Glenn Geery Construction Co. of Missoula, builders of the northerly section near Bearmouth.

Charles Shannon's 4.565-mi. contract, at $296,664, is perhaps typical of most of this reconstruction, calling for all excavation, production and installation of a granular sub-base, drainage features, a double-shot asphalt penetration treatment to carry traffic for a year while the fills settle, three channel changes in the Clark Fork River, and miscellaneous items.

Contract requirements

The project starts 6 mi. north of Deer Lodge and extends almost to Garrison Junction, where U. S. 10S and U. S. 10N branch. The contract calls for 270,600 cu. yd. of excavation and borrow, plus other items to match, but the contractor expects to complete it by September 15, less than six months from the day it was started.

Shannon's work will shape a subgrade 45 ft. wide across its crest. On top of this subgrade will go a 36-ft. width of crushed sub-base material from 10 to 12 in. thick. Bituminous surface under this contract will be 32 ft. wide. At some time in the future a 24-ft. mat of asphaltic concrete will be placed.

Grading is more than usually interesting, because some of the rock cuts are 80 ft. deep, some of the fills cross boggy marshes in the Clark Fork River bottom where the bog has no apparent bottom, and certain slope erosion control methods are being applied. For example, the topsoil at the edge of cuts is being skinned off for a width of at least two dozer passes. This will get rid of this material which soaks up winter precipitation like a sponge and hangs, surcharged for months, to erode and threaten the rest of the slope below.

Rock drilling

The Shannon company subcontracted 66,000 cu. yd. of material on the south end of the job to Union Credit Co. of Butte, to bring as much grading equipment as possible to bear on the job.

The rock drilling calls for maximum lengths of 22-ft. steel, bottoming holes at a diameter of 2½ in. Holes are going down on 5-ft. centers, with very little spring loading as the rock is up-ended, full of fissures, and tricky. A 60% gelatin powder is being used at a rather high blasting ratio—1.5 lb. per cu. yd.—to break up the material so that the scrapers can load it.

Some very interesting fills are being made across boggy places where men have been unable to find bottom with boards and poles 30 ft. long. Despite the soft nature of these marshes, heavy fills are being laid successfully by following a simple rule. Equipment is never permitted to get out in the bog and disturb the surface of the ground, the grass, or other growth which might be on the location. Strangely enough, this seems to help a great deal in producing a sound fill. The first lift is always end-dumped and shoved out in at least 3-ft. thickness by dozer. Not until that first lift is completed are further lifts placed, or compaction equipment turned loose.

Montana has several precedents for such construction, and in each case where these precautions were taken, bad settlement and side blowouts have been prevented. To bridge or attempt to muck out the objectionable bog would be, for Montana, prohibitively costly.

ROCK WORK on Montana highway cuts puts a wagon drill on a tough angle.

Channel changes

A considerable amount of roadway grade is being established by the three channel changes—1,600, 700 and 400 ft. long. Material is dredged up and cast to one side to make the new roadway base.

In spite of the fact that the dragline has always had to work from mats, because of the marshy condition, it consistently is casting about 2,600 cu. yd. a shift. The new channel is being shaped 10 ft. deep and 40 ft. wide. When the connections are made, heavy earthen dikes are being placed to hold the river in its new channel during flood periods. Every effort is made to assist drainage of the wet material before further roadway fill is added by the tractor equipment.

A concrete bridge across the Clark

IN THE BORROW PIT, two rigs load for hauling to the fill. Much of this yardage went into embankment built over deep marsh.

Fork River is an important feature of the project. The old bridge at that point has been a dangerous bottleneck for several years.

The new bridge is 140 ft. long, consisting of three concrete spans and deck. The structure has been designed (H-20 loading) with a minimum amount of critical steel. The deck will be 28 ft. wide, curb to curb.

RAY HOLLERN, general superintendent for Union Credit Co. (left) talks over progress on the job with L. M. Chittim, resident engineer.

Location of the new structure was identical with the old, and to get the new bridge started, it was necessary to construct two short detour approaches and move the old bridge downriver 50 ft. This turned out to be one of the best-timed and interesting parts of the project.

Wood piles were driven to hold timber caps, which served as temporary abutments for the old bridge. Railroad rails were laid downstream and the weight was transferred to the temporary falsework by jacks while traffic continued to use the structure. A truck-mounted winch hooked its line to one end, and a 2-drum hoisting engine made fast to the other, after rollers had been placed.

In just 30 min. the old bridge was 50 ft. downriver on its temporary cribbing, and flagmen allowed the two motorists whose cars had been held up to proceed. When the new bridge is finished, the old one will be either junked or used on a minor part of the state highway system. Completion schedules call for Montana Engineering & Construction Co. to finish the bridge by September 15.

L. N. Chittim, project engineer in charge of field work for the Montana State Highway Department, is in an enviable spot to supervise the work because a year ago last winter he and his crew made the final location on the section. It was rugged, zero-and-below weather, with snow so deep the entire survey party used skis and snowshoes. Snow was too deep to set up an instrument or find a permanent turning point. So Chittim set a level up by keeping the three tripod legs together and jamming them down in the deep snow in that position. Turning points were conve ently arranged by jamming a sho down to where it was solid, and turni on the handle. It worked very well, a project quantities are checking out tremely close.

Personnel

The project is under general sup vision of Troy Carmichael, State Hig way Engineer, with A. W. Jones bridge engineer, W. J. Leary as co struction engineer, and Fred Quinn Jr., as division construction engineer the Butte Division.

MAJOR EQUIPMENT

(UNION CREDIT CO.)

- 1 Le Tourneau Carryall
- 2 Caterpillar scrapers (Model 80)
- 1 Caterpillar D8 tractor
- 2 International tractor dozers and pushers
- 1 Caterpillar motor grader
- 1 Badger backdigger
- 1 Worthington 350-ft. compressor
- 2 Gardner-Denver wagon drills
- Timken rock bits
- Du Pont powder

(CHARLES SHANNON CONSTRUCTION CO.)

- 2 Caterpillar D8 tractors
- 2 LeTourneau W Carryalls
- 2 Caterpillar D8 dozers
- 1 Caterpillar D8 pusher
- 1 Caterpillar D8 and LeTourneau rooter
- 2 Super C Tournapulls
- 1 1½-yd. Lima dragline
- 2 Sullivan wagon drills
- 3 Ingersoll-Rand jackhammers
- 1 500-ft. Gardner-Denver compressor
- 1 Ford-mounted water truck
- 1 Caterpillar motor grader (No. 12)
- Timken rock bits
- Du Pont powder

SLID 50 FT. DOWNSTREAM, the pony-truss in the background has been moved from its original location for a temporary detour while the new concrete bridge is being built.

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Use of local materials can cut Intermountain highway costs

Through experience, satisfactory asphaltic concrete pavements can be constructed using the softer aggregates—Recent projects in New Mexico illustrate the possible economies

By
MARSHALL J. WYLIE
President
Wylie Brothers Contracting Co.
Albuquerque
New Mexico

THE SCARCITY of proved paving materials is more or less a common problem throughout the Rocky Mountain area. In the past, the general belief has prevailed that softer aggregates resulted in unsatisfactory bituminous pavements. Consequently, only the harder materials were accepted by the engineers. Naturally, in areas where only the so-called unsuitable aggregates were to be found, the only alternative was to ship in aggregate from a distant source, thereby increasing the ultimate cost, and in some cases, making it prohibitive.

Throughout the eastern portion of New Mexico, for instance, very little sand and gravel can be found. There is, however, an abundance of caliche, one of the softer aggregates In the past, the use of caliche in asphaltic concrete paving has been discouraged by most engineers. Caliche is characterized by a layer of medium hard cap rock close to the surface, which varies in thickness from one to four feet. Beneath this lies a layer of soft chalky material which has a variable depth. The outstanding characteristic of caliche pits is that no two will be alike. On an average the caliche cap will show a hardness of about 50 by the Los Angeles Rattler test. The soft, chalky substance beneath the cap has a high P. I. and its use in the paving mix is objectionable. In all cases where we have used the caliche cap for asphaltic concrete pavement, it has produced a tough, dense, and durable surface.

Experience with caliche

For years, the City of Hobbs, located in the extreme southeastern part of New Mexico, did little to improve its streets because of the lack of hard aggregate, although there was an abundance of good caliche rock in that vicinity. The nearest source of gravel was 150 mi. away, making the ultimate cost of pavement prohibitive. Recently, the city embarked on a paving program which included 300 blocks of asphaltic concrete pavement. The invitation for bids on this work requested a bid on asphaltic concrete paving using imported aggregates and an alternate using local caliche aggregate. Wylie Brothers Contracting Co. was awarded the contract and the alternate was selected.

The local aggregate alternate called for a seal coat using 0.25 gal. of asphalt and 20 lb. of stone chips and the imported aggregate called for no seal coat. The alternate selected was approximately 15 cents per sq. yd. under the imported aggregate alternate. The total saving to the City of Hobbs was approximately $50,000. The freight rate to the nearest source of hard aggregate was $2.50 per ton. Approximately 40,000 tons of aggregate was required for this project. If imported aggregate had been used, the transportation cost alone would have been $100,000.

All of this $100,000 saving was not reflected in the bids because the local caliche aggregate required approximately 10% asphalt by weight or 24 gal. per ton, as compared to 6% asphalt or 14 gal. per ton required for the imported aggregate. This 10% asphalt may seem excessive but caliche aggregate has a high absorptive quality that is characteristic of some of the softer aggregates. We have found that in some cases 12% asphalt was required to produce good stability when using caliche aggregate.

Equipment adaptations

The specifications for this street improvement project called for a 7-in. compacted caliche base placed on a previously compacted subgrade. The asphaltic concrete pavement was 1½ in. thick.

Considerable difficulty was encountered in producing the desired gradation for the asphaltic concrete pavement. We invariably ended up with an aggregate containing an excessive amount of material passing the #200 mesh screen. The most modern crushing equipment available was used to produce the top course aggregate but due to the characteristics of the material, in the process of crushing it down to a maximum of ¾ in., we produced too many objectionable fines. Attempts to eliminate these fines at the crushing plant resulted in an excessive loss of material between the #40 and #4 mesh screen. This problem was finally overcome by modifying the dust collector in the hot plant and eliminating the excess mineral filter through the stack. In addition, it was also necessary to reject a percentage of the fines after the aggregate had gone through the gradation unit.

The pavement was laid with a Barber-Greene laydown machine and a certain amount of "pulling" resulted whi attributed to the material and n machine. It is to be remembered th were placing ¾-in. aggregate in a l mat and we found that some o elongated particles approached the ness of the mat. This did prod rather harsh surface.

After the initial rolling was com with a 10- to 12-ton tandem roller, tional rolling was done with a ru tired roller. This rolling ironed o of the roughness caused by pulli the paver. In order for us to obta required density, it was necessary a heavy roller and, consequently, so the larger rocks near the surface crushed. Wherever this happen white spot would appear. Hov these white spots disappeared under traffic.

Daily density tests were taken as progressed and we were pleased t that the average of these tests sh a density of 96% of the theoretica sity. The pavement was allowed t for six months before it was seale no ravelling or failures of any showed up during that time.

The contract required the cont to maintain the pavement for one after it was accepted. No failures developed nor has any money been by the contractor for repairs durin one-year maintenance period, though Hobbs is an oil field tow the streets carry a large volume of truck traffic.

Success on other projects

The New Mexico State Highwa partment recently completed a stretch of asphaltic concrete pave which extends for 3 mi. on each s Gallup on Highway 66. Here aga highway engineers were faced wit problem of shipping proved aggr from Albuquerque at a cost of more $3.00 per ton or trying some combi of local materials. A satisfactor phaltic concrete pavement was structed by using approximately 40% crushed lime rock and 60 t sandy material with a hardness con ably less than the limestone. The r obtained from this local material w satisfactory that the CAA approv use for paving the Gallup Municipa port. Since then the approximate bination of the same material has approved by the Army Engineer asphaltic concrete pavement at Wi Ordnance Depot.

On each of the projects the jo formula called for a rather dense g tion with an above average asp content. All of these projects have subjected to extreme weather condi and repeated freezing and tha action. When one considers all the tors—heavy traffic, extreme we conditions, and the age of the pave —the conclusion naturally follows more consideration should be giv the use of local materials wherever sible. I do not advance these mat in preference to the harder aggreg but I am convinced through exper that satisfactory pavement may be structed from the softer aggregates

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PLUMB PERFECT on 275-ft. deep escape hatch to sewer tunnel

DOWN in the Palos Verdes Hills between Los Angeles and Long Beach, California, a flat steel lid secured by a big padlock bears the inscription of Los Angeles County Sanitation District No. 2. Beneath that lid, which was recently installed, lies one of the most interesting drilling feats which has come up in recent years in Southern California.

The main outfall line of the Sanitation District at this point ducks under the Palos Verdes Hills through a big tunnel, which carries sewage from residential areas toward the new White's Point outfall sewer just completed. Engineers of the District needed some means of reaching this tunnel in emergencies, so the idea of an escape hatch big enough for a man to pass through was conceived. The logical place for the hatch was about 1½ mi. in from the main tunnel portal. The engineers had designed the hatch for a finished dimension of 32 in. inside diameter, and from that point on the problem of constructing the hole was up to M. R. Peck & Sons, well drilling contractors of Gardena, Calif., who received the assignment.

Overburden from the tunnel roof to the top of the ground was 275 ft. deep at the point where the escape hatch was proposed. To help complicate the drilling problem, geological determinations showed that layers of exceptionally hard sedimentary rock of calcareous origin would be found.

Peck assigned a trailer-mounted Bucyrus-Erie 24-L well drill to the job, and because the hole was so much bigger in diameter than the usual job, he then made up some of the special tools which would be required. Eventually the 24-L would carry a back-straining load of 3,200 lb. in its tool string, including a special 36-in. drill bit 7 ft. long, a 22-ft. stem, and a 4-ft. rope socket. The drill bit was made up by Roscoe Moss of Los Angeles. It consisted of a 24-in. casting, filled out to the final dimension by hard ribs welded on each side and hardfaced. The Stoody tube borium hardfacing was replaced once during the course of the hole.

Drilling had progressed but 18 ft. when a hard layer of limestone was reached, and these layers, from 18 in. to 5 ft. thick apiece, repeated themselves on an average of every 16 ft. down to a depth of 204 ft. Below the last hard rock lay firm blue shale, and in general other

M. R. PECK, SR. (left) stands with Office M ager R. L. Tracy (center) and Driller E. P. beside drilling machinery.

variations of this same shale lay betw the limestone layers.

When the first hard rock was countered, Peck's drillers scratc their heads and put in a telephone for the "old man." What should t do? Should they go ahead and try worry the drill bit through the for tion?

Peck solved the problem quickly rather spectacularly by bringing a cu. ft. portable air compressor an jackhammer out to the job. He hoo these machines up, and with the aid the baling drum lowered a man with jackhammer to the bottom of the h A center breakout hole was drilled the exact center of the hole, and a 5-h pattern in addition was spotted aro the perimeter of the 36-in. excavat The holes were started several inche from the perimeter, and angled outw to the perimeter to give a burning breakout effect when they explo Ordinary rock bits were used on jackhammer, with steel just long eno to reach the projected bottom of holes. The center cut hole was dri to reach through the limestone str Other holes were planned so they st ped a few inches short of the botton the limestone.

Two sticks of ordinary 40% pow were used in holes 18 in. long, and amount was increased to 4 sticks hole in a 5-ft. stratum. An instantane exploder was placed in the center h and 3 delays were spread around perimeter to break the rock into center. Shots were fired electrically fr the top of the ground.

After a blast had been set off, the r fragments were usually bailed out a the big bit had been used for a while pulverize the material still further. some cases where the particles were big, they were hoisted out after a had loaded them into a bucket.

As successive layers of the hard li

Concluded on page 90

HERE'S the large diameter casing (foreground, right) and drill bit (left) on the trailer-mounted Bucyrus-Erie 24-L well drill that did the job. The machine handled a 3,200-lb. load on its tool string.

The Surveyor's Notebook

Reporting on Unusual Surveying Problems and Their Solutions

Notekeeper: W. & L. E. Gurley, America's Oldest Engineering Instrument Maker

A Report to Surveyors

It has been more than a year since the first in this series of "unusual surveying problems and their solutions" appeared in your engineering journals.

Massachusetts survey

The initial page in "The Surveyor's Notebook" showed how a Commonwealth of Massachusetts survey party used captive pilot balloons to get initial lines between stakes separated by heavy timber.

Since then, "The Surveyor's Notebook" has developed into a forum through which veteran field men voice their experiences in solving tough problems and eliminating common surveying hazards—for the benefit of other surveyors and engineers.

A Nebraska deputy county surveyor, for example, has relieved many a headache by explaining how he quickly determined a quarter-section line which was completely blocked by railroad cars. So did Stan Shartle of Danville, Indiana, with his account of leveling over 10 feet of corn.

Joe Thoma

One month, Joe Thoma, the prominent cadastral engineer, gave his remedy for "frozen" tripods; later told of the advantages of the solar transit.

These stories—and letters commenting on them—have come from all over the nation.

Niagara Falls' Corps of Engineers related how it made the first accurate survey of the Niagara River bed with the aid of unusual transit practices. The Chief Locating Engineer of North Carolina has created a great deal of discussion with his plan for improving land survey records.

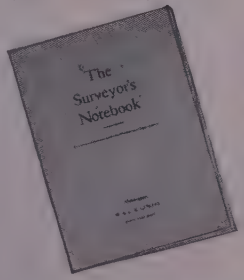
Through "The Surveyor's Notebook", Gordon Ainsworth told how to get an oil pipeline laid in record time by using a few tricks of the trade.

Gordon Ainsworth

Dick Merritt described the unusual problems of surveying in the Arctic, while Jim Caputo showed how aircraft plants use transits. (His story led to the development of a new Gurley instrument for the industry.)

A great many surveyors have written to us saying that the experiences they read about in "The Surveyor's Notebook" have helped them solve their own field problems. And a number of the engineering colleges have requested copies regularly as classroom aids.

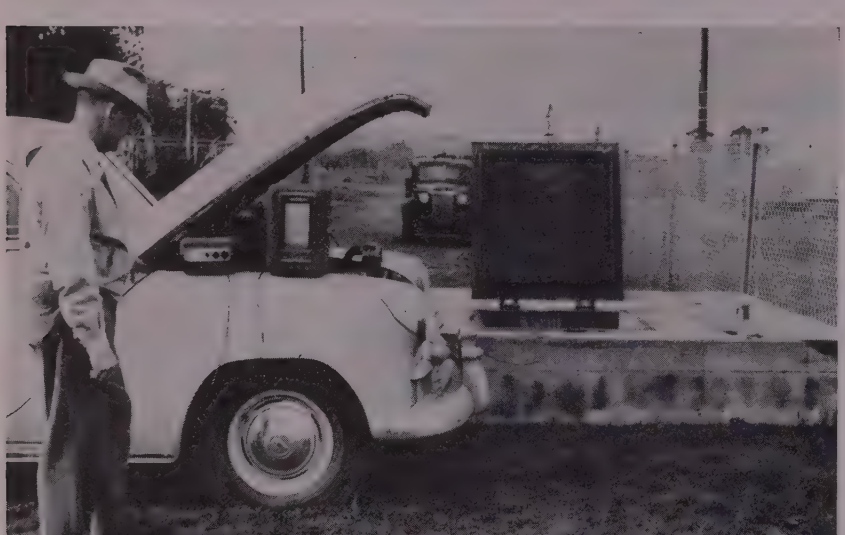
Gurley will continue to be notekeeper for the series; welcomes your comments and suggestions—and, of course, your own experiences.



The first year's stories and surveying tips have been gathered together and reprinted in permanent form. Write for your free copy of "The Surveyor's Notebook" *collection.*

When writing for your bound copy of "The Surveyor's Notebook" stories, ask also for Bulletin 50. It gives full details on Gurley instruments.

Water-pipe line corrosion checked by portable photo-electric recorder



KEEPING RIVER CROSSINGS and water-pipe lines in the East Bay free from corrosion is no longer a guessing game, according to David Hendrickson, senior electrical engineer of the East Bay Municipal Utility District.

Through the use of a General Electric photo-electric recorder, which measures what the eye can not see, the job of locating corrosion has been greatly simplified, Mr. Hendrickson said.

The recorder was first used in 1948 during the construction of the Second Mokelumne Aqueduct, when engineers were faced with a serious corrosion problem on the earlier pipe line running parallel to it. By conventional meters, Mr. Hendrickson pointed out, it would have been almost impossible to solve the problem.

Through the use of the photo-electric recorder, the old pipe line was saved, and the expense of $22,000,000 to replace it was avoided.

Since then, this meter has been used to check corrosion in water crossings as well as pipe lines throughout the East Bay District. Because of the portability of the instrument, engineers can set it up in their automobiles as they make the corrosion tests, place it on the banks of the river, or take it out in a boat.

PLUMB PERFECT

Continued from page 88

stone were encountered, the same process was repeated. When the drill passed through the last one, the man with the jackhammer was working 204 ft. below the surface of the ground.

When the bottom of the hole reached a point within 6 ft. of the tunnel roof, drilling stopped and the 32-in. steel casing was lowered to the position. By serrating the lower edge of the casing and twisting, the liner was lowered to the tunnel roof, where the final connection was made. Considerable driving was also done in the last 6 ft. to get the casing down.

The drillers began to realize how accurately the hole had been drilled when they were within 6 ft. of the tunnel roof. For at that point the casing still could be turned quite freely. When the liner was in place, amazed engineers checked its position and found that it was almost exactly vertical, deviating only ⅜ in. from true plumb in its entire length of 275 ft.!

Elapsed drilling time had been only a month and seven days, working one 10-hr. shift a day. Eight more days were taken up as the men lowered prefabricated sections of steel ladder rungs and welded them to the side of the casing. A 2½-in. electrical conduit and an 8-in. compressed air line also were installed along the ladder rungs to complete the job.

The 24-L Bucyrus-Erie drill meanwhile had been sent on to its next job without the necessity of an overhaul or repair. No special pains were taken to carry the heavy tool string, and the machine handled its load uneventfully.

So far as the Sanitation District engineers and officials were concerned, an unusually difficult excavation had been drilled speedily, accurately and successfully.

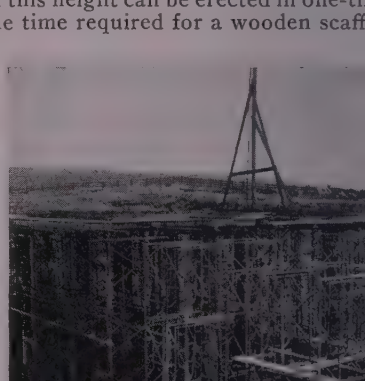
Steel scaffold supports reservoir roof forms

ANOTHER EXAMPLE of the use steel for shoring jobs is found curren in the roofing of a 10,000,000-gal. cle water reservoir at Vallejo, Calif. Wa Construction Co. of San Francisco doing the work as a part of its $4,000, contract to construct a water treatm plant and pipe line and adapt pres facilities to the new water supply syst planned for the city and township Vallejo, and for Army, Navy and Force bases in the vicinity.

The clearwater reservoir was c structed several years ago and the Wa contract includes its rehabilitation well as roofing. The structure has c crete sides 4 to 8 in. thick, built o slope of 1:1½. Dimensions are appro mately 465 x 250 ft. at ground surf and 402 x 141 ft. at the reservoir bott

This area will be completely cove by a concrete slab roof 6 in. thick w drop panels over the supporting c umns. Beatty Scaffold, Inc., San Fr cisco, has supplied and erected the t ular steel scaffold to support the for Prefabricated scaffold end frames, 6 4 in. by 5 ft., spaced 6 ft. apart and joi with "X" braces, have been erected fo high from the reservoir floor.

It is estimated that a working platfo of this height can be erected in one-th the time required for a wooden scaff



FOUR-HIGH steel scaffold system supp forms for concrete slab roof 6 in. thick.

of the same height. Advantages gai from the use of steel are even more portant in construction work on steeply sloping sides of the reserv Here, steel scaffold, available in vari sizes for ready adjustment to any hei is a great deal more economical t lumber which would have to be cu a variety of lengths. The system of s bracing, traveling through from a c tral point, insures absolute uniform of shoring support with no flexibi after alignment has been made. screw-jack legs allow for minute adj ments.

IT'S TRAXCAVATOR® SHOVELS ALL THE WAY

For Samuel D. Kraus Co.
General Contractors, St. Louis, Missouri

...IN PRODUCING PIT MATERIAL FOR ELECTRIC POWER PLANT CONSTRUCTION!

STRIPPING...

Removing 6 feet of damp, red-clay overburden, called for big, sure-footed power—the T7 TRAXCAVATOR Shovel had it. With over 21,000 pounds of push, the T7 heaps its 2½ cu. yd. bucket in 20 seconds . . . pushes the load 300 feet in 70 seconds . . . dumps and is back for another in 40 seconds—to move over 75 yards an hour!

STOCKPILING...

The uncovered gravel—1″ rock with clay binder—is 'dozed 200 feet down a 5% grade by a T6 TRAXCAVATOR Shovel. 2½ to 4 cu. yds. pile up before the bucket. At the base of the slope the T6 puts the material into 8-foot stock-piles. Cycle time: 110 seconds!

LOADING...

An HT4 TRAXCAVATOR Shovel takes over—loads sixteen 5 and 7 cu. yd. trucks each hour. High-lifting bucket easily clears big dump bodies. Material is being used in the construction of a huge electrical generating plant in Southern Illinois.

There's a TRAXCAVATOR Shovel to do your jobs, too—and do them at a cost so low that profits are insured! See your "Caterpillar" Dealer for full details or write direct.

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TRAXCAVATOR® SHOVELS
TRACLOADERS
PIPE LAYERS
ANGLEFILLERS

Vanes streamlined to stop turbine vibration

TWO INGENIOUS Bureau of Re mation engineers earned themselv $600 efficiency award and saved the ernment at least $500,000 by solvi difficult vibration problem destro four turbine runners and reducing put at Parker power plant.

I. A. Winter and John Parmakia Denver, Colo., pooled their talent head of the hydraulic machinery bra and instrument expert in the d branch, respectively, to diagnose the ing equipment. The 60-ton turbines, largest owned by the Bureau, were stalled in 1943 and by 1946 their va were cracking badly enough to nec tate replacement.

Winter and Parmakian discov through studies that vortex trails c ing the vibration were due to the sh of the trailing edges of the vanes. T edges were streamlined, and subseq operation proved that this redesig not only solved the vibration prob but also it increased turbine efficie permitting the production of $40 worth of additional power annu

A way to save money on right-of-way maps

A $10 CHECK and a certificate of aw have been presented to Lillian Meach senior drafting aid in the Bishop o of the California Division of Highw for a suggestion which will save State of California about $150 each y The draftswoman suggested that m used statewide by right-of-way dep ments be furnished from the prin plant with wordings and lines alre printed on them to save hand letteri

The award was presented by Dist Engineer Alan S. Hart. Awarding cash for valuable suggestions in orde stimulate increased efficiency in gov mental work was authorized by the C fornia Legislation in 1951.

Flagman for sewer cre eliminated at Seattle

A $250 AWARD to A. W. Sawyer, ployee of the Seattle City Enginee Department, has been made for a s gestion that will save the departm about $12,000 annually. Sawyer s gested that a combined temporary co and warning flag be placed over m holes where sewer cleaning operati are under way. Thus, a flagman wo be eliminated for each of Seattle's sewer crews.

New record at Grand Cou

A NEW WORLD RECORD for e tric power generation from a single p was established July 21 only to be bro on July 22 when the Grand Co Power Plant generated 2,252,000 kw a single hour, Supervising Enginee F. Darland, Bureau of Reclamation, announced.

Latest LeTourneau tire is 10 ft. tall, 4 ft. wide

R. G. LeTourneau inspects the latest and largest tire made according to his specifications. Other tires shown here are various sizes used on LeTourneau earthmoving equipment.

THE GIANT "48 x 68" has been mounted on a 35-ton capacity Tourna for testing purposes at the LeTourneau plant in Longview, Texas. Note tires do not sink in marsh.

THE MAN who introduced rubber tires on earthmoving equipment 20 years ago has now come up with the biggest tire of them all. It's the special LeTourneau "48 x 68", 10 ft. tall, 4 ft. wide, capable of carrying a tire load of 17,500 lb. at 20 mph., and weighing in at 1,482 lb. R. G. LeTourneau designed the giant tire for experimental use on a "swamp buggy" now undergoing development by the LeTourneau company at its plant at Longview, Texas. Major reason for development of the tire is its ability to carry heavy loads over soft, swampy terrain. To give it a test run before its installation on the machine for which it was built, the company mounted a pair of the giants on the front wheels of a 35-ton capacity Tournapull.

The new tire, manufactured by Firestone Tire & Rubber Co., is tubeless. It is designed to operate at air pressure from 10 to 15 lb. (depending upon flection). To accommodate the tire, Tourneau developed an improved, flange, wedge-type wheel which perm operation of the tire at the low air pr sure, a maximum of sidewall flex without incurring sidewall damage, at the same time permits the possibil of changing tires under field conditi which may include insufficient tools a poor working conditions.

How seepage was stemmed on pumping plant project

WHEN WORK was just beginning on construction of the Central Valley Project's Columbia Pumping Plant, near Mendota, Calif., the contractor, Johnson-Western Construction Co., was confronted with a serious drainage problem. Normal land surface of the plant site is 2 ft. under the surface of the nearby San Joaquin River, which flows within protective levees at the point where the project was undertaken.

A Stang well point water system was installed to meet the problem. Well points were placed at 4-ft. centers and were 20 ft. long. A heavy 6-in. pipe was jetted into position with a small crane and water pressure to install the pipes. The well point was dropped into this pipe, sand poured in, and the pipe moved. Seepage water was then pump from the excavation site, with a 40- pump, over the levee into the river.

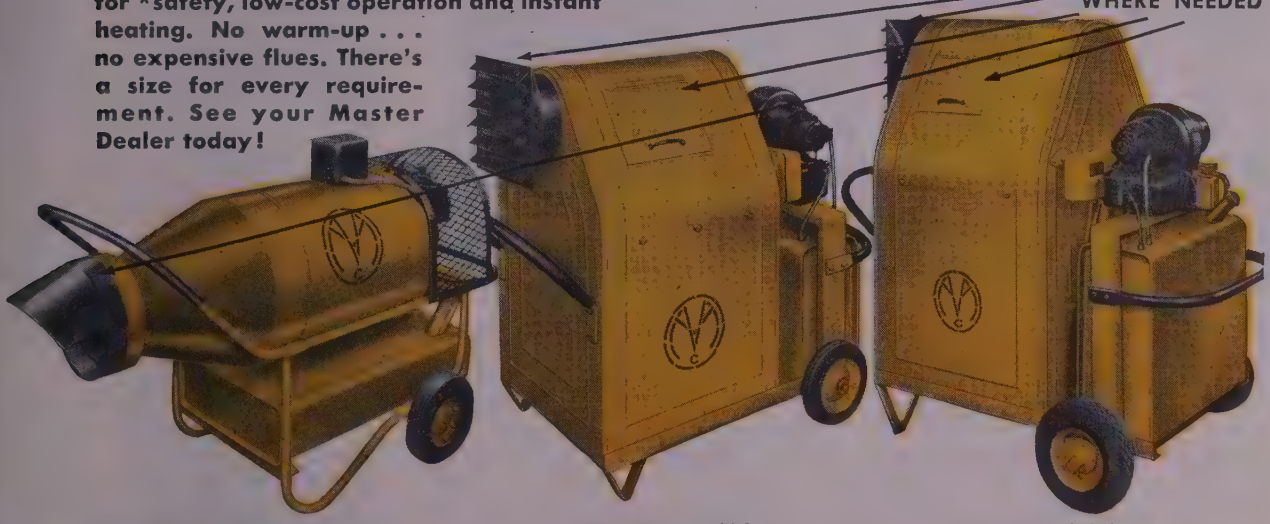
The above pictures show (left) a 6- pipe being lowered into place and co pleted well points to the left, and (rig the completely drained site, with furt excavation under way.

3 New SUPER SPACE HEATERS designed for your job

Give you *Fast Safe Heat* for Drying, Thawing, Preheating, Spot Heating, Space Heating and many other uses.

These new Master Space Heaters are tops for *safety, low-cost operation and instant heating. No warm-up . . . no expensive flues. There's a size for every requirement. See your Master Dealer today!

DEFLECTORS THROW HEAT WHERE NEEDED



New Master B-140 high output for smaller heating jobs.

New Master H-231 for larger heating jobs.

New Master H-350 to meet large heating output requirements.

NEW MASTER SPACE HEATER SPECIFICATIONS

MODEL NO.	CAPACITY	*SAFETY	BURNER	FUEL	FUEL CONSUMPTION	HOT AIR OUTPUT	CONTROLS	SIZE	WEIGHT
B-140	140,000 BTU per hour	Indications of carbon monoxide in the exhaust gases of the kerosene fueled Master Space Heater was less than 0.001 per cent by volume . . . as tested by an independent testing laboratory. According to accepted standards this content is one tenth of the amount considered hazardous.	Approved by Underwriters' Laboratory	Kerosene, No. 1 Fuel Oil or No. 2 Fuel Oil	1 gal. per hr.	800 C.F.M.	Fuel tank and burner safety control, solenoid pump control, thermostat control available extra.	W-24½" L-58" H-34"	145 lbs. less fuel
H-231	241,000 BTU per hour				1.65 gal. per hr.	1500 C.F.M.	Thermostat for full automatic temperature control. Fuel tank and burner safety control. Over-heat safety control.	W-29⅜" L-51¼" H-45¾"	295 lbs. less fuel
H-350	350,000 BTU per hour				2.5 gal. per hr.	2500 C.F.M.		W-31½" L-58" H-58"	360 lbs. less fuel

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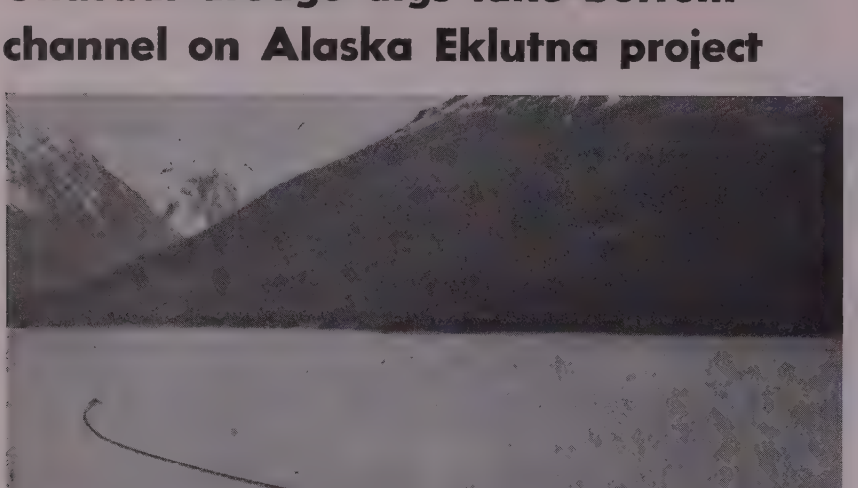
Unusual dredge digs lake-bottom channel on Alaska Eklutna project



AN UNUSUAL 14-in. hydraulic suction dredge dropped her 100-ft. digging ladder into the ice-filled waters of Lake Eklutna in Alaska this summer to begin a story unique in the annals of dredging history. Assignment for the dredge "Skookum" is to prepare a channel in the lake bottom a half-mile long and 85 ft. deep. This channel will connect with a precast concrete trashrack structure and precast concrete pipe conduit. From this, water will flow through a 5-mi. tunnel leading to penstocks with an 800-ft. head, an integral part of the 30,000-kva. Eklutna power project of the Bureau of Reclamation.

General contract for the Eklutna project was awarded last fall to a joint-venture firm composed of Palmer Constructors, Morrison-Knudsen Co., Inc., Peter Kiewit Sons' Co., and Coker Constructors. Ben C. Gerwick, Inc., of San Francisco, was then awarded a sub-contract for construction of the intake, job which included the lake-bottom channel. For this portion of the work the Gerwick firm associated with Hydraulic Dredging Co., Ltd., of Oakland, Calif.

Two major problems confronted the designers and builders of the dredge. The nature of the job demanded that no part of the overall unit be wider than 10 ft., no part longer than 40 ft., and no section weigh more than 15 tons. Secondly, there were unusually difficult problems connected with building a dredge that could be disassembled economically, shipped to Anchorage, then trans-shipped over difficult terrain to the site of the operations.

Design of the dredge, and procurement of machinery and materials, was carried out by Hydraulic Dredging Co. under the general direction of Paul Cushing. Actual construction and assembly was assigned to Bethlehem Pacific Coast Steel Corporation's San Francisco shipyard. Construction of the dredge began in February 1952, and by May 1952, the dredge sections had been shipped to Anchorage, hauled by rail and truck over icy mountain roads, re-assembled on Lake Eklutna, and the dredge began pumping the first of 450,000 cu. yd. from the lake bottom. Dredge capacity, 24-hr basis, is 100,000 to 150,000 cu. yd. per month.

The 100-ft. digging ladder has a 75-h cutter motor, Pacific Gear & Tool C reduction gear, and a special cutter sha thrust bearing assembly. Forward of th trunnion section the digging ladder consists of two identical units, each 32 f long. The cutter is five-bladed, of fab ricated steel. Suction pipe is 16-in. I. D and has a rubber hose connecting to th hull suction pipe. The digging ladder designed to operate at an angle of 60 de from horizontal when digging to th maximum depth of 85 ft.

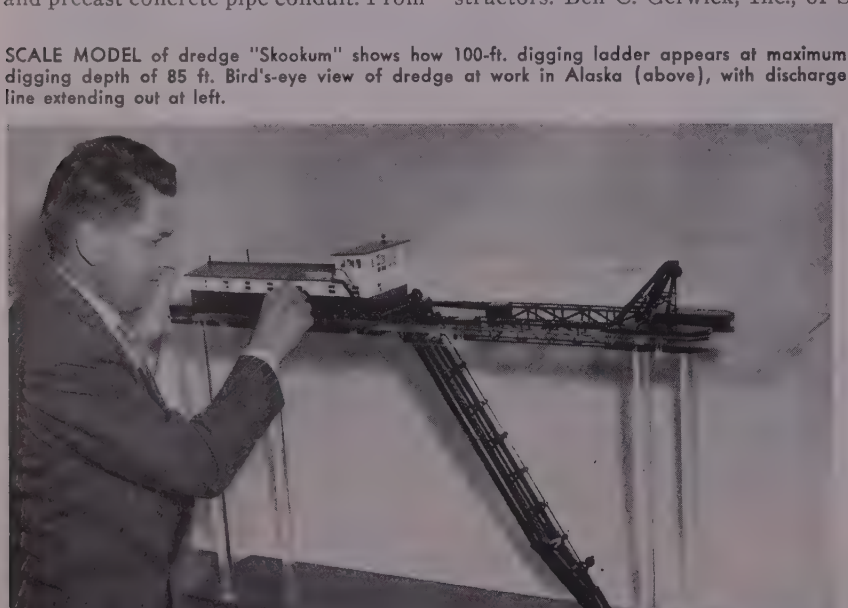
The hull incorporates 49 of the fam liar 5 x 5 x 7-ft. "CB" tanks which ar fastened together with 6 x 6 x ½-i corner angle strength members to mak 9 hull pontoons. The deck house is read ily portable, built of double plywoo panels.

Each unit of operating machinery permanently mounted on an integr structural steel base, which is bolted t the hull to permit portability. Pump en gine is a 600-hp. General Motors "Quad direct-connected to the 16-in. suctio 14-in. discharge dredge pump.

Approximately 2,000 lin. ft. of floatin pipe line will be used to carry dredge mud from the dredge to deeper portion of the lake. More than three miles o ¾-in. diameter and ⅞-in. diameter wi rope will be required for swing line anchor lines, etc.

Jean M. Allen, Los Angeles, dredg engineer, acted as consultant on the spe cial design for the digging ladder, hoi and spud gear, assisted by his associate W. E. Christison and L. M. Berner.

SCALE MODEL of dredge "Skookum" shows how 100-ft. digging ladder appears at maximum digging depth of 85 ft. Bird's-eye view of dredge at work in Alaska (above), with discharge line extending out at left.



REPORTS *from the* COURTS

By
HOWARD S. BURNSIDE
Attorney at Law
Registered
Professional Engineer

Dust damage not within liability policy

BEFORE COMMENCING construction on a highway contractor secured a liability insurance policy to cover his operation. The policy obligated the insurer to pay on behalf of the contractor all sums for damages due to bodily injury, sickness and property damage caused by accident which he became obligated to pay as the result of liability imposed on him by law or assumed by him under contract.

Thereafter in performing a highway construction contract, the contractor received in railroad cars bulk cement which was dropped into a screw conveyor and lifted to overhead tanks for delivery to open dump trucks. This cement mill was located near an occupied residence and operation of it released cement dust into the air resulting in property damage and injuries. Efforts by the contractor to control the dust were ineffective and several law suits were commenced against him. The insurance company was called upon to defend the various suits but declined to do so whereupon the contractor defended with his own counsel and sued the insurance company on the liability policy.

In the trial court the contractor prevailed against the insurer who appealed the decision to the State Supreme Court. This court viewed the situation as presenting the single paramount question of whether or not the damages asserted against the contractor were "caused by accident." If they were not caused by accident then the liability was not within the terms of the policy and the insurer had no obligation to contractor. After a critical review of the significance of the word "accident" the court could find no sudden event or unexpected happening in the four-month period of operation of the cement mill to qualify the dust damage as an accident as distinguished from planned and known course of activity. Thus the suits against the contractor did not arise out of an accident and the insurer was not obligated under the policy.[1]

[1] U. S. Fidelity and Guaranty Co. v. Briscoe 239 d 784.

Notes from eminent domain proceeding

WHEN, AS HERE, the state highway commission adopts a resolution declaring that public interest and necessity require the acquisition of certain real property for public improvements, that resolution becomes conclusive of such facts recited therein, and the same may not be disputed in the absence of fraud, bad faith, or an abuse of discretion.

"The resolution . . . did not create in (adjacent owner's) property a new right of access to a freeway to be constructed where no highway, conventional or otherwise, existed before.

"The construction of freeways or limited access highways is within the statutory authority of the state highway commission and the department of public works. Section 102, of the Streets and Highways Code empowers the department in the name of the people to condemn real property or interest therein which it is authorized to acquire.

"The appellants have no vested rights to the continued existence of a state highway in a specific location or to the permanent maintenance of a fence as a part of such highway since the highway may be relocated if, as and when necessary in the public interest."[1]

[1] People v. Thomas 108 C.A. 2d 832.

Credit protection sought through personal sale

IN THE LAST ISSUE of these Reports a case dealing with one class of contracts within the Statute of Frauds was reviewed. Another aspect of the statute is the requirement of a writing to hold one under promise to answer for the debt, default or miscarriage of another. This usually refers to the guarantor of an obligation. In the case below the statute was unsuccessfully invoked as a defense in a situation where the plaintiff had taken pains to sell to a responsible party.

In an action by a lumber company to foreclose a mechanic's lien the pleadings and the evidence described a sale of lumber to be used for a commercial structure in San Bernardino, California. The structure was to be built and operated by a small corporation which had three shareholders including the defendant who was the principal shareholder.

In negotiating the sale of lumber the corporation sought credit. The "credit manager" of the lumber company advised that he "did not sell to any small corporation because previous to that time . . . the company had taken a loss selling to small corporations because there was no single personal financial responsibility . . ." Some time later the defendant agreed to open an account and have the material charged to her which was done. When the bills were overdue and the defendant refused to pay, this action was brought and a money judgment obtained against the defendant.

In her appeal of the decision the defendant argued that she was merely the guarantor of the account of the corporation and therefore the agreement had to be in writing before she could be held liable. This contention would be meritorious if true for the statute provides that a signed writing is required to hold one who promises to "answer for the debt, default or miscarriage of another."[1] However, the court found this to be a personal sale and there was no evidence to support a guarantor arrangement by defendant of a sale to the corporation.[2]

[1] 1973 Calif. C.C.P.
[2] Suverkrup vs. Suhl, 238.

Arbitration award is binding

THE LAW generally favors settlement of disputes outside the courts. Accordingly, agreements to arbitrate and the awards of arbitrators may be enforced, subject of course to the law of each particular state. In this favorable atmosphere and because many believe arbitration of complicated and technical situations to be desirable, the arbitration clause in contracts is rather popular.

As for the recognition accorded arbitration awards by the courts it is suggested by the case at hand that an award fairly determined as agreed by the parties is enforceable although a procedure set out in the statutes was not followed.

In Pawling v. Malley[1] disputes arose during the course of construction. A foreclosure action on a mechanics lien was brought but the parties agreed to arbitrate and the arbitrator's decision would be final and would be entered as a judgment in the foreclosure action. Events proceeded along these lines. Later the loser on the award complained that the judgment based on the award was no good because there was not compliance with the provisions of the Code covering arbitration. To this the court replied: "(the agreement to arbitrate) contains no reference to the arbitration sections of the code * * * (It) provided that upon arriving at a decision, the amount determined to be due shall be entered as a judgment in favor of the party found to be entitled in the within action." Citing earlier authority, "At common law it is competent for persons to submit any question or matter of difference between them to the decision of third persons, whether it could be the subject of an action or not, and, when they have done so, the decision will be binding upon them."[2]

[1] Pawling v. Malley 237 P2d 663.
[2] Dore v. Southern Pac. Co. 163 Cal. 182, 189.

RAILROAD TUNNEL

. . . Continued from page 75

the west portal. Complicating the picture in Tunnel 5 was an indicated offset of as much as 4 ft. in transverse alignment, an entirely credible possibility in view of the extent of cave-in. Since time is most important to a railroad, and since no prediction can be made as to the length of time for repairing Tunnel 5, a shoo-fly track is being built around the hill it pierces. Rolling stock may be limited as to weight and length on this temporary length of bypass track, but traffic will be restored at an early date.

Tunnel 6 lies about 640 ft. beyond Tunnel 5, the intervening track being almost entirely on sidehill fill that was badly distorted and settled. Tunnel 6 was damaged throughout its 366-ft. length, and exhibited one instance of partial cave-in similar to that in Tunnel 4. Tunnel 6 is being daylighted.

In all tunnels, especially in Tunnel 5 (which will be restored as a tunnel throughout its length), removal of lining concrete will be necessary to a greater or lesser extent, depending in part on the degree of offset between old and new track alignment where daylighting is called for. The work involves blasting, a tricky chore in ground definitely known to be cracked and broken but where the pattern and extent of breakage is just as definitely unknown. Also, burning is necessary to cut reinforcing and free chunks of lining. The material penetrated by these tunnels is generally

SOUTHERN PACIFIC reviews its attack on tunnel damage near Tehachapi. From left: J. Corbett, vice president in charge of operations; W. M. Jaekle, assistant engineer, mainten of way; E. E. Mayo, chief engineer; D. P. Boykin, San Joaquin Division superintendent; R. Putnam, engineer of maintenance.

a tuff, requiring full support even under normal conditions. The plan is to support with timber and set reinforcing steel, which will in turn receive gunite to complete the repair. Others of the 18 tunnels in the Tehachapi range will require some pressure grouting of cracks and gunite patching.

Personnel

L. L. Wheeler and others of Morrison-Knudsen's staff on the Broad Tunnel in San Francisco appeared on scene within days and were joined J. N. Wells and George Gray, mana and assistant manager, respectively Morrison-Knudsen's Los Angeles trict. H. L. Leventon is superintend on the job. Day superintendents on earthmoving are B. L. Perkins and J Ricker, while Rex Mayfield is runn the night shift. For the Southern Pac

OP MEN stand at west end of plug in Tunnel J. W. Corbett (left), vice president in harge of operations for Southern Pacific, nd H. L. Leventon, project superintendent r Morrison-Knudsen Co., Inc.

. E. Mayo, chief engineer, is in charge, ssisted by R. W. Putnam, engineer of aintenance. D. P. Boykin is superinendent of the Southern Pacific's San oaquin Division.

ermit for $26,000,000 ydroelectric project

HE FEDERAL Power Commission as ordered issuance of a 50-year license o Oroville-Wyandotte Irrigation Disict, of Oroville, Calif., for its proposed outh Fork hydroelectric project, to be enerally centered about 25 mi. east of roville, in Butte County, Calif.

The project, which will have a total stalled capacity of 75,000 hp., will inlude two rock-fill storage dams and two oncrete arch storage dams, one already onstructed; two diversion conduits; hree concrete arch diversion dams; two owerhouses served by tunnels and penocks; and two substations and apurtenant facilities. The project will be cated in Butte, Plumas, Sierra and uba counties, Calif., on the South ork of Feather River, Slate Creek and ost Creek.

A rock-fill dam, about 150 ft. high, will e built across the South Fork of eather River creating the Grass Valley eservoir; a concrete arch dam 136 ft. igh will extend across Slate Creek, reating the Slate Creek Reservoir; and 225-ft. high rock-fill dam will be conructed on Lost Creek, creating the Sly reek Reservoir. The existing dam, also cated on Lost Creek, is about 100 ft. igh and creates the Lost Creek Reserir.

One of the powerhouses, on the South ork of Feather River, will contain one mpulse turbine, rated at 48,000 hp., dict-connected to a generator rated at 0,000 kva. The other powerhouse, also n the South Fork of the Feather River, ill contain a single 27,000-hp. turbine irect-connected to a generator rated at 2,500 kva.

Total overall cost of the project is stimated at approximately $26,200,000.

Federal Aid Airport program announced

A LIST of 52 airport construction o velopment projects to be undertake part of the Federal Aid Airport Prog in the eleven Western States, Alaska Hawaii during fiscal year 1953 has announced by the Civil Aeronautics ministration. The 52 projects invol total expenditure of $4,515,000. All p ects in the United States and territ total 169 at a total expenditure of 055,000.

Major projects ($50,000 and o scheduled in the West for 1953 ar follows:

Arizona

$301,568—Complete taxiway system apron at Sky Harbor, Pho
52,313—Construct runway extensi Flagstaff Municipal.

California

$540,590—Construct cargo bldg.; in stand-by power plant at Francisco.
375,590—Acquire land, construct ap and taxiways at Long B Municipal.
166,144—Grade and strengthen run complete sewerage at Oak Municipal.
75,000—Construct control tower at tario International.
55,381—Construct new terminal at Napa County Airport.
50,000—Construct apron and taxi at Visalia Municipal.
50,000—Construct apron, repair ways at Lindbergh, San D

Colorado

$141,353—Extend N/S (instrument) way at Pueblo Municipal
89,561—Move existing lights, in new lights at Denver Stapl
67,555—Pave runway, apron and way at Sterling, Logan Co

Idaho

$56,900—Complete terminal bldg., road, sewerage at Boise nicipal.

Nevada

$58,748—Construct runway, tax and apron at Gabbs.

New Mexico

$60,000—Pave runway at Silver Grant County.
56,860—Construct taxiway at He Lea County.
52,632—Construct and light run extension at Tucumcari nicipal.
52,632—Construct and light run extension at Santa Fe Mu ipal.

Oregon

$292,733—Install lighting, extend a at Portland International
57,500—Pave apron, surface par area, misc. utilities at Med Municipal.

Utah

$547,030—Pave new instrument run and taxiway, install lightin Salt Lake City Municipal 1.

Washington

$280,000—Reconstruct portion of NNW-SSE runway at Seattle Boeing.

104,000—Repair portion of N-S runway at Seattle-Tacoma International.

Wyoming

$50,000—Construct apron addition at Cheyenne Municipal.

50,000—Acquire land, grade and drain landing strip at Riverton Municipal.

Alaska

$86,667—Regrade strip, pave runway at Skagway Municipal.

Hawaii

$158,000—Acquire land, widen and extend runway, construct taxiway and runway at Lanai City.

100,000—Construct runway extension, stabilize runway shoulders at Kailua Kona.

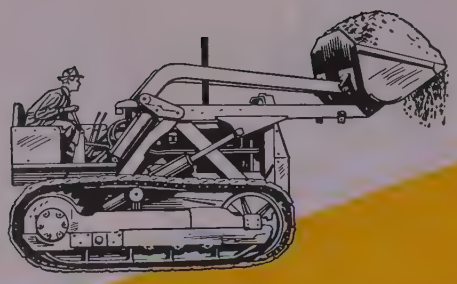
Columbia River power project permit asked

PUBLIC UTILITY District No. 2 of Grant County, Washington, has applied to the Federal Power Commission for a 24-month preliminary permit for the Priest Rapids hydroelectric project on the Columbia River, planned for initial installation of 23 generators to develop 1,725,000 hp., with an ultimate installation of 30 generators to develop 2,250,000 hp. Estimated cost of the system is $250,000,000.

The project, according to the application, would consist of a combination concrete and earth-filled embankment dam across the Columbia River at approximately mile 397, with a total length of about 11,780 ft. at an elevation of 560 ft. The spillway of concrete, occupying the present channel, will be an overflow section founded on rock, with a downstream concrete apron to provide a stilling basin. Provisions for installation of future navigation locks will be made in a short gravity non-overflow section to the right of the spillway.

The powerhouse design will permit the ultimate installation of 30 generators, at 75,000 hp. each, producing a total of 2,250,000 hp., the application states. Twenty-three generators would be installed immediately with a name-plate rating of 1,725,000 hp. The dam will create a pool extending upstream 56 mi. to the tail race of Rock Island Dam, and some 23 mi. up the Crab Creek channel.

Power developed in Priest Rapids would be used, to a large extent, to supply the growing requirements of the agricultural and industrial development in the Columbia Basin Irigation Project now being constructed by the U. S. Bureau of Reclamation, the application states. Surplus power would be delivered into the Northwest Power Pool for sale to electric utilities now engaged in the distribution of electric energy to industrial, commercial, and domestic services in the Northwest region. Surplus power sales would be handled with direct contractual arrangements between the Grant County District and local distribution agencies.



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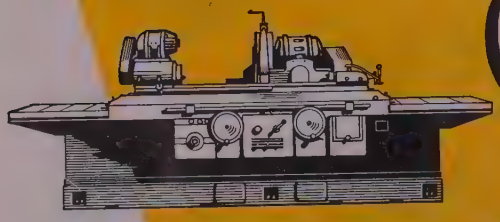

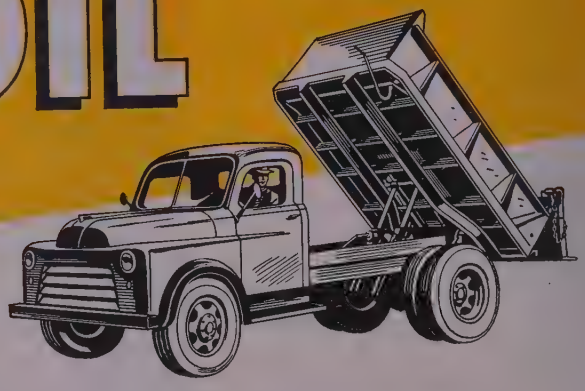

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"Labor pirating" charge upheld in Nevada

CONTENTIONS of a contractor that he was unable to meet the completion date on a government project at the Nevada atomic test base because a rival firm "pirated" his labor have been upheld by the Atomic Energy Commission. The appeal from government cancellation of his contract was made by Bruce McNeil, head of McNeil Contracting Co., based on his loss of workers because another firm paid "exorbitant overtime rates."

In a 40-page decision, an Atomic Energy Commission contract dispute panel handed down the ruling, which now has been sustained by M. W. Boyer, general manager of AEC, whose decision is final. Members of the panel found that McNeil is entitled to compensation for work performed on the atomic test installation up to Sept. 28, 1951, and that his right to proceed was unjustly terminated by the government as of that date. The panel also ruled that McNeil and his surety agents are not liable for any excess costs incurred by the government when the job was turned over to Haddock-Engineers, Ltd.

Reasons for McNeil's inability to complete the project under his $661,000 contract, as reviewed by the panel, included: (1) Loss of workmen who left McNeil to work for Haddock-Engineers, Ltd., at longer hours and resultant high overtime wages, (2) award of a cost-plus contract to the second firm after McNeil had started work under a fixed-fee contract, (3) a government order relocating construction men in two camps which brought McNeil men into contact with the second firm's higher-paid men. The panel also noted that McNeil should have worked his men on Saturdays and Sundays, instead of the actual 9-hr. day, 5-day week. Haddock-Engineers, Ltd., worked its crews a minimum 60-hr. week with many working up to 80 and more hours.

Field work starts for Monticello Dam

FIELD CREWS of the Bureau of Reclamation are at work in the rugged Putah Creek canyon west of Winters, Calif., preparing plans and specifications for Monticello Dam planned as a part of the Solano Project. Congress recently allocated $3,000,000 to the project, but specified that the money could be used only for plans and specifications until pending legislation determines whether operations should be conducted on the basis of an individual project or whether the development should be a part of California's Central Valley Project.

The Solano Project, which consists of the main dam, a diversion dam 6 mi. downstream, the Putah South canal, two wasteways, and a terminal reservoir, was authorized by the Secretary of the Interior on a finding of feasibility in 1948. Main feature of the reclamation project is Monticello Dam, a concrete arch structure 276 ft. in height above the bed of Putah Creek at Devil's Gate. The crest will measure 1,017 ft. in length. This site is near the point where Napa, Yolo, and Solano counties meet, and is 9 mi. west of Winters.

The dam will impound a reservoir of 1,600,000 acre-feet, with an annual yield of 262,000 acre-feet. The lake will be an irregularly shaped body of water 17 mi. long and 3½ mi. wide at the maximum point.

A field office for the surveys and other preliminary work has been set up in Winters and a concrete and materials laboratory is now in operation at the same site, according to Delta District Manager Carl H. Kadie. He announced that Marvin Smith and M. O. Simons, formerly employed on the Contra Costa Canal distribution system, will coordinate Bureau of Reclamation activities in the Winters offices.

Work during the next several months will consist of obtaining design data for the Monticello Dam, the Putah Diversion dam, Putah South Canal and wasteways, drilling to test foundation rock, and testing of materials for concrete aggregate.

Colorado water project added to USBR program

A PROJECT to provide an increased water supply for industrial use in connection with the development of the world's largest known deposits of strategic uranium ore and oil-bearing shales and for irrigation and domestic uses in the vicinity of Grand Junction, Colorado, has been added to the Federal Reclamation program by President Truman's approval of the Collbran Project Act passed by the last Congress.

The Collbran Project area, located in Mesa County, Colo., about 170 mi. west of Denver, is bordered on the north by the Bookcliffe Range and on the south and west by the Grand Mesa and Uncompahgre Plateau. The project will furnish in addition more than 82,000,000 kw-hr of firm and secondary hydroelectric power annually for farms, homes, communities and industries in the area at plants to be installed near Molina and Cameo, Colo.

In the aggregate, the project will furnish a supplemental water supply for 18,340 acres of land now inadequately irrigated in the Plateau Valley of West Central Colorado on the west slope of the Continental Divide, and a full irrigation supply for 2,310 acres of new irrigated land.

Engineering and operational features of the Collbran Project include the diversion of the run-off of Big and Cottonwood Creeks by pipeline as a supplemental municipal and domestic water

HERE'S HOW the first portion of the University of Washington's new $12,000,000 300-bed teaching hospital will look when J. C. Boespflug Construction Co., Seattle, completes the first-phase contract awarded to the firm on June 10. Supervising the job for Boespflug are Arnold Anderson, construction engineer, and Clement A. Smith, superintendent. Other prime contractors for the $2,750,000 construction are Wenzler & Ward, plumbing and heating, and Industrial Electric, electrical work.

supply for the valley. This water wo be utilized in its steep drop to the va from its origin on the mesa slopes to duce hydroelectric power, and a m mum flow in the pipeline of 20 sec feet would be maintained throug the year by storage regulation in Bonham Reservoir, which will be larged to six times its present size, in eight small natural lakes in the up reaches of Big and Cottonwood Cre

The water supply for the power municipal systems would be colle from the Big and Cottonwood C watersheds by two feeder canals. pipeline to convey the water from reservoirs to the valley would be proximately 44 mi. in length.

The municipal water would be de ered to an equalizing reservoir would be constructed by the water u at Grand Junction.

Two interconnected power pl would be constructed along the pipe course—the upper one near Molin 5,000-kw. capacity, and the lower on 2,400-kw. capacity near Cameo.

As the water thus diverted to Gr Valley is presently used for irrigatio Plateau Valley, it will be replaced surplus spring run-off from upper teau, Leon, and Park creeks that wo be stored until needed at the Vega ervoir, to be constructed under the gram. The Vega Reservoir on Plat Creek, with a storage capacity of 30 acre-feet, would be created by V Dam, a rolled earth-and-rock-fill st ture 140 ft. in height and 1,765 ft length at the crest. A 2-mi. feeder c will convey the flow of Leon and P creeks to the reservoir. A South Canal 30 mi. in length will be c structed to convey the water to the p ect lands.

Construction cost of the projec estimated at $16,086,000.

Western Highway Institut "approves" toll roads

QUALIFIED APPROVAL of roads in the Western States has b made by the board of directors of Western Highway Institute. The policy is a change from former opp tion to toll roads.

The Institute, a non-profit Califo corporation, functions as an engin ing and research agency for the mo carrier industry in the 11 Western St and Alaska.

Meeting in San Francisco July 23 24, WHI directors noted that toll ro "generally are unacceptable in princ because they impose charges for a s ice that should be furnished to taxpa without additional cost."

However, the directors said it is ognized that such toll road projects come necessary in particular instan They recommended that proposed roads in the 11 Western States Alaska be individually evaluated special reference to views of other groups and the following principles:

1. Toll roads shall not be located u existing public highways.

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2. Plans, locations, alignments and standards of construction shall meet with the approval of state highway departments.

3. Revenue in excess of operating cost, including interest, shall be used exclusively to retire outstanding obligations for the toll roads.

4. When the outstanding obligations are retired, toll roads shall become free public highways.

WHI directors reaffirmed the Institute's policy of opposing deliberate overloading of trucks. However, they noted that some operators must cope with unavoidable overloads, such as fuel trucks as the result of varying weights of fuel.

The board approved a motion to encourage sizes and weights of trucking equipment in Alaska similar to those permitted in the Western States.

Pelton Project stumbles on legal hurdles

THE FATE of "on-again off-again" Pelton Project on the Deschutes River in Oregon is still not settled. The State Hydroelectric Commission has denied permission to Portland General Electric to proceed with the project, which would cost an estimated $24,000,000.

This marks another chapter in a bitterly contested series of events surrounding the proposed project. The Federal Power Commission has already granted its permission to PGE for co struction of the dam plus a prelimin permit for a dam at Round Butte, the state commission has appealed FPC's decision to the U. S. Circuit Co of Appeals.

The Oregon body objects to the p posed dam on the basis of the statutes the state. The proposed structure, cording to the Commission, would v late the laws specified for dam constr tion in Oregon, in that it would be high to permit the continuance of r by salmon and steelheads. State fish a game commissions as well as spor men's groups have opposed the proj on this basis.

The State hydroelectric commiss has refused to grant a permit until th difficulties can be worked out in co pliance with Oregon laws which requ preserving the usefulness of the schutes River and the continued pro gation of the fish it contains.

PGE spokesmen indicate that action is to be taken by the compa on its FPC permit, since the state wo undoubtedly instigate further s against it.

Contractor blamed for Wyoming bridge burning

A $16,466 DAMAGE suit has been fi by the Wyoming State Highway Co mission against Inland Construction The state body claims the construct firm's negligence was responsible for destruction of a 161-ft. long, 19-ft. w bridge 10 mi. south of Newcastle Highway 85.

The Commission's complaint scribed the July 1948 blaze as follo It is claimed that an Inland truck haul a conveyor which protruded over center line of the bridge, did not g traffic proceeding in the opposite di tion a sufficient space in which to p As a result a collision ensued betw the truck hauling the conveyor and belonging to M & M Trucking which happened to be a gasoline carr After the collision the gasoline tru tank burst, spilling fuel over the bri The fuel was ignited, causing the en bridge to burn.

Estimated cost of the bridge is $14,5 but the Commission claims an additio $1,926 for detour construction and posting of a watchman at the scene.

$2,500,000 pipeline to southern Oregon

THE NEWLY-FORMED Californ Oregon Pipeline Co. has a permit build a $2,500,000, 103-mi. pipeline fr Crescent City, Calif., to Medford, O which will serve southern Oregon a

Preliminary surveys, etc., will started this summer in the hope of ting under way on the project by r year.

At present oil is floated by tank ba from San Francisco to Crescent and then trucked into Oregon. The plan calls for delivery of 7,000 bar daily with one pumping station.

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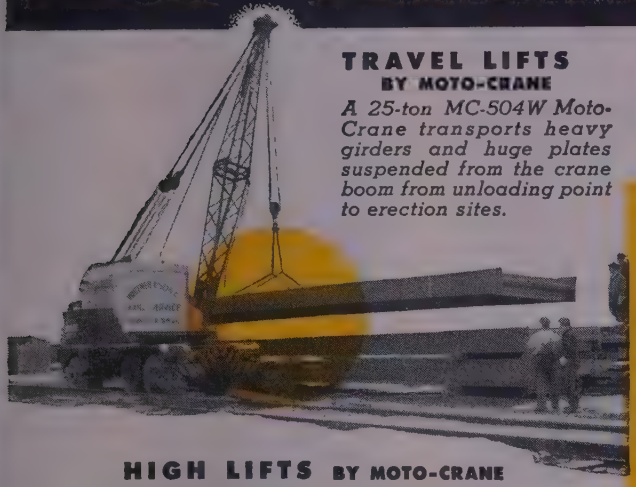

TRAVEL LIFTS
BY MOTO-CRANE

A 25-ton MC-504W Moto-Crane transports heavy girders and huge plates suspended from the crane boom from unloading point to erection sites.

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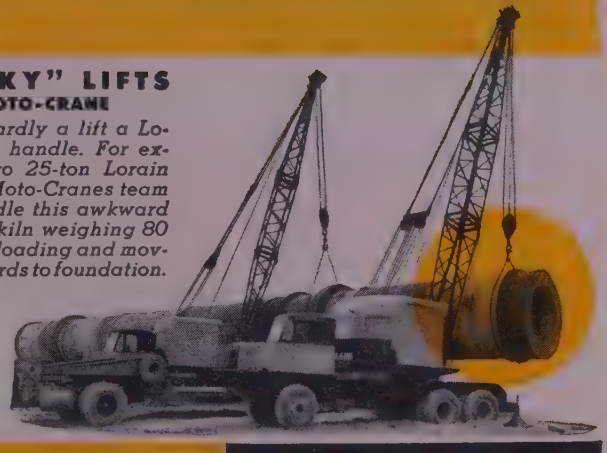

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High-gear research for salt water purification

A PUBLIC-PRIVATE salt water purification research program is being launched with President Truman's approval of H.R. 6578. Goodrich W. Lineweaver, Assistant Commissioner of Reclamation, has been designated to head up the activity. Congress has appropriated $125,000 to finance coordination work until the program can be reviewed next year.

The program calls for scientific and practical research to develop means to bring down costs of making fresh water from salt water to within reach of irrigated farms, industries and cities in water-short areas over the United States which have access to the seas or other salty water sources.

It calls also for research into purifying brackish and alkaline waters in inland areas to provide additional irrigation supplies throughout the Western States.

The program is to be carried on through cooperation with universities, private industries and other organizations, in cooperation with Government agencies, under the leadership of the Secretary of the Interior. The limited funds appropriated will curb the extent of grants and contracts with public and private agencies.

Extensive technological research has already been done in purifying salt water and the defense agencies have met the problem as emergencies required. Fresh water can easily be made by distilling sea water—it can even be done with a tea kettle. Ocean-going ships do it as a common practice. But the big question is how to do it cheaply enough to make the process practical from an economic standpoint, as a source of large quantities of fresh water.

Fresh versus salt water battle resumes

THE WAR against underground seepage of ocean water is once again under way at Manhattan Beach, Calif.

With the receipt of the last waiver required by the California State Water Resources Board, the engineering experiments can proceed once again. The waiver was filed by the California Water Service, which was the sole holdout in the battle to absolve the project from any damages caused.

Work on the project, which consists of drilling wells and laying pipe to shoot fresh water underground and form a barrier against sea water intrusion, was halted when damage suits were threatened by fresh water well owners in the area. The Los Angeles Flood Control District is undertaking the project under a state contract.

Although filing the waiver with the State board and thereby clearing the way for the experiments to resume, the California Water Service specified that its waiver reserved the right to call a halt to the tests if too much salt water permeated fresh water wells as a result o the experiment.

New executives for American Pipe

AMERICAN Pipe and Construction C announces a number of additions to an changes in the executive staff of th company. These changes, which becam effective August 1, are as follows:

William A. Johnson, for more tha thirty years an active figure in the in dustrial and commercial life of Souther California, relinquishes the presidency o the firm, but remains as chairman of th board and member of the executive com mittee. Robert V. Edwards, former sales vice president, moves up to execu tive vice president.

Dudley A. Dunkle is vice president i charge of industrial and labor relation and general administrative function and Elliott E. Brainard, who recentl joined American after a number of yea as an executive of Lock Joint Pipe Co becomes sales vice president.

W. Allen Grubb is vice president an general manager of the Northwest Div sion of the Portland District. Fred J Jenkins is vice president in charge o production and construction with Erne F. Bent as vice president on general a signments. Grant Crawford is secretary treasurer.

H. L. White, chief engineer, becom a vice president in charge of the Sa Francisco Bay Area. No change in con

any policy is planned according to officials.

American Pipe and Construction Co. has for many years been a key supplier of various and widely used types of large diameter prestressed and reinforced concrete pipe and related products as well as being active in the field of water line construction.

Site not yet in fight in Colorado

ANOTHER DAY, another detour for the Colorado State Highway Department as far as locating a site for its new $2,000,000 departmental office building is concerned.

A number of violent protests from the citizenry again faced State Highway Engineer Mark U. Watrous when he decided upon a site in the vicinity of South University Blvd. and East Iowa Ave., and attempted to get the Board of Adjustment Zoning to approve the location.

All of Watrous' trouble with various citizens groups seems to stem from the belief that the Department's administration building will be an eye-sore and that residents of the area will be plagued by heavy equipment rumbling along the streets. No matter how often Watrous explains that this building is to merely house offices, that it will sit in the middle of a 9-ac. tract and be properly landscaped, and that the department does not plan on expanding to the fringes of the proposed tract, waves of protest greet him.

Meanwhile, Watrous did succeed in winning his case before the Capitol Building Committee for decentralization. W. M. Williams, planning director, urged centralization of state facilities, but the Committee adopted Watrous' suggestion that since the immediate capitol area was congested, decentralization was imperative.

Though Watrous assured the committee that the highway department had no intention of locating outside Denver, available space seems always to be in contest.

Construction to boom at Idaho atomic center

CONSTRUCTION of facilities related to the eventual development of nuclear propulsion for aircraft has been authorized by the U. S. Atomic Energy Commission. Testing facilities will be built at the AEC's National Reactor Testing Station in Idaho.

The new facilities are estimated to cost approximately $33,000,000 and construction is scheduled to begin this summer, it was announced by AEC General Manager M. W. Boyer. During the peak of construction about 1,000 workers will be employed.

Preliminary design studies for the AEC ground test station have been performed by the Parsons-Macco-Kiewit Co., Los Angeles, under a subcontract with General Electric. Design and construction of the ground test facilities will be administered by the AEC's Idaho Operations Office.

Ventura County plans two storage dams

THE UNITED Water Conservation District of Ventura County, Calif., is planning the construction of two dams to aid the preservation of the county's water supply.

A limit of $15,000,000 has been set upon the cost for the two structures—one to be at the Topa Topa site and the other on Piru Creek at San Feliciano.

The present difficulties facing the plan are, of course, whether two dams can be built without exceeding this limit. Engineer Julian Hinds states that the District has but two alternatives in the event that funds are insufficient. It can either lessen the size of its proposed reservoirs, which it does not want to do, or it can request more money, which it also does not want to do.

Ultimately, the funds for the dam will be voted upon by the district.

Go-ahead for Seidelhuber Steel plant additions

SEIDELHUBER Steel Rolling Mill Corp., Seattle, Wash., has received a Necessity Certificate from the Defense Production Administration in the amount of $1,403,712.

The DPA's action certifies that the firm's facilities are necessary in the interest of national defense during the emergency period and that 55% of the cost of construction is attributable to defense purposes.

Facilities covered include the scrap-yard equipment and craneway, and the complete electric melt plant, completed early this year. Tax amortization also covers the firm's new 10-in. merchant bar mill, at present under construction.

This certificate coupled with a Reconstruction Finance Corp. loan of $760,000 will permit the firm to enlarge its rolling mills and produce large structural steel bars and forging billets. The firm will also produce alloy steels and special shapes.

American River diverted at Folsom Dam site

DIVERSION of the American River around the site of Folsom Dam and excavation for the main dam foundation began late last month. Crews moved into the river bottom immediately after completion of an earthfill cofferdam upstream and diversion of about 4,500 second-feet of river flow through the recently completed 1,500-ft. diversion tunnel around the right abutment. Merritt-Chapman Scott Corp., and The Savin Construction Corp. are joint holders of the $29,444,000 prime contract for the project. The tunnel was completed under a $642,690 contract held by T. E. Connolly, Inc., San Francisco.

It is expected that channel excavation will require removal of as much as 50 ft. of river gravels, hydraulic mining debris from an earlier day in California's h tory. The excavation work started ab 100 yd. downstream from the act foundation site. Crews will work on incline until bedrock is reached. Ten tive plans call for completion of chan excavation to allow placing of concr to begin in October.

Major expansion at Hanford atomic works

"BOOM TOWN '52", is sure to be t area around Richland, Kennewick a Pasco, Wash., as the multi-million d lar expansion of the Hanford Works gins to once again take shape.

Kaiser Engineers, division of Hen J. Kaiser Co., Oakland, Calif., holds contract for construction of large p of the expansion activities and will gin hiring construction workers Septe ber 15. Estimates give the peak total workers at 11,000 by late in 1953.

Hanford expansion plans, with G eral Electric Co. as operating contract will take an estimated $411,000,000 of $2,986,000,000 allotted by Congress atomic projects.

The nature of the work is withheld security reasons, but it is known t General Electric will design the ba plan and do the complete design for c tain intricate parts of the plutoni plant project.

During World War II, the area und went a tremendous construction bo for the atomic energy program.

Ten big pumps for Colorado River aqueduct

DIRECTORS of the Metropolitan Water District of Southern California have authorized the purchase of ten pumps, each with a capacity of 90,000 gal., for installation in the district's five pumping plants on the main aqueduct for Colorado River water.

Each pumping station will get two of the super pumps and this will increase the amount of water brought into Los Angeles and surrounding areas.

The total cost of the pumps will be $1,548,620. Worthington Corp. and Byron Jackson Co. will supply four pumps each, while Allis-Chalmers Co. will supply two. A previous board action allotted $1,811,200 for motors to drive the pumps. General Electric Co. will supply the motors which will operate on Hoover and Parker Dam energy.

Cutting torch plus creosote: bridge burns

FIRE virtually destroyed the old San Gabriel Blvd. bridge across the Rio Hondo River in Los Angeles, Calif., when a cutting torch was used close by freshly applied creosote.

The bridge, which was erected in the early 1920's as a temporary structure, was undergoing widening and reinforcing operations when the accident occurred. A 35-man county fire fighting squad battled the blaze. County officials estimate the damage at around $75,000.

Send-off blast at Palisades Dam

APPROXIMATELY 1,500 persons jammed the north bank of the Snake River near Irwin, Idaho, to give a rousing send-off to Palisades Dam construction, when the initial blasting began.

Soon after the first blast a big dragline bucket began operations for the diversion tunnel. Diversion of the stream is planned this fall by the Bureau of Reclamation to permit stripping and placement of the initial embankment.

The $76,000,000 Palisades Project is a multi-purpose undertaking which will provide flood control, irrigation and power.

Nimbus Dam project under way

WORK IS now in progress on the Bureau of Reclamation's Nimbus Dam and power plant, located about 14 mi. east of Sacramento, Calif., on the American River. (See page 132 of this issue for unit prices).

Excavation is under way on the north abutment of the 800-ft. long concrete structure. A reservoir of 8,500 acre-feet capacity will be created when the project is completed in 1954, and this will be an afterbay for Folsom power plant, 7 mi. upstream. Approximately 13,500 kw. of power will be added to the Central Valley Project power system by the Nimbus Project.

Street sweeper gives dog the brush-off

A MUNICIPAL street sweeper in Glendale, California, its brushes whirling along the gutter in the usual thorough manner, recently went one step too far. It swept up the dog as well.

The sweeper operator, interrupted in his work by the shouts of Susan Lewis, 10, and her brother Randy, 6, ground to a halt and threw open the machine's hopper. Debe, a 5-yr. old, 35-lb. English bulldog and the house pet of the Lewis youngsters, lay in a confusion of rocks, dirt and brush. Removed from her trashy surroundings to the antiseptic environment of a veterinarian's office, Debe was found to have suffered scrapes and bruises in her brush with the sweeper but was otherwise unhurt.

How the dog made the round trip without further injury baffled the sweeper operator. From the shaggy embrace of the revolving brush, she had been dumped without ceremony on a studded conveyor belt that led to imprisonment in the trash hopper. Since this mechanism often chokes on rocks the size of baseballs, it may be considered to have been extraordinarily gentle in its treatment of Debe, a bulldog.

Contractor uses derrick to transport 125-ton tow boats from dock-to-water

LAUNCHING 125-ton steel tow boat hulls by reaching out and plucking them from a dock, then placing them into the water was a simple job for the Smith Rice Company, San Francisco marine contractors.

Marking the first time vessels of this size were launched in such a manner—usually hulls this large are built in ways and launched by sliding into the water—the project was accomplished by use of two barge-mounted derricks with a long reach. Versatility in boom movement under load is made possible by working the derricks in tandem.

As their ways were already occupied with other craft under construction, the Pacific Coast Engineering Co. elected to build the two tow boats on the end of their Alameda dock and launch them by the lift method. To facilitate handling the prefabricated sections with their own crane during construction they built the boats so that when completed they were resting at an angle of 45 deg. to the end of the dock.

Each of the two hulls, 95 ft. long and containing the shaft propeller and rudder, was launched separately. Superstructure, engine and other equipment were to be added after launching.

The launching operations, which were completed within 2 hr., consisted basically of rigging slings around a hull, lifting, aligning hull with the edge of the dock, backing barges away from dock, and lowering hull into the water. When the first hull was in the water a tugboat pulled it from between the barges and the dock to permit the barges to move into the dock for launching the second hull.

Rigging hulls

To lift the hulls, slings were placed under them at four points where transverse bulkheads extended solidly through them to prevent any caving action during the work. Hulls were protected from scratching by inserting wood blocks between hull and sling. Two sets of four slings were used. One set was placed about 25 ft. aft of the bow and the other was placed about 25 ft. forward of the stern. The stern slings, where there was more weight due to the presence of the shaft and propeller, consisted of two 2-in., 44-wire cables passing under the hull from gunwale to gunwale, and two 1½-in. 50-wire cables, attached to the ends of the under cables with U-bolts, connecting them, and providing a loop at each side of the hull for the derrick's hook. The forward sling consisted of two 1½-in. 50-wire cables under the hull and two 1½-in. 60-wire slings linking them to the hook.

Derricks

As the boom of one derrick is only 32 ft. from the edge of the barge it is mounted on and the other is 52 ft., it was possible to fix them 82 ft. apart when setting them in against the edge of the dock. The proximity of the booms permitted a straight lift with each unit raising its proportion of the weight. It further permitted aligning the hulls with the side of the dock by booming in, or raising the height of the boom rather than swinging it horizontally. While holding the hull aloft during the launching the equal sharing of the load provided maximum safety to the equipment while lines holding the barges to the dock were cast off and the barges, held in tandem, utilized lines attached to anchors set out in the water to pull themselves away from the dock far enough to provide space to set the hulls down in front of them.

Derrick description

The derrick used for the aft section of the hulls (Smith Rice #3) is classed as a swingline A-frame with stiff leg and has a capacity of 100 tons. It has a lifting radius of 76 ft., that is, it can apply its full capacity for lifting up to 76 ft. from the base of the boom. This derrick was rigged with 11 parts of 1-in. cable. The derrick for the forward part of the hulls (Smith Rice #4) is classed as an A-frame boom stepped 38 ft. above the water. (Base of boom is 38 ft. above water level.) Rigged with 9 parts of 1¼-in. cable this derrick has an 80-ton capacity and 72-ft. lifting radius.

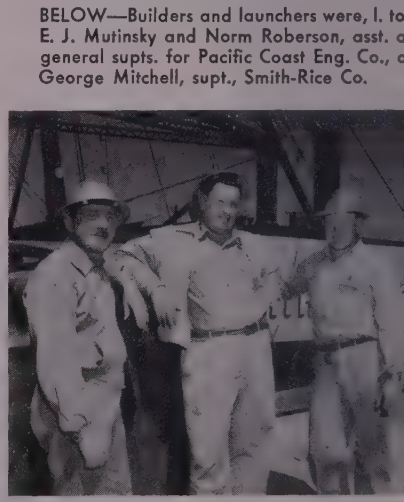
Rigging for the lift was primarily Macwhyte wire rope.

Personnel

George Mitchell was general superintendent for Smith Rice Company. Pacific Coast Engineering Company's general superintendent Norm Roberson was in charge of tow boat construction with E. J. Mutinsky acting as assistant superintendent. The tow boats were constructed for Ship Owners and Merchants Towboat Co.

ABOVE—Prior to backing derrick barges aw from dock to provide water area for floati steel hull craft being launched was alig with edge of dock.

BELOW—Builders and launchers were, l. to E. J. Mutinsky and Norm Roberson, asst. g general supts. for Pacific Coast Eng. Co., g George Mitchell, supt., Smith-Rice Co.



P. G. & E. awards multi-million dollar contract for tunnel job which will initiate Pit River Project

THE WALSH CONSTRUCTION Company won the contract for construction of a multi-million dollar tunnel, the first major element of Pacific Gas and Electric Company's proposed new hydroelectric development on the Pit River in Shasta County.

The tunnel will divert water from the river to the Company's proposed new Pit 4 Powerhouse. It will be 4 mi. long, 19 ft. in diameter and concrete-lined. The tunneling will take an estimated 2½ years and a peak labor force of 350 men.

Preliminary work already is in progress, including construction of an access road and a power line. Separate contracts are to be let later for construction of the powerhouse, penstock and generating equipment.

Pit 4 will have a generating capac of 84,000 kw. and its overall constructi cost is estimated at $25,000,000. It w be located approximately 1 mi. upstrea from the existing Pit 5 Powerhou diversion dam.

The construction work is begi ni under a temporary go-ahead from t Federal Power Commission on P. G. E.'s application for amendment of existing license to include the Pit 4 pr ect. The company also has an appli tion pending before the Commission f a license to construct Pit 6 Powerhou a 60,000-kw. plant estimated to cost $2 000,000. The latter would be located 7 r downstream from Pit 5 Powerhouse.

P. G. & E. Pit River system alrea includes five hydro plants—Pit 1, 3 an

nd Hat Creek 1 and 2. With the proosed additions of Pit 4 and 6, the total apacity of the seven plants would be 40,000 kw.

Next step under way t Canyon Ferry Dam

THIRD STAGE diversion operations at anyon Ferry Dam, Mont., are in the rocess as Missouri River waters are orced through temporary diversion ibes and river outlets.

Shortly, concrete gates will close the ace of Block 12 which remained shalow during second-stage diversion oprations. When the block is filled, by 5-ft. fts, water will be forced through the iversion tunnels and permanent outlets n the dam face.

Engineers are planning the timing chedule in cooperation with Montana ower Co., which will control the level f Hauser Lake.

Wyo. looks ahead to now removal chores

THE WYOMING State Highway Department is the purchaser of a pair of V-type snow plow blades with wings for se in the Cheyenne and Newcastle areas his winter. The devices are designed to e attached to all-purpose graders for now clearing operations where the epth of the snow is not prohibitive.

These attachments cost about $2,400, whereas the larger snow plows cost bout $15,000. County highway departnents have had good luck with the lades and wings in shallow snow clearng operations.

Corps shifts work load n two Wash. districts

N A "share the work load" move by the Corps of Engineers in the Pacific Northwest, certain air base work, previously dministered by the Walla Walla, Wash., district will be handled by the Seattle district. There will be no effect n employment.

Great Falls Air Base, Great Falls, Mont., and Geiger and Fairchild fields ear Spokane, Wash., are involved.

Walla Walla district will still retain arson Air Force Base, Mountain Home ir Force Base, Camp Hanford, Pasco ngineer depot and Umatilla Ordnance epot.

Copter delivered to BPA or fast field work

THE FIRST of two Bell Aircraft helicopters is now in the hands of Bonneville Power Administration, which will se it to check its vast power system and speed up leak detection, etc.

This model, 47-D, is of the all-view ype and will seat three people. Since 948 BPA has utilized rented helicopters or patroling its network, stringing new ines in rugged country and repair oprations. It will continue to rent some of he 'copters for operations east of the Cascades.

Dozer runs amuck— causes injuries, damages

A DRIVERLESS BULLDOZER at San Diego injured two people and made a shambles of five houses, two garages and an automobile recently. It happened late on Sunday night. The machine plunged without warning into one house, pushed its way into the bedroom where a man and his wife were sleeping and propelled bed and all into the yard. The man lost an arm and his wife was badly bruised. Police finally caught up with the dozer while it was pushing against a utility pole. It had traveled a mile and a half, leaving its trail of damage. Two boys were arrested later and admitted driving the bulldozer around a nearby construction project. They left the machine without stopping the motor.

S. O. C. plans new unit for So. Calif. plant

STANDARD OIL Company of California will build a new catalytic cracking unit at its El Segundo refinery to convert heavy fuel oil into aviation gasolines and high grade automotive oils.

The new unit will include a feed stock preparation unit capable of handling 54,000 bbls. of the heavy fuel daily. The unit will include facilities to recover H2S gas for conversion into sulphuric acid. Actual construction will begin in mid-1953.

NEW BOOKS

SURVEYOR'S FIELD-NOTE FORMS (3rd ed.)—Bardsley and Carlton

No surveyor need be told the importance of accuracy in his field-note forms, but this little book can certainly aid him in keeping his notes in a legible and systematic manner. An orderly approach is taken in the presentation of the material, since it proceeds in the order one would normally take in field work. Engineers and surveyors will find the index ideal for reference since subjects are grouped in series under main subject headings. Here is a guide to notes that will make your technical information more readable and perhaps more accurate. Published by International Textbook Co., Scranton, Pa. 119 pages, 5 x 9½. Priced at $3.00.

A GEOLOGY FOR ENGINEERS (3rd ed.)—Blyth

F. G. H. Blyth has presented this book in the interests of a closer working unity between the geologist and the engineer. The text is aimed at acquainting the engineer with the basic fundamentals of the geological science first, and then explaining certain elements of the field which will be involved in his work. There is an effort to inform the engineer of the terminology common to geolo so that consultation will be easier. this edition material has been added the section on dams and the section tunneling. Published by Edward Arn & Co., London. 336 pages, 6 x 9. Pric at $4.75.

UNIFORM BUILDING CODE (1952 ed.)

There is, of course, no need to ela orate upon the splendid purposes of t Uniform Building Code, since it has lo been considered an important st toward the elimination of favoritis politics in building, variances in pra tices, and unnecessary costs. This is t latest edition. It is filled with valua information presented in indexed, grap ically portrayed form, for easy referen to any specific point. Published by t Pacific Coast Building Officials Co ference, 1952. 342 pages, 5½ x 8. Pric at $3.75.

FARM GAS ENGINES AND TRA TORS (3rd ed.)—Jones

Fred Jones, an authority in the fie and the author of this book has revis a great deal of the material in the fi two editions to bring this up to date. H has tried to answer the need for a mo technical discussion of farm power, an in so doing, he offers information on t use of LP gas as a tractor fuel, alo with information on hydraulic transmi sion and hydraulic controls. The book fully illustrated and diagrams appe throughout to supplement the te Though principally designed as a te for senior agricultural engineering st dents (and, therefore, dwelling on t internal-combustion engine) there interesting tractor information here f the field. Published by McGraw-H Book Co., New York. 489 pages, $6.00.

MANUAL OF STRUCTURAL DESIG (3rd. ed.)—Singleton

Jack Singleton, prominent profe sional engineer, brought out the fi edition of this book as a ready referen for engineers on structural design. H thought it would serve as one book which the engineer could count up finding answers to the day-to-day ty of problems in design which he face and for which he would normally ha to search through several books. Th latest edition serves to incorporate late developments in the field. The auth stresses that the book is aimed at wor ing engineers who are actively engag in their fields. Published by H. M. Iv & Son, Topeka, Kan. 336 pages, 7 x Priced at $6.00.

ORGANIZING AND FINANCIN BUSINESS (5th ed.)—Bonnevil and Dewey

This is a fringe book for the field, b one which certainly has its place in a businessman's library. This edition i corporates facts about the new law amended laws, and practices which ha bearing on the business scene, in ad tion to giving the important backgrou

material which many people know lightly but perhaps not well enough. There is a reference chapter on sizing up your field, beginning a business, choosing its form, the corporate organization, etc. Later chapters discuss financing with borrowed capital, managing financing with stock, and much more information. This can easily be your business practice reference book. Published by Prentice-Hall, Inc., New York. 401 pages, 6¼ x 9¼. Priced at $6.35.

HOW TO USE HAND TOOLS—Reid

Tools, how to buy them, use them, maintain them, etc.—it's all here in this convenient book. There is a myriad of up-to-date information on tools in this book and many tips of the trade which will help you get more for your money and more for your time. Illustrations and diagrams are contained in the text. Published by Thomas Y. Crowell Co., New York. 306 pages, 5½ x 8¼. Priced at $3.50.

HOW TO DESIGN AND INSTALL PLUMBING, 3rd Ed.—by Matthias and Smith

Authors A. J. Matthias, Jr., and E. Smith, Sr., have packed a good amount of practical information into this book. It is up to the minute in new developments in Uniform Plumbing Code, utilization of new materials in plumbing systems for many types of structures and in giving complete specifications and blueprints for the design of a plumbing system for a 6-room modern house. All of the information contained in the book is of the practical nature which makes interesting and easy reading. Illustrations and diagrams of techniques and equipment appear throughout the test. Published by the American Technical Society, Chicago, Ill. 444 pages, 5½ x 8½. Price $3.95.

DICTIONARY OF ARCHITECTURE—Saylor

Here is a handy pocket-sized volume in which one can find the spelling, pronunciation, and concise definition of the terms met in the study, historical reading and practice of architecture. Plates at the end of the dictionary illustrate impossible-to-describe objects. The author is editor of "Jornal of the AIA," Published by John Wiley & Sons, New York. 226 pages, 4½ x 6½. Price $4.50. along the ladder rungs.

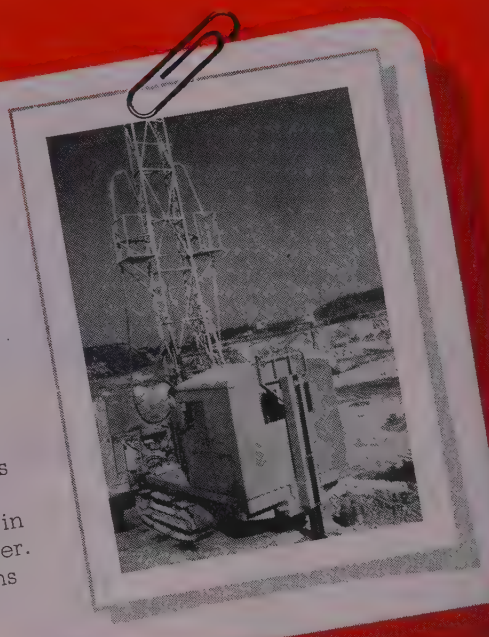
Books reviewed in this section are made available by J. W. Stacey, Inc., retailers of technical books (stores at San Francisco and Denver). You may obtain a copy of any book reviewed this month by sending an order to J. W. Stacey, Inc., c/o Western Construction, 609 Mission St., San Francisco 5, California. C.O.D. orders will be accepted.

GM Diesel
Case History No. 5011-27

USER: Thomasville Stone and Lime Company, Thomasville, Pennsylvania

INSTALLATION: 3-71 and 6-71 GM Diesels power Joy Heavyweight Champion blast hole drill; 3-71 for rotary and propulsion, 6-71 on compressor and "pulldown."

PERFORMANCE: Replaced 5 small drills. Maximum footage with previous equipment 15 feet per drill in 6¼ hours; with new equipment 180 feet in 6¼ hours. Reduces drilling manpower. Fuel consumption: less than 7 gallons per hour (both engines).



This Diesel replaces five drills

— and more than doubles the footage

Case after case proves that *any* machine with General Motors Diesel power is a *better* machine —gets *more* work done at *lower* cost. Using General Motors 2-cycle design—this Diesel packs more power per pound, runs smoother and accelerates faster. Result—greater production per hour! With most parts interchangeable and easy to replace—GM Diesels take less time out for servicing, cost less to maintain. Check it with other operators—*prove it for yourself* by specifying GM Diesel power in any equipment you buy.

DETROIT DIESEL ENGINE DIVISION
GENERAL MOTORS, DETROIT 28, MICHIGAN
SINGLE ENGINES... Up to 275 H. P. MULTIPLE UNITS... Up to 800 H. P.

It pays to ***Standardize*** *on*

GM
GENERAL MOTORS
DIESEL POWER

ENGINEERS ON THE MOVE

Lt. Col. Robert L. Trout will head up the Denver, Colo., area for the Corps of Engineers. Trout will have charge of both the civil works and military construction programs in the area.

* * *

James B. Hays is now in Nechaka, British Columbia, as consultant and chief engineer for International Engineering Co., Vancouver. He is in charge of engineering on the construction of 312-ft. rock-fill Kenney Dam. Hays was formerly project manager, Morrison-Knudsen Afghanistan Co., as consultant to the Israeli government. At one time he served with Tennessee Valley Authority as construction engineer and project manager, and with the Bureau of Reclamation on Hoover Dam.

* * *

Two more engineers in the Irrigation Construction Division of the Columbia Basin Project have been honored with superior accomplishment awards. **Althe Thomas,** head of contract construction section No. 11 at Eltopia, and **John W. Stone,** supervisory construction inspector general at Othello, were the recipients. Thomas received his award for economically administering a series of major construction contracts over a large geographical area. Stone was honored for the general excellence of his performance with special emphasis on the safety record of contracts to which he has been assigned.

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R. A. Young is resident engineer for the Bureau of Reclamation on the Nimbus Dam and Power Plant unit of the Central Valley Project.

* * *

Col. Charles J. Joffus replaces **Lt. Col. John K. Addison** as executive officer for the Missouri River Division, Corps of Engineers, Omaha, Neb. Addison was recently assigned a tour of duty in Alaska.

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Fred E. Lange resigns his post as assistant director of public works in Vallejo, Calif., to become manager and chief engineer of the Vallejo sanitation and flood control district.

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Bernard P. Bellport is construction engineer for the Bureau of Reclamation's Solano project in California. Supervising construction of the 276-ft. high Monticello Dam on Putah Creek will be Bellport's main duty in his new position.

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William A. Smith and **H. L. Cooper,** California State Division of Highways assistant maintenance engineers, were honored by fellow employees at a Sacramento, Calif., dinner on their retirements. Both men have long service records behind them—Smith serving 33 years and Cooper 27.

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Howard I. Stites is the new assistant to the Los Angeles, Calif., Board of Public Works. Stites comes to his new post from his position as city manager of Burbank.

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Robert E. Dean, engineer of the soil conservation service, is temporarily assigned to Valley County, Mont. Dean is scheduled to head flood rehabilitation activities.

* * *

Nielsen

Taylor

E. G. Nielsen will succeed **E. A. Moritz** as regional director of the Bureau of Reclamation's Region 3, Boulder City, Nev. Nielsen has been assistant regional director since December 1950. Moritz is retiring after 47 years with the Bureau. He will continue to be on call as a consultant. **Wade H. Taylor,** regional power manager, will be promoted to fill the assistant regional director post, previously held by Nielsen.

* * *

I. B. Miller succeeds **C. O. Erwin** as New Mexico State Highway Department's chief maintenance engineer. Erwin recently replaced **Burton Dwyre** as state highway engineer.

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Emrys E. Lewarch becomes Seattle, Washington's traffic engineer, succeeding **J. W. A. Bollong,** who retires. Lewarch has been associated with the department since 1941.

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Paul L. Nichols is now chief engineer for the Sonoma County Flood Control District, Calif. Nichols was at one time a member of the Nevada State Highway Department.

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The City Council of Lewiston, Idaho, met recently and the first item on the agenda was the firing of **W. P. Hughes,** city engineer for 27 years. No charges were leveled against Hughes at the dismissal hearing.

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Carter S. Showell is now assistant resident engineer, relocation projects, Corps of Engineers. Showell is now at Riverdale, No. Dak., working on bridge construction and railroad and highway relocation. He was previously with the Corps at Delano, Calif.

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Left: Corps of Engineers new Alaska district chief. (See item below.)

Col. Louis H. Foote is now district engineer in Alaska. He replaces **Col. L. E. Seeman.** Foote has three years of previous construction experience in Alaska and the Aleutians during World War II.

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Lt. Col. Erland A. Tillman is now district engineer of the Fort Peck District, Corps of Engineers. Tillman succeeds **Col. R. E. York** in his new post.

* * *

Col. William Whipple, who established the office of district engineer in Walla Walla, Wash., in 1948 will now be assigned to the executive officer post in the civil works division, chief of army engineers. Whipple was transferred from Walla Walla in 1950.

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New vice president of Walter Kidde Constructors is **Taylor Milton.** He will

CALENDAR OF MEETINGS

September 8-10—Associated General Contractors of America, Meeting of the Board, White Sulphur Springs, W. Va.

September 29-October 2—American Institute of Steel Construction, Empress Hotel, Victoria, B. C.

October 6-9—Federation of Sewage and Industrial Wastes Association, Hotel Statler, New York, N. Y.

October 19-21—Associated Equipment Distributors, Regional Meeting, Santa Barbara Biltmore, Santa Barbara, Calif.

October 27-31—American Water Works Association, Calif. Section, Huntington Hotel, Pasadena, Calif.

October 31—Forestry Products Research Society, Fall Meeting, Sacramento, Calif.

December 9-12—American Association of State Highway Officials, Annual Meeting, Kansas City, Mo.

continue as vice president and chief engineer of Walter Kidde Engineer-Southwest, Inc., a subsidiary with headquarters in Houston, Tex. Milton was with Austin Company before joining the Kidde organization several years ago.

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H. J. Brunnier, prominent consulting structural engineer, San Francisco, Calif., is serving as president of Rotary International for the 1952-1953 fiscal year.

* * *

J. M. Sturgeon is with the California State Division of Highways near Salinas, Calif., as resident engineer for District V on construction of the Salinas Freeway.

I. T. Whistler, employee of the Walker River Irrigation District in Nevada, since 1922, is retiring this month.

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Robert E. Sharp, 31, youthful city manager of Anchorage, Alaska, resigned his position recently with the announced intention of seeking another field.

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Kaiser Engineers Division of Henry J. Kaiser Company is establishing headquarters at Richland, Wash., to initiate work on a major construction contract involving expansion of the Hanford operations of the Atomic Energy Commission.

John H. Tacke, resident manager for Kaiser Engineers, and a group of the company's engineering and construction chiefs assigned to the project, have arrived in Richland to administer the new construction program.

Tacke was accompanied by **L. H. Oppenheim,** assistant general manager of Kaiser Engineers, who arrived from Oakland to complete organization plans.

Oppenheim said that preliminary work has already started at temporary offices located in Building 10 in the North Richland area, and that applications for employment are now being received.

Kaiser Engineers are scheduled to begin actual construction work late this fall, with hiring of construction workers commencing about October 15.

Personnel for engineering, purchasing, office and other departments necessary to staff the headquarters will be hired immediately. Erection of construction offices and other service facilities at the work site will also be started as soon as possible.

According to the AEC, the maximum construction force required for the total new Hanford expansion program, including the work to be done by Kaiser is expected to be approximately 11,000 and will reach its peak late next year or during the first half of 1954. Kaiser Engineers also announced that sub-contracts will be entered into for certain phases of the work and that a substantial sum will be involved.

The company currently employs approximately 7,000 men, including a staff of 800 in the home offices at Oakland, Calif.

The firm is well known for its accomplishments in the Northwest, dating back to Grand Coulee and Bonneville dams, the shipyards at Portland and Vancouver, Washington, and more recently for the erection of aluminum and cement facilities in Tacoma, Spokane and Seattle. Kaiser is now completing construction of Detroit Dam on the Santiam River at Mills City, Oregon.

Tacke is a veteran engineering and construction man who first joined the Kaiser organization in 1931 when the Six Companies started building Hoover Dam. The 52-year-old resident manager for the new Hanford construction program subsequently worked in a supervisory capacity in the construction of the dam and powerhouse at Grand Coulee and the Portland shipyards.

Before coming here, Tacke completed conversion of the mammoth Willow Run plant to production of C-119 aircraft and tooling up for the C-123.

Other key members of the Kaiser organization who are already in Richland to staff the Hanford project are **J. Eldon Lents,** administrative manager; **G. Gale Wilson,** assistant resident manager; **Jack O. Murray,** director of industrial relations; **Robert C. Hammersmith,** project engineer; **H. Robert Putland,** procurement manager; **M. L. "Red" Fulton,** general superintendent of construction, and **O. M. Mikkelsen,** general superintendent and master mechanic.

Kaiser Engineers will employ all local labor, and it is anticipated that many of the present Hanford construction workers will be employed for the new contract when work gets under way.

DEATHS

Christian O. Larsen, 67, retired steel ntractor, died July 8 in Seattle, Wash.

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Richard B. Clough, 50, partner in the nstruction firm of Lembke-Clough & ng, died July 30. He had been active construction enterprises throughout e West.

* * *

Edward J. Kewley, 62, former city en- neer of Fallon, Nev., died July 8 in no, Nevada.

* * *

Claude Leon McKesson, 71, nationally cognized authority on bituminous pav- g, died July 21 at Altadena, Calif. Mc- sson's death ends a career which be- n with the design and construction of e Incline Railway up Mt. Manitou in lorado. This was followed by work th the Bureau of Public Roads in Ore- n, Washington, Utah and Montana as ior highway engineer. After World ar I McKesson was associated with e late William Mulholland in the con- uction of the Owens Valley Aqueduct. is was followed by staff engineering rk for the City of Los Angeles until 22 when he joined the California State ghway Department as materials and search engineer. McKesson's interest paving brought him to the American tumuls Co. of San Francisco in 1928 vice president in charge of engineer- g and director of research. He retired 1946, but continued in a consultant's pacity until his death.

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Franklin P. Ulrich, chief, seismolog- l field survey, U. S. Coast & Geodetic rvey, died July 1 in Mill Valley, Calif. rich was an authority on the subject earthquakes and their effect on engi- ering structures and was widely own among structural engineers roughout the West. He was active in airs of the San Francisco Section of SCE and had served for many years as asurer of the Structural Engineers sociation of Northern California.

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Edwin L. Hansen, 53, civil engineer th Bethlehem Pacific Coast Steel rp., died July 23 in Los Angeles, Calif.

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Walker Boudwin, president of the nstruction firm which bears his name, d July 20 in Reno, Nev. Boudwin's m is well-known throughout Nevada ad Northern California.

* * *

Charles V. Fowler, 87, retired general ntractor, died July 22 in Los Angeles.

* * *

Harold A. Daffin, 27, Morrison-Knud- n Co., Inc., employee, was electrocuted high tension wires June 21 near ace, Idaho.

* * *

John Harold Dawson, 44, building con- ctor, died in his Oroville, Calif., home.

SUPERVISING THE JOBS

Rains & Son have a ditch lining job in Las Deltas, Calif., near Fresno. **Pat Rogers** is superintendent. **Nick Valento** represents Contractors Equipment & Supply Co. in the materials supply.

' ' '

Scott J. Cross is superintendent for Carson Construction Co., Helena, Mont., on general contract for a Civil Aeronautics Administration project, International Airport Building, Anchorage, Alaska. The basic contract with CAA is $1,700,000. An addition to the Airport Terminal Building constructed by Northwest Airlines, is under the same supervision, for $165,000. **Don A. Gillis** is assistant superintendent and **Hobart L. Cross** is office manager and **LeRoy Miller** is superintendent for plumbing and heating for Reber Plumbing and Heating Co.

' ' '

Powerhouse construction at Bridgeport, Wash., for the Corps of Engineers is under supervision of **George Piedmont. Floyd Mercer** is electrical superintendent, **Dave Shaw,** master mechanic, and **Charles Reiswig** is carpenter superintendent. **Joe Ray** is pipe fitter superintendent; **D. B. Williams,** office and equipment superintendent, and **Lloyd Hixson,** concrete superintendent. **A. D. Tyron** is excavation superintendent; **LaFay Pace,** swing superintendent, and **William Haggerty,** general electrical foreman. **R. A. Gutro** is office manager and **William H. Smith,** paymaster. **Phil J. Soukup** is project manager for Columbia River Constructors, a joint venture.

' ' '

Two contracts totaling nearly $10,000,000 are being worked at Ft. Richardson, Alaska, by The Alaska Constructors, Morrison-Knudsen Co., Inc., and Peter Kiewit Sons' Co., joint venturers. Involved in the two contracts are utilities construction and training center construction. **Mel Evenson** is superintendent for the training center. **Aner W. Erickson** is project manager. **Bill Lofholm** has overall charge for M-K in Alaska and **C. J. Haglund** is area manager. **F. E. Hester** is ironworker foreman, **Manuel Levendosky** is carpenter foreman, and **Stewart Tope** is carpenter foreman. **Glenn Bush** is labor foreman on the training center job. On the utilities project, **Al Brown** is stripping and grading superintendent, and **Kipper Ransdell** is trenching superintendent. **Don Adams** is field engineer and **Jack Yoakum** is railroad superintendent on utilities. **George DuGay** is general foreman on training center construction. **Jack Riley** is project engineer.

' ' '

John D. Heckert is general superintendent for Albeni Constructors, joint venture, on construction of Albeni Falls Dam. **H. S. (Dutch) Peters** is assistant superintendent. **G. R. Roskowits** is iron worker foreman; **O. D. Hill,** gene foreman, and **Joe Heckert,** carpen foreman, on the $8,601,240 project. **L. Johnson** is a carpenter foreman; **Lloyd,** a labor foreman, and **Joe Spenc** rock foreman. **R. M. Bacon** is office ma ager and **W. Davis** is project engine

' ' '

Commercial buildings going up in S kane, Wash., for the Coca Cola Co. being supervised by **E. N. Van Noy** John H. Sellen Construction Co. **Will Watkins** is general foreman.

' ' '

Andy Weesner is general superinte ent for Clyde Wood & Sons on 3.2 highway construction near Gaviota Pa Calif. **H. B. Arnold** assists Weesn **Dick Holman** is dirt superintendent, **Wright** is master mechanic. **C. Brand burg** is office manager.

' ' '

M. K. Hecht is general superintend for Millie & Severson on construction a warehouse in Long Beach, Calif., Regal Pale breweries. **J. F. Garland** carpenter foreman. **E. H. Dewitt** is la foreman.

' ' '

Jim Glass is general superintend for Peter Sorenson, contractor on c struction of a water filtration plant the City of Pittsburg, Calif. **Rob Webber** is resident engineer with **Le Nunez** as his assistant.

' ' '

Bakker Construction Co. has a $1 000 contract for work on the Wilson G field School in Compton, Calif. **B Ward** is superintendent and **V. M. Ch bonneau** is foreman.

' ' '

Construction of a highway bridge n Garrison, Mont., is under the supervis of **E. A. (Sam) Derrer. Art Baden** carpenter foreman and **Mike Cinker** steel foreman for Montana Engineer and Construction Co., holder of the $ 000 contract.

' ' '

Marye-Northwestern Co. is curren engaged in the $1,171,417 construction a hangar building at Lowry Air Fo Base near Denver, Colo. **James Nor** is superintendent on the project. **Rob McIntosh** is project manager.

' ' '

Henry Horbordt is job superintend for Robert E. McKee on the gene construction of buildings at Patton St Hospital, Patton, Calif. Horbordt's sistant on the $1,697,820 project is **E. Farrell. J. R. Patton** is office engin and **R. A. Johnson** is field engineer.

' ' '

Construction of a 450-ft. steel a concrete bridge on the Shelby So Highway in Toole County, Mont., is ing supervised by **O. A. Olson. R. Forsyth** is foreman of steel operati on the $231,996 McKinnon-Decker project.

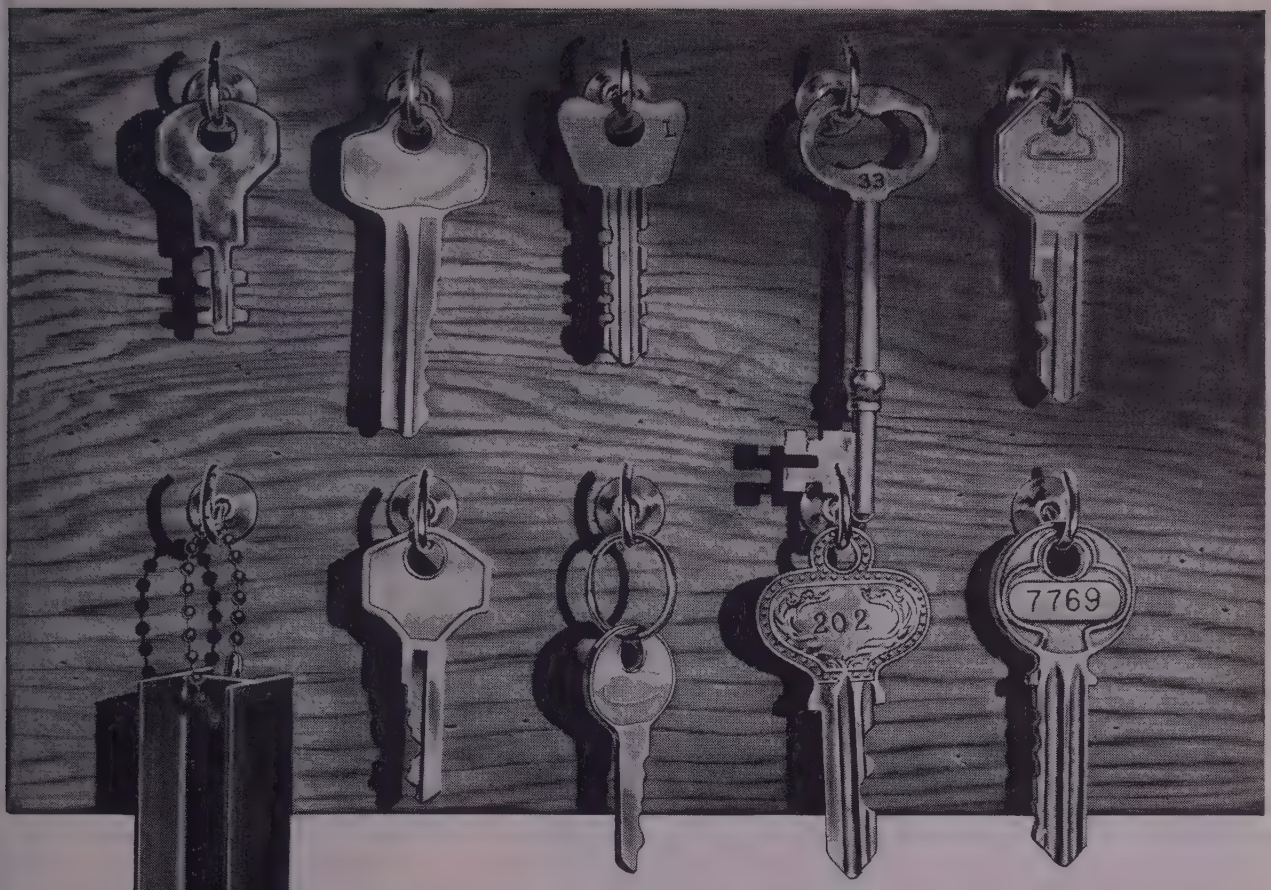
' ' '

R. L. Devers is job superintendent Armstrong & Armstrong on 88.6 mi highway work between Roswell

Down-time . . . . . By Domagalski

"I don't mind a little shop talk, but who's going to clean up the pile?"

Western Construction



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For western construction men now have a *dependable, nearby* source of supply for this vital structural shape.

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Tularosa, U. S. 70. **Paul Taylor** is crusher and hot plant foreman on the $165,237 project in Lincoln and Otero counties, New Mexico.

* * *

H. P. Bosworth is superintendent for Birch, Lytle and Green on road and street paving at Ft. Richardson, Alaska. **Ross McDonald** is paving superintendent and **I. Sawby** is project engineer.

* * *

Clarence Nelson is supervising the job for K. C. Dack Construction Co. on 6.1 mi. of grading and oil mat surfacing the Pocahontas-Baker Section of the Baker-Pine Creek-Wingville county road in Oregon. The contract is for $128,563.

* * *

Cliff Craig is job superintendent for Nilson-Smith Construction Co. on 5.1 mi. of grading and gravel surfacing Fairfield west highway in Teton County, Mont. **A. L. Williams** is dirt foreman and **John Paul** is pipe foreman, on this $155,847 job.

* * *

Peter Kiewit Sons' Co. holds a $114,-085 contract for construction of the east approach to Cowlitz River Bridge, Kelso, Wash. **Leo Jones** is supervising the job and **Carl Short** is his assistant.

* * *

In Chaves County, New Mexico, Armstrong and Armstrong holds a $281,277 contract for 4.2 mi. of work between Roswell and Walker Air Force Base. **T. G. Moore** is superintendent. **C. W. Rossow** is grading foreman, **Paul Taylor** is crusher and hot plant foreman and **T. C. Carr** is structure foreman.

* * *

Construction on Bloomfield-Blanco Rd. in San Juan County, New Mexico, for a distance of 3.3 mi. is being supervised by **C. L. Earsley** for Henry Thygesen & Co. **Earl Shannon** is purchasing agent on the $142,831 job.

* * *

Water, sewer, and gas line construction at the U. S. Naval Air Station in Alameda, Calif., is being supervised by **Barney Hedberg. Conrad Hass** is office manager for Stolte, Inc., and Gallagher & Burk, Inc., on the joint venture's $1,058,590 project.

* * *

Ken Morris is supervising Grove, Shepherd, Wilson and Kruge, Inc.'s $4,429,470 operations at Elmendorf Air Force Base in Alaska. The firm is constructing a 3-story airmen's dormitory building. Morris is assisted by **Jim March. Pete Roy** is office manager, **Joe Dandis** is office engineer. **Steve Kandra** is general labor foreman.

* * *

Koppisch Construction Co. has **Adam Boehm** as superintendent on its $182,480 contract for 2.7 mi. rock base and paving on Cannon Beach-Arcadia section of the Oregon Coast Highway in Clatsop County, Oregon.

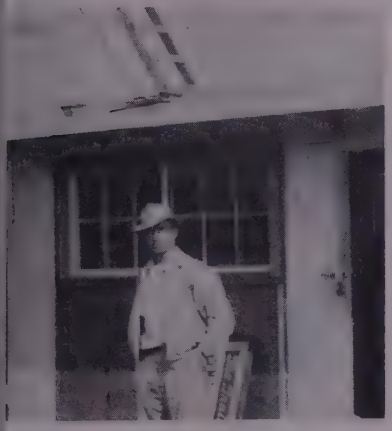
AT MATHER Air Force Base in C fornia Stolte, Inc., has these men on job building additional troop facili Above: *Don Mahony*, left, engin talks things over with *Bill House*, p ect manager.

Right: (top) *Vic Weidmar*, supe tendent.

(center) *Charles Jones*, carpe foreman.

(bottom) l. to r., *E. Cupps*, c foreman, *Darrel Sissel*, la foreman, and *Frank Wi* carpenter foreman.

(See item below last picture)



Construction of additional troop facilities, Sacramento Beam Station, Mather Air Force Base, Calif., is under the supervision of **Vick Weidmar** in the field. **Chuck Lee** is utilities superintendent. **Dave Freitas** is carpenter foreman along with **Frank White, E. Cupps** and **Charles Jones. Darrel Sissel** is labor foreman. **Charlie Upton** and **Frank Wilson** are utilities foremen. **Art Manchester** is master mechanic. Stolte, Inc., holds the $562,842 contract. **Don Mahoney** is project engineer.

* * *

George Neely is plant superintendent at the new ready-mix concrete plant on 14th Ave. in Sacramento, Calif.

* * *

Approximately 7 mi. east of Laramie, Wyo., on U. S. 30, Brown Construction Co. has **H. P. Graham** as superintendent on road construction. **Dan Ratliff** is drill foreman, **Bob Walden** is shovel foreman with **W. Quisenberry. C. Overton** is master mechanic. **C. D. Keller** is welder, and **Glenn Milsap** is scraper foreman.

Ira E. Powers is labor foreman. **W. F. Murphy** is paymaster.

* * *

In Montana, McLaughlin Construction Co. has a $364,000 contract for grading and gravel surfacing and oiling between Three Forks and Teton. **C. M. Loser** is general superintendent with **Dave Wheeler** as his assistant. **Tony Wells** is master mechanic. **Buck Willis** and **Ed Kirenen** are grading foremen. **Lee Fickes** is office manager and **Jim Grippe** is resident engineer.

* * *

The relocation of the Columbia River Highway and the Union Pacific Railway tracks, between Cascade Locks and Hood River, Ore., is under the supervision of **Roy Ladd. Bill Ellis** is shop foreman and **George Lowry** is rock foreman for Gibbons & Reed Co., holders of the $2,296,769 contract.

* * *

Construction of a dam for Denver Rio Grande & Western near Crescent, Colo., is under the supervision of **John E. Broton** with **George P. McIndoe** as his assistant. **Sam Penna** is excavation superintendent, **Jim Jeffries** is master mechanic, and **Guy Smith** is electrical superintendent. Macco Corp. and Puget Sound Bridge & Dredging Co. hold the $7,000,000 contract.

* * *

B. D. Ness is supervising the job for his own firm on construction of a $50,000 building in Sidney, Mont.

* * *

Fred Singleton is superintendent for Northwest Engineering Co. on construction of the Archer Overpass, 7 mi. east of Cheyenne on Highway 30 in Wyoming. **Jack Daughterty** is assistant superintendent on this $451,694 project.

* * *

Curt Whitney is general superintendent for Williams & Burrows, Inc., and Carl N. Swenson Co., Inc., on general contracting in Sacramento, Calif. **La Marr Dees** is Whitney's assistant.

* * *

Lord & Bishop has **R. M. Haggerty** as general superintendent on construction of a $350,000 underpass and grade separation structure on J Street at 58th in Sacramento, Calif. **Charles McPhee** is assistant superintendent and **A. F. Bishop** is project manager. **R. N. Brink** is resident engineer on the State project.

* * *

Surfacing and paving 16.2 mi. of Highway 89 near Monarch, Mont., is being supervised by **Garth Culp** for Peter Kiewit Sons' Co. **O. P. Bronson** is paving foreman and **Johnnie Hansen** is plant foreman. **Jerry Sheehan** is master mechanic on the $292,000 project.

* * *

Al Wright is superintendent for Foster and Foster on construction of $150,000 apartment building at Sepulveda and Montana streets in Westwood, Calif.

* * *

S. J. Cook & Son has **Russell Hanvelt** as superintendent on additions to Centennial School, Norwalk, Calif. **George Britton** is foreman on the $300,000 job.

* * *

Construction of a building for Sacramento Junior College by Campbell Construction Co. is under the supervision

With Bechtel Corp. in Idaho

on $8,000,000 chemical plant additions project

RIGHT: l. to r.—*H. J. Winandy*, off. mgr., *N. L. Barron*, supt., and *Don R. Martin*, asst. supt., where Bechtel Corp. is building plant additions for Westvaco Chemical Co., division of Food Machinery and Chemical Corp.

BELOW: Front row, l. to r.—*Ed. J. Martin*, asst. supt., *Murray Martindale*, ironworker, *L. M. Cole*, millwright, and *Myron Barcus*, carpenter.

Back row—*Walt Chaney*, boilermaker, *Morris Larsen*, laborer, *Les Billings*, electrician.

BELOW: Front row—*H. J. Winandy*, off. mgr., *E. J. Hall*, job eng., *G. V. Reynolds*, jr. field eng., *Tilton O'Brien*, field eng.

Second row—*Gene Whiteside*, clerk-typist, *Martha Barry*, clerk-typist, *Connie Garrett*, clerk-steno., *Les Gentry*, materialman.

Third row—*Ray Newbould*, materialman, *Dave McNichols*, warehouseman, *Paul DeVriendt*, timekeeper, *J. Wm. Beasley*, accountant, and *Lloyd Thomas*, time checker.

Earl Holloway with **Bill Campbell** as assistant. **J. F. Randolph** is assistant foreman.

* * *

General construction at Sacramento, Calif., Signal Corps Depot is under the supervision of **Ken Gooding** for McDonald, Young & Nelson, Inc., and Morrison-Knudsen Co., Inc. **Robert Cox** and **Howard Madden** are concrete foremen on the $8,000,000 project. **Bill Mueting, Jack Douglas, Charles Louden, John Nelson** and **Ben Fletcher** are general foremen.

* * *

Clarence Heckle, assisted by **Fred Hill,** is general superintendent for George J. Harlan on construction of a frame and brick veneer building in North Sacramento, Calif.

* * *

Construction of the Sunset Cliff Bridge, San Diego, Calif., is under the supervision of **Jim Cox. Ed Boike** is floor foreman and **Gaylord McCoy** is carpenter foreman. **B. E. McCown** is city inspector. Guy F. Atkinson Co. holds the contract.

* * *

Construction on the De Anzo Cover Highway in San Diego County, Calif., is being supervised by **Duncan Manning** for Cox Bros. Construction Co. **Ed Brad** is foreman.

* * *

Barney C. Johnson & Son has **Barney W. Johnson** as general superintendent on the $400,000 construction of a housing project in Williston, No. Dak.

* * *

Enlargement of a shaft in Westvaco, Wyo., for the Westvaco Chemical Division of Food Machinery & Chemical Corp. is being supervised by **Ray S. Stidham.** Peter Kiewit Sons' Co. has **Frank W. Weibel** as master mechanic. **James L. Womack, William Landis** and **Calvin Upton** are walkers. **Richard D. Lawson** is office manager and **A. M. Coker** is project manager.

* * *

Crushing operations in Cokeville, Wyo., for 23,000 cu. yd. in stockpile, is under the supervision of **"Slim" Richardson.** Peter Kiewit Sons' Co. has **Walter E. Knopp** as general foreman and **Cliff Hammond** as crusher mechanic. **Stanley Holoxham** and **Bob Hoffman** are crusher operators.

* * *

Key personnel with Morrison-Knudsen Co., Inc., on quarrying operations at Granite Canyon, Wyo., include the following: **Arthur S. Piper** is equipment superintendent, **Joseph L. Peak** is plant superintendent, and **William Maxwell** is quarry foreman. **Harry Bullock** is project engineer and **Lloyd Peak** is general foreman.

* * *

Construction of Intermountain Chemical Co.'s plant in Green River, Wyo., is under the supervision of **Ed A. Draeger** with **Len Cole** as his assistant. **D. Brothers** is carpenter foreman; **J. Busk,** mill-

Continued on page 132

CONTRACTS

A Summary of Bids and Awards For Major Projects in the West

★★

Alaska

$2,438,118—**Boen-Sealand Constructors,** 3647 Stone Way, Seattle—Low bid for construction of 16 eight-family dwelling units, Eielson Air Force Base; by C. of E.

$2,334,635—**Peter Kiewit Sons' Co.** and **Fred J. Early Co., Inc.,** 1300 Aloha, Seattle—Low bid for construction of seven buildings, Eielson Air Force Base; by C. of E.

$540,000—**C. F. Lytle** and **Green Construction Co.,** 312 Masonic Temple Bldg., Des Moines, Iowa—Low bid for construction of 8.5 mi. of the Copper River Highway, Chugach National Forest, Alaska; by BPR.

Arizona

$313,920—**Fisher Contracting Co.,** P. O. Box 4035, Phoenix—Award for taxiway, lighting, communications facilities, roads, etc., Sky Harbor, Phoenix; by City Council.

$494,402—**Macco Corp.,** 14409 So. Paramount Blvd., Paramount, Calif.—Low bid for earthwork, concrete lateral lining and structures, Unit 2, Mohawk Distribution System, Wellton-Mohawk Division, Gila Project; by USBR.

$1,176,494—**D. O. Norton & Son,** 3002 N. 26th St., Phoenix—Award for rehabilitation and addition to Yuma High School, Yuma; by Yuma Union High School Dist.

California

$3,243,749—**Allison Honer Co.** and **Cox Brothers Construction Co.,** 312 No. Main St., Santa Ana—Award for expansion of training facilities, Camp San Mateo, Camp Pendleton, Oceanside; by 11th Naval Dist.

$2,941,000—**Allison Honer Co.** and **Cox Brothers Construction Co.,** 312 No. Main St., Santa Ana—Award for expansion of training facilities, Camp Pulgas, Camp Pendleton, Oceanside; by 11th Naval Dist.

$489,000—**Allison Honer Co.** and **Cox Brothers Construction Co.,** 312 No. Main St., Santa Ana—Award for expansion of field training facilities (rifle ranges), Camp Pendleton, Oceanside; by 11th Naval Dist.

$1,045,263—**Allison Honer Co.,** 312 No. Main St., Santa Ana—Award for construction of the Social Sciences and Humanities Building, Riverside Campus, University of California; by Regents of the University of California.

$958,873—**Guy F. Atkinson Co.,** P. O. Box 259, Long Beach—Low bid for construction of a 4-lane divided highway with frontage roads and connections to be graded and surfaced with portland cement concrete pavement and plant-mix surfacing, and three grade separation structures and a pedestrian undercrossing to be constructed, Los Angeles County; by St. Div. of Hwys.

$1,214,338—**Guy F. Atkinson Co.,** 10 Orange Ave., So. San Francisco—Low bid for repairs and alterations to water supply tunnel, Oakland; by EBMUD.

$1,220,000—**Baruch Corp.,** 321 S. Vincente Blvd., Los Angeles—Low bid for construction of a one-story hospital, Los Angeles; by Los Angeles County.

$108,551—**Baun Construction Co.,** 324 Princeton, Fresno—Low bid for surfacing a reinforced concrete bridge and approache with plant-mix surfacing, at Whites Bridge, across Kings Sloug about 2.7 mi. S. of Mendota, Fresno County; by St. Div. of Hwy

$256,968—**J. P. Brennan,** Zeis Bldg., Redding—Low bid for 6 mi. grading, imported base material to be placed and Class "F Double" seal coat applied, bet. 0.3 mi. W. of Cow Creek and 1 mi. E. of Whitmore, Shasta County; by St. Div. of Hwys.

$1,811,800—**Connolly-Pacific Co.,** 1925 Water St., Long Beach-Award for construction of a quay wall at Pier D, Long Beac by Port of Long Beach.

$564,575—**Fred J. Early, Jr., Co., Inc.,** 369 Pine St., San Francisc—Award for additional aviation fuel storage facilities, U. S. Nav Air Station, Alameda; by 12th Naval Dist.

$197,410—**Fred J. Early, Jr., Co., Inc.,** 369 Pine St., San Fra cisco—Low bid for construction of Cache Slough pumping plan Vallejo; by City of Vallejo.

$113,959—**Eaton & Smith,** 1215 Michigan Ave., San Francisco-Low bid for improvements on Third St., track removal, repavin etc., San Francisco; by Dept. of Public Works.

$176,765—**Al Erickson & Co.** and **W. C. Railing,** Woodland-Low bid for 12.2 mi. imported base material, borders to be co structed, seal coat applied and existing drainage structures wi ened bet. Esparto and Brown's Corner, Yolo County; by St. Di of Hwys.

$242,936—**Fay Improvement Co.,** 101 Caroline St., San Francis—Low bid for removal of tracks and repaving operations, Vale cia St., San Francisco; by Dept. of Public Works.

$2,529,391—**Granite Construction Co.,** Box 900, Watsonville-Low bid for 8.1 mi. grading and paving with portland ceme concrete on cement treated subgrade and with plant-mix surfa ing on various types of base material, and grade separation stru tures to be constructed bet. Route 68 at Gish Rd. and War Springs, Santa Clara and Alameda counties; by St. Div. of Hwy

$274,452—**Griffith Company,** 1060 S. Broadway, Los Angeles-Low bid for 10.8 mi. of scarifying and surfacing with plant-m surfacing over cement-treated base bet. Bear Mountain Ran and west end of Tehachapi Overhead, Kern County; by St. Di of Hwys.

$1,009,700—**Haddock Engineers, Ltd.,** 1616 S. Greenwood Av Montebello—Low bid for construction of enlisted men's club a misc. facilities, Miramar; by USN.

$398,665—**Charles L. Harney, Inc.,** 575 Berry St., San Francis—Low bid for track removal, repairing, Van Ness Ave., S Francisco; by Dept. of Public Works.

$1,081,412—**Harris Construction Co., Inc.,** 265 Palm Ave., Fres—Low bid for construction of Roosevelt High School, Fresn by Fresno City United School Dist.

$2,047,809—**Healy Tibbetts Construction Co.,** Box 473, Lo Beach—Award on Proposal No. 1 of the marine section outf sewer, Santa Ana; by Orange County Sanitation Dist.

$360,374—**Huettig, Schromm & Bennett,** P. O. Box 798, Pa Alto—Low bid for 1.3 mi. road construction from near Se Valley across Klamath River, Klamath National Forest, Sis you County; by BPR.

$1,126,000—**H. M. Hodges & Pozzo Construction Co.,** 55 Venice Blvd., Los Angeles—Low bid for construction of a bi logical science building at the Riverside campus of the Univers of California; by University of California.

$182,203—**Humboldt Constructors, Inc.,** Eureka—Low bid f grading and surfacing with plant-mix surfacing on ceme treated base and slope protection at Shively Bluffs, Humbo County; by St. Div. of Hwys.

$1,151,958—**Indenco, Inc.,** 960 98th Ave., Oakland—Award f construction of Pleasant Hill High School, Pleasant Hill; by M Diablo Unified School Dist.

$249,921—**Lee J. Immel,** 3030 San Pablo Ave., San Pablo—L bid for 6.7 mi. of surfacing with plant-mix surfacing on ceme treated base material and portions to be reconstructed, bet.

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- Maximum safe lift is 25½ tons at 12′ radius.
- Speed means more work capacity. Compare hoist speeds as high as 227′/min., swing 4.35 R.P.M., and travel 1.1 M.P.H.
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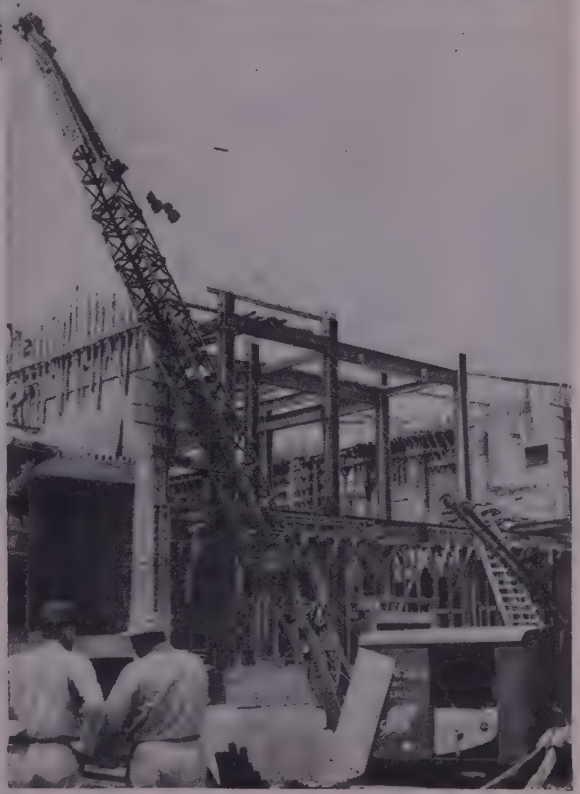
- Easily moved on trailers or flat car.

It's the best buy, by far in the 1¼ yard class. That's why more and more contractors are switching over to fleets of these husky 2000's every day. Manitowoc Engineering Corp., Manitowoc, Wis.



One of the 4 Manitowoc 2000's owned by John McShain, Inc., Wash., D.C., excavating for Georgetown University Athletic Field.

Another Model 2000 placing concrete at Naval Health Institute, Bethesda, Maryland.

BAY EQUIPMENT COMPANY
3254 East Shore Highway, Richmond, Calif.
2605 Second Avenue, Seattle 1, Washington

OLSON MANUFACTURING COMPANY
4001 Springs Avenue, Boise, Idaho

mi. E. of Redmond Overhead and Greenville, Alameda County; by St. Div. of Hwys.

$335,592—**Peter Kiewit Sons' Co.,** 345 Kieways, Arcadia—Low bid for 5.5 mi. existing roadbed to be reinforced with cement treated base and surfaced with plant-mix surfacing bet. 0.7 mi. E. of Route 208 and Cordelia Underpass, Solano County; by St. Div. of Hwys.

$229,206—**Kovich Bros. Construction Co.,** P. O. Box 1323, Fresno—Low bid for construction of sanitary sewer system additions, Fresno; by City of Fresno.

$105,000—**Lefever & Bing,** Box 553, West Sacramento—Low bid for 3.0 mi. grading and surfacing with imported base material and a penetration treatment and a seal coat applied bet. Stripli Rd. and Nicolaus Ave., Sutter County; by St. Div. of Hwys.

$221,592—**Madonna Construction Co.,** P. O. Box 910, San Luis Obispo—Low bid for repairs to existing bridge, consisting of new piers, abutments and spans to be constructed across Santa Ynez River, about 1 mi. north of Lompoc, Santa Barbara County; by St. Div. of Hwys.

$254,155—**Madonna Construction Co.,** P. O. Box 910, San Luis Obispo—Low bid for 10 mi. grading and surfacing with road-mix surfacing on cement-treated base, Wheeler Ridge Road, bet. David Rd. and State Rt. 140, Kern County; by St. Div. of Hwys.

$6,292,937—**Mercer Fraser Co.** and **Mercer Fraser Gas Co., Inc.,** 2nd and Commercial Sts., Eureka—Low bid for grading and surfacing portions with plant-mix surfacing on imported base material or cement treated base bet. Gannon Slough and 0.9 mi. N. of Plaza Ave.; by St. Div. of Hwys.

$279,407—**Rice Brothers, Inc.,** 8th and Yuba St., Marysville—Low bid for 1 mi. grading a 4-lane divided highway to be graded and surfaced with plant-mix surfacing on cement-treated base bet. 0.2 mi. W. of Onstott Rd. and Rt. 3 in Yuba City, Sutter County; by St. Div. of Hwys.

$1,096,176—**Stanton-Reed Co.,** 816 W. 5th St., Los Angeles—Award for construction of office buildings at Naval Air Station, San Diego; by Dept. of the Navy.

$916,874—**Stolte, Inc.,** and **Morrison-Knudsen Co., Inc.,** 8451 San Leandro St., Oakland—Low bid for construction of approximately 30 buildings and miscel. work, Beale Air Force Base; by C. of E.

$435,846—**A. Teichert & Son, Inc.,** 1931 Stockton Blvd., Sacramento—Low bid for construction of an aircraft storage area, approach road, etc., McClellan Air Force Base; by C. of E.

$958,841—**Ukropina-Polich-Kral** (joint venture) 8425 E. Clarence, San Gabriel—Low bid for 2 mi. grading and surfacing with portland cement concrete on cement-treated subgrade; street connection frontage roads; inlets and outlets and acceleration, deceleration lanes to be surfaced with plant-mix surfacing on untreated base and two overcrossing structures to provide a freeway with a 4-lane divided roadway, on Santa Ana Freeway, bet. Lakewood Blvd. and Orr and Day Rd., Los Angeles County; by St. Div. of Hwys.

$2,094,780—**Del E. Webb Construction Co.,** 5101 San Fernando Rd., Los Angeles—Award for construction of utilities at Fort Ord; by C. of E.

$6,021,590—**Del E. Webb Construction Co.,** 5101 San Fernando Rd., Los Angeles—Low bid for construction of about 24 buildings, Travis Air Force Base, Solano County; by C. of E.

Idaho

$332,106—**Burgraff Construction Co.,** Box 397, Idaho Falls—Low bid for construction of a roadway and a bituminous surface treatment and two concrete bridges on 5.5 mi. of the Lemhi Highway from High Bridge to Lemhi, Lemhi County; by St. Dept. of Hwys.

$193,551—**Peter Kiewit Sons' Co.,** Box 875, Sheridan—Award for reconditioning the roadbed and constructing a road-mi

uminous surface on 8.4 mi. of U. S. Highway 30N. bet. Alton ats and Border in Bear Lake County; by St. Dept. of Hwys.

05,750—**Peter Kiewit Sons' Co.,** P. O. Box 875, Sheridan—ward for maintenance, repair on approx. 40 mi. of Highway 91 om the Jefferson County Line to the Montana State Line, ark County; by St. Dept. of Hwys.

07,242—**Morrison-Knudsen Co., Inc.,** Box 450, Boise—Low d for construction and reconstruction of roads, construction of disposal area at the National Reactor Test Station, Idaho Falls; AEC.

63,155—**Pickett & Nelson,** P. O. Box 755, Idaho Falls—Award r construction of a roadway, a road-mix bituminous surface d five concrete bridges on 3.9 mi. of the Rexburg-Parker-St. nthony Rd., Fremont County; by St. Dept. of Hwys.

ontana

26,963—**A. J. Cheff Construction Co.,** 10054 W. Marginal Way, attle—Low bid for construction of the Toston Tunnel and cess road at Crow Creek Pumping Unit, Three Forks Diver-on, Missouri River Basin Project; by USBR.

399,872—**F. & S. Contracting Co.,** P. O. Box 4, Butte—Award r 12 mi. of grading, gravel surfacing, road-mix oiling and con-ruction of small drainage structures, Whitehall, southwest; by t. Hwy. Comm.

12,838,190—**James Construction Co.** and **Wunderlich Contract-g Co.,** 206 Patterson Bldg., Omaha, Neb.—Low bid for con-ruction of Tiber Dam and dike, Marius unit, Missouri River asin Project; USBR.

144,607—**Montana Engineering & Construction Co.,** Box 823, elena—Award for construction of a 310.5-ft. steel and concrete verpass between Forsyth and Miles City, Custer County; by t. Hwy. Comm.

331,660—**Morgenstern & Schelt,** Missoula—Award for 9.2 mi. rading, gravel surfacing, road-mix oiling, bet. Hamilton and lorence, Ravalli County; by St. Hwy. Comm.

254,411—**Nilson-Smith Construction Co.,** P. O. Box 1147, Great alls—Award for 10.3 mi. grading and draining, bet. Dillon and win Bridges, Madison County; by St. Hwy. Comm.

179,994—**Northolt Electric Co.,** 1201 Dyke Ave., Grand Forks, o. Dak.—Low bid for Dawson County Substation, office, ware-ouse and service facilities and additions to Williston Substation ort Peck Project; by USBR.

evada

329,831—**Wells Cargo, Inc.,** 1800 E. 4th St., Reno—Award for onstruction from Main St., Bonanza Rd., in Las Vegas to Col-ge Rd. vicinity in North Las Vegas, Clark County; by St. Hwy. ept.

ew Mexico

172,687—**O. D. Cowart,** Albuquerque—Award for 11.2 mi. con-truction, Chamberino-Texas-New Mexico State, Dona Ana ounty; by St. Hwy. Dept.

238,930—**Pecos Valley Construction Co.,** Carlsbad—Award for ard surfacing seventy blocks in Jal; by City Council.

regon

426,430—**General Construction Co.,** 4850 N.W. Front Ave., ortland—Low bid for reconstructing dock moorage wall, Washington shore, McNary Lock and Dam; by C. of E.

472,740—**General Electric Co.,** Portland—Low bid for supply-ng 15,000-kv. generator for Dexter regulating dam, downstream rom Lookout Point Dam; by C. of E.

408,826—**Newport Construction Co.,** 7031 N.E. Halsey St., Port-

land—Low bid for 8 mi. reconditioning and oiling the John Day-Burns highway; by BPR.

$2,143,991—**Parker-Schram Co.,** Builders Exchange Bldg., Portland—Low bid for schedules 1 and 2, construction and clearing, Big Eddy-Troutdale 300-kv. line, Wasco, Hood River, Clackamas and Multnomah counties; by BPA.

$219,009—**Power City Electric Co.,** N. 920 Howard St., Spokane, Wash.—Award for construction (Sched. I), Redmond-Klamath Falls 230-kv. transmission line in Klamath and Deschutes counties; by BPA.

$2,372,634—**Ralph & Horwitz,** 1835 N. Flint St., Portland—Low bid for construction of a 7-story office building for Bonneville Power Administration; by Lloyd Corporation.

Utah

$199,969—**R. M. Jensen,** 1057 S. 4th W., Salt Lake City—Low bid for construction of a 2-in. road-mix bituminous surfaced road to be 7.8 mi. long, Upalco and U. S. 40, Duschesne County; by St. Rd. Comm.

$639,800—**J. K. Thayn Construction Co.,** 2670 Berkeley Circle, Salt Lake City—Award for construction of 2.5 mi. grids and associated facilities, Dugway Proving Grounds, Tooele; by C. of E.

Washington

$226,957—**J. S. Anderson Co.,** 2124 N. Waterworks St., Spokane—Low bid for removal of timber, clearing of right-of-way and access road construction for Coleville-Republic transmission line; by BPA.

$219,820—**Burrows, Milone & Tucci,** 3215 S. M St., Tacoma—Low bid for construction of fuel storage facilities, McChord Air Force Base; by C. of E.

$1,429,791—**Dahlgren Construction Co.,** 1700 21st Ave., Seattle—Award for construction of bulk storage petroleum facilities at Mukilteo; by C. of E.

$169,324—**N. Fiorito Co.,** 844 W. 48th St., Seattle—Award for construction on the Chehalis Western railroad overcrossing Lewis County; by St. Dept. of Hwys.

$782,875—**Goetz & Brennan,** 914 Seaboard Bldg., Seattle—Award for 5.3 mi. from Toutle River to Foster Creek, Cowlitz and Lewis counties; by St. Dept. of Hwys.

$316,441—**Goodfellow Bros., Inc.,** Wenatchee—Award for 5.3 mi. of work from Lind to Paha, Adams County; by St. Dept. of Hwys.

$167,515—**Hawkins & Armstrong,** 16274 39th N.E., Seattle—Award for construction on Naselle River Bridge and approaches Pacific County; by St. Dept. of Hwys.

$377,752—**L. E. Hoback,** and **R. H. Sussex,** P. O. Box 1, Bellingham—Award for construction on the Northern Pacific railway overcrossing south, Lewis County; by St. Dept. of Hwys.

$122,549—**L. H. Hoffman,** 56 S.E. Belmont St., Portland, Ore.—Award for converting an area into a parking space, Richland by AEC.

$116,150—**Hutchinson Sand & Gravel,** Thorp—Award for stock piling, Snoqualmie Pass vicinity, King and Kittitas counties; by St. Dept. of Hwys.

$616,624—**Peter Kiewit Sons' Co.,** P. O. Box 491, Longview—Award for construction of the Northern Pacific overcrossing a junction with P.S.H. No. 12, Lewis County; by St. Dept. Hwys.

$104,365—**McAtee & Heathe,** Box 4083, Station B, Spokane—Low bid for construction of utilities at Larson Air Force Base Moses Lake; by C. of E.

$113,515—**Everett McKellar,** Box 965, Chelan—Low bid for construction of the Snohomish Reservoir; by City Council.

6,794—**Montgomery Electric Co.,** 2375 N.W. Thurman St., Portland, Ore.—Award for construction (Sched. 3) Olympia-Columbia Section, Grand Coulee-Olympia transmission line, Thurston, Pierce, King, Kittitas, Chelan and Douglas counties; by BPA.

3,367—**Standard Asphalt Paving Co., Inc.,** 119 Post St., Spokane—Award for 6.1 mi. construction in Wallula and vicinity, Franklin and Walla Walla counties; by St. Dept. of Hwys.

5,760—**Valley Construction Co.,** 7722 Rainier Ave., Seattle—Low bid for construction of sewers, Lake City; by LID.

1,719—**Woodworth & Co., Inc.,** 1200 E. D St., Tacoma—Award for 1.5 mi. construction, Kent east, King County; by St. Dept. of Hwys.

16,408—**Howard S. Wright & Co., Inc.,** 414 Pontius, Seattle—Award for general construction of a hangar building, Boeing Field; by Boeing Airplane Co.

Wyoming

8,203—**Lichty Construction Co.,** P. O. Box 1068, Riverton—Low bid for grading, draining, crushed gravel base course and misc. work on 8.1 mi. of the Ethete road, Fremont County; by St. Hwy. Dept.

3,128—**Platte Valley Construction Co.,** Grand Island, Neb.—Award for grading, draining, 5 reinforced concrete culverts, base course surfacing and misc. work on 11.4 mi. of the Green River-Kemmerer road, Sweetwater County; by St. Hwy. Dept.

2,836—**Read Construction Co.,** 706 W. 19th St., Cheyenne—Award for grading, draining and misc. work on 10.7 mi. of the Medicine Bow-North road in Carbon County; by St. Hwy. Dept.

6,000—**Strong & Company,** Springville—Low bid for construction of 2.2 mi. parking areas and concrete roads and 2.8 mi. main line, Yellowstone National Park; by BPR.

SUPERVISING THE JOBS . . .

. . . Continued from page 125

wright foreman, **J. McKee** is electrical foreman, **M. Vole**, iron foreman, and **T. Pettingill**, paint foreman. **B. Norton** is pipe foreman and **C. Baker** is labor foreman. **W. Gregg** is pile-maker foreman, with **R. Adams** as cement foreman and **S. Hoopes** as teamster foreman. **E. Parker** is master mechanic. **C. Landmark** is buyer and **G. Fitzimmons** is in charge of store. **H. Eliason** is office manager and **Ray Portlock** is job engineer.

* * *

Construction of Perris Hills High School, San Bernardino, Calif., is under the supervision of **John Christenson**, with **Roy Rodin** as his assistant, for Gordon Fields, contractor. **Otis Burrows, Art Huett, Howard Hewett** and **Emil Mintz** are carpenter foremen. **Carmen Lopez** is labor foreman. Other key men on the job are **Red Nelson, Joe Azyedo, Louis Marada, Bennie Stalcup** and **Bob Stevens. William H. Hughes** is chief inspector.

* * *

Morrison-Knudsen Co., Inc. holds a contract totaling more than $16,000,000 for major line changes of the Union Pacific Railroad trackage from Cheyenne to Laramie, Wyo., a distance of 42 mi. **R. E. Denham** is project manager. **Ralph Jones** is assistant superintendent. **Bill Anderson, Joe Haines, Clint Taylor, Grant Peacock, Clark Johnson, Kensel Shotwell, Russ Healey, Dean Rule** are superintendents. **Johnny Johnson, Bill Miller, Johnny Williamson, Jim Barta, Leroy Byers**, master mechanics. **Harry Worthinton, Bill Anderson, Ray Jessen, Tevis Pulliam, Wallace Withrow** are grade foremen. Shop foremen are: **Whitey Crouch, "Kokamo" Thompson, "Hub" Edwards.** Drill foremen are: **"Doc" Nelson, Bob O'Neil**, and **Bill Moody** is general foreman. **Bill Perkins** is project engineer with **Walt Romberg** as his assistant.

* * *

Mine stripping in Montpelier, Idaho, for San Francisco Chemical Co., is being supervised by **L. J. Hinnewinkel** for Peter Kiewit Sons' Co. **F. J. Crable** is grade foreman along with **Dick Watson. Art Day** is master mechanic.

* * *

A $952,511 contract for construction of a roadway on the Old Oregon Trail between Regina and Cleft was awarded to Duffy Reed Construction Co. **Clarence Webb** is superintendent for the firm on the 13.7 mi. of surfacing. **Don Turner** is grading foreman, **Sherman Weisgerber**, grading foreman, and **Harry Merrick**, master mechanic. **Roy Pearson** is office manager.

* * *

In Riverside, Calif., H. M. Hodges has one $880,900 contract for construction of the Physical Sciences building at the University of California campus. The same firm holds a joint contract with Pozzo Construction Co. for the $1,126,-

Continued on page 134

UNIT BID PRICES

Selected bid abstracts for Western projects

Dam

Nimbus Dam and power plant

California—Central Valley Project—USBR. Winston Bros. Co. and Al Johnson Construction Co., Monrovia, submitted the low bid of $6,067,353 for construction of Nimbus Dam, power plant and appurtenant works, Folsom Unit, American River Division, Central Valley Project. Unit prices were as follows:

(1)	Winston Bros. Co. and Al Johnson Const. Co.	$6,067,353
(2)	The Arundel Corporation and L. E. Dixon Co.	6,219,870
(3)	Peter Kiewit Sons' Co. and Stolte, Inc.	6,335,464
—	Guy F. Atkinson Co.	6,378,212
—	Merritt-Chapman & Scott Corp. and The Savin Construction Co.	6,528,311
—	Morrison-Knudsen Co., Inc.	6,775,274
—	A. Teichert & Son, Inc. and John Gist Co.	6,791,759
—	C. R. Lytle Co., Donovan Construction Co. and Johnson Drake and Piper, Inc.	7,223,030
—	Walsh Construction Co.	7,250,010
(4)	Engineer's estimate	6,874,936

		(1)	(2)	(3)	(
Lump sum, diver. and care of river during constr. and unwat'g fndtns.		515,000	600,000	665,000	450,0
242,500	cu. yd. excav., common, first 242,500 cu. yd.	2.25	2.00	1.30	1.
242,500	cu. yd. excav., common, over 242,500 cu. yd.	.70	.75	1.30	1.
140,000	cu. yd. excav., rock, first 140,000 cu. yd.	3.75	2.00	1.30	3
140,000	cu. yd. excav., rock, over 140,000 cu. yd.	2.50	.75	.90	2
65,000	sq. ft. applying protective coating to finished foundtn. surf.	.56	.50	.10	
12,000	cu. yd. excav. of impervious core from borrow	.95	.50	.50	
12,000	cu. yd. compacting impervious core	.30	.15	.23	
22,350	cu. yd. backfill	.60	.50	.60	
53,340	cu. yd. impervious backfill	1.00	.50	.60	
19,150	cu. yd. free-draining backfill	.90	.40	.60	
54,840	cu. yd. compacting backfill and impervious backfill	.70	.30	1.40	1
19,150	cu. yd. compacting free-draining backfill	.18	.30	1.40	1
900	cu. yd. furn. and placing 24-in. riprap	4.00	7.00	5.00	5
11,350	cu. yd. furn. and placing 1 cu. yd. riprap	5.50	8.00	9.00	8
3,100	cu. yd. furn. and placing grav. bedding for riprap and dr. tile	2.50	3.50	4.30	6
6,000	lin. ft. furn. matls. and constr. graded sand and gravel drains with perforated pipe	3.60	8.50	6.30	3
600	cu. yd. constructing reverse filter	7.00	12.50	5.80	10
2,550	lin. ft. furn. and laying 8-in. diam. sewer pipe with cem. jts.	2.30	2.00	4.60	2
280	lin. ft. furn. and laying 6-in. diam. sewer pipe with cem. jts.	2.00	2.50	3.90	2
700	lin. ft. constr. relief walls	30.00	65.00	50.00	2
40	cu. yd. constr. graded sand and gravel drain without pipe	5.00	5.00	4.30	1
1,500	cu. yd. selected surfacing for roads and service area	3.00	4.00	2.00	
10	cu. yd. gravel surfacing for transformer area	3.00	20.00	4.30	
60	lin. ft. furn. and laying 24-in. corru. metal pipe	5.50	5.50	6.60	
200	lin. ft. furn. and laying 36-in. corru. metal pipe	10.00	8.50	9.90	1
160	lin. ft. furn. and laying 48-in. corru. metal pipe	16.00	13.50	13.20	1
200	M.b.m. furn. and erecting timber cut-off wall	180.00	350.00	300.00	25
115,000	bbl. furn. and handling cement	4.00	4.25	4.30	
180,000	lb. furn. and placing reinf. bars ½-in. diam. and smaller	.12	.147	.12	
2,570,000	lb. furn. and placing reinf. bars ⅝-in. diam. to ⅞-in. diam.	.11	.11	.11	
1,470,000	lb. furn. and placing reinf. bars 1-in. diam. and larger	.10	.11	.10	
700	cu. yd. backfill conc. for power plant struct.	13.60	5.00	9.00	2
5,500	cu. yd. first-stage conc. in power plant substruct.	24.00	42.65	30.00	4
4,200	cu. yd. first-stage conc. in power pl. intermed. struct. Cl. A	45.00	42.65	50.00	5
1,900	cu. yd. first-stage conc. in power pl. intermed. struct, Cl. B	24.40	42.65	36.00	4
3,200	cu. yd. second-stage conc. in power plant struct.	23.40	42.65	34.50	4
550	cu. yd. third-stage conc. in power plant struct.	47.50	102.20	60.00	9
6,000	sq. ft. furn. and applying each coat of water-proofing compound for turbine scroll cases	.30	.40	.35	
140	cu. yd. concrete in blockouts	92.00	350.00	138.00	11
71,900	cu. yd. concrete in overflow weir and gravity walls	15.40	11.00	16.00	1
5,775	cu. yd. concrete in piers and bridge	33.00	58.40	50.00	6
22,000	cu. yd. concrete in aprons	15.50	22.00	19.00	2
2,600	cu. yd. concrete in walls	40.50	46.50	41.00	4
125	cu. yd. concrete in miscl. structs.	51.00	80.00	102.00	7
125	sq. ft. furn. and placing ½-in. preformed bitum. joint filler	.72	1.25	.80	
4,900	sq. ft. furn. and placing elastic joint filler	1.50	3.00	1.80	
3,600	sq. ft. furn. and placing 1-in. corkboard joint filler	1.35	1.60	.69	
1,100	sq. ft. furn. placing, and removing temp. jt. filler 1 in. thick	1.40	1.60	.91	
200	sq. ft. furn. placing, and removing temp. jt. filler ½ in. thick	1.30	1.85	.87	
475	lin. ft. installing rubber joint strips	1.00	.70	1.80	
7,900	lin. ft. placing type "A" rubber water stops	1.00	1.85	1.80	
1,350	dowel bars placing dowel bars with rubber sleeves	.30	1.30	1.50	
4	recesses finishing recesses for type "A" lighting fixtures	20.00	25.00	9.00	
7	recesses fin. recesses for lighting panel boards, miscl. power boards, and other recessed elect. equip.	33.00	40.00	11.00	
5,000	sq. ft. furn. and placing membrane waterproofing	.70	1.00	.46	
200	sq. yd. furn. and applying 2-coat asph.-emuls. dampproofing	1.75	1.50	1.90	
169,000	lb. furn. and erecting struct.-steel deck framing	.20	.22	.24	
49,000	lb. furn. and installing metal hatch covers	.45	.25	.33	
670	sq. ft. furn. and installing mineral wool insul. on hatch covers	.90	1.50	1.60	
28,000	lb. furn. and installing track rails in conc.	.20	.15	.19	
3.1	M.b.m. furn. and installing timber ties and guard timbers	300.00	200.00	200.00	3
7,100	lb. furn. and installing track rails on timber ties	.20	.15	.19	
90	cu. yd. rock ballast	5.00	4.50	4.30	
150,000	lb. installing anchor bolts	.27	.32	.34	
3,500	lb. furn. and installing anchor bolts	.40	.60	.60	
7,500	lb. furn. and installing embedded metal frames	.55	.43	.76	
38,000	lb. furn. and installing miscl. metal work	.40	.50	.71	
1,883,000	lb. installing radial gates	.08	.12	.14	
450,000	lb. installing radial gate hoists	.07	.09	.07	
96,000	lb. installing frames, seats, and guides for fixed-wheel and bulkhead gates	.20	.18	.19	

Continued on next page

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SUPERVISING THE JOBS...

. . . Continued from page 132

000 Biological building at the same site. **P. N. Schmoker** will be general superintendent on both projects. **P. D. Schmoker** will be foreman.

Construction of Frank Walton Junior High School in Compton, Calif., is under the supervision of **Clell Preston. Oscar Deakins, Gene Parker, Garland Cannon, C. E. Black** and **Guy Covington** are foremen. **Bob Mitchell** is labor foreman.

F. E. Decker Construction Co., Worling, Wyo., holds a $1,000,000 contract for construction of a 176-unit housing project in Williston, No. Dak. **E. E. Decker** is general superintendent, with **Wayne Parkon** as his assistant.

A $550,000 housing project in Williston, No. Dak., is being supervised by **Dale Forsberg** with **G. A. Forsberg** as project manager. Forsberg Construction Co. holds the contract.

Construction of an addition to Ventura County Hospital, Ventura, Calif., is under the general supervision of **William Bouck,** superintendent; **LaVerne Pember,** assistant superintendent; **Pete Ferguson,** general carpenter foreman, for Allison Honer Co. **Fritz Meyer** is office manager and **Larry Cenetto** is labor foreman. The project totals $1,265,000.

"Andy" Jensen, superintendent, will be in charge of construction of the Social Sciences and Humanities Building, Riverside campus, University of California, for Allison Honer Co. **Jim Higginbotham,** assistant superintendent, and **Joe Crane,** labor foreman, will also be on the job.

E. W. Kind is project manager for Allison Honer Co. on the $2,000,000 State School for the Deaf job, Riverside, Calif. **Jim Dykstra,** assistant superintendent; **Jim Hastings,** general carpenter foreman; **Kenny Brazier,** carpenter foreman; **Jeff Herroth,** labor foreman, and **Hobie Brader,** equipment superintendent. **Ralph Chase** is office engineer and **R. Honer** is office manager.

A new high school plant in Orange, Calif., being built by Allison Honer Co., is being supervised by **Ernie Everman,** superintendent, and **Carl Moore,** assistant superintendent. This $800,000 job is also staffed by **Jim Alderson** as carpenter foreman.

After many years in the construction field in the West—mainly California, Nevada, and Arizona—**Jack Ballard** has given it up for the restaurant business. He now operates the Royal Grill in Orlando, Fla. Ballard worked for many well-known firms during his career—among them Macco Corp., Morrison-Knudsen Co., Inc. and Womack Construction Co.

UNIT BID PRICES... CONTINUED

	(1)	(2)	(3)	(4)
180,300 lb. installing fixed-wheel and bulkhead gates	.10	.12	.09	.0
2,000 lb. furn. and installing draft-tube unwatering valves	.95	1.10	.75	.9
190,000 lb. erecting gantry crane	.10	.10	.06	.0
52,300 lb. installing trashracks and trash rake aprons	.065	.08	.10	.0
16,400 lb. installing trashrack supports and seats	.25	.14	.22	.1
9,700 lb. erecting trash rake assembly	.07	.08	.15	.1
91,000 lb. installing stop-log guide keys	.14	.06	.18	.1
24,000 lb. installing oil storage tanks	.05	.04	.73	.0
Lump sum, installing embedded parts of two 9-400-hp. hydraulic turbines				
3 units installing fire-hose and serv. cabinets and fire-hose reels	30.00	50.00	50.00	40.0
7,000 lb. installing motor-driven drainage and unwatering pumps	.14	.13	.15	.1
13,000 lb. furn. and install. steel tubing, pipe, valves and fittings 6 in. in diam. and larger	.45	.56	.41	.5
4,850 lb. furn. and install. steel tubing, pipe, valves, and fittings smaller and 6 in. in diam.	.50	.65	.60	.7
5,100 lb. furn. and install. cast-iron soil pipe and fittings 6 in. in diam. and larger	.40	.40	.36	.4
8,800 lb. furn. and install. cast-iron soil pipe and fittings less than 6 in. in diam.	.35	.42	.53	.5
40,000 lb. furn. and install. cast-iron bell-and-spigot water pipe and fittings 6 in. in diam. and larger	.30	.45	.32	.4
4,500 lb. furn. and install. cast-iron bell-and-spigot water pipe and fittings less than 6 in. in diam.	.30	.45	.38	.5
60 lin. ft. furn. and lay. 4-in. diam. vitrified clay sewer pipe with closed joints	2.00	1.00	1.20	2.0
400 lin. ft. furn. and lay. 4-in. diam. drain tile with open joints	1.00	1.00	.89	1.0
3,500 lb. furn. and installing ground cables and ground rods and making ground connections	2.00	2.00	1.90	2.0
130 lin. ft. furn. and install. embedded elect. metal conduit ½ in. in diam.	1.20	1.20	1.40	0.9
6,700 lin. ft. furn. and install. embedded elect. metal conduit ¾ in. in diam.	1.20	1.20	1.70	1.0
1,680 lin. ft. furn. and install. embedded elect. metal conduit 1 in. in diam.	2.00	2.10	2.00	1.9
2,700 lin. ft. furn. and install. embedded elect. metal conduit 1 and ½ in. in diam.	2.15	2.20	2.30	1.9
680 lin. ft. furn. and install. embedded elect. metal conduit 2 in. in diam.	2.50	2.60	2.90	2.0
550 lin. ft. furn. and install. embedded elect. metal conduit 2 and ½ in. in diam.	2.80	2.90	3.40	2.9
200 lin. ft. furn. and install. embedded elect. metal conduit 3 in. in diam.	3.80	3.90	4.60	3.9
250 lin. ft. furn. and install. exposed elect. metal conduit ½ in. in diam.	1.20	1.40	1.70	1.3
50 lin. ft. furn. and install. exposed elect. metal conduit ¾ in. in diam.	1.30	1.50	2.30	1.9
100 lin. ft. furn. and install. exposed elect. metal conduit 1 in. in diam.	1.80	2.00	2.60	2.3
90 lin. ft. furn. and install. embedded elect. non-metallic conduit 2 in. in diam.	1.50	1.60	1.60	1.9
110 lin. ft. furn. and install. embedded elect. non-metallic conduit 3 in. in diam.	2.00	2.10	1.80	2.9
7,000 lin. ft. furn. and install. single conductor, No. 12 AWG, 600-volt insulated elect. wire	.15	.20	.11	.1
6,000 lin. ft. furn. and install. single conductor, No. 10 AWG, 600-volt insulated elect. wire	.16	.20	.15	.1
4 panel bds. furn. and install. recessed lighting panel boards	350.00	350.00	310.00	30
4 fixts. furn. and installing type "A" lighting fixtures	6.00	10.00	4.50	1
107 fixts. furn. and installing type "B" lighting fixtures	10.00	10.00	23.00	2
18 fixts. furn. and installing type "C" lighting fixtures	6.00	6.00	23.00	1
2 fixts. furn. and installing type "D" lighting fixtures	12.00	12.00	29.00	3
19 fixts. furn. and installing type "E" lighting fixtures	41.00	45.00	34.00	7
4 fixts. furn. and installing type "F" lighting fixtures	13.00	15.00	34.00	2
4 fixts. furn. and installing type "G" lighting fixtures	10.00	9.00	34.00	3
7 fixts. furn. and installing type "H" lighting fixtures	11.00	12.00	175.00	2
8 fixts. furn. and installing type "I" lighting fixtures	63.00	65.00	34.00	10
14 fixts. furn. and installing type "K" lighting fixtures	144.00	150.00	34.00	17
8 fixts. furn. and installing type "L" lighting fixtures	28.00	30.00	390.00	3
4 fixts. furn. and installing type "AA" 96-in., 2-lamps fluorescent lighting fixtures	90.00	100.00	150.00	12
100 devices furn. and installing lighting sys. wiring devices in power plant	5.00	5.00	8.00	
1 receptacle furn. and install. 100-ampere, 460-volt, watertight, angle type, miscl. power receptacle	80.00	90.00	85.00	10
1 receptacle furn. and install. 60-ampere, 460-volt, watertight, angle type, miscl. power receptacle	55.00	60.00	60.00	8
1 receptacle furn. and install. 100-ampere, 460-volt, angle type, miscl. power receptacle	78.00	85.00	70.00	7
3 receptacles furn. and install 60-ampere, 460-volt, angle type, miscl. power receptacles	53.00	60.00	46.00	6
Lump sum, constr. 12.47-kilovolt constr. power transmission line	$50,000	$5,000	$50,000	$2(
4,500 lin. ft. placing type "F" rubber water stops	1.00	1.90	1.60	
10,000 lb. installing scroll case access doors and frames	.08	.07	.13	

Streets and Highways

Million-dollar grading and drainage job on Pacific Highway in Oreg

Oregon—Douglas County—State. Babler Bros., Inc., Portland, submitted the low bid of $988,62 grading the Anlauf-Elkhead Road unit, Divide-Rice Hill section of Pacific Highway. Unit prices we follows:

(1) Babler Bros., Inc.	$ 988,629	(4) Fred H. Slate Co. Oregon Ltd.	$1,1(
(2) Guy F. Atkinson Co.	1,040,004	(5) Kuckenberg Construction Co., Inc.	1,1
(3) McNutt Brothers	1,107,023	(6) Peter Kiewit Sons' Co.	1,3

	(1)	(2)	(3)	(4)	(5)	
All specified, clearing and grubbing	100,000	60,000	132,000	80,000	100,000	1
1,700 cu. yd. structl. excav., unclass.	4.00	2.00	4.00	4.00	10.00	

Continued on next page

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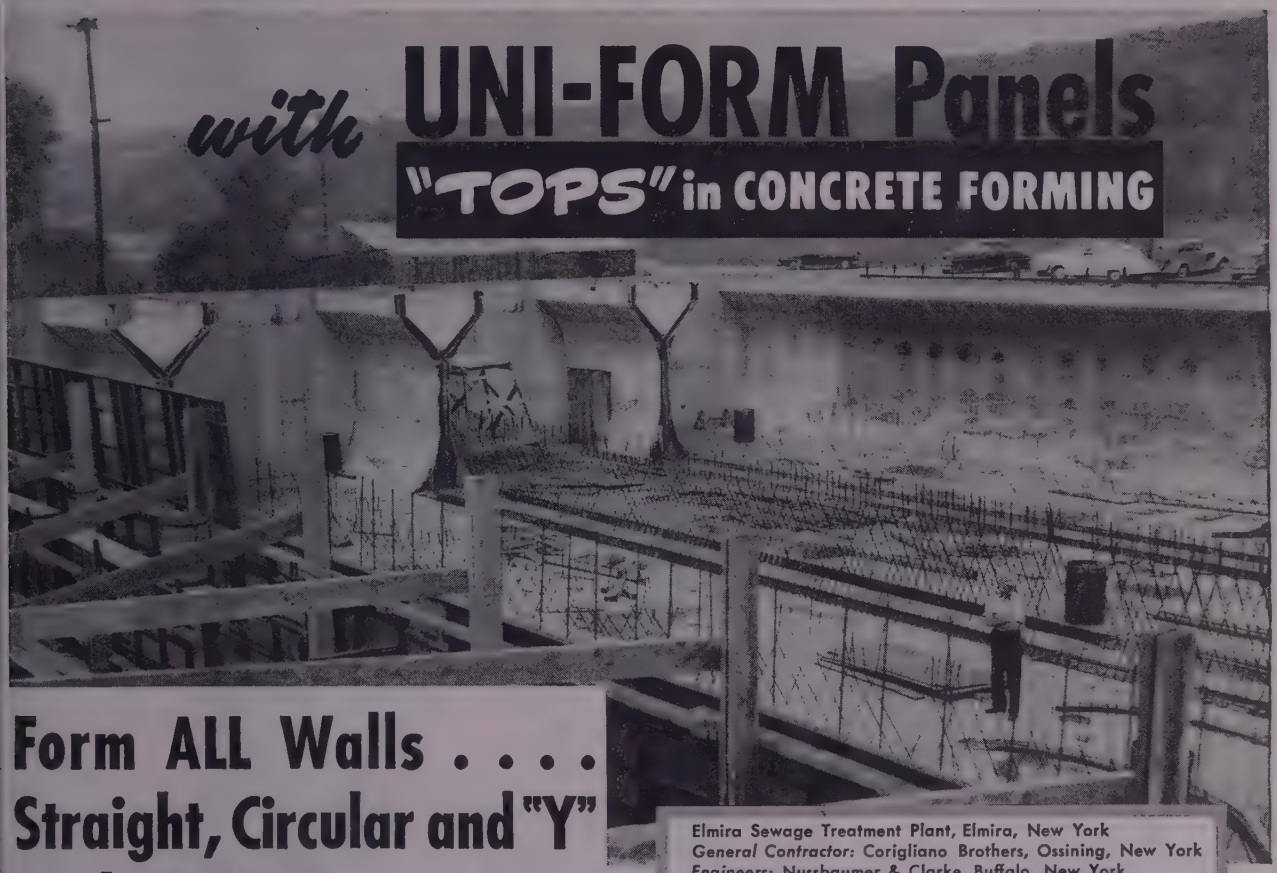

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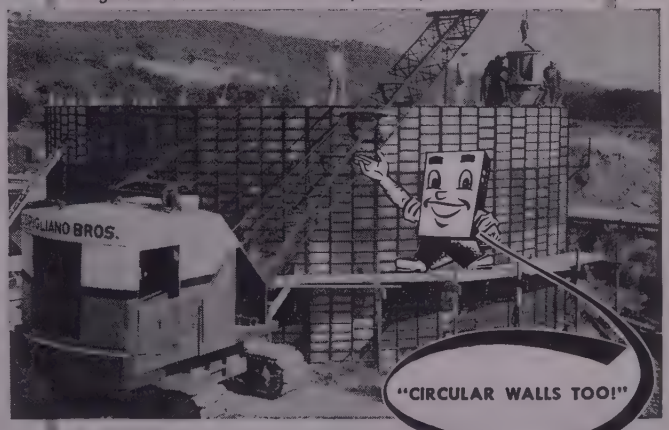

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Cat D4—Special Delivery —and how!

SPECTACULAR DELIVERY of a Caterpillar D4 Tractor and bulldozer was made recently by Poole-Krieger Implement Co., Caterpillar dealer at Redmond, Oregon, to a purchaser who wanted the machine delivered to the bottom of Oregon's picturesque and awe-inspiring Crooked River Canyon.

Opal Springs Water District, a privately owned concern furnishing the major portion of the domestic water supply for the towns of Culver, Madras, and Metolius in Jefferson County, as well as water for many farms in that county, purchased the machine to aid in construction of a new canal.

From the surrounding country to the river bed at Opal Springs is 1,000 ft. There are two ways to get to the bottom of the gorge—a tortuous trail down the cliff and a highline constructed on a bench 500 ft. straight up from the river bed. On this bench there is a 30-ft. highline tower and winch platform and the line covers a distance of 1,500 ft. from the tower to the landing below.

To make delivery of the tractor-bulldozer, Poole-Krieger dismantled the machine into loads of four tons or less to correspond with the winch capacity, and lowered the machinery to the landing in one day. The machine was reassembled the following day and promptly went to work building the canal.

UNIT BID PRICES ... CONTINUED

		(1)	(2)	(3)	(4)	(5)	(6)
600	cu. yd. trench excav., unclass.	3.00	1.60	3.00	2.00	3.00	2.50
1,280,000	cu. yd. general excav., unclass.	.44	.51	.47	.58	.60	.67
2,629,000	yd. sta. short overhaul	.02	.01	.02	.02	.02	.01
34,000	yd. sta. long overhaul	.50	.80	.60	.50	.50	.60
7.34	mi. finishing roadbed and slopes	$1,000	$1,700	$1,000	$1,250	500.00	$1,600
25,200	lin. ft. rounding cutbanks	.25	.15	.20	.20	.25	.20
200	lin. ft. 72-in. corru. metal pipe	40.00	47.00	43.35	36.00	35.00	53.00
90	lin. ft. 84-in. corru. metal pipe	50.00	66.00	58.85	52.00	50.00	72.00
260	lin. ft. 6-in. perf. metal drain pipe, coated	2.00	2.50	1.80	2.00	4.00	2.00
290	lin. ft. 12-in. concrete pipe	2.00	5.00	1.80	2.20	2.00	3.40
3,150	lin. ft. 18-in. concrete pipe	3.50	6.50	3.45	4.00	4.00	5.00
1,080	lin. ft. 24-in. concrete pipe	5.00	8.00	4.85	5.25	5.00	6.75
130	lin. ft. 30-in. concrete pipe	8.00	10.50	6.60	7.00	7.00	9.40
220	lin. ft. 36-in. concrete pipe	10.00	12.50	8.95	10.00	9.00	12.00
800	lin. ft. 30-in. ex. str. concrete pipe	7.00	12.75	7.65	7.50	9.00	10.80
60	cu. yd. ¾-in. - 0 backfill in drains	10.00	5.50	6.00	8.00	5.00	10.00
420	cu. yd. Cl. "A" concrete in box culverts	60.00	68.00	70.00	56.00	70.00	62.00
66,200	lb. metal reinf. in box culverts	.12	.13	.12	.11	.12	.12
35,600	cu. yd. 3-in. - 0 rock in base	3.50	3.30	4.50	2.70	3.00	3.80
7,900	cu. yd. ¾-in. - 0 rock in base	4.00	3.50	4.50	2.70	3.00	4.4
2,400	M. gal. sprinkling	2.00	4.00	2.50	2.50	3.00	2.5

PCC paving and grade separation structures on Eastshore Freeway

California—Alameda County—State. Peter Kiewit Sons' Co., San Francisco, submitted the low bid of $2,552,500 to the State Division of Highways for about 1.5 mi. of grading, and surfacing with portland cement concrete pavement and plant mix surfacing on cement treated base and separation structures constructed on Eastshore Freeway between distribution structure and Ashby Ave. Unit prices were as follows:

(1) Peter Kiewit Sons' Co. $2,552,500
(2) Charles L. Harney, Inc. 2,563,058
(3) Carl N. Swenson Co., Inc. and Ball & Simpson 2,690,723
(4) Stolte, Inc., The Duncanson-Harrison Co. and Lee J. Immen $2,834,73
(5) Fredrickson & Watson Construction Co. and M & K Corp. 3,112,89

		(1)	(2)	(3)	(4)	(5)
740	cu. yd. removing concrete	10.00	6.00	12.00	19.50	12.8
3,250	cu. yd. removing pavment	2.00	3.60	3.00	3.25	3.3
80	sta. clearing and grubbing	100.00	72.00	60.00	60.00	440.0
270,000	cu. yd. predredging	.47	.48	.555	.45	.5
26,800	cu. yd. roadway excav.	.70	1.00	.80	2.40	1.2
6,200	cu. yd. struct. excav.	3.00	5.00	7.00	8.40	5.4
10,000	sq. yd. compact. orig. ground	.07	.10	.06	.09	.0
4,050	cu. yd. struct. excav. (bridges)	3.00	11.50	3.40	2.85	12.8
4,740	cu. yd. struct. backfill (bridges)	2.50	4.80	2.00	2.85	4.0
50,500	ton imp. subbase matl.	2.50	2.50	2.79	2.95	2.5
30,400	ton I.B.M.	3.40	3.00	2.79	2.95	3.3
7,000	lb. soil sterilizer	3.40	3.20	3.70	3.75	3.5
190	lb. seed (erosion control)	14.00	14.00	14.00	14.00	12.5
Lump sum,	dev. wat. sup. and furn. wat. equip.	$7,500	$10,000	$10,000	$7,000	$39,0
3,100	M. gal. applying water	2.00	1.50	1.60	2.50	2.5
80	sta. finishing roadway	25.00	20.00	30.00	20.00	120
3,600	bbl. portland cem. (cem. tr. subgr. and base)	3.80	3.60	4.30	5.00	4.5
40,000	sq. yd. mix. and compact. (cem. tr. subgr.)	.25	.50	.25	.35	.5
14,400	ton mineral aggregate (cem. tr. base)	6.00	2.60	4.00	4.80	4.5
96	ton asph. emul. (sl. ct. curing sl. and pt. bdr.)	50.00	36.00	42.00	36.00	42.5
65	ton liq. asph., SC-1 (pen. tr. and pr. ct.)	33.00	34.00	32.00	33.00	41.5
8	ton liq. asph., SC-2 (pen. tr.)	38.00	50.00	33.00	33.00	41.5
60	ton screenings (sl. ct.)	9.00	10.00	7.50	8.00	9.5
18,000	ton min. aggr. (P.M.S.)	7.50	6.20	7.00	6.05	8.5
900	ton paving asph. (P.M.S.)	7.50	25.00	7.00	20.00	8.5
1,300	lin. ft. raised traf. bars	1.00	1.75	1.50	1.25	2.5
9,000	cu. yd. P.C.C. (pavt.)	16.00	16.00	15.30	16.00	16.5
9,300	ea. pavt. tie bolt assemblies	.60	.54	.65	.53	.5
2	M.F.B.M. treated timber	500.00	400.00	350.00	345.00	470.0
6,440	cu. yd. Class "A" P.C.C. (struct.)	54.00	60.00	49.00	64.00	67.0
754	lin. ft. conc. railing	5.50	7.00	6.00	11.50	6.5
1,660	lin. ft. rubber waterstops	2.00	1.80	4.00	3.45	4.0
Lump sum,	open steel floor and supports	$4,000	$5,000	$2,700	$4,150	$3,4
1,300	lin. ft. furn. untreated timber piling	.75	.84	.80	.80	.8
41,544	lin. ft. furn. conc. piling	3.00	3.40	3.15	3.25	3.0
31	ea. driving timber piles	60.00	58.00	60.00	57.00	58.0
879	ea. driving conc. piles	60.00	55.00	59.00	54.00	55.0
210	ea. driving steel sheet piles	60.00	45.00	56.00	36.00	60.0
22	ton backing matl.	4.00	12.00	4.50	4.50	7.0
43,900	lb. miscl. iron and steel	.35	.30	.70	.30	.3
43,600	lb. placing bulkhead miscl. iron and steel	.11	.14	.30	.10	.1
52	lin. ft. 4-in. steel pipe	2.00	3.00	4.75	4.50	8.0
42	lin. ft. 4-in. cast iron pipe	3.00	4.00	3.25	4.50	3.0
310	lin. ft. 6-in. cast iron pipe	4.50	4.00	3.75	3.45	4.0
194	cu. yd. filter matl.	5.00	5.00	5.00	7.00	12.0
1,120,000	lb. bar reinf. steel	.008	.10	.09	.10	.0
1,640	cu. yd. P.C.C. (curbs and gutters)	35.00	37.00	34.00	35.00	35.0
450	lin. ft. salv. and reset. timber curbs	.70	1.25	1.00	1.25	.7
5	ea. r/w monuments	8.00	12.00	8.00	15.00	12.0
6	ea. survey monuments	30.00	40.00	32.00	40.00	35.0
135	ea. guide posts, horiz. refl. units and markers	8.00	7.00	7.00	12.00	8.0
232	lin. ft. metal plate guard railing	3.00	5.40	5.00	5.00	3.0
6,100	lin. ft. 2-in. chain link fence	2.00	2.00	2.15	2.00	2.0
3,660	lin. ft. 12-in. R.C.P.	3.00	2.00	4.25	4.00	3.0
90	lin. ft. 18-in. R.C.P.	5.50	3.40	5.30	5.00	5.0
1,110	lin. ft. 24-in. R.C.P.	7.00	5.60	7.50	8.00	7.0
456	lin. ft. 30-in. R.C.P.	10.00	8.00	11.00	15.00	10.0
294	lin. ft. 54-in. R.C.P.	23.00	27.00	33.00	35.00	30.0
1,078	lin. ft. 8-in. C.M.P. (16 ga.)	2.00	2.40	2.20	2.50	2.0
80	lin. ft. salv. exist. C.M.P.	1.00	1.20	1.25	1.50	1.0
1	ea. new manhole	500.00	480.00	500.00	350.00	470.0
1,880	lin. ft. salv. exist. galv. iron pipe	.65	.50	.65	.40	.6
1,880	lin. ft. relay. salv. galv. iron pipe	.75	.80	1.00	.40	.7
3,200	lin. ft. 2-in. galv. iron pipe	1.25	1.50	1.80	1.15	1.2
Lump sum,	drainage pumping equip.	500.00	$1,800	$1,300	$1,835	$2,0
Lump sum,	electrical equip.	170.00	180.00	200.00	$1,400	18
Lump sum,	structure lighting	$3,500	$4,000	$4,000	$3,400	$4,0
Lump sum,	highway lighting	$40,000	$38,000	$45,000	$40,000	$41,0
Lump sum,	illuminated direction sign frames	$3,000	$2,800	$5,600	$3,100	$3,0

Continued on next page

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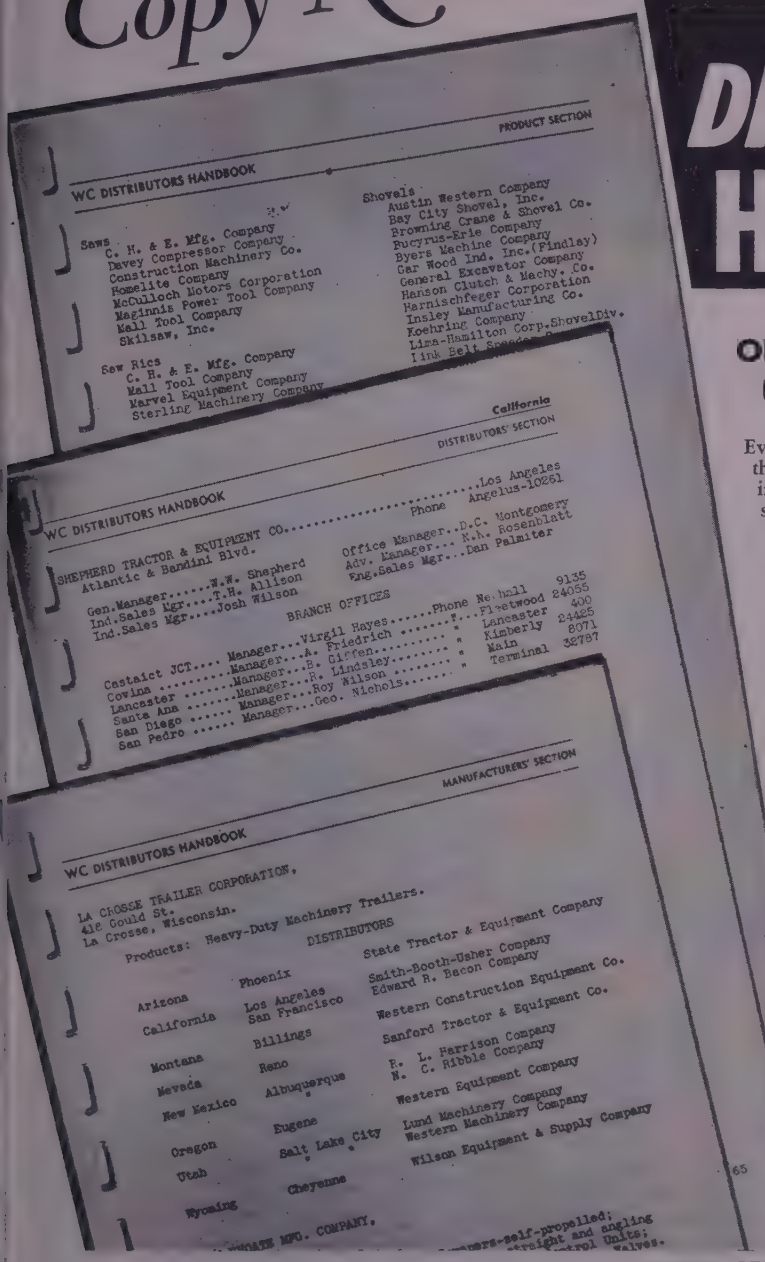

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WYOMING USES SCORIA

. . . Continued from page 62

On March 27 of this year a second project of 7.141 mi. immediately adjacent to the above contract was awarded to the Inland Construction Co. at a contract price of $536,258. This project called for an identical type of construction and the use of materials from the same sources. Grading on this project is practically complete, structures are advancing rapidly and selected embankment is presently being placed. The contractor has been planning to use a central mixing plant set up at the stockpile to mix the scoria-cement base, but present indications are that he may choose to have the Big Horn Construction Co. continue with its equipment. Progress on both projects appear to assure completion early in September, thus giving a 17-mi. continuous section of this type of construction.

So far as is known, this is the first time that scoria has been used for a cement-stabilized base. Both the base and the plant-mixed surface course appear to be of excellent quality and it may well be that this type will serve as the answer to many more miles of both primary and secondary roadways that will soon have to be constructed in the north-central and north-eastern part of Wyoming.

Personnel

Acting under J. R. Bromley, Superintendent, Wyoming Highway Department, R. J. Templeton, construction engineer, is in immediate supervision of these projects with Russell Doud as project engineer. Donald Berg is superintendent for the Big Horn Construction Co.

ASPHALT-LINED RESERVOIR

. . . Continued from page 59

the capacity of the incoming line, and extending below the floor level it will also take away the flow from the underdrains. Drain line from the outlet structure is also 48 in.

At the outlet end, a concrete structure will stand at the toe of the slope and rise to the level of the embankment. Three 4 x 4-ft. sluice gates are arranged on the sides so that water may be drawn from any one of three levels. Also incorporated in the structure are vertical panels of 20-mesh screen in double channels so that a clean screen may be inserted as a dirty one is pulled to be washed.

Outside the embankment at the outlet end is being erected a control building. The outlet line passes through the basement of the building where a 48-in. flow meter will register and record continuous rate of flow and also actuate the automatic chlorinators. On the main floor will be the chlorinator room, small office space, washroom, and space provided for installation of fluoridation equipment, if later required. The building has been designed in such a way that

Continued on page 140

UNIT BID PRICES . . . CONTINUED

	(1)	(2)	(3)	(4)	(5)
Lump sum, traffic signals and inters. lighting systems	$5,500	$5,500	$5,500	$4,600	$5,800
29 ea. remov. and salv. electroliers	25.00	8.00	54.00	50.00	28.0
3 ea. moving and relocating electroliers	200.00	212.00	270.00	260.00	207.00
15 ea. wooden pole electroliers	350.00	400.00	314.00	265.00	400.0
ALTERNATE ITEMS					
Alternative A					
1,196,800 cu. yd. dredger sand fill	.69	.64	.784	.79	
Alternative B					
660,000 cu. yd. sand fill					1.6

3-in plant mix surfacing in Utah

Utah—Box Elder County—State. LeGrand Johnson, Logan, submitted the low bid of $600,598 to the State Road Commission for construction of a 3 in. plant mix bituminous surfaced road 4.3 mi. in length between Rattlesnake Pass and Snowville on U. S. Highway 30-S. Unit prices were as follows:

(1) LeGrand Johnson $600,598
(2) W. W. Clyde & Co. 603,594
(3) Floyd S. Whiting & Co. 676,981
(4) Gibbons & Reed Co. $743,03
(5) Engineer's estimate 593,86

	(1)	(2)	(3)	(4)	(5)
19,500 ton plant mixed bituminous surfacing	2.60	2.60	3.25	3.50	2.5
222,000 gal. bituminous matl., Type 120-150 Pen.	.12	.115	.13	.12	.1
59,500 gal. bituminous matl., Type MC-1 or MC-2	.13	.13	.14	.14	.1
4,000 gal. bituminous matl., Type RC-2	.14	.14	.15	.15	.1
19,000 gal. bituminous matl., Type RC-4	.15	.15	.15	.15	.1
190 gal. bituminous additive	2.00	2.25	2.00	2.50	2.(
950 ton cover matl.	3.50	4.00	4.00	6.00	2.5
0.22 mi. obliteration of old road	400.00	400.00	500.00	500.00	200.(
19,700 ton cr. rock and cr. gravel surface course	.70	.90	1.00	.90	.8
20,900 ton gravel or crushed rock base course	.70	.95	1.00	.85	.7
40,000 cu. yd. selected matl. base course	.55	.75	.60	.70	.5
337,000 cu. yd. unclassified excav.	.87	.83	.95	1.00	.9
1,464,000 sta. yd. overhaul, Class "A"	.0175	.012	.015	.015	.0
17,000 yd. mi. overhaul, Class "B"	.20	.15	.15	.20	.
3,800 1,000 gal. watering	3.00	2.00	3.00	5.00	1.5
2,600 hr. rolling (tamping roller)	5.00	10.00	6.00	10.00	9.(
350 hr. rolling (pneumatic tire roller or power roller)	5.00	6.00	8.00	7.00	5.(
60 lin. ft. 15-in. C.G.M. pipe	3.00	2.80	3.00	4.00	2.5
62 lin. ft. 18-in. C.G.M. pipe	3.50	3.30	4.00	4.50	3.5
1,014 lin. ft. 24-in. C.G.M. pipe	5.00	5.20	5.50	5.50	4.5
96 lin. ft. 30-in. C.G.M. pipe	6.00	6.30	7.00	7.50	5.5
94 lin. ft. 36-in. C.G.M. pipe	10.50	10.30	10.00	11.50	7.(
358 lin. ft. 48-in. C.G.M. pipe (10 gauge)	18.00	16.00	16.00	20.00	17.(
366 cu. yd. concrete, Class "A"	75.00	65.00	80.00	90.00	60.(
70,700 lb. reinforcing steel	.15	.13	.14	.14	.
2,000 cu. yd. excav. for structs.	2.00	2.00	2.00	4.00	1.
17,000 cu. yd. channel excav.	.60	.90	1.00	2.60	.
55 acre clearing and grubbing	40.00	50.00	100.00	50.00	50.
60 ea. guide posts	7.00	6.00	8.00	8.00	5(
5,495 lin. ft. guard rail	4.00	4.00	4.00	4.00	3.
50 ea. right-of-way markers	6.50	7.00	8.00	8.00	5.
2 ea. F.A.P. markers	30.00	25.00	25.00	20.00	20.
45,666 lin. ft. right-of-way fence, Type "B"	.34	.32	.35	.35	.
10 ea. 10-ft. gates	30.00	30.00	30.00	35.00	30.
10 ea. 16-ft. gates	40.00	40.00	40.00	40.00	35.
5,000 lin. ft. surface ditches	.12	.07	.10	.10	.
Lump sum, furn. watering equip.	$1,500	$4,000	$1,000	$3,000	$2,5
Lump sum, furn. construction signs	500.00	500.00	500.00	800.00	500.

Concrete arch culvert and fill

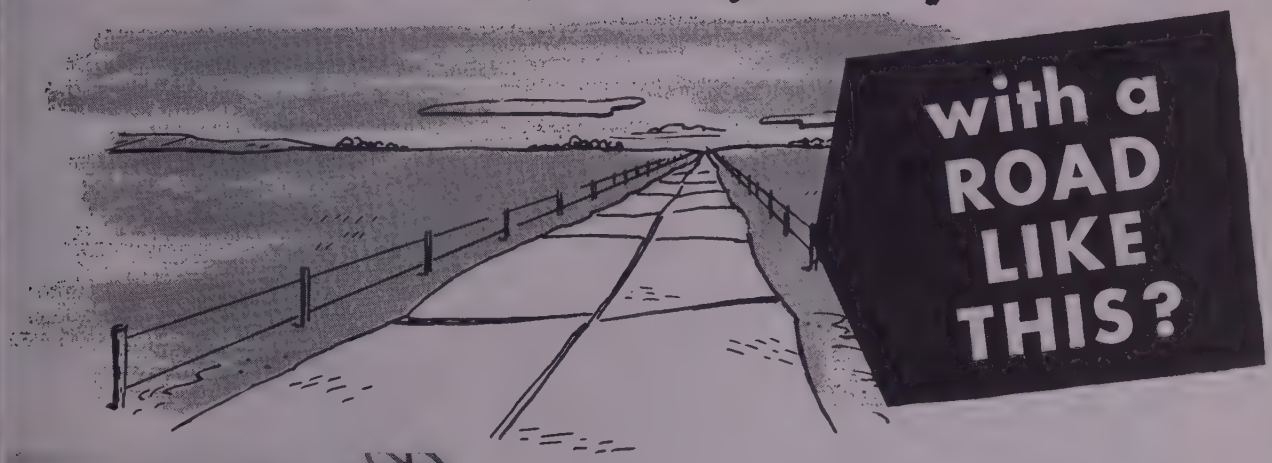
California—Mendocino—State. Eaton & Smith, San Francisco, submitted the low bid of $516,184 to t Division of Highways for construction of a reinforced concrete arch culvert and placing a fill thereon a grading about 9.4 mi. or road and surfacing with road-mix surfacing on cement treated base at Rattlesna Creek, about 1 mi. south of Cummings Post Office. Unit prices were as follows:

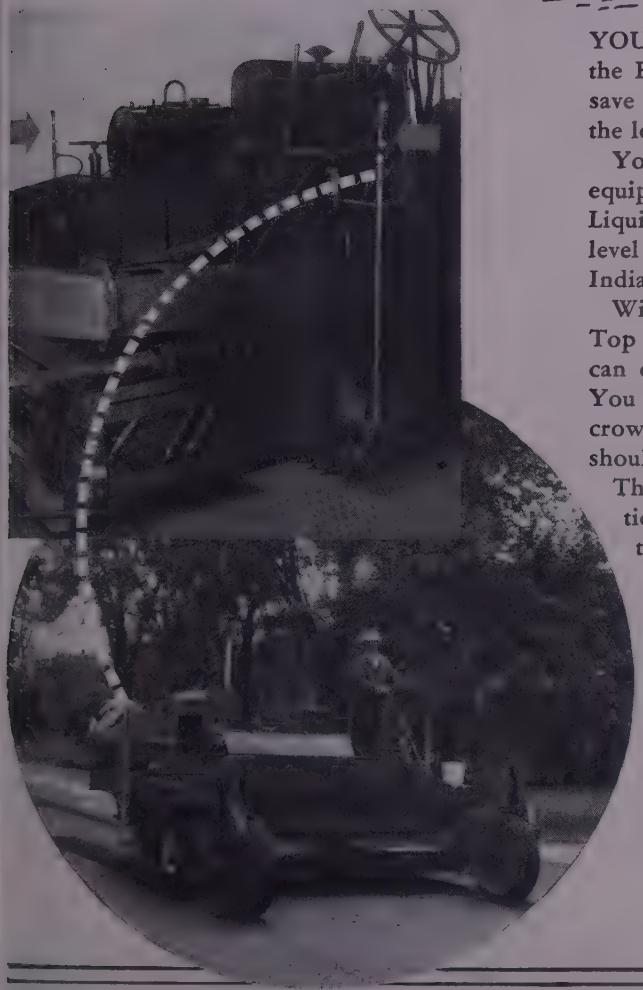
(1) Eaton & Smith $516,184
(2) J. Henry Harris 585,541
(3) Fredrickson Bros. 612,132
(4) Tumblin Co. $682,1
(5) Rothschild, Raffin & Weirick 685,4

	(1)	(2)	(3)	(4)	(
5 cu. yd. removing conc.	26.00	15.00	12.00	14 00	14
9 acres clearing and grubbing	$1,150	$1,939	900.00	600.00	600
99,200 cu. yd. roadway excav.	1.28	1.41	1.65	1.77	2
13,500 cu. yd. trench excav.	.55	1.50	2.25	3.50	3
1,685 cu. yd. struct. excav. (bridge)	9.40	16.35	25.00	30.00	15
700 cu. yd. struct. backfill (bridge)	4.60	9.20	7.00	3.00	6
2,500 cu. yd. struct. excav.	5.10	4.10	4.40	4.00	4
170 cu. yd. ditch and channel excav.	3.80	4.80	3.00	4.00	4
403,000 sta. yd. overhaul	.0075	.01	.015	.01	
Lump sum, dev. wat. sup. and furn. wat. equip.	$15,000	$2,000	$3,000	$5,000	$5,
3,800 M. gal. applying water	.80	2.50	2.00	2.50	2
24 sta. finishing roadway	15.00	12.00	20.00	10.00	10
2,050 cu. yd. min. aggr. (com. tr. base)	4.15	4.30	6.30	3.70	3
900 bbls. portland cement (cem. tr. base)	8.25	5.40	5.20	5.00	5
9,900 sq. yd. mix. and compact. (cem. tr. base)	.25	.36	.35	.20	
11 ton asph. emul. (curing sl. and sl. ct.)	90.00	60.00	75.00	50.00	5(
5 ton liq. asph., SC-2 (pr. ct.)	79.00	54.00	63.00	50.00	5(
45 cu. yd. sand (curing sl.)	12.50	8.50	11.50	7.50	
1,050 cu. yd. min. aggr. (R.M.S.)	5.15	4.32	7.00	4.00	
80 ton liq. asph., MC-3 or MC-4 (R.M.S.)	35.00	34.00	46.00	40.00	4(
9,400 sq. yd. mix and compact. R.M.S.	.20	.24	.20	.15	
11 ton liq. asph., RORC-5 (sl. ct.)	48.50	48.00	52.00	50.00	5(
105 cu. yd. screenings (sl. ct.)	14.25	8.40	14.00	8.00	1
800 lin. ft. placing R.M.S. dikes	.30	.40	.30	.40	
200 sq. yd. placing R.M.S. ditch pav't.	.77	1.00	2.50	1.00	
2,760 cu. yd. Class "A" P.C.C. (struct.)	56.60	76.05	65.00	76.00	8
35 cu. yd. Class "C" P.C.C. (backfill)	50.50	36.00	44.00	20.00	4
220,000 lb. erect. struct. steel (drift barrier)	.058	.12	.09	.04	

Continued on next page

What are you going to do





YOU'VE seen roads warped like this drawing! For the Highway Department it's a question of how to save it! For the Contractor it's how to do it right for the least cost.

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IN ONE PACKAGE from BLAW-KNOX

a second story can be added to provide space for chemical storage and hoppers if fluoridation is decided upon. Continuous chart records will be kept of water in the reservoir, rate of flow, and residual chlorine. Feasibility of transmitting these readings by electrical circuits to indicating instruments at the operating building in Salem is being investigated. It is planned to continue chlorination at Stayton, with additional chlorine added at Turner to make up loss through the reservoir.

Other features of the project remaining to be constructed are an oiled roadway around the rim, which will also serve to prevent surface water from seeping down behind the lining, a drain line to carry the overflow away to a nearby draw, and a 7-ft. fence around the entire project, including the roadway.

Total cost of the project, including land, will be about $450,000. This will represent a unit cost of $4,500 per million gallons, which is a low figure for artificial storage.

When completed and placed in operation, Turner Reservoir will give Salem's water system a short breathing spell in its race to keep up with the growth of the city. Studies are now being made to determine the next steps to be taken. In general, choice lies between development of an auxiliary supply on the Willamette River or further development of the Santiam supply. In order to take full advantage of the investment already made at Turner, a second supply line to that point should logically be the next step.

Salem prides itself on being a "green" city and on not having had to ration or restrict the use of water. Every effort is being made to continue that record.

Personnel

Construction of the reservoir was made under three contracts with additional work being done by city forces. Excavation and construction of the embankment was done by Stevenson Construction Co. of Salem, with M. K. Buick as superintendent. Tunneling for inlet and outlet lines and blasting of subdrain ditches, under C. R. Anderson, and preparation of floor and slopes and laying of subdrains, with W. H. Smith in charge, was done by city forces.

Placing of base rock and asphaltic paving and sealing is being done by Central Paving Co., Dallas, under the supervision of Fred Voigt. Construction of the outlet structure and control building is under contract to E. E. Batterman Co., Salem, with Lorin W. Johnson in charge.

Representing the City of Salem, J. L. Franzen is City Manager and C. E. Guenther was Manager of the Water Department at the start of the project. W. H. Stewart is engineer in charge of asphalt paving operations. The author succeeded to the position of Manager of the Water Department in February, 1952, and has been responsible for design and construction of the project since its beginning.

UNIT BID PRICES . . . CONTINUED

		(1)	(2)	(3)	(4)
200	cu. yd. light stone riprap	7.40	24.00	22.00	30.00	20.0
21	ea. r/w monuments	9.00	8.40	9.00	8.00	8.0
36	ea. instal. culv. markers and guide posts	5.20	5.40	4.50	5.00	5.0
18	ea. salv. and reset. guide posts	3.90	4.20	3.00	4.00	4.0
0.36	mi. new property fence	$1,880	$3,000	$4,000	$2,520	$2,52
282	lin. ft. 18-in. R.C.P.	6.20	4.80	4.60	7.00	7.0
165	lin. ft. 24-in. R.C.P.	7.60	6.60	6.30	9.10	9.1
2,235	lin. ft. 8-in. perf. metal pipe underdrains (16 ga.)	2.05	2.28	3.35	2.25	2.2
3,800	cu. yd. filter mat'l.	6.00	4.80	7.00	9.25	9.2
70	lin. ft. 8-in. corrug. metal pipe down drains (16 ga.)	2.10	2.40	2.50	2.00	2.0
214	lin. ft. 12-in. corrug. metal pipe down drains (16 ga.)	2.55	3.00	3.20	2.80	2.8
52	lin. ft. 18-in. corrug. metal pipe down drains (16 ga.)	3.65	4.60	4.30	3.85	3.8
3	ea. spillway assemblies	38.00	42.00	35.00	40.00	40.0
2	ea. spillway assembly down drain slip joints	34.70	24.00	25.00	40.00	40.0
166	lin. ft. salv. exist. pipe culv.	1.15	2.40	3.00	2.80	2.8
136	lin. ft. relay. salv. C.M.P. culv.	1.35	2.40	2.50	2.10	2.1
2	ea. redwood covers for drop inlets	23.00	20.00	25.00	14.00	14.0
Lump sum,	remov. exist. cribbing	$6,760	$3,121	$2,000	$6,000	$6,00
348,000	lb. bar and reinf. steel	.126	.11	.12	.14	.1
Lump sum,	remov. exist. bridge	$23,000	$10,000	$7,500	$7,000	$13,50
	CONCRETE CRIBBING					
140	ea. 8-in. x 5-in. x 6-ft. headers	8.60	9.00	8.75	10.20	10.2
375	ea. 10-in. x 5-in. x 6-in. headers	11.50	11.00	10.50	12.65	12.6
110	ea. 10-in. x 5-in. x 8-ft. headers	14.00	13.00	12.75	15.45	15.4
550	ea. 6-in. x 6-in. x 6-ft. stretchers	7.20	8.00	7.75	8.75	8.7
560	ea. 8-in. x 6-in. x 6-ft. stretchers	8.50	9.00	8.75	10.00	10.0
110	ea. 10-in. x 6-in. x 6-ft. stretchers	10.60	11.00	9.50	12.10	12.1
85	ea. 10-in. x 6-in. x 10-ft. filler blocks	3.10	3.00	1.00	2.50	2.5

Heavy grading and plant-mix bituminous surfacing in Idaho

Idaho—Ada and Elmore Counties—State. Duffy Reed Construction Co., Twin Falls, received an awar from the State Department of Highways on its low bid of $952,511 for construction of a roadway and a plan mix bituminous surface on 13.7 mi. of the Old Oregon Trail from Regina to Cleft. Unit prices were as follow

(1) Duffy Reed Construction Co. ..... $ 952,511
(2) Peter Kiewit Sons' Co. 1,064,211
(3) Quinn Bros. & Robbins 1,207,008
(4) McNutt Bros. $1,305,3
(5) Engineer's estimate 972,8

		(1)	(2)	(3)	(4)	(5
1	ea. removal of bridge	$1,000	$1,200	$1,000	$1,500	$1,0
715,000	cu. yd. unclasified excav.	.33	.39	.42	.56	
260	cu. yd. excav. for structs. Sched. No. 1	2.00	2.00	2.00	8.00	3.
630	cu. yd. excav. for structs. Sched. No. 2	2.00	3.00	2.00	3.00	2.
30,000	cu. yd. borrow	.28	.30	.27	.38	
85,600	cu. yd. selected borrow, Class B	.50	.40	1.25	.70	1.
117,000	yd. mi. haul	.22	.20	.24	.30	
22,500	M. gal. watering embankments	2.00	3.00	2.50	3.25	2.
11,000	M. gal. watering base and surface courses	2.00	3.50	2.50	3.25	2.
86	days rolling power roller	45.00	45.00	55.00	60.00	45.
1,200	days rolling pneumatic tire roller	44.00	40.00	50.00	50.00	45
3,500	cu. yd. mechanical tamping	2.00	1.50	2.00	1.00	2
1,100	lin. ft. small ditches	.10	.25	.25	.80	
96	sta. obliteration of old roads Class I	10.00	12.00	15.00	10.00	25
0.174	mi. reconditioning existing roadbed Class B	500.00	800.00	750.00	800.00	300
108,000	ton cr. gr. surface course ¾-in. max.	1.75	1.75	2.29	2.10	2
1,560	bbl. RC-1 asph. road matl. for prime coat	7.50	7.50	6.65	9.30	7
1,020	bbl. MC-1 asph. rd. matl. for Type B surf. tr.	7.50	7.50	7.00	9.20	7
1,020	bbl. MC-5 asph. rd. matl. for Type B surf. tr.	8.50	7.50	7.00	9.20	7
2,490	ton cover coat matl. Cl. 5 for Type B surf. tr.	3.00	4.50	3.00	5.00	2
6,600	bbl. 121-150 Pen. asph. rd. matl. for pl. mix	7.00	7.00	6.40	6.20	6
23,400	ton plant-mix bituminous surface Class B	4.50	5.00	6.00	6.00	4
1,420	bbl. RC-5 asph. rqad matl. for seal coat	8.00	7.50	7.00	9.30	7
3,000	ton cover coat matl. Class 2	4.00	6.00	4.00	5.00	3
16,000	ton cr. gr. for shoulders ¾-in. max.	1.75	2.05	2.40	2.25	2
283	cu. yd. concrete Class A	60.00	75.00	63.00	78.00	55
41,000	lb. metal reinforcement	.15	.15	.14	.14	
Lump sum,	furn. pile driving equip.	800.00	$1,000	500.00	$3,000	300
1,960	lin. ft. furn. timber piles, treated	1.50	2.00	2.15	1.50	1
1,840	lin. ft. driving timber piles, treated	1.50	1.25	1.80	1.00	1
120	lin. ft. driving timber test piles	3.50	5.00	4.00	2.00	4
960	lin. ft. 12-in. pipe culverts	2.00	3.50	1.75	2.75	2
190	lin. ft. 18-in. pipe culverts	3.30	5.00	3.75	3.80	3
2,860	lin. ft. 24-in. pipe culverts	4.50	7.00	4.75	5.80	4
520	lin. ft. 30-in. pipe culverts	6.50	8.00	7.50	7.00	6
590	lin. ft. 36-in. pipe culverts	9.00	12.00	10.00	10.00	8
230	lin. ft. 42-in. pipe culverts	11.25	14.00	12.50	13.10	12
460	lin. ft. 48-in. pipe culverts	15.00	17.00	17.00	17.00	16
82	lin. ft. salvage 18-in. corr. metal pipe	1.00	2.00	2.00	2.00	2
120	ea. guide posts	10.00	12.00	12.00	12.00	8
2	ea. steel gates	50.00	50.00	60.00	70.00	50
90	lin. ft. tunnel liner underpass	67.25	70.00	60.00	80.00	50
10	cu. yd. gravel surface 1½-in. to 3-in. max.	3.00	5.00	5.00	10.00	3
3,550	cu. yd. gravel blanket	.80	1.80	.85	2.25	2
10,100	lin. ft. wire fence Type 2-A	.35	.21	.20	.20	

Mine-to-market road in Washington

Washington—Skagit County—State. J. J. Welcome Construction Co., Seattle, received a contract f the State on its low bid of $81,161 for 2.6 mi. on a mine-to-market road, Cascade River Extension and Bo Road Basin. Unit prices were as follows:

(1) J. J. Welcome Construction Co. ..... $ 81,161
(2) Excavators, Inc. 96,579
(3) B. P. Gerard 100,687
(4) Christofferson & Stakkeland $111
(5) Frank F. Propes & L. C. Moriarty.... 118
(6) Briggs Construction Co. 149

		(1)	(2)	(3)	(4)	(5)	
134.7	stas. (100 ft.) roadway complete except culverts and log bridges	475.00	450.00	450.00	490.00	572.00	86
762	lin. ft. 3-ft. x 2-ft. log culverts complete in place	4.50	5.00	5.00	10.00	10.00	
194	lin. ft. 4-ft. x 2-ft. log culverts complete in place	4.50	7.00	7.00	11.00	11.00	
80	lin. ft. 4-ft. x 3-ft. log culverts complete in place	4.75	8.50	8.50	12.00	12.50	

Continued on next page

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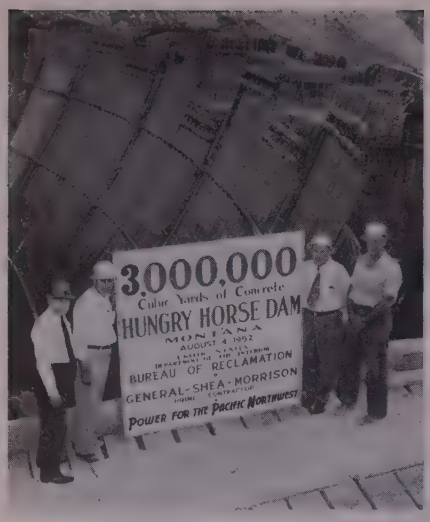

INSPECTION of Hungry Horse dam by Congressman *Michael J. Kirwin* (left) of Ohio, chairman of the house subcommittee on appropriations for the Department of the Interior, coincided with placement of the 3,000,000th cu. yd. of concrete in the huge multi-purpose dam being constructed by the Bureau of Reclamation in northwestern Montana. Less than 100,000 cu. yd. of concrete remain to be placed to complete the dam to its full height of 564 ft. this fall. Power from the first two 71,250-kw. generators will be available this winter. Shown with Congressman Kirwin are (l. to r.) *C. W. Wood*, proj. mgr. for General-Shea-Morrison, prime contractor; *C. H. Spencer*, const. engr., USBR, and *E. W. Simpson*, gen. supt.

UNIT BID PRICES... CONTINUED

36 lin. ft. 5-ft. x 3-ft. log culverts complete in place	5.00	11.00	14.00	15.00	13.00
36 lin. ft. 6-ft. x 4-ft. log culverts complete in place	5.50	20.00	20.00	18.00	16.00
1 only log bridge 60-ft. long complete in place	$2,500	$6,000	$7,000	$6,000	$5,700
1 only log bridge 70-ft. long complete in place	$3,000	$7,000	$8,000	$7,500	$7,000
2 only log bridges 80-ft. long complete in place	$3,500	$8,000	$9,000	$10,000	$8,400

Heavy grading and asphaltic concrete paving in Oregon

Oregon—Wasco County—State. Parker Schram Co., Portland, submitted the low bid of $1,223,561 to State Highway Department for grading and paving the Shogren-Rowena Unit, Moiser-The Dalles Secti Columbia River highway. Unit prices were as follows:

(1)	Parker Schram Co.	$1,223,561	
(2)	Peter Kiewit Sons' Co.	1,253,016	
(3)	Kuckenberg Construction Co.	1,353,213	
(4)	Rogers Construction Co.	1,418,785	
(5)	Fred H. Slate Co., Oregon Ltd. and E. C. Hall Co.	1,528,771	
(6)	J. N. Conley	$1,589,	
—	McNutt Bros.	1,602,	
—	Sather & Sons	1,659,	
—	Guy F. Atkinson Co.	1,678,	
—	J. A. Terteling & Sons	2,014,	

	(1)	(2)	(3)	(4)	(5)	(6
All specified, clearing and grubbing	$23,000	$7,500	$10,000	$50,000	$40,000	$22,
40 cu. yd. structl. excav, unclassified	3.50	4.00	10.00	3.00	10.00	15
944,000 cu. yd. special borrow excav, unclassified	.40	.32	.59	.58	.55	
128,000 cu. yd. gen. excav., location "A," unclassified	.50	.70	.59	.60	.60	
336,000 cu. yd. gen. excav., location "B," unclassified	1.10	1.35	1.10	1.20	1.30	1
7,800,000 yd. sta. short overhaul	.01	.01	.005	.01	.015	.0
235,000 cu. yd. sta. long overhaul	.45	.50	.30	.32	.50	
2.17 mi. finishing roadbed and slopes	750.00	$1,000	$1,000	600.00	$1,500	$1,
5,000 lin. ft. rounding cutbanks	.20	.20	.30	.12	.25	
50 lin. ft. 18-in. corru, metal pipe	4.40	4.50	6.00	4.00	4.50	4
220 lin. ft. 24-in. extra str. corru. metal pipe	8.25	7.00	8.00	7.50	8.00	8
150 lin. ft. 48-in. extra str. corru. metal pipe	22.50	22.00	20.00	20.00	22.00	21
140 lin. ft. 72-in. sectional plate pipe	53.00	51.00	40.00	45.00	46.00	50
70 only concrete sight posts	10.00	12.00	15.00	8.00	12.00	12
1,200 lin. ft. metal guard rail	3.00	2.70	4.00	3.00	4.00	4
26,000 cu. yd. 2-in. - 0 rock in base	2.00	2.00	2.50	1.80	2.05	2
10,000 cu. yd. ¾-in. - 0 rock in base and shoulders	2.30	2.50	2.75	1.80	2.20	2
1,000 M. gal. sprinkling	2.00	2.00	2.00	2.00	2.50	2
5.41 mi. prep. of base, main highway	200.00	300.00	300.00	100.00	150.00	200
0.66 mi. prep. of base, detour roads	200.00	300.00	500.00	200.00	$1,000	600
800 cu. yd. ¾-in. - 0 rock in binder course	3.00	3.50	4.00	3.50	3.50	4
130 ton RC-3 asphalt in biader course	42.00	45.00	50.00	42.00	40.00	41
300 cu. yd. furn. and placing aggregates	4.00	6.50	6.00	3.50	6.50	4
24 ton furn. and placing 150-200 asphalt	40.00	50.00	50.00	50.00	70.00	40
16,000 ton Class "B" asphaltic concrete	5.80	5.40	6.00	5.50	6.40	5
70 ton RS-1 emuls. asph. in seal coat	44.00	50.00	50.00	45.00	50.00	42
400 cu. yd. aggregates in seal coat	4.00	6.50	6.00	4.00	6.00	4

Sealing pavement joints

California—Various Counties—State. Concrete Pavement Maintenance Co., San Francisco, submitte low bid of $45,832 for sealing of pavement joints at various locations in San Luis Obispo, Monterey, Ma Kern, Tulare and Fresno counties. Unit prices were as follows:

(1)	Concrete Pavement Maintenance Co.	$45,832	
(2)	Dana R. Tyson Co.	49,990	
(3)	James M. Pope	$63,	
(4)	N. M. Saliba Co.	63,	

	(1)	(2)	(3)	(
76 ton joint sealing compound	306.00	335.67	350.00	376
544,000 lin. ft. clean and seal transv. and longitud. joints	.0415	.045	.068	

Bridge and Grade Separation

Concrete piers and abutments for Arizona canyon bridge

Arizona—Yavapai County—State. Dail Construction Co., Phoenix, submitted the low bid of $77,592 to State Highway Department for work on the Prescott-Ashfork Highway. Work is located on a new alignm about 35 mi. north of Prescott and about 18 mi. south of Ashfork. It consists of constructing reinforced c crete piers and abutments for a new bridge across Hell Canyon. Unit prices were as follows:

(1)	Dail Construction Co.	$77,592	
(2)	Western Constructors, Inc.	88,074	
(3)	John C. Kelton & Son	89,099	
(4)	Fisher Contracting Co.	$93,	
(5)	Royden Construction Co.	98,	

	(1)	(2)	(3)	(4)	(
1,150 cu. yd. structural excav.	6.00	6.50	10.00	11.25	9
11,750 lb. structural steel (CIP)	.40	.40	.30	.60	
898 cu. yd. Class "A" conc. (incl. cement)	58.00	70.00	67.00	63.50	77
86,930 lb. reinforcing steel (bars) (CIP)	.16	.15	.16	.20	

Treated timber pile bridges in Montana

Montana—Jefferson County—State. Paul R. Lee, Bozeman, submitted the low bid of $15,728 to the St Highway Commission for construction of one 38-ft. and one 76-ft. treated timber pile bridge. Unit pri were as follows:

(1)	Paul R. Lee	$15,728	
(2)	Coconougher Construction Co.	20,834	
(3)	Montana Engineering Construction Co.	$21,	
(4)	Hakkerty-Messmer Co.	21,	

	(1)	(2)	(3)	(
41.94 M.B.M. treated timber	270.00	365.00	355.00	370
2.48 M.B.M. untreated timber	270.00	300.00	315.00	370
21 ea. 20-ft. treated timber piles	60.00	57.00	80.00	82
4 ea. 35-ft. treated timber piles	70.00	85.00	100.00	100
27 ea. 40-ft. treated timber piles	.50	2.00	2.00	1

Airport

Apron paving and utilities at Fairchild Air Force Base

Washington—Fairchild Air Force Base—Corps of Engineers. McLaughlin, Inc., Spokane, submitted the w bid of $995,847 to the Corps of Engineers, Walla Walla District, for apron paving and utilities, Fairchild ir Force Base. Unit prices were as follows:

) McLaughlin, Inc. ..... $995,847 (2) Engineer's estimate $620,319

		(1)	(2)
7	ea. manhole for sanitary sewer	435.00	310.00
1,650	lin. ft. 8-in. diam. concrete pipe	7.00	3.40
1,950	lin. ft. 12-in. diam. reinf. concrete pipe	8.50	6.90
460	lin. ft. 15-in. diam. reinf. concrete pipe	11.00	5.30
250	lin. ft. 12-in. diam. cast iron sewer pipe	15.00	9.85
330	lin. ft. 24-in. diam. extra str. reinf. concrete pipe	16.00	8.30
8	ea. manhole for storm drain	435.00	330.00
8	ea. manhole for storm drain with vapor trap	640.00	390.00
1,440	lin. ft. 4-in. single duct encased in concrete	8.00	2.50
600	lin. ft. 4-in. double duct encased in concrete	11.00	4.05
200	lin. ft. 4-in. quadruple duct encased in concrete	14.00	7.00
150	lin. ft. 2-in. rigid conduit	5.00	1.25
34	ea. conduit marker	16.00	2.00
ump	sum, grounding system, complete	$4,900	$2,735
46	acre stripping	325.00	260.00
45,000	cu. yd. excavation, unclassified	.89	.39
53,000	cu. yd. sand or sandy gravel fill	4.70	4.00
30,400	ton base course	3.15	2.15
1,400	M. gal sprinkling	3.10	1.90
135	ton liquid asphalt, MC-0 or MC-1	54.00	51.00
1,460	ton asphalt cement 100-120 penetration	42.00	32.30
25,800	ton asphaltic concrete	10.90	5.15
80	ton liquid asphalt, RC-2	54.00	53.00
1,400	cu. yd. topsoil	.72	.36
3.5	acre turfing	590.00	275.00

Miscellaneous

Driving timber test piles

Idaho—Bonner County—State. Hansen & Parr Construction Co., Spokane, received an award from the tate Department of Highways for its low bid of $12,890 for driving test piles at the Sandpoint Bridge Site Highway US-95. Unit prices were as follows:

Hansen and Parr Construction Co. ..... $12,890 (2) Engineer's estimate $11,035

		(1)	(2)
p	sum, furn. pile driving equipment	$5,675	$2,000
50	lin. ft. furn. timber piles, untr.	1.50	1.25
	lin. ft. driving timber piles, untr.	4.00	2.50
	lin. ft. driving steel shell or casing	4.00	3.50
2	ea. metal pile splices	50.00	20.00
3	ea. pile loading tests	$1,000	$2,000
1	ea. timber test pile splices	25.00	50.00
40	hr. time for special tests	20.00	16.00

Rental rates for various types of equipment

California—San Luis Obispo County—State. The following is a resumé of equipment rental bids received y the State Division of Highways for various pieces of equipment. Description of the equipment and the ates offered were as follows:

One (1) self-propelled tamping-leveling-finishing machine, as a Barber-Greene, or equal, fully fueled, maintained and with operator.

Bid was awarded to Edward Keeble, San Jose, California.

Bidder	Make	Year	Rental Rate Per Hour	*Transportation Lump Sum Bid
Edward Keeble, Rt. 4, Box 64, San Jose, Calif.	Jaeger	1950	$15.00	$200.00

*From Vendor's headquarters to the Salinas Maintenance Station, Salinas, and return to Vendor's headquarters at the completion of work.

* * *

One (1) Trenching Machine, track laying type, designed for a digging width of from 17 in. minimum to 30 in. maximum, as a Cleveland Model 140, or equal, to be fully operated, fueled and maintained.

Bid was awarded to Granite Construction Co., Monterey, California.

Bidder	Make	Year	Rental Rate Per Day	*Transportation Lump Sum Bid
Granite Construction Co. Box 287, Monterey, California	Model 44C Barber-Greene	1946	$16.70	$100.00

*From Vendor's headquarters to a location 12 miles North of Salinas on Highway U. S. 101 and return to Vendor's headquarters at completion of work.

* * *

One (1) pneumatic tired, trailer type roller, designed for use with pneumatic tired tractor equipment, to have not less than eight rigidly mounted tires and weighing not less than eight thousand (8,000 pounds) when loaded.

Bid was awarded to R. McGray, Santa Maria, California.

Bidder	Weight	Make	Year	Rental Rate Per Day	*Transportation Lump Sum Bid
R. McGray P. O. Box 348 Santa Maria, Calif.	3,000 Lt. Wt. 8-10,000 Loaded	Madson	1948	$ 5.00	$ 20.00
Radich & Fergusson, Inc. P. O. Box 67 Burbank, Calif.		Bros. Wobbly Wheel 13 Tire		$15.00	$190.00

*From Vendor's headquarters to the Division of Highways Maintenance Yard, Cambria, and return upon completion of work.

NEW LITERATURE

701

From crushers to bin gates in 36-page buyer's guide

A well-illustrated 36-page catalog, made available by the manufacturer of Telsmith equipment for quarries, gravel pits and contractors, gives comprehensive tables on sizes, capacities, weights and power requirements. First section of the guide presents this information on Telsmith primary and secondary crushers, gyratory breaker, jaw, gyrasphere, intercone and roll crushers, apron and plate feeders, scalping, sizing and washing screens, and super-scrubbers and sand classifiers. Last section covers belt and chain elevators, conveyors, bin gates and Telsmith portable crushing plants. Available from **Smith Engineering Works.**

702

Concrete accessories bulletins

W. J. Burke & Co. has made available for you a series of bulletins describing cost-savers for concrete jobs. Complete with drawings, specifications and application data, the bulletins cover (1) The new "Clamp Jack," which is used as a scaffold bracket and eliminates almost all other scaffolding needs, (2) Burke Snap Ties, which are economical and easy to break off before forms are stripped, (3) the Acme Form Clamp, which eliminates wood spreaders, metal spreaders, cones and external spacer locks, and (4) The Burke Form Sealer, to preserve plywood forms against water and moisture penetration, checking, grain raising and warping.

703

Bitumuls penetration pavement in road and highway jobs

You shouldn't miss adding this excellent two-color booklet on the use of Bitumuls Penetration Pavements in road and highway construction to your collection. Scenic photographs, selected to show a typical cross-section of various uses of, and results obtained with, quick setting Bitumuls emulsified asphalt appear in this 28-page booklet. Sections include: Bitumuls—The Modern Way to Use Asphalt; Bitumuls Full Penetration Pavements; Texture of Bitumuls Penetration Pavements; Table of Quantities; Standard Construction Operations; Bitumuls Surface Treatment (Seal Coats, Armorcoats); Texture o Bitumuls Surface Treatment and Tabl of Quantities, plus much more informa tion. **American Bitumuls & Asphalt Co** is offering this information.

704

A 186-page handbook on wires and cables

More than 500 different types of wire and cables, with comprehensive data o construction and operating characte istics, are described in this 186-page ge eral catalog made available by **Unite States Rubber Company's** electrical wi and cable department. General descri tion and technical engineering data a given for such products as control an signal cables, wire and cables for th building industry, mine cables, portab cords, etc. Key number on coupon wi bring you your copy.

705

Harnischfeger highlights its popular heavy-duty excavator

This is a 40-page bulletin highlightin **Harnischfeger Corporation's** Mod 955-A excavator. In addition to a tho ough explanation of this rock-rate machine's features, the bulletin offe numerous photographs of the model i action on a variety of operations. Th model, of the 2½-yd. category, is d scribed as easily convertible for servi as a shovel, dragline, clamshell or cra due to P & H's split sprocket and dru

gging arrangement which eliminates he need for auxiliary shafts, gears and prockets. This one is really worth look-ng over.

906

uccessful techniques of precast ilt-up construction

A 24-page handbook describing the anelcrete Method of precast tilt-up onstruction is available from **National anelcrete, Inc.,** a new firm in Los An-eles. Wm. P. Neil Co., Ltd., and But-ress & McClellan, Inc., two leading con-truction firms with broad experience in tilt-up", have published the booklet to lescribe details of the new firm's serv-ces and a licensee plan.

907

urveying instruments

Henry Wild Surveying Instruments upply Co. of America, Inc., is offering n interesting folder which gives con-lensed technical data on time-saving optical transits and levels. There is also illustrated literature available on the new T-12 pocket theodolite. The re-cently developed instrument, with a total weight of 7 lb., including packing con-tainer and folding leg tripod, is speedily used for preliminary surveys, reconnais-sance work and construction.

908

64-page idea book on field short-cuts

Here is a job-picture book made avail-able to you by **Blackhawk Manufac-turing Co.** which gives 64 pages of ideas on how hydraulic tools can solve pro-duction, construction, maintenance and other problems. The book presents its material in pictorial form with brief but fully-descriptive explanations included. You are certain to find information about many pieces of equipment that you did not know existed in this field as well as new and valuable uses for the familiar tools in your shop. Diagrams and product statistics accompany this interesting booklet, which has a place in your reference library.

909

Re-issuance of famous saw tips bulletin

Current wood-working problems and developments will get the full treatment once again when **DeWalt, Inc.,** begins to re-issue its famous publication twice monthly. The popular bulletin will keep you abreast of the latest information in the field. Although some of the issues of the wood-working bulletin will deal with specific problems of specialized indus-tries, the general tone of the publication will appeal to a widely diversified audi-ence. Why not get yourself on the mail-ing list?

Literature briefs . . .

910

FLOOR LATH—Steeltex floor lath is the subject of a new bulletin just re-leased by **Pittsburgh Steel Products Co.**

911

DEHYDRATORS—**Pioneer Engineer-ing Works, Inc.,** has issued a new bul-letin on sand drag type Dehydrators (classifiers) used for sand production in gravel, quarry and washing plant opera-tions.

912

BUCKEYE BULLSEYE—A new cata-log describing the many features of the recently introduced Buckeye Model 5 Spreader is announced by **Gar Wood Industries, Inc., Findlay Division.**

913

TRENCHLINER—**Parsons Company** special "pipeline trenchliner" is fully de-scribed in a new 4-page bulletin issued by the firm.

914

TRUCK MIXER—The new Rex Ad-justa-Wate Moto-Mixer (truck-mixer) bulletin (52-32) is being released by **Chain Belt Co.**

915

HAULING TRAILERS — The com-plete line of rubber-tired hauling trailers of **Athey Products Corp.** is described in a new 4-page, two-color, cartoon-style booklet just released by the firm.

916

BANTAM APPLICATIONS—Here is a well-illustrated on-the-job application folder for the truck-mounted Bantam machines which **Schield Bantam Co.** has just released.

917

MOTOR MUST—**U. S. Electrical Mo-tors, Inc.,** is offering a new bulletin on the Type GW Syncrogear Motor which includes diagrams, photos, etc.

918

GRID ROLLER—An attractive illus-trated catalog describing the features and applications of this new machine for highway repair and salvage, is now available from **Hyster Company.**

CLIP AND MAIL THIS COUPON

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NEW LITERATURE

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NEW EQUIPMENT

described in the following pages.

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Organization _____

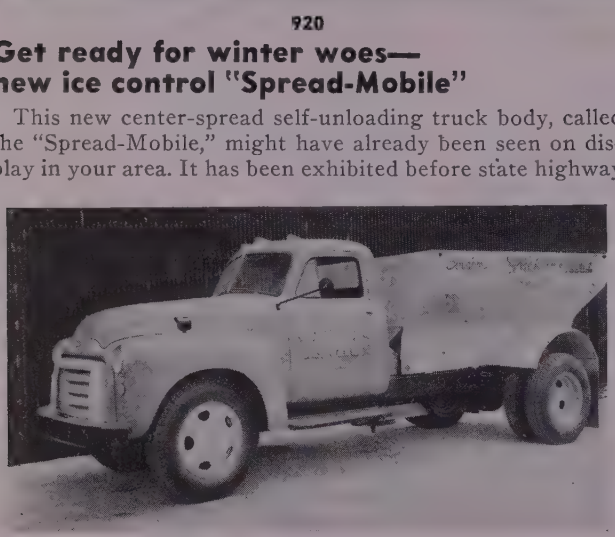
NEW EQUIPMENT

More information on any of the items in this section may be obtained by using coupon on page 145.

920

Get ready for winter woes— new ice control "Spread-Mobile"

This new center-spread self-unloading truck body, called the "Spread-Mobile," might have already been seen on display in your area. It has been exhibited before state highway



departments and city groups as the latest solution to ice control problems. Most revolutionary feature of this new body is the location of the distributor plate at the left center of the chassis beneath the forward end of the body, instead of at the rear. This complete reversal of the design of all previous spreader bodies has a very important advantage: the skid-proofing material is spread ahead of the rear wheels and well under the front wheels, thus assuring far better traction for the truck under all conditions. No longer is it necessary for the truck to back up slippery hills. Another outstanding feature is the self-heating system which prevents freezing of the conveying and spreading mechanism, as well as the contents in the lower part of the body. Manufactured by **Baughman Manufacturing Co.**

922

Tough drilling jobs are a cinch for this new boring set

Would you like to be able to drill holes from 5/8 in. to 1 in. in diameter through 27 ft. of joists or studding or 56 in. through solid wood? If the answer is yes, consider this new boring set manufactured by **Time Saver Tools, Inc.** It consists of a 5½-in. steel shaft, four tempered, blue spring steel blades, precision ground after heat treating, sizes 1, 7/8, 3/4 and 5/8 in., all packaged in a handy vest pocket wood box. An allen wrench included with the set permits easy blade changing without removing the shaft from the electric drill. Another unique feature is that Time Saver extensions in 6-in. or 12-in. lengths can be joined together to permit drilling through studding, floor joists, rafters—anywhere holes of extreme depth are required.

921

Belt-type loader will load from stock piles as well as windrows

As the result of a design change in this Adams Traveloader, it can now load material from stock piles as well as windrows. Spiral blades on the full floating feeder work the material in to 14 curved blades which place the material on the revolving conveyor belt. The feeder is hinged at the rear and is free to float in order to adapt itself to size of windrow or stock pile.

Gravel, crushed stone, sand, top soil, etc., can be loaded from stock piles by this Adams Traveloader. The rear section of the conveyor is adjustable, from the cab, to provide a wide range of discharge heights for trucks of varying sizes. The full-floating feeder, the entire front of the loader and the rear section of the conveyor may be raised or lowered through hydraulic controls from the operator's cab. The machine is powered by an International industrial-type gasoline engine which furnishes power for operating the feeder and conveyor as well as propelling the machine. **J. D. Adams Manufacturing Co.** is the manufacturer.

923

Stripping shovel proves helpful on casting operations

Koehring Company's Hi-Lift stripping shovel, at work in various sections of the country, is reported as giving excellent performance on casting operations, with the new excavating unit using both 2 and 2½ cu. yd. dippers. The

Hi-Lift stripper operates with 50-ft. boom and 36-in. dipper stick to allow a maximum dumping height of 40 ft. and a reach of 60 ft. with boom angle at 45 deg. By comparison, the standard 1005 shovel attachment, operating by chain crowd, carries a 26-ft. boom and standard 19½-in. double dipper sticks for heavy-duty digging work. Unusually large sheaves are employed throughout to prolong cable life.

924

New line of mechanical side-dump truck bodies announced

Ready now is the "Roll-Over" line of side-dump, entirely mechanical truck bodies, manufactured by **The Galion All-Steel Body Co.** These 10-gauge steel bodies dump to either

right or left and can be mounted on all standard trailers. Self-contained subframe consists of three heavy box type outrigger cross members. Front and rear outriggers are built with a series of gear-like teeth which roll inside the formed channel tracks welded to the body. This prevents forward or backward movement of the body on the subframe. Main locking mechanism is a down-pull spring-loaded type plunger pin which engages in a socket built into an angle welded to the head of the body. To effect dump operation, driver disengages the spring lock chain on the opposite side of the body to which load is to discharge, then releases plunger lock lever. Bodies can be righted manually or by a slight snaking movement of the truck. Well-suited to general construction projects.

925

New weather strip sticks to cold metal permanently

Kling Felt No. 113, manufactured by **Products Research Co.**, features a new, solvent-activated adhesive-back (one side) that permits weather stripping of metal casements and all other windows, doors, vents, etc., in all kinds of weather. No gooking, gluing or tacking in required. Suited to both original installation and resealing jobs. Application is easy and quick and positive, deterioration-resistant seal against rain, wind, dust and cold is assured. Can be used as a protective spacer between linoleum and heavy appliance bases. Available in thicknesses of $\frac{1}{32}$, $\frac{1}{16}$, $\frac{1}{8}$ and $\frac{1}{4}$ in. and widths from $\frac{1}{4}$ to 66 in.

926

Kwik-Mix plaster-mortar mixer in 3- to 4-cu. ft. capacity

Now in production at **Kwik-Mix Company** is this 3-P tilting plaster mortar mixer of 3- to 4-cu. ft. capacity. Prime features of the unit are its portability, low charging height, wide base tires, end-to-end mixing action and simple declutching system for fast engine starting. Its 29-in. width clears narrow doorways for moving indoors. A low 37-in. shoveling height makes charging easy. Pneumatic tires have a wide base for added stability and flotation.

927

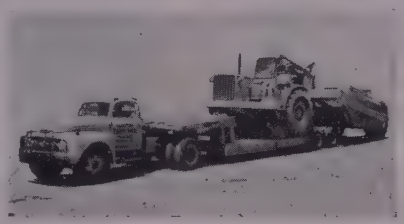
Torque converters for 6 sizes of industrial engines

Factory installed torque converters can be provided for six sizes of **Caterpillar Tractor Co.'s** industrial engines, according to the firm. Diesels with converters are being used to power excavators, cranes and other equipment. On heavy and varying loads, these torque converters allow the engines to maintain a continuously high output. Turning effort is multiplied considerably at low output speeds. When loads are lifted or lowered, as in crane operation, the converter facilitates the "pick-up" of a standing load or the braking of load being lowered. Cat diesel engines available with torque converter range from 70 to 500 brake-hp., and include the D397, D386, D375, D337, D318 and D315. With the smaller in-line engines—D337, 318 and 315—power can be delivered to the converters with or without a clutch, or with a clutch and reversing gear. Output arrangements include either a stub shaft or chain housing, the latter available in two sizes. Converters for the three larger V-type engines may also be installed with or without a clutch. They may be either direct-coupled to the engine or chain driven. A stub shaft is provided on the output end of the converter.

928

Complex hauling problem solved by new trailer

The heavier the equipment to be hauled the better as far as this new folding gooseneck trailer by **Martin Machine**



Co. is concerned. It is a variation of the Martin trailer which can handle Cat DW21 tractors and No. 21 scrapers, yet keep within the legal weight limit. The folding gooseneck is lowered and the front chocks removed. The tractor-scraper pulls alongside, with the tractor slightly ahead of the front end of the trailer. The tractor is then backed onto the wide platform, jackknifing the scraper until the drive wheels rest against the rear chocks. The front chocks are secured in place and the winch-equipped truck-tractor raises the gooseneck to hauling position. When the truck and trailer drive away, the body of the scraper swings over the back end of the trailer and the rear wheels of the scraper trail behind. This, however, is not a single purpose trailer. Having a standard 8 ft. x 14 ft. platform, it enables the contractor to haul other equipment customarily hauled on low-bed trailers.

929

Five color-coded hose types replace previous eighteen

Thermoid Company has reduced the number of hose types it manufactures from eighteen to a basic five. These five basic types, which incorporate new components for increased versatility, are color-coded for identification according to use. The decrease in types, and the codification system, will aid users of the hose in cutting down on storage space required. Here is a brief description of the components of the line: Versaflex stands pressures up to 800 psi. for air

oil, gas, butane, propane; Versicon is designed for industrial uses at working pressures up to 300 psi.; Aquair designed principally for conducting water, air, oxygen and acetylene at working pressures up to 200 psi.; Utility is a general purpose hose for working pressures up to 125 psi.; Powerflex is designed for superheated steam at pressures up to 200 psi.

930

Sturdy head protection with new Fiberglas safety helmets

Ever heard of a 12-oz. life-saver? Well, this is it. That is the weight of the new Fiberglas Safety Helmets designed to protect you from falling objects on

the job. In addition to the helmet which is scientifically designed for the variance in head shapes, there is also a 10-oz. cap for those who prefer it. The helmet and the cap meet all government test specifications for your protection. There is a leather sweatband, and accessories are available (i.e., chin straps, lamp brackets and winter linings). **Industrial Products Co.** is the manufacturer.

931

New tractor model enters the diesel field

The model F-23DT, a high-speed truck-tractor powered by the new lightweight, Cummins JBS-600 diesel engine, is announced by **Reo Motors, Inc.** It is stated that the chassis and cab with 20 gal. of fuel and all tractor equipment, except the fifth wheel, weighs approximately 9,475 lb. Gross tractor rating is 50,000 lb., wheelbase is 130 in. Engine develops 550 hp. at a governed speed of 2,500 rpm., and 360 ft. lb. of torque at 1,400 rpm. Weight of the complete power plant, including clutch and transmission is only 1,825 lb.

932

Economical 3½-cu. ft. concrete mixer available

This is a 3½-cu. ft. end-discharge mixer with semi-steel cast drum and yoke. The unit, called the "Morspeed Econo-Master," features a ring gear integrally cast with the load balanced drum for better alignment and smoother operation. Drum drive shaft and yoke are both mounted on Timken roller bearings. Charging and discharging is made easier by a geared tilting mechanism and friction brake lever which locks the drum at

any desired position in its complete swing. A detachable towing bar permits operators to "get in close" for charging and discharging. **Gilson Brothers Co.** is the manufacturer.

933

Cabinet designed for filing blueprints

The Draw-In-Dex cabinet might provide contractors and engineers with an efficient and convenient method for filing blueprints. As can be seen in the

accompanying photograph, this specially designed cabinet prevents wrinkles, creases, or curled edges. The unit accommodates 1,250 prints, all of which can be indexed to avoid any loss of time in locating the material. Suspension rods support the drawings which are very easily attached to manila hangers. Cabinet is designed so that when the front panel is opened, any drawing may be immediately filed or removed. **Empire Development Corp.** is the manufacturer.

934

Wheelbarrow base type generator attachment

Wincharger Corporation announces the development of "Speedy-Shift," wheelbarrow base type attachment for engine-generator sets. Model 187 is for

attachment to Models 700 and 1800 engine-generators and Model 543 is for attachment to Model 500 engine-generator set. The single handle permits the unit to be easily pulled instead of pushed. Sturdy, semi-pneumatic rubber-tired wheels are provided and located in reference to the center of gravity to provide a secure footing for the unit in conjunction with the double legs attached at the opposite end of the cradle base, and still located to accept the largest portion possible of the total weight of the unit. The Speedy-Shift comes complete as a package and may be attached or detached from the standard cradle base in a matter of minutes. Portability of the engine-generator sets themselves has been enhanced by the use of a belted engine-generator construction which permits higher, more efficient operating speeds and maximum weight reduction for both engine and generator.

935

Liquid level attachment for black top paver

This is a liquid level attachment for the Adnun Black Top Paver. The device gives positive leveling control for black top paving and the spreading of aggregate. It can hold a level grade without modifying the desired crown and will level up old shoulder and blend the course into an old crown. This simplifies the straightening up of old and wavy road by simple adjustment. **The Foote Co., Inc.**, is the manufacturer.

936

New hydraulic lift bucket for the Agricat

For light earth-moving operations the **Joose Manufacturing Co.** offers the midget-sized tractor called Agricat, and

Earl H. Pence & Co., Inc., distributor, has perfected a 5-cu. ft. capacity high lift bucket for mounting on the machine. It is powered by a Vickers 1,000-lb.-per-sq.-in. pump, feeding into two rams whose pushing capacity is 491 lb. per 100 lb. pump pressure, and pulling capacity of 368 lb. per 100 lb. pump pressure. The bucket lifts to a height of 72 in. from the ground level, and can be lowered 4 in. below track level.

937

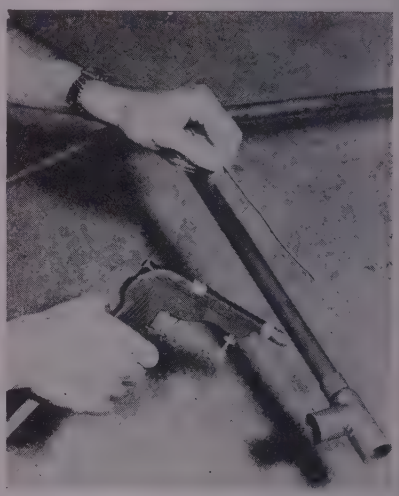
Preparation for rebuilding tractor, shovel rollers

Mir-O-Col 45-90 Method is designed for rebuilding tractor and shovel rollers, idlers and rails. This is a combination method derived from the firm's No. 45 wire with superior impact resistance and No. 90 wire with abrasion resistance into method derived from the firm's No. 45 automatic wire has a high nickel content to withstand heavy impact and can be used in multiple-pass operations with no spalling. Hardness of deposit is from 22 to 28 Rockwell C. No. 90 automatic wire contains chromium, molybdenum, and vanadium; has Rockwell C scale hardness of 46 to 48. Both wires are readily adaptable to the submerged arc process of welding. **The Mir-O-Col Alloy Co., Inc.**, is the manufacturer.

938

You can save time by carrying this torch

For on-again off-again work, such as in plumbing, piping, heating, sheet metal jobs, etc., the Torch-O-Matic is well-

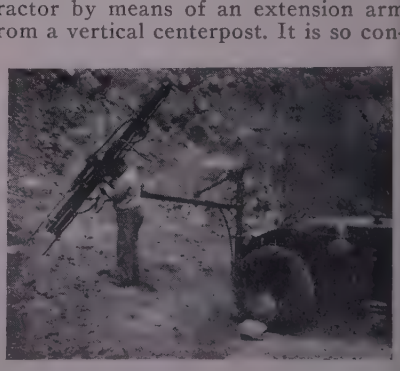


suited. This pistol-shaped device lights at squeeze of trigger and shuts off upon release, thereby eliminating separate operation and equipment for relighting, manual valve adjustment, pumping or priming, etc. Squeezing the spring-loaded trigger simultaneously opens the torch gas valve and sparks the heavy-duty flint for ignition. Trigger also can be locked open for continuous flame. One-hand operation makes for better user comfort and efficiency. Weighs only 12 ounces; provides instantaneous heat up to 2,800 deg. Combustion tubes available in three sizes—⅛, 3/16 and ¼ in. **Velocity Power Tool Co.** is the manufacturer.

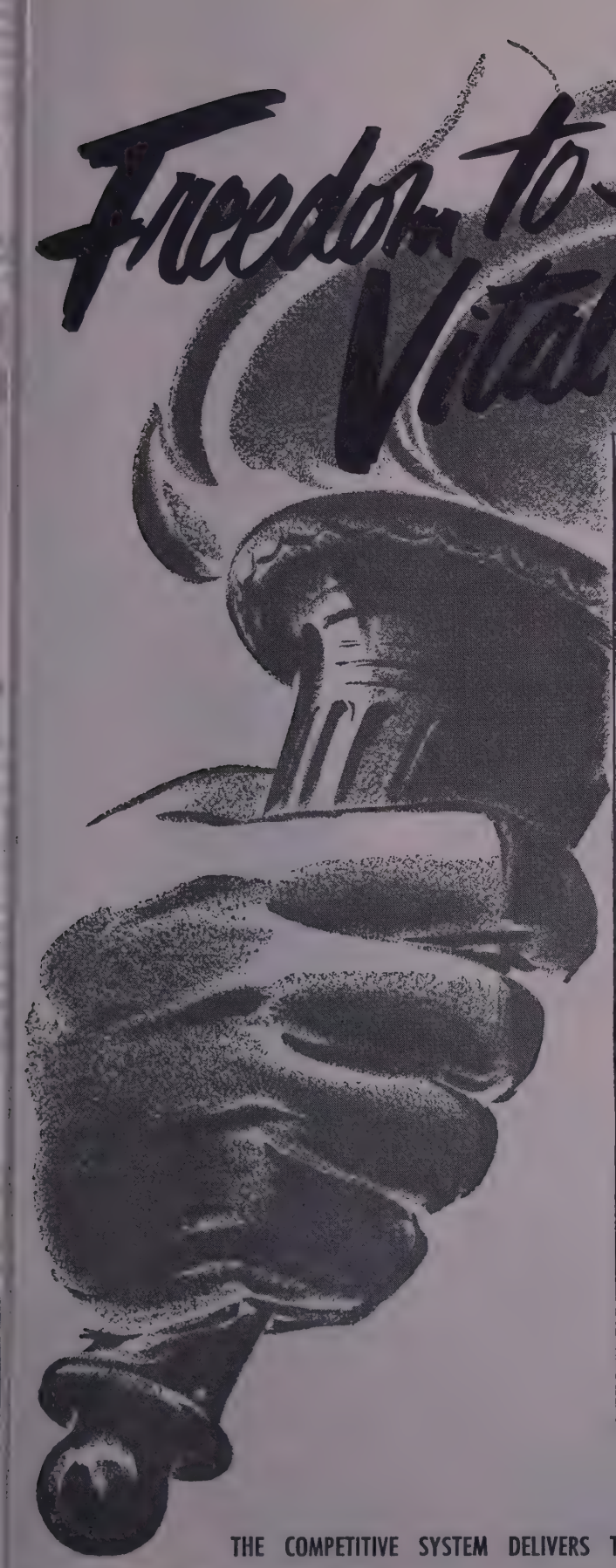
939

Self-propelled, self-powered wagon drill available

The Pneumafeed wagon drill by **Schramm, Inc.**, has the ability to drill in 180-deg. arc at any angle and at a distance 6 ft. to the rear of the Pneumatractor by means of an extension arm from a vertical centerpost. It is so con-



Freedom to Sell is Vital to us All



Eight decades ago 70% of all gainful workers in the U. S. A. toiled in agriculture. Today farms and factories, put together, account for less than 40%.

Where do the rest serve? Chiefly in distribution, which includes the physical movement of products to buyers, and all forms of selling, advertising and sales promotion at the manufacturing, wholesale and retail levels, as well as the widely varied services related to the maintenance and use of American products.

With over 60% of our total labor force falling outside of farm and factory employment, obviously salesmen on the front line of selling contribute greatly to the productivity, prosperity and the world's highest standard of living enjoyed by the U. S. A.

Without sales a business fails and jobs vanish. No matter how good a product may be, it must be sold in competition with other goods. A salesman sometimes finds his products not truly competitive. He then exercises tremendous pressures on his employer for better products, lower prices, or both. Thus, competitive selling greatly influences the progress of American prosperity.

Countries where selling is inefficient, restricted or eliminated generate far less wealth, happiness and security.

Competition, especially competitive selling, is a great American Freedom. Let us preserve it to assure Progress For All Our People.

• • •

THE COMPETITIVE SYSTEM DELIVERS THE MOST TO THE GREATEST NUMBER OF PEOPLE

structed as to permit drilling horizontally to a distance of 10 ft. above ground level and 3 ft. below ground level. When in transit the Deluxe Pneumafeed fits snugly in front of the rear wheel and close to the tractor body permitting free and easy travel.

940

New product added to line of protective coatings

Rubber & Plastics Compound Co., Inc., has added a new product, Nerva-Clad, to its line of waterproofing and corrosion protective materials. Nerva-Clad is a truly engineered membrane built around a woven spun-glass ply, ready for installation in one operation, and is designed for waterproofing and corrosion protection of structural steel, reinforced concrete, tanks, tunnels, pipelines, etc.

941

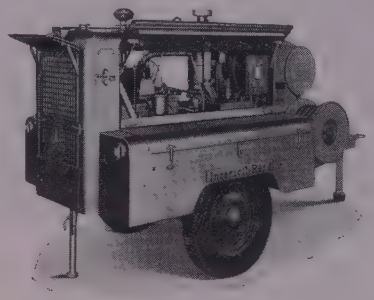
Line adds medium-duty truck bodies and hoists

For trucks of 1½, 2 and 2½-ton sizes, **The Converto Manufacturing Co.** has expanded its line of PicUPac truck bodies and hoists to include a new medium-duty line of hoists and bodies. Two types of hoists are presently manufactured by the firm to suit two distinct types of operations. The "double arm" type is used for extreme loads, while the "direct" hoist is used for average loads. Both hoists elevate the truck body to a full 60 deg. dumping angle in a matter of seconds. Converto has added 8-gauge steel on the floor of the body for additional strength and has established 6½ ft. as its standard body width.

942

Complete line of Gyro-Flo portable compressors

Ingersoll-Rand is rounding out its line of Gyro-Flo portable compressors with three sizes in addition to its widely acclaimed 600-cfm. model. The introduc-



tion of 315, 210 and 105-cfm. units makes the advantages of the rotary sliding-vane design available for a wide range of operating requirements. Low cost of operation and maintenance are advantages of the equipment. The two-stage oil-cooled, rotary sliding-vane compressor design of the Gyro-Flo machine eliminates most of the problems of reciprocating units for portable service. There are no valves to leak, no pistons, rings, rods or clutch to wear. Air, discharged at less than 200 deg. under normal operating conditions, together with thorough oil separation, eliminates hose deterioration caused by heat and oil. The 600-cfm. model is powered by a GM diesel engine. The 315- and 210-cfm. sizes offer a choice of either GM diesels or Continental Red Seal gasoline engines. The 105 uses a Continental gasoline engine.

943

Knocked-down drainage pipe for field assembly

The advantages of knocked-down drainage pipe for field assembly are instantly apparent when you consider the decrease in shipping difficulties where this nestable corrugated metal culvert type is used. Although this pipe is light in weight, it is said to be very satisfactory when put into use on highway, airport and railroad operations. These flanged half-round sections can be bolted together in the field to form tight, continuous conduits. Well-suited for foreign operations where shipping is required or on remote construction projects in the continental United States. **Penn Metal Corp.** is the manufacturer.

944

Wage tax computer might save lots of time

This is a new device for rapidly computing payroll deductions with speed, accuracy and simplicity, according to **Ayres Corp.**, the manufacturer. The de-

vice gives direct "window" readings on a single line of accurate F.I.C.A. (F.O.A.B.) and withholding tax deductions. Designed so that new drum charts may be easily affixed to keep the computer up to date.

945

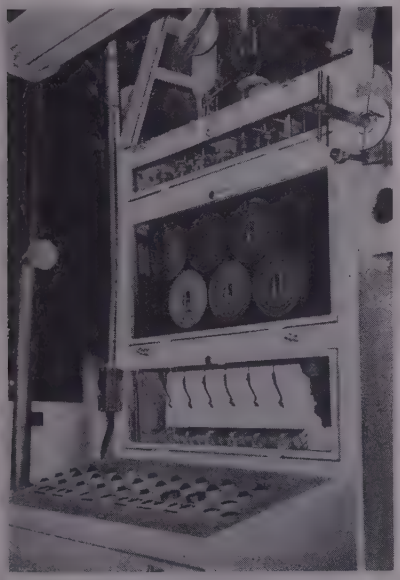
Cold galvanizing process available for distribution

This new process is not a paint, but a cold galvanizing compound manufactured by **Galvonite Corporation.** Galvanite may be applied with any ordinary paint brush, electric spray gun or by cold dip. Special equipment or personnel training is unnecessary, and the process is effective on large or small jobs.

946

Control panel designed for automatic re-batching

This push-button control panel, pictured, automatically produces 24 different size and type batches of aggregate and cement, according to **C. S. Johnson**



Co., the manufacturer. The firm believes the panel will increase the efficiency of transit mix and central mix concrete operations. A "repeater" mechanism provides for uninterrupted automatic re-batching of any one selection a predetermined number of times. The mechanism is installed under the Johnson multiple compartment aggregate and cement bin where it is electrically controlled. Fully automatic single material batchers on each compartment are controlled by the Central Dial Scale unit with pen recording of the weight of each single material batch. A water batcher and a cement batcher providing for automatic moisture compensation complete the set-up.

947

GMC announces new truck models

General Motors Corp. announces new GMC medium and heavy duty truck models in line with the trend toward lighter but more powerful trucks for highway and off-highway haulers. Three of the new diesels are six-wheelers, while the fourth is in the 21,000-lb. G.V.M.—45,000-lb. G.C.W. trucking field.

948

Gasoline engine powered portable compressor

This 2-cylinder air-cooled compressor has a displacement of 8.5 cfm. The 300-lb. test heavy gauge steel tank has an 18 gal. capacity. This unit is also available with a 1 hp. electric motor. Pressure setting is adjustable from 50 to 150 lb. Pressure gauge has a large face for easy reading. Furnished is 25 ft. of air hose with an air chuck and brass fitting. Valves are of brass and bronze and are rustproof. Semi-pneumatic, heavy duty ball-bearing wheels have 8 x 2.75 tires. Powered with a 3.6-hp. Kohler engine with governor control, parts are available everywhere. **Decker Manufacturing Co.** is the manufacturer.

949

Automatic high pressure booster gun

This gun is designed for the following applications: Lubrication of bearings on industrial machinery requiring injection of a small quantity of lubricant at extremely high pressure; an auxiliary high pressure lubricator to service bearing requiring injection of limited quantities of special purpose lubricants; cracking "frozen" or clogged bearings on contractors' equipment without use

of power-operated gun. Gun provides complete range of pressures up to 10,000 psi. Easy one-hand push action eliminates fatigue, and the device weighs only 2 lb. Holds 2½ oz., can be refilled in seconds. **Lincoln Engineering Co.** is the manufacturer.

950

New method of concrete cutting available

Elimination of the cracked, spalled or broken edges experienced in ordinary pavement breaking methods is promised by **Tri-Line Co.** through use of its Tri-

Line cutter. This machine uses a double-bonded, water-cooled diamond cutting blade to produce a smooth-surfaced cut. In repair and maintenance of streets and highways, the machine gives a positive locking wedge-type joint which permanently holds the concrete section securely even though the underfill may settle excessively. It is not necessary to lay bituminous or metal construction strips. Desired planes of weakness are simply sawed shortly after concrete has initially set, providing highly superior contraction joints at lower costs. Tri-Line also aids in repairing airport runways and aprons, and cuts hard aggregate flooring in commercial and industrial buildings. The cutters are powered by a 13-hp., two-cylinder Wisconsin engine, and permit continuous or intermittent cuts on straight or reasonably curved lines at any desired depth to 6½ in.

951

LeTourneau announces its new pusher unit

Tournatractor is a new pusher unit for contractors who are using dozers exclusively as pushers. The pusher is a new version of the Super C Tournadozer with the dozer blade, power control unit, A-frame and dozer controls omitted. In place of these is a massive billet, 3 in x 15 in., and spanning the width of the machine. On the billet the manufacturer has placed a large pusher plate. The machine can be equipped with a torque-converter as original equipment and is equally adaptable to pulling operations, either with a rear power control unit or with its drawbar alone. If later the need for a dozer develops, the billet and pusher plate can easily be removed and the A-frame, power control unit and dozer added. A variety of tire choices is available to meet job requirements. **R. G. LeTourneau, Inc.**, is the manufacturer.

952

New lightweight jaw crusher 10 x 16 in.

This new crusher features a single wall pressed steel base that is strong and rigid, and yet lighter in weight. The pitman bearing is a full round bronze sleeve bearing. Side bearings are bronze on the bottom half and babbitt on the top half. Bearings are protected by felt oil seals in each end of each bearing. Reversible jaw plates are of manganese steel. Production capacity will range from 4 to 40 tons per hour, depending on stage of reduction required. The approximate weight of the new crusher is 3,350 lb. **Pioneer Engineering Works** is the manufacturer.

953

Increased durability found in this scalping screen

The new UHS Deister heavy-duty scalping screen features increased sizing efficiency plus longer headmotion wear life. Built as a unit by **Deister Machine Co.**, the new lifetime headmotion features 2-bearing construction and runs in a bath of oil. Other features include: powerful but fully-cushioned vibrations; automatic screen cloth tension. The screen features Deister's opposed elliptical-throw action.

you'll kick yourself Nov. 4

if you don't register now

No doubt about it. This is going to be the most exciting—the most important—election in years and you won't want to be left out. But you won't be able to do a thing about it—*unless* you are registered.

That goes for all your relatives and friends and neighbors, too. So help them as you help yourself. Find out WHEN, WHERE, and HOW to register. Then pass the information along to all your friends. It's easy to get. Just call your local office in charge of elections, your City Hall or County Court House. Do it today! If you don't you'll kick yourself for passing up the chance to have your say on election day.

P & H news

The Harnischfeger Corp, announces the appointment of the Construction Equipment Co., Spokane, Wash., as its distributor of the shovels and cranes manufactured by their Small Excavator Division. The area covered by Construction Equipment Co. is eastern Washington and northern Idaho. The firm also announces Frank Effenberger will transfer to the firm's Seattle branch, replacing George Glass who is now a sales representative with headquarters at Spokane. Effenberger will now be office manager.

Heil district office

The Heil Co. announces the opening of a new district office in Denver, Colo. It will serve Colorado, Wyoming, Utah, New Mexico, parts of Texas, No. and So. Dak., Montana and Idaho. John Zimmerman is district manager.

American-Coleman appoints distributors

The American Truck Equipment Co., Portland, Ore., is now a distributor for Coleman Front Wheel Drives, an American-Coleman Co. product. The distribution firm will cover the Portland area. The company also announces appointment of The Leonard Motor Co., Albuquerque, New Mex., as distributor for American Motor Graders. This firm will handle sales and service in the Albuquerque area.

Telsmith makes changes in engineering dept.

The Smith Engineering Works, Milwaukee, Wis., announces changes in its engineering department. Alexander Lorn Munro, formerly chief engineer, is the new director of engineering. Elmer E. Kraig, formerly Munro's assistant, succeeds him as chief engineer.

Feenaughty Mach. Co. personnel changes

Frank D. Masner is branch manager and Edward Villeneuve is office manager at Feenaughty Machinery Co., Boise, Idaho.

B-L-H distributor

Bay Cities Equipment, Inc., is the new Northern California distributor for Baldwin-Lima-Hamilton Corp. The territory comprises the 38 northern counties.

Merrill-Brose adds several staffers

New salesmen with Merrill-Brose Co. of Oakland, Calif., are: Bob Olson, formerly with Casson-Hale Corp.; Henry S. Miller, formerly with Sacramento Valley Tractor Co.; Ken Kruse, who will be in charge of the Peninsula territory.

Arnold Mach. Co. sets up in Idaho Falls

To supply the needs of materials handling equipment users in the Idaho Falls, Idaho, area, Arnold Machinery Co., Inc., has opened a branch office in that city. Eugene Sandell is the manager and Frank Hoaglund is sales engineer for the area.

NEWS of DISTRIBUTORS AND FACTORY BRANCHES

F. H. "Jesse" James joins Coast Equipment Co.

F. H. "Jesse" James has accepted a position at Coast Equipment Co., San Francisco, Calif. He has been actively engaged in the construction equipment business all over the world since 1925. He was acquisition manager for Utah Construction Co. on the Alcan Highway, purchasing agent for UPM on the Geneva Steel Plant at Provo, Utah, and worked in Karachi, Pakistan, as purchasing agent for Morrison-Knudsen & Afghanistan Co. James is a familiar figure in the Western construction field. In his new position he will continue his contacts with the contractors and engineers, selling equipment where requirements permit.

James

Collins

"Cat" Wash. distributor

Collins Machinery Co. succeeds Western Tractor & Equipment Co. as distributor for Caterpillar Tractor Co. in nine northwest Washington counties. Complete sales and service and parts facilities will be provided to serve King, Snohomish, Skagit, Whatcom, Clallam, Kitsap, San Juan, Jefferson and Island counties. Temporary quarters have been set up at No. 2 Hanford St., Seattle, but plans are under way for development of a new site in the southern industrial section of the city. B. F. Collins, former vice president in charge of sales for Boeing Airplane Co., is president of the new firm.

New "Cat" distributor in No. Dak.

Schultz Machinery Co. is now distributor for Caterpillar Tractor Co. in the western portion of No. Dak. The newly formed organization is guided by P. M. Schultz as president and general manager. C. H. Schultz is vice president and W. D. Schultz will head the parts and service activities. H. J. Faken is secretary-treasurer. Stores will be operated in Bismarck and Minot.

Calaveras Cement Co. appointments

Charles W. Lindgren, formerly resident engineer for Calaveras Cement Co. at Pine Flat Dam, is now sales engineer with headquarters in the Sacramento Builders' Exchange. William Dale Wadlington, who has been on military leave since January 1951, is reopening his office in the Butte County Builders' Exchange at Chico, Calif., as sales representative in the territory from Chico and Marysville north to the Oregon border.

Le Roi Northwest rep.

Tom Stone is now district representative in the Northwest territory for Le Roi Company. Stone covers Washington, Oregon, British Columbia and Alberta.

Wemco adds to Phoenix staff

Robert Kent is now office manager at Western Machinery Co., Phoenix, Ariz. Kemp Yorke joins the firm as salesman and R. B. George is promoted from office manager to sales manager.

Patton joins Koehring Co. of Calif.

Herb R. Patton, formerly chief draftsman of The C. S. Johnson Co., Champaign, Ill., is now chief engineer for Koehring Company of California.

Three reps appointed by valve manufacturer

C. B. Hunt & Son, Inc., Salem, O., manufacturers of Quick-As-Wink Air and Hydraulic Control Valves announces the appointment of three new representatives: Circle Seal Supply Co., Pasadena, Calif.; Process Equipment Co., Denver, Colo.; and Pollard and Co., Spokane, Wash.

Macwhyte Co. president dies

Jessel S. Whyte, president of Macwhyte Company, died May 28 at the age of 61. Whyte worked his way up in the firm from the winding department to the presidency.

Air Reduction names v. p. in Los Angeles district

E. W. MacCorkle, Jr., is now the vice president and manager of the Los Angeles, Calif., district of Air Reduction Pacific Co. For the past five years MacCorkle has been vice president and manager of the Portland, Ore., district. He succeeds H. A. Hoth, who goes to Portland as vice president and manager.

MacCorkle

Davis

Nordberg makes changes in Western territories

Territorial change in the West Coast operations of the Crusher and Process Machinery Divisions of Nordberg Manufacturing Co. means that T. D. Davis as Western branch manager of the divi

ion, will be in charge of the firm's entire West Coast operation including the Northwest territory formerly under the jurisdiction of G. E. "Gunnar" Jarpe. Davis will headquarter at the firm's San Francisco branch, and J. W. Crandall and L. O. Makholm, sales engineers, will assist Davis.

Steel exec joins United Concrete corporation as pres.

Lloyd R. Earl, formerly vice president of Consolidated Western Steel Corp., has been elected president of United Concrete Pipe Corp., Baldwin Park, Calif.

NEWS of MANUFACTURERS

Air Reduction names industrial relations mgr.

Jack V. Evans is the new manager of industrial relations for Air Reduction Pacific Co. He will headquarter in the firm's general offices located in Emeryville, Calif. Evans will supervise all activities in connection with industrial relations for the company on the Pacific Coast.

Independent Pneumatic sets new industrial sales division

Independent Pneumatic Tool Co., manufacturers of Thor portable power tools, inaugurates a new Thor industrial sales division and makes three promotions to effect the new division's expansion of the sales department. J. A. Hill is appointed manager of industrial sales. J. F. Corkery becomes manager of electric tools sales, succeeding Hill and G. A. Thoma takes over as sales promotion manager succeeding Corkery.

Olin Industries takes over Ramset Fasteners, Inc.

In line with the expansion problem of Olin Industries, the firm has acquired Ramset Fasteners, Inc., of Cleveland, O., manufacturer of powder-actuated industrial tools. Ramset Fasteners, Inc., will continue under its present management with Jesse E. Williams as president, as part of the Arms and Ammunition Division of Olin Industries.

Coast visitor

G. T. Coffey, vice president of Chicago Pneumatic Tool Co., was a recent visitor to the West Coast.

Former head of Columbia Steel dies in the East

J. Lester Perry, former president of Columbia Steel Co., died in Pittsburgh, Pa., at the age of 71.

PCA promotes four staffers

Portland Cement Association announces the promotion of four staff members. G. Donald Kennedy, formerly assistant to the president and consulting engineer, is promoted to vice president. W. D. M.

FLEET OF NEW WHITE 3000 MIXER TRUCKS

Lined up below, ready for action, are eight of 22 new White Motor Co. Mixer trucks. Consolidated Rock Products Company of Los Angeles, Calif. will put the units into service. A new principle of weight distribution has been employed on the models, to increase legal mixer capacity. To make units easier to handle on rugged construction jobs, power steering has been incorporated as another primary feature.

Allan, former director of promotion, receives the post of vice president for promotion, and Evelyn Pinkerton and J. L. Schneider were appointed assistant secretaries of the association.

Thermoid v. p.

Lester F. Cox is the newly elected vice president and executive manager of Thermoid Co., Trenton, N. J. One year ago he became senior vice president in charge of manufacturing and engineering for the firm's seven plants. In his new position, Cox will supervise all divisions of the Thermoid Co.

Hercules vice president dies

George C. McClure, 46, executive vice president and general manager of Hercules Steel Products Corp., died suddenly of a heart attack at his home in Galion, O., on April 26.

Insley appoints three Western dealers

Insley Manufacturing Corp. announces appointment of Aikins & Williams Tractor Co., Eureka; Graco, with stores located at Woodland, Stockton, Lodi, and Tracy; Inland Service & Supply Co., Las Vegas, Nev., as dealers.

Republic Supply holds open house in Calif.

The new Northern Division headquarters of Republic Supply Co. of California in San Leandro were inspected by some 2,500 visitors when the firm held open house at the new $1,000,000 building. Northern Division Manager Malcolm D. Jayred and his staff joined visiting executives from the main Los Angeles plant in welcoming visitors to the ten-acre site.

Jaeger promotes two

The Jaeger Machine Co. announces the promotion of Herbert F. Twaits to the position of Western factory representative succeeding Roy A. Mosel, who moves to the firm's home office in Columbia, O.

"Waco" distribution

Exclusive distribution rights for "Waco" brand sectional steel scaffolding equipment in the San Francisco Bay Area have been granted Laurence Myers and Co., of Ohio. Jock Hemingway will head up the separate Waco division established by the Ohio distribution firm. He will work out of San Francisco. Exclusive distribution rights in the Stockton and Merced, Calif., areas have been granted Waco Scaffolding Co., Stockton. Waco-May Co., West Coast licensee manufacturer and distributor of Waco equipment, made the appointments.

T-K adds to sales staff

Phillip H. McManus, formerly general sales manager, Templeton, Kenly & Co., was elected vice president in charge of sales. In addition to directing sales McManus will travel in the far Western territory.

Joy Mfg. Co.'s v.p.

William L. Wearly is the newly elected sales vice president of Joy Manufacturing Co. in charge of all domestic sales including Canada and Mexico.

Kaiser Gypsum buys Ore. quarry

The Dant, Ore., properties of the Dantore division of Dant & Russell, Inc., have been acquired by Kaiser Gypsum Division of Henry J. Kaiser Co. The Dantore quarry and plant situated on the banks of the Deschutes River, produces mineral acoustical tile, lightweight plaster aggregate and trowel coat fines for national distribution. The majority of the employees now at the Dant facilities will be retained.

Kaiser Steel promotions

Barney Dagan is now general superintendent of Kaiser Steel Corp. Dagan moves up from the position of assistant general superintendent to succeed Edward J. Duffy, who was appointed assistant to the works manager, in charge of iron ore and coal production.

Mixermobile's Smith succumbs

Charles W. Smith, 85-year-old office manager of Mixermobile Manufacturing Co., Portland, Ore., died recently in Portland.

Clipper v. p. resigns, forms own firm

Robert G. Evans, one of the origina founders of the Clipper Manufacturing Co., announces the formation of a new

ompany to distribute masonry and concrete sawing equipment. Products will e marketed under the tradename "Tarret." Deliveries on diamond blades are eported immediate for masonry and oncrete saws as well as small diameters or power hand saws. Robert G. Evans Co. will be located at 6315 Brookside Plaza, Kansas City, Mo.

Martin executive to locate factory

Location of new manufacturing facilities on the West Coast will be determined by Les Jones, general sales manager, Martin Machine Co. The new factory will be an assembly plant for the Kewanee, Ill., producer of construction equipment hauling trailers. The new manufacturing facilities will produce these and other models in the Martin line for West Coast distribution through Caterpillar dealers.

Macwhyte director

George C. Wilder was appointed a director of Macwhyte Company to fill the unexpired term of the late Jessel S. Whyte and was elected president. Wilder was formerly vice president and assistant general manager.

Round Chain changes

Gerald T. Knott, formerly assistant general manager of Round Seattle Chain Corp., Seattle, Wash., and Portland, Ore., is now vice president. Jack D. Cavan, who has been with the Round organization for fifteen years has been named general manager of Round California Chain Co., So. San Francisco, Calif. He formerly held this position in Los Angeles Chain Corp. Taking his place in Los Angeles is Leonard D. Woods, Jr., who was Cavan's assistant.

Sales mgr. post changes at Flexible Steel

John P. Ramsey succeeds Hugh L. Coats as sales manager of Flexible Steel Lacing Co. Coates will continue as secretary and director of the firm.

Gen. sales mgr. Wood Mfg. Co.

A . W. Ginther is appointed general sales manager of Wood Manufacturing Co., North Hollywood, Calif. Ginther was formerly with Harnischfeger Corp. Wood manufactures roadbuilding equipment.

Ginther

Pratte

Harnischfeger names new sales manager

B. Pratte, a veteran of nearly 20 years with Harnischfeger Corp., is the newly appointed general sales manager. In his new role, Pratte will direct domestic sales of all firm divisions, except welding products. He will be in charge of all domestic branch office operations, excluding the Pacific Division, whose activities he will help coordinate with overall sales and service policy.

Harnischfeger dedicates diesel engine plant

Harnischfeger Corporation officially opened its new Diesel Engine Division in Crystal Lake, Ill. Executives of the organization told visitors about the history of the 68-year-old firm at the dedication of this ninth plant, and tours of the new plant were conducted.

Trailmobile sales dept. appoints administrators

Joseph O. Young, present branch sales manager for Trailmobile, Inc., is now general operations manager. Harry E. Eyler, present manager of the firm's west central sales division, becomes general sales manager. Trailmobile, Inc., is a Pullman Incorporated subsidiary.

W. & L. E. Gurley name sales manager

Daniel H. Harkness becomes sales manager of W. & L. E. Gurley, Troy, New York. Harkness, who is also secretary of the 107-year-old firm, joined the sales department in 1943.

Armington elected Euclid Road board chairman

Stewart F. Armington is now chairman of the board of directors, Euclid Road Machinery Co. Armington, one of

the founders of the firm, steps up to the chairmanship from vice president. G. E. Armington succeeds him as vice president, engineering, and Hugh T. Monson is vice president, manufacturing.

Heil Road sales mgr.

Paul Miller is now Road Machinery Division Sales Manager of The Heil Co. He replaces his brother, Robert Miller, who has resigned to become sales manager of the Innes Equipment, Ltd., Toronto, Ontario, Heil Road Machinery distributors in eastern part of Canada.

Allis-Chalmers acquires LaPlant-Choate

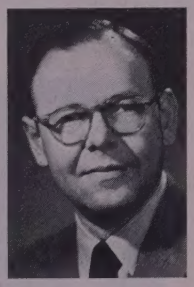
The board of directors of LaPlant-Choate Manufacturing Co., Inc., has approved an agreement and plan of reorganization with Allis-Chalmers Manufacturing Co. The A-C board had already approved the proposal. Acquisition of LaPlant-Choate will broaden the industrial line of the Tractor Division of Allis-Chalmers in earthmoving and other fields. The present organization of LaPlant-Choate, Cedar Rapids, Iowa, will be maintained.

Division of Motorola moves to new site

The Communications and Electronics Division of Motorola, Inc., which formerly operated within the firm's radio and television plant on Augusta Blvd. in Chicago, Ill., now occupies new headquarters adjacent to the main plant. The new location provides 200,000 sq. ft. of plant and office space.

Death claims V. M. Dobeus, Tractomotive president

V. M. Dobeus, president and general manager of the Tractomotive Corp., died April 8. He was co-founder, with Paul B. Cochran, of the firm, which manufactures allied equipment for crawler and industrial wheel tractors for use in road building, etc. Before founding Tractomotive, of which he became sole owner in 1948, Dobeus was chief engineer at the Springfield, Ill., works of the Tractor Division, Allis-Chalmers Manufacturing Co.



F. E. Englander **has a new position with Gar Wood Industries. (See item below.)**

Gar Wood division gets new sales manager

F. Eugene Englander is the newly appointed sales manager of the Richmond Division, Gar Wood Industries, Inc., Richmond, Calif. Englander was at one time Western States sales manager of the Golden State Sales Corp. He joins Gar Wood from Oscar Krenz, Inc., Berkeley, where he was sales manager. Englander will direct all sales activities for the products manufactured and sold by the Richmond Division.

Allis-Chalmers announces v. p. promotions

R. S. Stevenson was elected executive vice president of the Allis-Chalmers Manufacturing Co. Willis G. Scholl, formerly vice president and general sales manager of the Tractor Division will succeed Stevenson. Frank Mussell, eastern territory manager of the division, succeeds Scholl.

M-H Regulator names Peterson

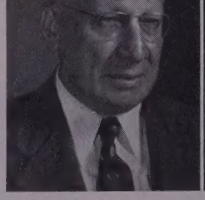
C. L. Peterson is now general sales manager of the Industrial Division of Minneapolis-Honeywell Regulator Co.

Dodge truck director

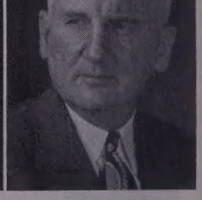
William S. Woolsey is the new director of truck sales, Dodge Division, Chrysler Corp. Woolsey's 30 years of diversified truck and automotive experience includes retail selling as well as service, field staff and factory sales work.

Sunderland leaves Roebling

C. C. Sunderland retires after 50 years of service with John Roebling's Sons Co. Sunderland, firm's chief bridge engineer, is a well-known figure in the bridge con-



Sunderland



Birdsall

struction industry for his part of the firm's participation in major bridge projects throughout the country. Sunderland's successor will be Blair Birdsall, who has assisted him since 1940.

GMC truck division general sls. mgr.

Richard C. Woodhouse, formerly assistant general truck sales manager for the General Motors Corp. Truck and Coach Division, is the newly appointed general sales manager. Woodhouse succeeds J. E. Johnson, who will handle special assignments for the general manager. Julian M. Gilroy becomes Western regional manager.

Woodwork Institute elects 1952 Board officers

L. G. Woodson, Nicolai Door Sales, is the newly elected president of the board of directors of the Woodwork Institute of California. L. J. Pierce, Pacific Manufacturing Co., is first vice president of the organization. Both men were elected to the board at the first anniversary meeting of the Institute.

CLASSIFIED ADS

See Also Pages 162 and 163

Two sales execs appointed by Farr

Farr Company, Los Angeles, Calif., manufacturer of air filters and air filtration equipment, announces the appointment of Robert S. Bebb of Los Angeles as division sales manager, supervising the Western division. James E. Matuska, Seattle, Wash., is the newly appointed district sales manager for the Northwest district.

Sturgeon of P&H dies in Great Falls mishap

R. H. Sturgeon, manager of the Seattle branch of Harnischfeger Corp., died August 8 in Great Falls, Mont. from a 4-story plunge down an elevator shaft. Circumstances surrounding Sturgeon's death are still somewhat of a mystery, although the county coroner stated that the death appeared to be accidental.

Stephenson of Bethlehem dies at 55

Sanford Stephenson, 55, manager of wire and wire products sales for Bethlehem Pacific Coast Steel Corp. since 1935, died August 18 in his Burlingame, Calif., home, after an illness of several months.

Space is sold as advertisers' inches. All advertisements in this section are ⅛ in. short of contracted space to allow for borders and composition.

CLASSIFIED SECTION

Rates are $8.50 a column inch. Copy should be sent in by the 20th of preceding month if proofs are required, by the 23rd if no proofs are required.

Come and Get it—Used Equipment That Will Make You Money

Take your choice.

Some units completely rebuilt and fully guaranteed; others as is.

1—Caterpillar D8 tractor
(2U series) with 8S bulldozer and No. 25 cable control.

1—Caterpillar DW20 tractor
with either U or straight tilt-type dozer.

2—Caterpillar DW20 tractors
equipped with No. 20 scrapers with side and tail gate extensions.

3—Caterpillar DW10 tractors
(1V series) equipped with No. 10 scrapers with side extensions for 11 yds. struck, 14 yds. heaped capacity.

1—Caterpillar DW10 tractor
(1V series) with LeTourneau LP scraper.

7—LaPlant-Choate TS300 tractor-scraper units;
14 yds. struck, 17½ yds. heaped.

5—Caterpillar No. 12 motor graders
(1—7T series, 4—9K series).

1—Caterpillar D6 tractor
(4R series) with T6 Traxcavator shovel.

2—Caterpillar D4 tractors
with T4 Traxcavator shovels.

All are available for immediate delivery. Act NOW. Call Used Equipment Manager Joe Salvador and ask about our Rental-Purchase Plan.

PETERSON TRACTOR AND EQUIPMENT COMPANY

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Major earthmoving equipment manufacturer has responsible position open for field representatives to serve in continental United States. Knowledge of time study . . . equipment performance . . . earthmoving techniques esential. Civil engineer graduate preferred.

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