WESTERN CONSTRUCTION

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FEBRUARY 1953

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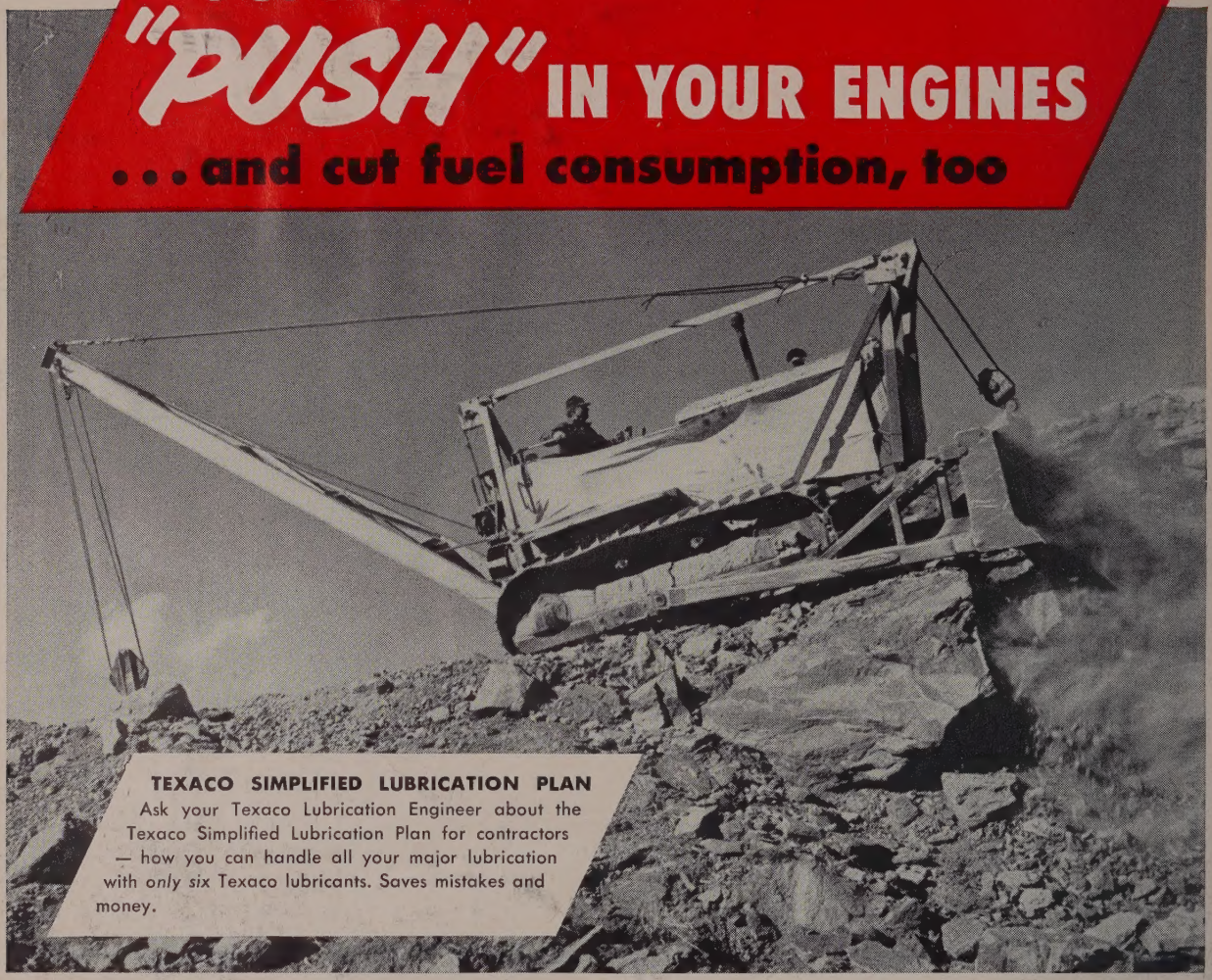

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WESTERN CONSTRUCTION

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FRONT COVER

ARTISTRY keynotes the cover of *Western Construction* this month. Setting the tone of a sincere layman's portrayal of what a modern airport should be is a retouched photograph of a model of the "tri-dimensional" airport. Raymond Rogers has created a realistic illusion through the use of draftsmanship and an airbrush. You can almost hear the operations officer calling clearance to one of the big planes from control tower! (See article page 68).

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WESTERN CONSTRUCTION

The owner calls for progress . . .

Pressure from the owner, who wishes to see "the dirt fly" on his job, is well understood by the construction industry. Ground breaking ceremonies recognizing initial operations have become commonplace, especially where the owner is a public body—a district, city or state—that might generate a lot of collective anxiety.

The custom is generally a happy one, and it obviously furnishes a needed opportunity for engineers to advise laymen on the conduct of engineering work. Occasionally, however, legitimate engineering problems arise at the last minute before such public ceremonies and threaten to embarrass everyone concerned. The ingenuity of contractors is perhaps nowhere so well illustrated as in these situations.

A recent steel erection job in Southern California is a case in point. The steel fabrication and erection contractor was under fire for failure to have his crews in the field before the ink was dry on his contract. The sight of an empty building site unnerved the owner, whose money was there . . . and yet, it wasn't! A happy solution came from the contractor's shop. Spotting the huskiest, most authoritative looking piece of structural steel in the place, the contractor had it trucked to the building site and erected on a hastily prepared concrete footing. Nothing further happened immediately thereafter; but the distraught owner was pacified. When actual construction of the building finally began, the "stand in" column was quietly removed and shipped to the job for which it had originally been intended.

In another instance at a Western damsite the day had arrived for pouring the first bucket of concrete. But, on that day the owner's inspector had rejected all aggregates as not grading up to specification. What to do? An elaborate speaker's platform had been built down in the hole, celebrities and officials had already arrived, and in appropriate speeches the occasion had been marked as one to "view with pride"!

The contractor met the occasion: he lowered away with the prescribed 8-yd. bucket—filled with grout. After it had been quite literally poured into place, the dignitaries were shooed away to the cook house for lunch, and the contractor broke out hoses to clean the foundation once again. Actual pouring began two weeks later.

And so go the little white lies of the construction industry. Misunderstanding by laymen is avoided, reputations are saved; and certainly the contractor is assured of at least one last laugh.

Contractors think differently

Young engineers who go to work for contractors must learn promptly that there is a contractors' approach to construction projects. This admonition applies to those graduates who look forward to working up to positions of responsibility on contractors' administrative staffs. The beginner must come to the immediate realization that a contractor's objective is to take a set of plans and specifications and apply all the know-how and ingenuity of his organization to the problem of finding a way to build the project at the least cost. This is the contractor's function, and the way he stays in business.

Concern over the reason why the designer did as he did, or contemplation of ways for improving the design tends to mix engineering with contracting and that usually should be avoided.

Bringing engineering principles and methods of analysis to bear on the problems of carrying out the field operations is very much in order. In fact, engineering understanding is essential for the bidding of a modern engineering project. But having established the objective, all efforts of a contractor are non-productive that do not contribute to finding methods of doing the required work for the least amount of money.

Airports in the goldfish bowl

Engineering works have the ultimate purpose of serving human needs. In many instances the relationship and distance between the originating structure and this final service eliminates much public concern and comment over the engineering design. A hydroelectric plant is a good example. The domestic user of power has no concern over the appearance of the plant or the relation and function of its engineering elements as long as the power goes on when he turns the switch.

Not so the modern air terminal. Here the facilities that involve so much civil engineering design and skill are under direct observation and searching comment from the public. The same man who would not care in the least about the design of a hydro plant will be visioning all manner of improvements in the airport facilities while he waits for his plane.

It is not surprising, therefore, that a layman should advance definite ideas on improvements for modern air terminals. The author of the airport article in this issue is a commercial artist with a long and keen interest in air transport. Although engineers may enjoy picking possible flaws in technical details, there is no denying the challenge of his basic new concept. In a field where advance is as jet-propelled as aviation it may be that an entirely new approach to airport design is worth considering.

WESTERN CONSTRUCTION

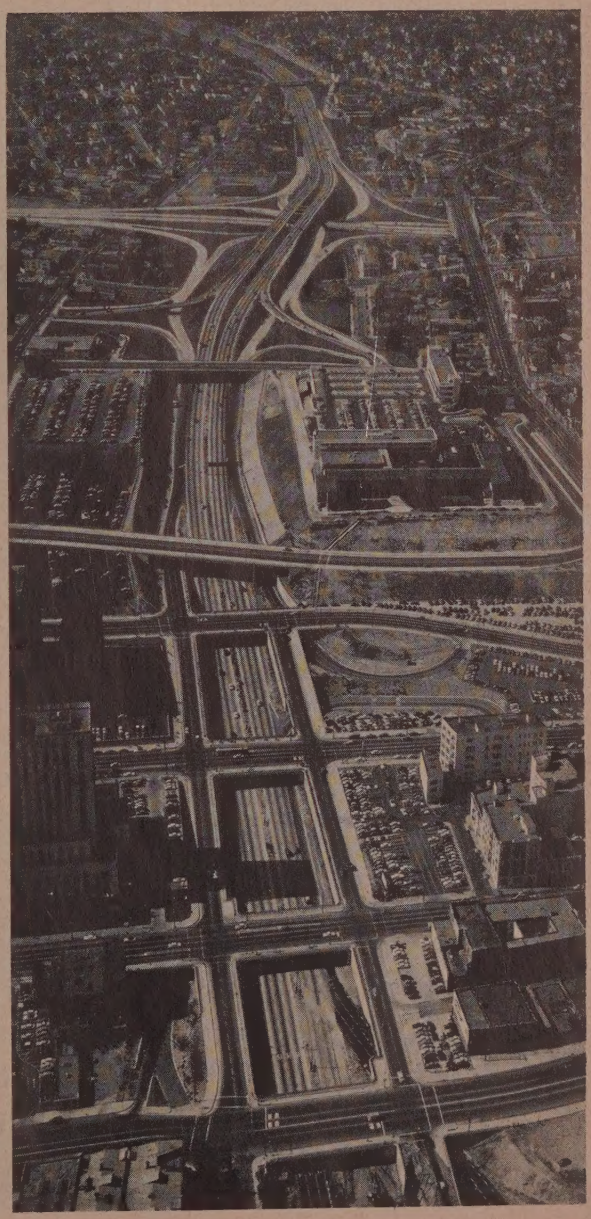
FEBRUARY 1953

Key problem in the Los Angeles area is—

FREEWAY STRUCTURE PRACTICE

With their cost almost equal to paving, the complex engineering design and construction problems for bridges represent a major element in building expressways through a metropolitan area

By J. W. GREEN
Southern Representative, Bridge Department
California Division of Highways

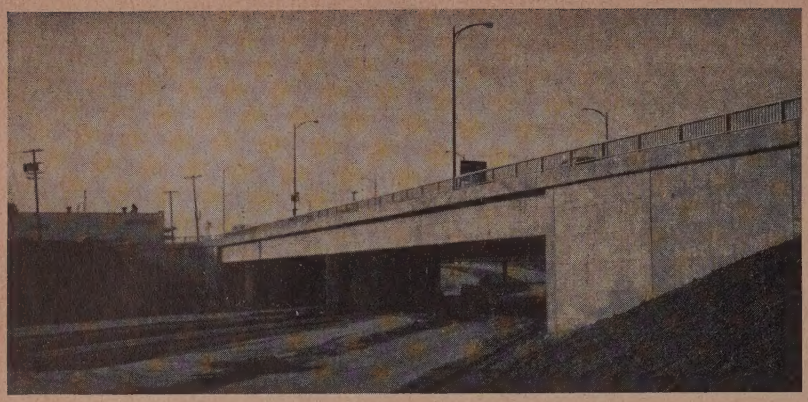


REPRESENTING a cost which approximates that of the multi-lane pavement, the structures required on the miles of freeway in the Los Angeles metropolitan area involve unusual design and construction problems. The volume of this work, which is required to provide street separations, traffic interchanges, elimination of grade crossings, not to mention bridges over waterways, has produced a trend toward standardization in both design and field procedures. A review of these current practices and their evolution represents a distinct chapter in highway bridge building in the West. The elements of this development are outlined in this article, with particular reference to field practice and the operation of the contracting forces.

Traffic pressure dictates

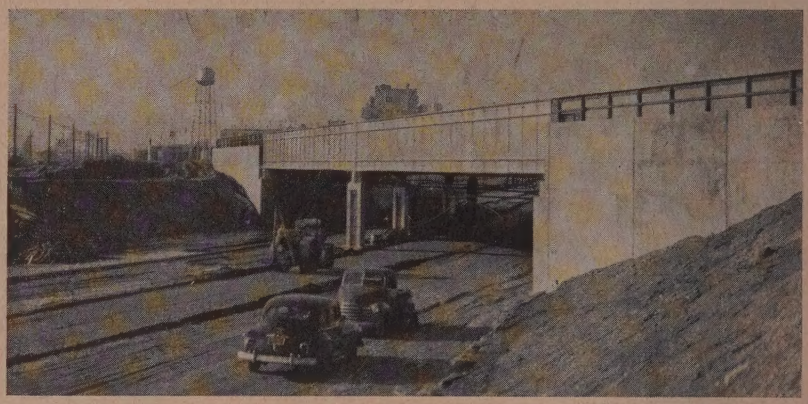
The proposed Los Angeles Metropolitan Freeway System contains some 613 mi. of freeways, of which about one-fourth (165 mi.) is a part of the state highway system. Of this latter about 48 mi. are completed and 29 mi. are under construction. Since the war, the California Division of Highways has spent or obligated about $180,000,000 for these freeways, and it is estimated that from $500,000,000 to $600,000,000 will be required to complete the main state highway arterial routes necessary as the basic network of the overall system.

Since the passage of the Collier-Burns Act in 1947, which launched the present freeway program, an all-out effort has been made to keep pace with the tremendous population growth in this area. As a result the increase in state highway bridge work in California has been considerable. Prior to World War II, the annual expenditure for bridge work in California was about $3,000,000. In the 1949-50 fiscal year, the state budget for bridge work was $16,000,000. In the 1951-52 fiscal year it had increased to $30,000,000. Today there are 55 state bridge construction contracts under way in the southern part of California totaling about $30,000,000. In January 1952 about five-sixths of the state bridge department design work was devoted to freeway structures planned to reduce congestion and speed the flow of traffic in metropolitan areas.



LONGEST of their type yet built in the Los Angeles area, these 146-ft. concrete box girder spans (left) carry Olympic Boulevard across the Santa Ana Freeway.

HEAVIEST steel girders in Los Angeles freeway system (below), these bridge the Santa Ana Freeway to carry four tracks of the Santa Fe railroad.



Even with this increased expenditure the program is hardly keeping abreast of the demands of mounting traffic. A few months after the opening of a portion of the Hollywood Freeway it was carrying over 100,000 cars per day. There are more than 2,000,000 motor vehicles in Los Angeles County alone, which is a larger number than registration in 41 of the 48 states. It is expected that this number will approach 3,000,000 by 1960. Estimates indicate that Los Angeles County motorists travel more than 17,000,000,000 miles per year.

As an example of costs, the 10-mi. length of Hollywood Freeway is being completed at an expenditure of some $55,000,000, of which right-of-way accounts for $27,000,000 and construction another $28,000,000. Structure costs amount to about half of the total construction, or some $14,000,000. Of course it should be pointed out that these proportionate costs do not necessarily apply in all cases, but vary considerably with local conditions.

Freeways accept street patterns

Where freeways traverse fully developed sections of cities, the design of the freeway itself must usually meet the established street pattern. This will generally mean that separation structures will be closely spaced in developed urban areas. In order to avoid excessive right-of-way damage it is generally necessary to maintain existing grades on streets in developed urban areas, and to depress or elevate the freeways where necessary at crossings of those streets.

Since structure work is one of the large cost items in constructing metropolitan freeways, and since the projected freeways require numerous separations at major cross streets, it is anticipated that freeway structure work in the Los Angeles metropolitan area will be of considerable magnitude for many years.

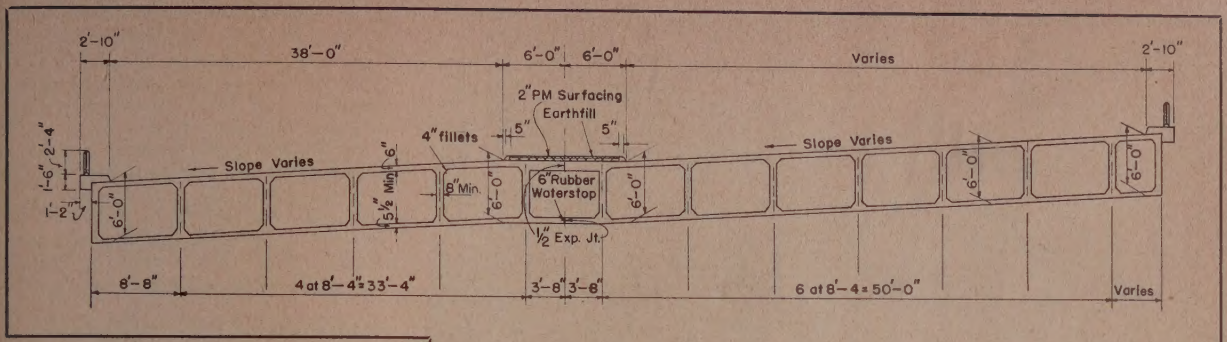
Peculiar problems

Design and construction of freeway structures in cities, in many ways, is similar to the design and construction of structures over rivers. In the case of freeway separation structures, however, there are very few stream flow and scour problems. Instead, other problems make the work interesting. For example, there are traffic, utility, and right-of-way problems, and the problems of designing with tight controls of curvature and grade. It is usually advantageous to keep the distance from freeway grade to separated street grade as small as possible, thus making thin decks extremely desirable. Thin decks are often needed to make possible the building of off-and-on roadway connections on reasonable grades at reasonable cost. Frequently some structure economy must be sacrificed to secure overall road economy.

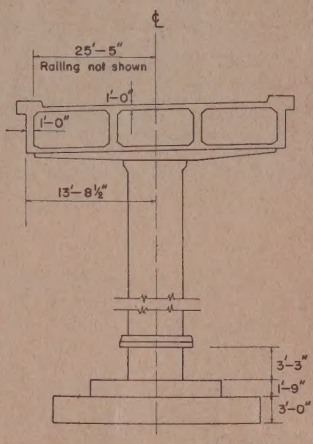
General design features

With the increased volume of bridge design and construction, continuous attempts are made to develop practical standard designs in an effort to expedite the preparation of structure plans and to reduce the cost of construction. Combined with this aim is the desire to provide structures

SINGLE RECTANGULAR piers carry Marianna Ave. on-ramp traffic to the Santa Ana Freeway. Eastern Ave. overcrossing is in the background. Note accentuated horizontal lines, obtained by use of straight soffits, light metal railing.



TYPICAL SECTIONS of reinforced concrete box girders illustrate a type of structure that is practically standard on much of the freeway construction in Southern California.



with architecturally pleasing lines and proportions, especially in and around the metropolitan areas. To conform with the concept of high speed traffic, horizontal lines have been accentuated in the structural design. There has been a trend from curved to straight soffits. Galvanized steel bridge railings have been substituted for the previous concrete railings to accentuate the horizontal lines of the structures. Steel railings also help reduce the apparent mass of the superstructures, particularly in the longer spans.

Box girder standard

Various types of structures have been used to conform with varying requirements of the bridge sites. However, the reinforced concrete box girder type has practically become the standard type of freeway separation structure in the Los Angeles area. It has been found that this structure is especially well adapted to the requirements of freeway construction. It provides a well proportioned structure and possesses the required stiffness for structures built on curves and involving large skew angles. It also lends itself well to locations requiring relatively thin superstructures. The hollow cells within the structure provide ideal ducts for carrying water lines, gas mains, telephone ducts, signal systems and various other utilities, the relocation of which has become a major problem in the metropolitan area.

Box girders have been constructed for spans as long as 150 ft. Because of the heavy reinforcement required in several of the longer spans, especially the steel in the caps, the necessary clearance required for the placing of concrete has been obtained by tying reinforcing bars in "bundles" of 4 bars.

Single-column piers

Another trend in design is the round, single column pier, which has been extensively used in this area, for one or two lane bridges. Combined with the boxed girder deck, the single column pier presents a pleasing appearance and provides a maximum of clearance for roadways passing beneath the structures regardless of the angle of intersection. In the design of these structures, an attempt is made to standardize on the diameter of single columns to permit a maximum re-use of column forms. However, circular single column piers are not the rule, since several structures using single rectangular column piers have also been constructed.

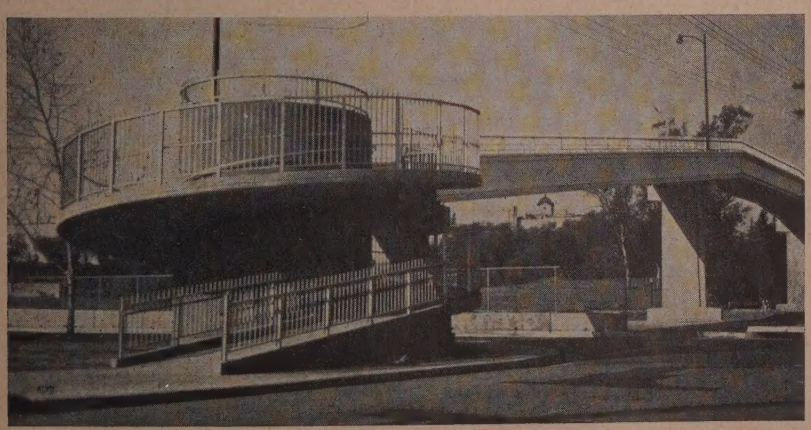
Right-angle crossings are the exception in freeway design. Since the free flow of traffic is the prime consideration, the bridge structures must, of necessity, be located as governed by the lines and grades required to maintain a high standard of geometric design. The need for bus lanes and on-and-off ramps further complicates the layout of the structures.

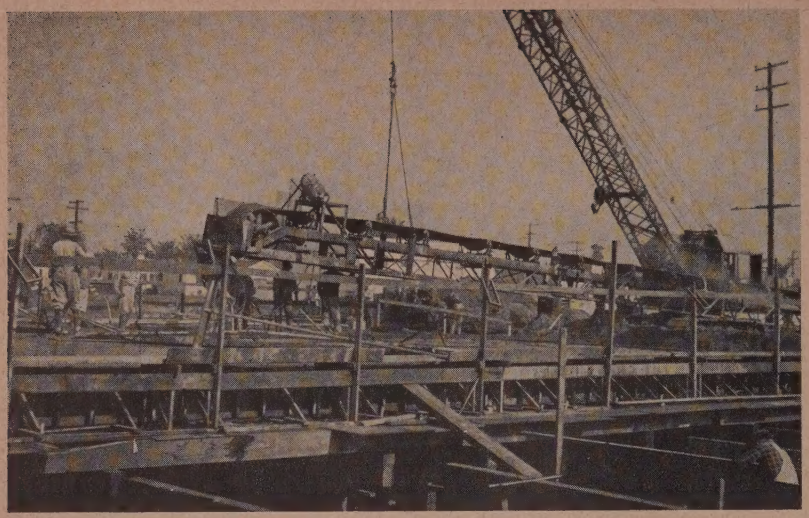
Because of the variety of terrain in this area, foundation material ranges from granite in mountainous area to alluvial deposits near the coast. These varying conditions call for a wide variety of footing designs. Spread footings, or footings on timber piles, precast concrete, cast-in-place concrete, drilled-in concrete piles and structural steel H-piles, are used as required to best meet conditions at the site. There are locations where economy has been effected by removing unsuitable material below the planned grade of footings to expose adequate foundation material and then backfilling with crushed rock to planned grade, thus eliminating the expense of piling or the added cost of lowering concrete spread footings.

Evolution in construction

When the box girder type of structure was first designed for use in this area, a lack of contractor experience in this type of construction was re-

SPIRAL RAMP approach gives access to pedestrian overcrossing on Ramona Freeway. These structures are built using welded steel girders, as here, or concrete girders. Where space permits, approaches may be straight ramps or stairways lying parallel to the freeway.





CONCRETE POURING over large areas like this Ramona Freeway structure was done with a belt conveyor by Griffith Company. Coordination of crane and mixer spots discharge over any selected point.

flected in a slight rise in bid prices for the reinforced concrete in such structures. As contractors gained experience, lower bids were received. Bids on concrete box girders now compare favorably with bids received on exposed beam types, unit bids varying between $40.00 and $50.00 per cu. yd. It might be pointed out that the exposed surfaces of the box girder structures are more simple than surfaces of T-beam structures and the forms for exposed surfaces are more readily constructed and more readily removed without injury. In fact several contractors have expressed a preference for box girder construction over the more conventional T-beams, giving lower form labor costs, greater speed of form building and lower surface finishing costs as reasons.

In the case of wide box girder structures constructed over city streets, it is not uncommon for the contractor to construct a section of falsework on steel rollers so the entire unit of falsework can be moved ahead as the work progresses.

Plywood is specified for forms for all exposed surfaces, but ship-lap or nearly worn-out plywood is ordinarily used for forming surfaces inside of the structure.

Pouring sequence

The box girder decks are usually poured in two operations: (1) the bottom slab and girder stems and (2) the top slab. In pouring the soffit and girder stems, experience has shown that it is more satisfactory to pour the bottom slab a short time in advance of the girder stems. This eliminates boiling-up of the concrete near the bottoms of girder stem forms and avoids the possibility of voids in the concrete at the base of the stems.

Following the pouring of the bottom slab and girder stems, the boxes are stripped and construction of top deck forms begins. The floor joists which support the top deck forms are usually supported on a ribbon fixed to the girder stems. The ribbons are usually held in place by form bolts or by nails shot into the concrete by means of powder-actuated guns. In box girder cells which do not contain utilities, the forms for the top deck are ordinarily left in place. However, it is customary to remove forms in those openings containing utilities to provide greater clearance for maintenance operations.

Biggest pours

There has been a tendency toward the construction of wall forms in larger units to effect savings in labor. Forms for retaining walls and abutments are often constructed in panels as large as 30 x 30 ft. and placed by means of a crane as the work progresses. These forms are made unusually heavy and are used as many times as practicable.

In placing concrete, the trend is toward larger and larger pours. Contractors find that this is more economical on work of this magnitude.

With the large volume of work now in progress, it is not unusual for one contractor to be low bidder on two or more adjacent contracts including the construction of several freeway separation structures. In such cases the contractor handles all of the bridge work on adjacent contracts as one large project. In this way, he can organize specialized crews to handle special phases of the work for the entire job, such as erection of falsework, placing concrete, and deck finishing operations.

Contractors own batches

As a result of the larger units of concrete work, several contractors have found it economical to erect their own batching plants for concrete aggregates. This provides them with better control of the production and delivery of concrete. The same plant can be used for several contracts in the same area.

In placing deck concrete distribution into the forms is usually carried out by means of hand-operated or power-driven concrete buggies, or by hoisting concrete buckets to all points on the deck with cranes operating alongside the structure.

Innovation

Griffith Company of Los Angeles, contractor on several of the Ramona Freeway structures, has successfully used a method of distributing deck concrete by means of an endless belt. A crawler-type pavement mixer is located on the bridge approach. One end of the steel frame supporting the conveyor is attached to the paver. The other end of the frame is supported by a crane also located on the approach but equipped with a boom long enough to move the discharge end of the belt to any point on the bridge deck. By maneuvering the crane and the mixer during the placing operation, concrete is distributed to the entire deck area, thus entirely eliminating the need for hoppers, runways, concrete buggies and concrete buckets. This operation is shown in the accompanying photographs. It was used recently in the placing of concrete for a portion of the deck of a continuous flat slab structure, 45 x 90 ft. The maximum rate of pour during this operation was 85 cu. yd. per hr.

Principal contractors

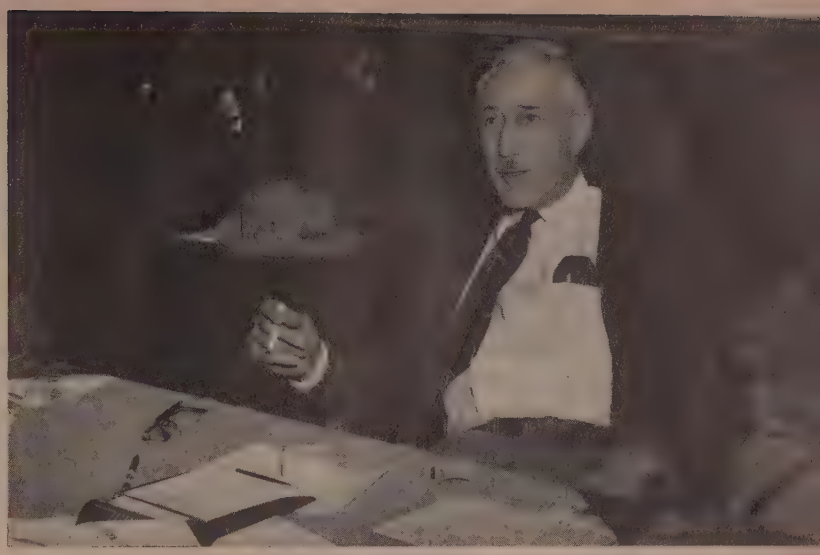
The greater part of the freeway structure work in the Los Angeles area has been or is being done under contract by the following contractors, to name a few:

Guy F. Atkinson Co.
James I. Barnes Const. Co.
Bent Const. Co.
Bongiovanni Const. Co.
W. J. Disteli
Fredericksen & Kasler
J. E. Haddock, Ltd.
Peter Kiewit Sons' Co.
Charles MacClosky Co.
Walter F. Maxwell
Oberg Bros.
Peterson & Baker
R. M. Price Co.
C. B. Tuttle Co.
United Concrete Pipe Corp.
Webb & White
Winston Bros. Co.

Personnel

F. W. Panhorst, Assistant State Highway Engineer, is in charge of the design and construction of all state highway bridges in California. The writer is in charge of the southern office located in Los Angeles. Geo. T. McCoy is State Highway Engineer of California.

"Nobody calls a superintendent in the middle of the night to say that things are going right. What they get him out of bed for is to shoot trouble and straighten things out."



So you Want to be a SUPERINTENDENT?

By C. W. "Smoky" WOOD
Project Manager
Hungry Horse Dam
AS TOLD TO
RAY DAY

IF ANYBODY BELIEVES it's easy to be a modern construction superintendent, or that this piece contains any easy short cuts, he can stop reading right now.

For there are no short cuts. Today's superintendent or project manager has one of the toughest jobs in America.

There are no substitutes for the things he needs. They're as definite as black and white. Today's modern construction job calls for a trained psychologist with the patience of Job to exemplify all the old-time values while directing engineering and construction work which daily gets bigger, more difficult, and more complex. It takes 24 hours a day 7 days a week to do the job properly.

Need many talents

A good superintendent must have many long years of experience. He must have the ability to pick the right man for each key job, and the courage to delegate authority. He must have a hundred different manners for disseminating orders to various men. He must command their loyalty, and must keep close harmony among dissimilar individuals.

Today's superintendent must have the ability to select and plan the setup of plant outlays running into million-dollar figures and more. Unless he does it right the first time, his mistakes can break a contractor. Yet he must make his decisions without hesitation, and take all the responsibility if things go sour. He must get along with engineers and other people from the agency paying for the work. He must work in harmony with labor union bosses.

And last, though certainly not least, he must command just as much respect and confidence from the contractor-owners as he does from the lowest priced laborer on his job. It is an important factor in developing the financial backing a good superintendent must have on his job to show the best possible profit.

Nobody calls a superintendent in the middle of the night to say that things are going right. What they get him out of bed for is to shoot trouble and straighten things out.

In a way, such adverse factors as these are good for the construction business. A man either belongs in construction or he doesn't. He belongs, and he can go far, if he is man enough to accept such harsh rules and still look ahead to the deep inner satisfaction which comes from working with them and getting a job done right. Young men from the 1952 engineering schools who can forget 40 hours a week and concentrate on making these adverse rules a part of their lives 24 hours a day, 7 days a week, can practically write their own ticket a few years from now. For the rules are just as basic and even more essential to success than they were in Abraham Lincoln's time.

The man who gives this advice speaks, after considerable thought, from a 30-yr. background in Western construction and engineering. He is C. W. Wood, better known as "Smoky" Wood, Vice President of General Construction Co. of Seattle and project manager of the USBR's big Hungry Horse Dam on the south fork of the Flathead River near Coram, Montana. Smoky Wood has supervised his share of the big ones: first and second steps at Ross Dam, Hetch Hetchy Dam (O'Shaughnessy Dam, raised 85 ft. in 1935-36.—Ed.), Harbor Island Shipyard at Seattle, and Tacoma Shipyard. He was assistant superintendent on Bonneville Dam, the San Francisco-Oakland Bay Bridge piers, Owyhee Dam, and many smaller jobs. Wood has literally watched the construction business grow up.

Theories useless unless practiced

Like all theories or rules, the ones for a construction superintendent are no good unless they are used and lived with day after day for many years. How can a superintendent learn to command respect on a big job, for example, unless he has merited respect for many years on smaller ones? How can he straighten out trouble on a pressure grouting crew or help a rigger boss unless he has actually pressure grouted or worked at rigging himself?

To those who would be construction superintendents, then, one of the first things to do is to start living with the rules, ironing out adverse conditions, and practicing all the things a man will need later on. Somehow all the priceless assets a man must have to direct big work must be sown, sprouted, nurtured and strengthened through the earlier, formative years.

There is absolutely no substitute nor any short cut.

Smoky Wood's methods are his own, and they are not at all unique. They are what every successful construction superintendent uses, basically, and the difference is only in degrees. Jack McEachern, under whom Wood worked for many years, used the same basic rules coupled with a demand for near perfection from his subordinates as well as from himself.

"It was a definite and favorable factor in the professional growth of everyone who worked close to Jack McEachern," Wood explains, "because his demands helped every one of these men grow; helped them become resourceful."

The school of hard knocks

When Wood was asked to name the things important these days to a superintendent, the first thing he put down was "Experience," in big letters. Wood is a graduate engineer from the 1921 class at Colorado A & M, and he believes an engineering education advisable or even necessary for men who want to be the construction superintendents of tomorrow. But in any discussion of the subject, he emphasizes the importance of practical experience in large quantities as soon as the formal schooling of the individual is finished.

"One of the valuable things about an engineering education is the fact that it gives a man an analytical mind," is the way Wood puts it. "A man with that kind of mind can analyze different aspects of a job, correct trouble, lower his costs, and do a better job than average of balancing the various economic values against each other. But they're not worth a damn unless a man makes up his mind to get some experience. How can you think, without the material to think with?

"Take the setup for a modern aggregate plant on a big concrete dam, for example. Lots of things have to be balanced against lots of other things. How far is the haul? How far upgrade can you lift the stuff economically so the cableway can drop most of it into the dam, instead of having to do a lot of hoisting? How deep can you go in your gravel pit? What equipment should you select? How tough are the specs?

"Unless a man deliberately goes out as often as possible and exposes himself to learning some of these things firsthand, he can't very well plan or direct such a setup. And it'll be even more important 10 or 20 years from now than it is today."

Think objectively

Wood holds regular project conferences to promote harmony and understanding these days, as do most superintendents on big projects. The young man aspiring to become a superintendent himself some day can

MOST IMPORTANT is experience: ***"Take the setup for a modern aggregate plant on a big dam, for example . . . Unless a man deliberately exposes himself to learning things firsthand, he can't very well plan or direct such a setup."***

gain a lot of experience from these conferences by listening and keeping his eyes open on the job. At the very least, such conferences teach a man to think of a project in its broadest perspective. When a foreman of embedded metals can see that his work interferes at certain times with a higher priced carpenter crew, he has come a long way in this experience-perspective business.

There are many ways for a construction man to gain experience, and one of the soundest is at once the toughest and most obvious. If a man will simply demonstrate a willingness to learn thoroughly a wide variety of jobs, it will pay dividends twice. First, it will teach him as nothing else can the fundamentals of a wide variety of work. Second, it will mark him at once as a man with a promising future. And construction management will see it, too, for that particular human trait is on the wane in this day of over-specialization and short hours.

How the other guy does it

In addition to the wide variety of experience possible on any job, to be had for the asking, one of the important extra-curricular activities any would-be superintendent owes himself is an occasional visit to another construction job nearby. A man can always see two things on any project. He can see some new innovation he can use sometime to his own advantage, or he can see mistakes he can profit by; mistakes he'll never make on his job. Either one is good experience.

The technical engineering-construction magazines of the trade are excellent extra-curricular material for broadening a man's theoretical experience, too, says Wood, whose office always contains current copies of many engineering periodicals. A foreman would do well to broaden his knowledge by this type of reading, because much of the information he learns can be put to good use when the great day comes to take over his first superintendency.

The importance of grabbing big chunks of practical construction experience as fast as possible cannot be over-emphasized, because later on, how well a man has gained experience will determine how well he handles one of his toughest jobs: human contacts.

Demonstrate abilities

In many respects, a superintendent's human contacts can make or break him faster than anything else. No superintendent is any better than the organization behind him; and to a large extent the organization is directly dependent on the superintendent for its creation, its work, and its efficiency or lack of it.

Many of the key men at Hungry Horse demonstrated their talents along various lines back in the days when the project manager was a project engineer, foreman, or superintendent on jobs considerably smaller than the present one. The man who hopes eventually to be superintendent in his own right will do well to watch for other men with potential talent along various lines. It cultivates a healthy respect for the talents of other people, and that's good for anyone on a construction job. It's more than good for the man who, some day, will manage his own job and have to depend on many of these people to supervise the details.

Keep in touch

Loyalty, harmony, mutual respect, confidence; all owe their existence to the intangibles in human contact. There are no set rules for making such things spring up and grow. But it seems highly significant that on the jobs where these things are most in evidence, the superintendent or project manager works harder at staying close to his job than ever.

Smoky Wood is no exception to this rule. The hours Wood has to spend on administrative matters in his office are so much drudgery as far as he is concerned, and he manages to delegate much of that work to administrative subordinates. Wood considers his most effective hours those he spends out on the job, close to details, and close to his men. Only by being close to his men can he sense incipient trouble in the making.

Possibly one of the worst causes of trouble and jealousy between men on a construction job is too little to do. There's always more trouble and

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Production and use of stone-sand in the concrete for large dams

Where natural sand is not suitable for fine aggregate, contractors are being required to manufacture the product—More jobs are going to involve the making of stone-sand at mountain sites—Stricter grading specifications will tend to accentuate this trend

By WILLIAM R. WAUGH
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MANY concrete dams have been constructed in regions where there were no natural aggregates available within economic range. This has often been the case where high concrete dams have been built in the upper reaches of tributary streams. Lack of natural aggregates in these locations results from the fact that the very processes of nature which made and delivered the natural aggregates to their final location began in the reaches of the river near the dam site, but final deposit of the materials occurred a hundred or so miles away. When such a condition exists it becomes necessary to transport natural materials for great distances or to find bodies of suitable rock near the dam site that can be quarried and manufactured into concrete aggregates. The final decision in any such case becomes largely one of economics.

Basis of knowledge

As in the past, there will no doubt be many instances in the future where the decision will be to use crushed stone coarse aggregate and stone-sand made from a locally available body of rock. Considerable experience has been gained in recent years in the manufacture of stone-sand which should serve as a basis for making improvements in the plants and operating procedures on future projects.

The importance of stone-sand in dam construction during the last 10 to 12 years is shown in the table on page 64 that lists 23 concrete dams completed or under construction since 1945. Thirteen of these have been constructed using stone-sand. These represent a volume of 14,600,000 cu. yd. of concrete or about 48% of the total volume in all of the dams listed. It is interesting to note that of the 16,200,000 yd. placed using natural sand 6,500,000 yd. is in one structure. It can thus be seen that the use of stone-sand has played an important part in the construction of massive concrete dams in recent years.

IN THE WEST more and more contractors will be required to "make" sand at mountain locations for dams and other structures involving closely controlled concrete aggregates. The process of grinding rock down to fine-aggregate size is not new, but the trend toward using the result in concrete has increased during the last few years. Use of air-entraining agents, and the added requirements for following the specified grading curve, have put more importance on the refinements of making sand.

Everyone concerned with the specifying, producing or handling of concrete must be familiar with this subject, for the next job may be one where stone-sand is the logical answer for fine aggregate. To provide an authoritative review of the subject this article was secured from the office of the Chief of Engineers. The information it contains adds helpful material to our coverage of modern developments in concrete construction.

—Editor.

Trends in grading requirements

Advent of the use of entrained air in concrete and the development of new methods for control of temperature changes in mass concrete have influenced considerably the trends in grading requirements for fine aggregate. Prior to the advent of the use of entrained air in concrete, there was a tendency to use relative coarse crushed stone fine aggregate with a rather high percentage of minus #100 material. It was considered desirable to have sand with a fineness modulus in the range 2.70 to 2.90 with the minus #100 material in the range from 12% to 16% as delivered to the mixers.

Grinding during the mixing process also usually increased the amount of fines and it was not unusual to find that after mixing the minus #100 in the sand had increased appreciably. In one unusual situation the minus #100 in the sand was found to have increased from about 12% to 14% as batched, to about 18% to 20% in the mixed concrete. Relatively high proportions of minus #100 was found to be desirable for use in lean interior mass concrete, particularly if a reasonable proportion of the minus #100 was also minus #200. There was also the matter of economy since in most grinding or pulverizing operations an excess of fines is produced and the

use of as much of this material as possible resulted in a minimum of waste.

Tighter specs now

In recent years specifications have been written so as to provide somewhat finer sand, having less minus #100 material than previously used. A table shows a comparison between a typical sand grading used in non-air-entrained mass concrete during the 1935 to 1945 period, with a sand grading now considered desirable for use in air-entrained mass concrete. Specifications have also been "tightened up" in recent years, particularly with regard to uniformity of grading.

Corps of Engineers' specifications set a limit on variations in fineness modulus of 0.10 from the average of fineness moduli of samples of sand produced over a period of the previous 30 days for nine out of each ten samples taken. The trend toward the requirement of less minus #100 material in the sand for air-entrained concrete results from the fact that the entrained-air supplies a superior form of "fines" which improves the cohesiveness and workability in very lean mass concrete.

The need for uniformity of grading has always been recognized, but uniformity of gradng becomes a "must" with the very lean air-entrained concrete. Without uniformity of grading it is impossible to control the quantity of air in the concrete. Control of the quantity of air and uniformity of grading of the sand are both essential to achievement of the use of a minimum of cement which is a necessary part of temperature control.

Proportioning of lean mass concrete mixes for use in the interior of a gravity dam is probably the most exacting of all concrete proportioning problems. The objectives, as in any other proportioning problem, are to produce with the available materials the most economical mixture possible having the required workability and other characteristics. One of the most important of the other characteristics is the lowest practicable cement factor. In order to achieve this important objective, the essential factor is to determine what is the optimum ratio of fine aggregate to coarse for the materials in question.

Proportioning of lean mixes

These very lean mixes are extremely sensitive to variation in grading of fine aggregate and to changes in proportion of fine aggregate to coarse aggregate. It is this extreme sensitivity which makes proportioning so much more exacting than it is for relatively rich mixes. Once this optimum proportion has been determined, close control of batching is essential to sustained production of concrete having the desired low cement factor. Properly graded and uniformly controlled fine aggregate are prerequisites to achievement of greatest economy and lowest practicable cement factors in the concrete.

As a general rule stone-sand concrete, with which almost invariably crushed stone coarse aggregate is used, requires more water per unit of volume for a given slump than concrete made with natural coarse aggregate and natural sand of comparable grading. Also, because of the angularity and the rough surface texture a higher proportion of stone-sand to total coarse aggregate is necessary to provide the required quantity of mortar for given plastic properties than is necessary with concrete made with natural sand and natural coarse aggregate of comparable grading. It follows therefore that for a given water-cement ratio the quantity of cement per unit of volume of concrete, of given plastic properties, made with stone-sand and crushed stone coarse aggregate is usually higher than for natural sand and natural coarse aggregate of equivalent grading.

Effect of "fineness"

The relative "fineness" of the sand also influences the proportions required for a properly balanced mix. Assuming a good continuous grading, the optimum proportion of relatively "coarse" sand will be higher than for relatively "fine" sand for equivalent balance. For example, the optimum proportion of stone-sand of fineness modulus 2.90 (relatively coarse) for a lean interior mass concrete mix **without** entrained air and containing 6-in. maximum size aggregate would normally be about 32% of the total aggregate; and for sand of fineness modulus 2.40 (relatively fine) it would be about 28%. Within reasonable limits of variation in fineness modulus the unit quantity of water required for a given consistency remains about constant when the proportion of sand to coarse aggregate is optimum for a particular set of materials. It therefore follows that for a fixed water-cement ratio the cement content should also remain constant for all practical purposes.

Changes with entrained air

Use of entrained air does not alter the qualitative relationships expressed in the foregoing but it does materially modify the quantitative relationships. When the entrained air is added to a mixture the net result simply stated is that the mortar phase is "bulked." In other words the yield of a mixture of sand, cement and water is increased by a percentage-amount equal to the quantity of air entrained. With this in mind there is, therefore, a basis for adjusting from non-air-entrained concrete to air-entrained concrete for a given set of materials.

Having determined what the proportions for a non-air-entrained concrete are, a reduction in the amount of sand to be used at the rate of about 1¼% to 1½% for each per cent of air entrained can be made in the proportions for the entrained-air concrete. Two other adjustments will follow: (1) a reduction in unit water

Type of aggregate used in dams completed or under construction since 1945

PROJECT NAME	PROJECT LOCATION	VOLUME OF CONCRETE (Cubic Yd.)	TYPE OF AGGREGATE Coarse	Fine
Philpott	Smith River—Va.	330,000	CS	SS
Conemaugh	Conemaugh River—Pa.	330,000	CS	NS
Narrows	Little Missouri River—Ark.	410,000	G	NS
Harlan County	Republican River—Neb.	430,000	CS	NS
Jim Woodruff	Chattahoochee River—Ga.	460,000	CS	NS
Allatoona	Etowa River—Ga.	520,000	CS	SS
Whitney	Brazos River—Texas	520,000	CS	SS
Ft. Gibson	Grand (Neosha) River—Okla.	530,000	CS	SS
Buggs Island	Roanoke River—Va. and N. C.	650,000	CS	SS
Mt. Morris	Genesee River—N. Y.	760,000	CS	SS
Bluestone	New River—W. Va.	940,000	CS	*Blend
Center Hill	Caney Fork River—Tenn.	960,000	CS	SS
Folsom	American River—Calif.	1,000,000	G	NS
Chief Joseph	Columbia River—Wash.	1,050,000	G	NS
Clark Hill	Savannah River—Ga.	1,050,000	CS	SS
Wolf Creek	Cumberland River—Ky.	1,380,000	CS	SS
Lookout Point	Willamette River—Ore.	1,490,000	CS	SS
Detroit	N. Santiam River—Ore.	1,530,000	CS	SS
Bull Shoals	White River—Ark. and Mo.	2,100,000	CS	SS
Pine Flat	Kings River—Calif.	2,200,000	G	NS
Fontana	Little Tenn. River—N. C.	2,800,000	CS	SS
Hungry Horse	Flathead River—Mont.	2,900,000	G	NS
Shasta	Sacramento River—Calif.	6,500,000	G	NS
	TOTAL	30,840,000		

*Natural sand and stone-sand blended.
CS—Crushed Stone. G—Gravel.
SS—Stone Sand. NS—Natural Sand.

MODERN STONE-SAND PLANT, showing the relatively standard features of surge storage ile, raw feed conveyor, screening structure, rod mill, wet classifier, classifier waste launder, nd finished sand conveyor.

equirement and consequently a re-uction in unit cement content for a iven water-cement ratio will result or a given consistency; and (2) an ncrease in unit quantity of coarse ggregate is necessary to maintain he yield.

While the method described above s not the usual approach to propor-ioning of a mixture it can be so used vhen a non-air-entrained mixture as already been successfully propor-ioned with a given set of materials nd it is desired to change to air-ntrained concrete.

The method of proportioning lean oncrete mixes which is most com-nonly used is the "trial mix" method. Analytical methods have been de-eloped which offer means of arriving t starting proportions and aggregate grading but a great amount of experi-nce with many kinds of materials is lso available and provides a simpler basis for arriving at the proportions or the first trial mix. The process hen boils down to making adjust-nents in succeeding trials until pro-portions which give greatest economy nd desired properties are arrived at.

This work is usually done in the aboratory, and provides a starting basis for field production of concrete. t is invariably necessary, however, o make field adjustments based on bservations and experience with the ggregates as produced on the job in order to arrive at the final propor-ions which give the best results nder the existing field conditions.

Trends in plant design

Manufacture of stone-sand for use n concrete for dams as a specific peration aimed at a product meet-ng predetermined grading require-nents has largely come about during he last 20 to 25 years. Prior to that ime it was sometimes customary to se "screenings" from a coarse ag-gregate plant for sand or mix the "screenings" with natural sand, but plants specifically designed for the manufacture of stone-sand were the exception rather than the rule.

In the period since the manufacture of stone-sand was first started, many different plant designs and operating procedures have been used. Plants have been of wet, dry, or a combination of dry grinding and wet classification. The grinding equipment used has included rolls, cone crushers, hammer mills, impactors, rod mills and other types. With the wet process, hydraulic classifiers of various types have been used. With the dry process air separators have been used for classifying. In some instances careful comparisons of grinding equipment have been made either under field conditions or under pilot plant conditions for the purpose of determining what was the most satisfactory piece of equipment for a particular application.

All too often, however, grinding and other components of a stone-sand plant have been selected on the basis of what was most readily available or was of lowest first cost. In one particular instance ten major plant changes and numerous operating changes were made in a plant during the first six months of operation in an attempt to produce sand meeting specification requirements. The material being processed was not unusual in nature and it is believed that preliminary grinding tests prior to design of the plant would have provided a sound basis for selection of proper equipment and avoided all of the expensive changes which were made. As experience has been gained and requirements more firmly established and better understood, more attention has been given to selection of equipment and to plant design.

Equipment makes a difference

Prior to the advent of air-entrainment good workability in lean mass concrete was difficult to achieve. Then, particular attention was given to improving the two characteristics of grading and particle shape for the sand that offered the best possibilities

Equipment and methods used in manufacture of stone-sand on recent projects

DAM	ROCK TYPE	METHOD OF CLASSIFYING	GRINDING EQUIPMENT
Philpott	Granite	Dry	2 Short head cone crushers 1 Roll crusher
Allatoona	Dolomitic Limestone	Wet and Dry	2 Roll crushers 2 Hammer mills 1 Impactor
Whitney	Limestone	Dry	4 Pulverizers 1 Hammer mill
Ft. Gibson	Limestone	Dry	1 Short head cone crusher 2 Hammer mills
Buggs Island	Granite	Wet	1 Rod mill (wet) Center periphery discharge
Mt. Morris	Cherty Limestone	Wet	1 Rod mill (wet) Center periphery discharge
Center Hill	Limestone	Dry	1 Hammer mill 1 Impactor 1 Roll crusher
Clark Hill	Granite	Wet	1 Rod mill (wet) Center periphery discharge
Wolf Creek	Dolitic Limestone	Dry	2 Roll crushers 2 Hammer mills 1 Short head cone crusher
Lookout Point	Diabase	Wet	1 Rod mill (wet) Center periphery discharge
Detroit	Diorite	Wet	2 Rod mills (wet) Center periphery discharge
Bull Shoals	Limestone	Dry	3 Hammer mills 2 Impactors
Fontana	Quartzite	Wet	2 Rod mills (wet) Overflow

of achieving the low cement factor concrete of required workability essential to proper control of temperature. Tests proved that for a given material some grinding equipment produced a better graded sand than other equipment. Also some equipment produced particles of superior shape, whereas other equipment produced sand with poorly shaped particles. The matter of economy also has had and will continue to have a bearing on trends in plant design.

Production economics

The two major points for consideration have been amount of waste and cost of metal. The first of these has at times become a problem because the grinding or crushing unit which produced material with the least waste also produced material having the least desirable particle shape and grading. However, where proper consideration has been given to all of the aspects of the problem, the advantages of desirable particle shape and good grading have outweighed the disadvantages of higher waste and resulted in selection of the unit which produced best particle shape and grading.

Considerations of metal-loss have exerted a major influence on trends in plant design. In an effort to get desirable grading and particle shape, grinding equipment of the high speed impact type such as the hammer mill and the impactor has been successfully used when the material being ground was low in silica. With highly siliceous materials such as granite, diorite, quartzite and similar materials metal-loss becomes a major consideration.

Wear in the grinding operation sometimes amounts to from .75 to 1.00 lb. of metal per ton of sand produced. Although hammer mills (and impactors) will produce sand from these materials having very good particle shape and grading there are two major objections to their use. First the cost per pound of the manganese steel used in the hammers, where most of the metal loss occurs is high, and second the downtime for replacing worn hammers cuts production and adds to cost of operation and maintenance. Some hammer mills of recent design are reversible which eliminates the turning of hammers and thus reduces the downtime.

Rod mills most common

Objections to the high-speed impact units for grinding highly abrasive material has no doubt influenced the trend toward use of rod mills for this purpose. The advantage in the use of a rod mill lies in the fact that the loss in metal is largely rods which cost only about ¼ to 1/5 as much per pound as the manganese steel used in hammers. Metal loss from liners made of steel comparable to that in hammers is only a fraction of the total metal loss in rod mill grinding.

While other types of grinding equipment have been used in plants built during the last 10 years, the rod mill has probably been more predominantly used than any other type, particularly in the most recent plants (see table). Both overflow and center-periphery-discharge mills have been used with a very definite trend toward use of the latter in the more recent plants.

Sand classifying

Wet classification of sand has been more predominantly used recently than dry classifications for several reasons. The outstanding reason is the fact that weather conditions and other factors such as water encountered during quarrying operations make it very difficult, and often almost impossible, to keep the raw feed dry.

Use of the rod mill as the grinding unit has also influenced this trend. The capacity of the rod mill operated wet is probably twice that when operated dry. Also the rod mill produces a much smaller quantity of excess fines when operated wet than when operated dry with a resulting decrease in waste. For these two reasons it has been universal, as far as is known, to grind wet with the rod mill when producing sand for use in concrete for dam construction. It therefore follows that wherever a wet rod mill is used as the grinding unit, wet classification will also be used.

Segregation problems

Most of the other types of grinding units such as hammer mills, rolls and cone crushers will handle either dry or damp feed and therefore have not exerted any material influence on choice between wet or dry classification. Where the raw feed is alternately wet and dry it is considered necessary to dry the raw sand before introducing it into the air separator. This is particularly important when dry and uniform results are to be obtained. This increases both plant and operating cost. Where dry classification is used there is also the problem of avoiding objectionable segregation during processing in the finished sand. Preparatory to introducing the dry sand into the air separator it is essential that handling be very carefully done. Segregation which can occur in handling will result in non-uniformity of the raw sand fed to the air separator with resulting non-uniformity in the finished sand.

After classification it is customary to deliver the finished sand to conical storage by belt conveyor. It is necessary then to add a uniform and adequate amount of moisture to the finished sand, preferably as it is discharged on to the final conveyor otherwise fines will be blown away as the materials drop from the end of the belt to the storage pile and the coarse particles will separate from the fine at the apex of the storage pile. This kind of segregation is typical with dry sand and can largely nullify the results of otherwise careful and satisfactory processing unless the moisture is added.

In addition to the other problems where dry processing is used, there is the dust hazard which presents a menace to both health and equipment. To alleviate properly the dangers involved there should be included in the plant dust collecting equipment. This also adds materially to the equipment and operating cost and has influenced the trend toward use of wet processing.

Hydraulic sizer

In one stone-sand plant of recent design, which is now in operation two pieces of equipment relatively new to sand manufacture are being utilized. The first of these is the hydraulic sizer by use of which the minus #16 sand from a wet grinding rod mill is separated into eight fractions. On this project the sand is separated into two size fractions. The coarse sand is #4 to #16 and the fine sand is minus #16. In this case the sizer is utilized only to remove excess fines from the minus #16 although provisions are made in the plant for wasting parts of any of the eight fractions if excesses occur. In a natural-sand processing plant now in operation a similar piece of equipment is used and provisions are made for storing excesses in any size group for later use when deficiencies occur. Utilization of this piece of equipment in future plants seems to offer an un

Typical gradings of stone-sand for lean mass concrete with and without entrained air

SIZES (Square Mesh Sieve)	Used in Concrete Without Entrained Air	Considered Desirable With Entrained Air
Pass #4 — Ret. #8	20%	10%
Pass #8 — Ret. #16	22%	15%
Pass #16 — Ret. #30	17%	25%
Pass #30 — Ret. #50	14%	25%
Pass #50 — Ret. #100	13%	17%
Pass #100	14%	8%
	100%	100%
Fineness Modulus	2.80	2.52

sual opportunity for control of grad-
g and uniformity of grading never
efore possible.

The second piece of equipment is dewaterer which is used to remove ie excess water carried by the minus 16 sand as it is discharged from the ydraulic sizer. The sand and water ixture is actually a slurry with ore than 20% free moisture (water). he dewaterer reduces this to 15% ee moisture which is about a stable oisture content for this sand. This advantageous from two points of ew: (1) Concrete of uniform consistency can be more easily produced hen the free moisture content of ggregates, particularly the fine aggregate, is uniform; and (2) when ice nd refrigerated water are used for recooling the lower the quantity of ee moisture in the aggregate the reater the quantities of cold water nd ice which can be added.

With the recent developments in ooling techniques in which all of ie materials which go into the concrete may be cooled, the latter is of ss importance but maintenance of w uniform free moisture content of ie aggregates as delivered to the ixers is prerequisite to production concrete of uniform consistency. lthough this device has not been sed for reducing the free moisture ontent of sand produced in one size #4 to pan) to a stable moisture conition it seems logical that such could e accomplished. The dewaterer is of rticular interest because the method putting the fine aggregate into free rainage storage for a minimum eriod in an attempt to attain low niform moisture content has not een entirely satisfactory in the past.

onsiderations in plant design nd operation

Many improvements have been ade in the last few years in both degn and operating techniques of one-sand plants. Valuable experince has also been gained and should rve as a basis for making further nprovements. Job conditions such as rrain, location of quarry, and other ant considerations will influence to great degree the arrangement of the ant. Every situation will be differnt and will therefore require a plant esigned for the particular conditions iat prevail. Nevertheless there are me basic considerations which ould be taken into account in the sign and selection of equipment for ery plant.

The crushing and grinding charcteristics of the stone which is to be anufactured into stone-sand should e investigated as a basis for selection equipment. If similar material has een previously used a critical review the plant used and the results obined should be made. Almost invarily the manufacture of stone-sand is ssociated with the manufacture of rushed-stone coarse aggregate. The anner in which the stone crushes will often determine what will compose the raw feed for the manufacture of the stone-sand.

SEGREGATION IS APPARENT in this conical surge storage pile of feed material for a stone-sand plant.

Whenever practical a full scale crushing test is desirable in a plant reasonably equivalent in size. As an alternative, crushing tests in a pilot plant may be conducted in which several types of crushing and grinding equipment can be utilized under varying operating procedures. Results of one or a combination of these methods of investigation of the crushing and grinding characteristics will yield valuable basic information. With such information it is possible to select equipment which will give the best balance between quality of the aggregates produced and economy in production.

Factors which influence the choice between wet and dry processing have been previously outlined. Under most conditions it is believed that wet processing is more practical and less expensive than dry processing. The trend in recent years to the wet rod mill for grinding seems to verify this conclusion.

Plant flexibility

Flexibility should be given due consideration in the design of a plant. This does not mean that a plant must be replete with devices for varying or modifying all of the operations through an infinite range. It is essential however that the basic steps in the processing procedure will be made reasonably flexible so that processing idiosyncrasies of the material, which were not apparent during the preliminary investigation, can be corrected for by varying the operating procedure. With a wet grinding rod mill, for instance, rate of feed, grading of feed, pulp density, size and grading of rod charge and speed of the mill all have an influence on the product of the mill. It is not usually practical to provide variable mill speed although, it is practical to change the mill speed. Provision can be made for controlling and varying the rate of feed and the pulp density in the mill. It is not usually practical to make provisions for varying the grading of the feed. The size and grading of the rod charge can be varied and once a determination of the proper size and grading of the charge has been made it should be maintained as nearly constant as practicable.

Two plants

The sand plant should be independent of the coarse aggregate plant with which it is usually associated. This is accomplished by providing surge storage for the material which is to be used as feed for the sand plant. This has become common practice in the design of sand plants in recent years.

Grading and rate of feed to a rod mill should be as nearly constant as practicable. It is believed that when difficulty has been encountered in producing sand of uniform grading by wet rod mill grinding the problem has resulted from variations in grading of the feed. It has been quite common in recent plants to put the primary fines (minus #4 from coarse aggregate production) and the coarse material (usually #4 to ⅝-in. or ¾-in.) in a common conical stock pile. Because of variations in production of the coarse aggregate this results in a random mixture which may vary quite widely in grading. Segregation also occurs as the materials are placed in storage and this aggravates the situation.

The obvious solution to this problem is separate storage, preferably in bins rather than conical piles from

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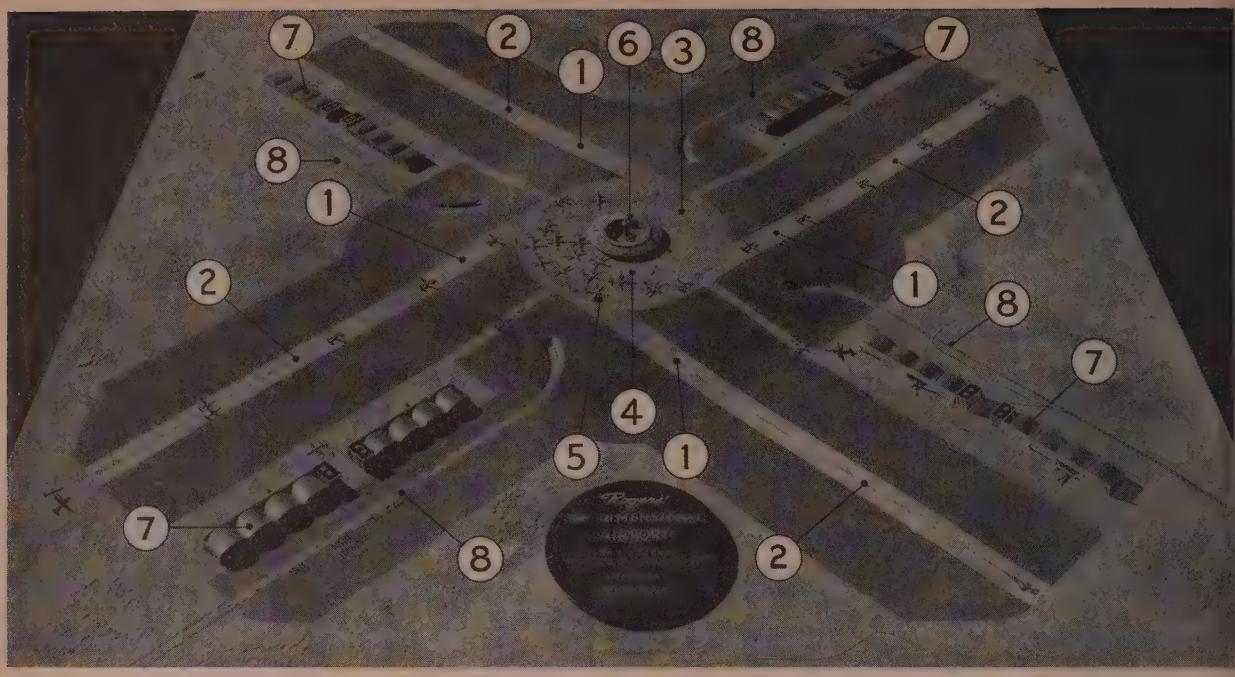


A fresh outlook on terminal traffic handling is—

THE TRI-DIMENSIONAL AIRPORT

By RAYMOND B. ROGERS
Portland, Oregon

LESS THAN FIFTY years ago the Wright brothers put their heads together and developed the first successful flying machine. Their fantastic mechanism has stimulated more mass thinking and has shown a greater acceleration of development than any other form of transportation. Our modern airplane is truly the crowning achievement of this age of mechanical marvels.

However, no form of transportation can advance in speed and efficiency if its terminal facilities do not keep pace. For example, how could the tremendous cargoes of ore, limestone and coal be moved so continuously over the Great Lakes if it were not for the ingenious bulk cargo handling machines to be found at every major lake port?

There has been unmistakable evidence during the past ten years that the nation's airport facilities are not keeping pace with the technological development of the aircraft they are supposed to serve. What are these conditions found on every major airport which cause delays and irritations, and which develop hazards that offset many of the advantages of the modern aircraft's speed and efficiency? It is only necessary to mention a few of these air-age "handicaps."

Air-age "handicaps"

First, there is too much real estate involved because of the present poor area design. Then, there is the usual maze of hazardous intersecting runways and taxiways. All this causes a tremendous loss of time during takeoffs and landings. Loading and unloading are primitive and time consuming, being based on similar operations with much slower surface vehicles. The loading apron is usually cluttered with every type of "perambulator" imaginable from huge gas-tank trucks to mobile stairs. This open-air activity is not bad in fair weather but during sleet, hail and rain storms it becomes a mess! Passengers are frequently drenched and wind-blown as they walk between plane and station.

Maintenance hangars are, in many cases, built too close to the terminal

About the author . . .

RAYMOND B. ROGERS is a commercial artist in the Pacific Northwest. He describes himself as having been "an interested spectator in the development of aviation since the time of the Wrights," though his own flying has been confined to "the cushioned seats of regular airline planes."

The result of Rogers' thoughts on air terminal facilities has been the "tri-dimensional" airport described here. Rogers has departed completely from current airport design, feeling that evolution along the present pattern is infeasible. He has considered many phases of the handling of air and ground traffic, and in numerical procession he has touched upon each of them here. Furthermore, he has used his professional talent to illustrate them in a manner that, by comparison with our more accustomed blueprint, is evocative indeed!—*Editor.*

(Further editorial comment on page 55.)

tation and loading areas, causing confusion and delays during rush periods. And lastly, there is the airport limousine. This notorious vehicle of the "age of flight" probably causes more than one air traveler to wail, "Next time I'll try the train!"

The foregoing introduction has sketched some of the growing pains of the present-day airport. The plain fact of the case is, the present "two-dimensional" type air terminal cannot be expanded or even designed larger without multiplying the above mentioned difficulties.

Air line operators, aircraft manufacturers and city officials have all been groping for an answer to the unique problems of our air terminals, which have all too suddenly evolved from lowly cow pastures. Therefore, it is the purpose of this article to introduce an entirely new idea to cope with these problems. This idea has been developed into a design called the "tri-dimensional airport" because its central portion is considerably higher than its outlying area. This effect is plainly shown in the accompanying photo of the scale model. The numbered pointers on the model refer to major features of the design which are described in the following text and illustrated with schematic drawings.

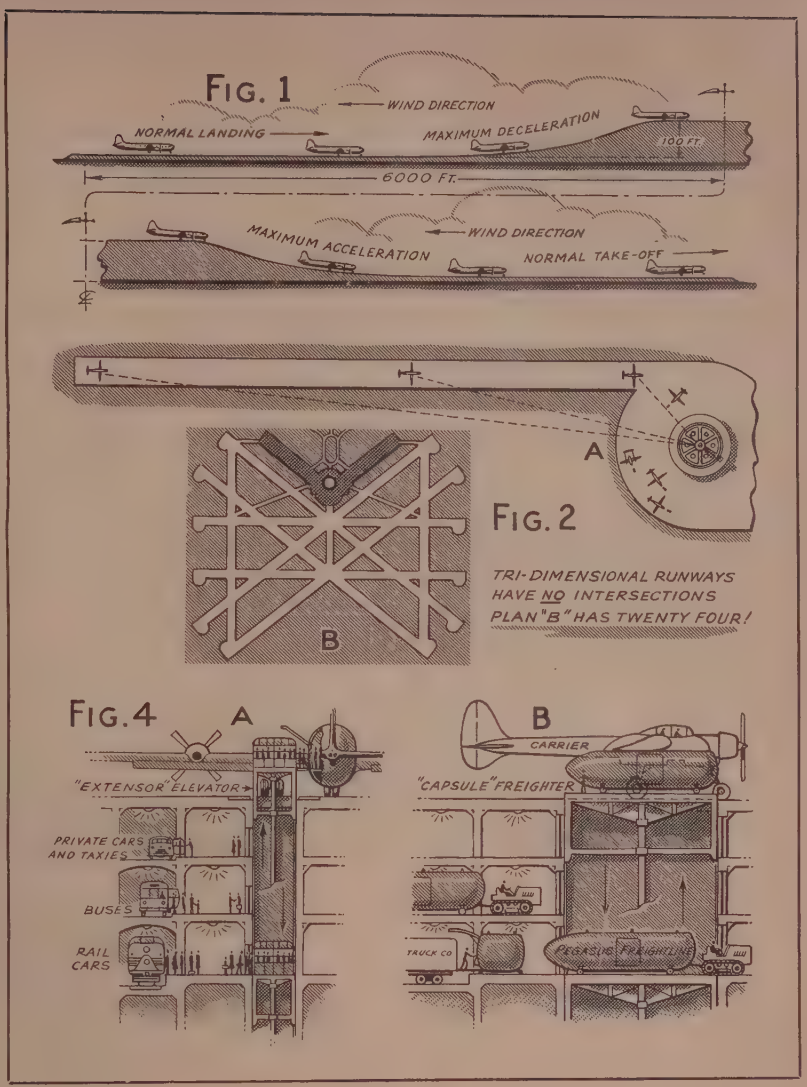
Runways are mechanical

The Number One feature is the unique runway design. These runways are to be operated in pairs and their inclined sections determine the general form of the airport as a whole. Properly engineered, the runway inclines are mechanical in function. As shown in Fig. 1, gravity is used as a positive force to act on a plane in motion to such an extent that excessively long landing and take-off runs are eliminated. This force is used in many other forms of transportation, why not use it as suggested here?

The second major feature of this airport is found in the runway pattern. Each strip is a free and independent unit of ample width and length (Fig. 2). There are no hazardous intersections or connecting taxiways. Planes always finish their landing runs on the loading apron and from here they always take off. And, because the terminus of each runway is offset from that of its twin by the width of the apron, it will be perfectly feasible and safe for one plane to land at the same time another is taking off. Such independent runway operation on our present flat fields would not only we dangerous but pracically impossible.

Terminal is functional

Feature Number Three is the terminal proper. This unusual structure is, in fact, a huge multi-storied building with the loading apron for its roof. It has been conceived as being built from the mean ground level to its predetermined height with an extensive earth fill smoothly graded up to the roof or apron surface. The internal plans would be based on scientific studies by traffic engineers to obtain the smoothest flow of passengers, mail, and freight. To this end there would probably be more mechanical gadgets used than in any major terminal today.



This introduces Feature Number Four: the use of dozens of hydraulic elevators, especially designed to go beyond the exterior surface to load and unload level with the aircraft floor. This feature is sketched in cross-section in Fig. 4. It is obvious that this method of transferring passengers, mail and baggage would be 100% weatherproof. Fig. 4 also illustrates the use of larger elevators for super-speed freight "capsule" loading.

Feature Number Five has to do with the service of the planes on the loading apron. The star performer here is a tractor-tanker, which always meets a plane just as it finishes its landing run. Connections are made and the aircraft is towed to a precise position beside a pair of elevator hatches. Here the transport is halted, signals given, the elevators rise to the floor of the plane and it is quickly unloaded. After the last load has been lowered into the terminal and the hatches closed, the plane is moved to the next pair of elevators and just as quickly loaded. All this while the towing-tanker has been pumping fuel, oil and water into the ship's tanks. This service should be completed in a half-hour or less, fair or foul weather. Then the empty tractor is disconnected and the plane moves a very short distance to the take-off position. Seconds later, due to the tri-dimensional runway, it is speeding to its next destination.

Number Six points out the "hub" structures at the center of the airport. Obviously, the control tower is situated here. Due to the tri-dimensional design, this control station is two or three times higher than any airport tower in use today. Furthermore, it

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Rock work was one jump ahead as contractor poured —

Concrete face on Bear River Dam

Progress on select rock placement controlled all other work on P. G. & E. project — Utah Construction Co. used Pumpcrete to keep face concreting separate from derrick-stone operations shown

FINAL STEP in rock-fill dam construction is the pouring of a reinforced concrete facing slab over the upstream blanket of select placed rock. This operation has recently been completed by Utah Construction Co., contractor for Pacific Gas & Electric Co. on the lower Bear River project in central California. The project consists of two dams, located on the Bear River, a branch of the Mokelumne. An outline of the project, including design details, appeared in *Western Construction* for March 1951, pp. 63-66; quarrying methods and rock placing were later reviewed in the issue of February 1952, pp. 61-64. The following description is confined to the design of the concrete facing slab and to the method used to cover almost 300,000 sq. ft. of crane-placed dry-rubble masonry.

Placed-rock considerations

The principal resisting element of a rock-fill dam is the weight of the dumped rock, which is deposited in horizontal lifts and thoroughly sluiced to secure maximum contact of the large rocks. Specifications on this job provided that nearly all the fill be of 1- to 10-ton size or larger.

On the upstream face of the dumped fill, a layer of select rock was placed as an intermediate between the loose fill and the concrete face. The purpose of the placed rock is threefold: (1) it distributes load from the concrete slab to the fill, (2) it acts as a retaining wall for the dumped fill when the upstream slope is to be steeper than the natural angle of repose of the fill, and (3) it supports the concrete membrane against unequal settlement of the fill, which would otherwise rupture the membrane. Natural angle of repose for loose fill such as was placed on the Bear River job is between 1.32:1 and 1.38:1. The upstream faces of the two structures were designed for slopes of 1.3:1 (No. 1, the main dam) and 1:1 (No. 2). Obviously, then, especially in the case of the secondary dam, the placed rock was to act as a retaining wall.

In fulfilling its functions, and for the sake of economy, the placed-rock section was designed to have a varying cross section. At the crest of the main dam, for instance, it is 10 ft thick, normal to the face of the dam (16.3 ft. horizontally). At any point below the crest, its thickness was designed to be 10 ft. plus $0.05h$, where h was the increment of dam height measured downward from the crest. Maximum thickness at the dam toe, as a result, is 29.7 ft. normal to the slope, and 48 ft. horizontally. This feature of the design was developed from a similar method used on the

record-height Salt Springs Dam built by P. G. & E. in 1931.

Material for the placed-rock section was handled in individual pieces by cranes and trained crews and was placed to conform to the design slope of the upstream face of the dam. Specifications provided that the rock in the upstream face be placed in approximately horizontal planes. This resulted in a stepped appearance for the face of structure, with the "upper front corner" of each rock thereby established about on the theoretical slope line of the dam.

Rock work progress

Problems in placing this rock, incidentally, constituted the key to progress on the entire job. Although the placed-rock accounted for only 8% of the volume of the dam structure, it controlled progress in every other phase of work. Quarrying and dumping the loose fill, or pouring the facing slab, did not represent any particular independent problems. However, the handling of large sections of quarried granite is a skill that is not frequently included in present-day construction work.

Requirements for the operation were such as are encountered in work of the type known as dry-rock paving, which includes tightly knit placing and chinking of the rock. The difference was that this job had to be constructed with derrick stone. As a result, it was necessary for the contractor first to train men for the work and then to maintain a training program that would provide both for replacements and for expansion of the operation along the lengthening crest.

In the final phases of the program last year, during the rush to complete the job on schedule and before the winter season, the contractor had as many as eleven large cranes and rock placing crews strung along the rising crests of both dams.

In the toe of the placed-rock face and extending up along both abutments to the crest a trench was excavated in the solid granite to provide for a concrete cut-off wall. This wall also served as a tie between the facing slab and the foundation rock. At streambed level this trench and cut-off wall reached a maximum section of 3 x 22 ft., but this size gradually reduced to a minimum of 3 x 5 ft. near the crest. This cut-off was poured in advance of both select rock and facing slab and was kept ahead of the rock placement as that work advanced upward.

Concrete facing

The reinforced concrete facing represents the watertight membrane required for a structure of this type. The concrete was formed in about 60 x 60-ft. squares (some miscellaneous sizes and shapes also required), and each was reinforced to act as a structural unit. Individual slabs were separated by a spacing of 1 or 2 in., depending upon the anticipated movement, and a copper waterstop was installed around all sides. This design provided an articulated face that will conform with any gradual settlement in the fill, maintaining an adequate watertight structure.

CLOSE SCHEDULE is apparent in work on secondary dam. Note small-unit face forms still in position on completed pour. Rock work wore out about 50 wire-rope slings daily, kept 8 iron-workers busy splicing new ones.

Thickness of the slab varies from a maximum of 3 ft., 9 in. to a minimum of 1 ft. along the crest. The reduction in thickness is gradual, with reinforcing proportioned to maintain a uniform percentage of steel. The pattern ranges from two layers of 1-in, square bars at 14-in. spacing each way at the toe of the dam, to a minimum of one layer of 1-in. square bars at 13-in. spacing each way for the top slabs at the crest.

One minor but important problem was the securing of materials of proper characteristics to maintain the concrete underneath the waterstops at the specified separation during pouring operations. The object was to fill this space with something that would support the concrete as poured, but would not provide enough strength to resist any movement as the slabs later adjusted. An aerated plastic, Styrofoam Type 1, of extremely light weight and adequate strength, was used for this purpose. In the space above the waterstops, a conventional type of filler covered with a hot mastic was used.

Construction joints

Since the placed-rock face was irregular, provision had to be made at

EXCEPTION TO THE RULE was use of crane and lay-down bucket to place facing concrete. Concrete at bottom is already stable and forms are being moved up for re-use on continuation of same pour.

construction joints to define the thickness of the slabs and support them at those points. To do this, the stair-step pattern of rock was altered at 60-ft. intervals up the face, creating berm-like depressions (keyways) 4 ft. deep and 2½ ft. high. Face forms held concrete poured along these keyways, filling them out to a smooth surface parallel to the plane of the dam face.

Other keyways, extending up the dam from cut-off to crest, and spaced 60 ft. apart, were also provided in construction of the placed-rock layer. These keyways were also filled with concrete, and the whole result was a 60-ft. grid of unreinforced concrete stringers over the face of the dam. In pouring the facing slabs, joints were established along the centerlines of these stringers, giving support to the slab edges and defining their thickness uniformly.

Production of concrete aggregate from crushed quarried granite was not allowed, but crushing of river gravels was permitted for the purpose. Most of the sand and gravel was obtained from a natural deposit along the river about ½ mi. upstream from the main dam. The material was washed and screened and hauled to stockpiles. It was batched and mixed as required and transported by means of transit mixers and Dumpcretes to the placing equipment.

Concrete placement

Concrete arriving at the upstream face of either dam was handled from there either by crane or by Pumpcrete. Since select-rock placement along the crest and concrete pouring across the face were going on at the same time, and rush conditions applied to both, it was necessary to keep the operations entirely separate from and independent of each other. Cranes would have been the obvious way of handling concrete for the facing slab, and they were used at times —mostly for pouring the cut-off wall. But, constant employment of cranes standing atop the dam would have interfered with their more important task on the rock work, and use of special cranes there, just to handle concrete, would have cluttered the scene additionally. Thus, about 80% of the concrete was moved into position by Pumpcrete. Incidentally, this illustrates an evolution in concrete placing procedure during the 20 yr. since similar work was carried out when Salt Springs Dam was built. At that time, concrete was hauled in rail cars by gasoline-driven locomotives and dumped into wooden chutes leading to the forms.

It was feasible to divert cranes from rock placement in order to pour cut-off concrete for a couple of reasons. First, such pouring was intermittent, more so than the facing slab pours. Secondly, the cut-off locations, against the abutment, meant that cranes working on the pours were out of the main area of rock work.

DETAIL AT ABUTMENT shows steel in position, form walers bolted to extensions of anchorage rods drilled into rock.

Forms for the top face of the slabs were a heavy-gauge modification of a standard metal panel with bent-up flanges for clipping together. These forms were quite similar to the type used in wall construction for concrete buildings. The use of a weighted sliding form which could be pulled up the dam face as the pour advanced, and which had been used at Salt Springs, was considered by the contractor but discarded. An extended slope length is needed to make such a form economically feasible. Also, a heavy form would have required a crane atop the dam to assist in lateral positioning; and this would have interfered with rock placement.

Handling form panels

For the Bear River job, form panels were built in small units, 2 ft., 3 in. wide and 7 ft., 8 in. long, which could readily be handled by manpower alone. Larger sizes would have become cumbersome mainly because of the weight of necessary extra stiffening. Steel walers formed of double channels were laid vertically on the face of the dam at 7 ft., 8-in. centers to support the form panels. The walers in turn were supported on anchorage rods drilled into the placed rock. These rods were spaced at 7 ft., 8-in. centers horizontally and 5 ft. vertically, and were used also to position the reinforcing steel for the facing slabs. A threaded rod welded to an anchorage rod permitted adjustment of a she-bolt to place the walers at proper height.

Concreting sequence

In general, the pouring plan carried alternate slabs ahead checkerboard style, so that the copper waterstops were first half-embedded and then completely covered as the slabs advanced. For a given slab, form panels were installed three-high (6 ft., 9 in.) at the outset, clear across the slab, and pouring begun. From a strategically placed receiving hopper, the concrete was conveyed by chute down into the forms. As the chute was swung through an arc along the face of the dam, concrete was distributed across the 60-ft. width.

Installation of succeeding lifts of form panels (two-high for each lift) followed close behind the movement of the chute. When the chute had finished at one end, panels were ready to receive concrete back at the beginning once again.

Progress and payment

Concrete was placed at a rate of about 40 cu. yd. per hr.; and when 3 hr. had elapsed, the pour was generally about half-way up the slab, or about 30 ft. Beyond this point, it was not necessary to install new panels; those at the bottom of the pour were unclipped and walked up for re-installation. Hunt's curing compound was sprayed on the concrete shortly after stripping.

Naturally, a certain amount of concrete dropped into the space between the rocks, not to mention the considerable volume required to fill the roughly triangular spaces where the placed rock stepped up the slope. Payment was at a flat unit price per cubic yard for the concrete quantity required for the theoretical volume of a given slab, plus an additional 8 in. of depth over the slab area. Overrun beyond this quantity was paid for at a unit price established by the specifications, a figure low enough to discourage such overrun.

Personnel

J. E. Cooney was project superintendent for P. G. & E. G. B. Thacher was project engineer and C. E. Joslin, resident engineer.

The contract was carried out by Utah Construction Co., with R. K. Ames as project manager. Ted Ames was general superintendent for the work, and B. O. Sandberg was project engineer for the contractor.

Arizona steam plant being expanded

A FEW MILES south of Tempe, Ariz., the $13,000,000 addition to Kyrene Steam Plant of the Salt River Power District is under way with Bechtel Corp. men hard at work on foundation excavation. More than 900 of the 4,000 cu. yd. of concrete necessary to complete the job were poured by the first of the year. The new unit is designed to outwardly resemble its companion piece but will house considerably larger major equipment, such as the turbo-generator, boiler and condenser. Its capacity of 66,000 kw. will more than double the generating capacity of the present 30,000 kw. plant. Bechtel Corp. now employs about 70 men on the job but peak construction will necessitate 250 workers. The plant is expected to be completed by June 1954.

Oil well platforms go in faster with assist from versatile crane

THE INSTALLATION of drill and pump platforms in oil fields, where wet ground is low in support value, was a time-consuming labor job until E. F. Core, a Bakersfield, Calif., contractor, introduced a mechanized Hydrocrane to speed this phase of oil drilling. In the Navy's Elk Hills reservation, Core has cut the installation time for a drill platform to one day. Wells up to 4,500 ft. deep are being completed from start to finish in two weeks.

Core had to overcome an oilman's natural resistance to small rigs to get his method introduced, but it is now so successful that he has more work than he can do. He is planning to add another machine to his line to help with oilfield work, gravel unloading, basement excavations, pipeline work and tank cleaning jobs he does around Bakersfield, California.

How Core goes about the various parts of a typical oil drill platform job is shown in this picture sequence, and is described in detail on the picture captions.

START of a summer day's work in the Elk Hills country finds the temperature already over 100 and E. F. Core (above) squinting through dark glasses as excavation for a drill platform begins. Before many passes are done, the area of the concrete pad takes shape, and screed forms are laid around the sides. Machine is a Bucyrus-Erie H-3 Hydrocrane, shown (right) excavating trench in which to lay pipe that will carry drilling tailings into dammed gulley in background.

STILL RIGGED to the Hydrocrane boom by its tagline, clamshell stands to one side while cellar form is swung into position over guide pipe. Platform area has been fine-graded, cellar trimmed, and lug bolts set in position ahead of form. (below)

IN PLACE, cellar form is quickly centered on guide pipe, the only installation made before Core and his crew moved on the job. A few bolts have to be fastened, and this part of the job is done. (right)

CONCRETE finishes the job after reinforcing steel is placed and tailings pipe laid in its trench and backfilled. Pipe being embedded in the concrete will anchor J-bolts placed to hold down oil pump that will eventually be installed. (right)

Basic facts and emerging concepts on the—

Yield from ground-water reservoirs

There is no simple solution to estimating the safe production from an underground basin — Volume of recharge and production control remain essential factors, but changing conditions in the area and the underground movement of the water in the reservoir are receiving more study

By DONALD M. BAKER
Consulting Engineer
Partner, Ruscardon Engineers
Los Angeles, California

INCREASED DEVELOPMENT of ground-water, coupled with recent dry years, has brought to the forefront in many arid sections of the country the matter of the safe yield of ground-water reservoirs, and the magnitude of the probable overdraft.

When water supplies are derived from surface streams, the discharge usually has been or can be measured. The relative paramountcy of the various rights involved is seldom a particularly complicated matter, and administration of such rights, if undertaken, is not a too difficult procedure. There is just so much water in a surface stream at any given time, at a given location. When rights to such water have been adjudicated, each owner of a water right knows that when the flow at his diversion point exceeds a certain quantity, he will have water available. When the flow falls below such quantity there is no water for owners of inferior rights, and a dry streambed is visible evidence of the lack of supply.

Ground-water is not visible. Even when production from a ground-water reservoir exceeds safe yield, there is still usually a large amount of water stored in the reservoir. The determination of safe yield is an extremely expensive and involved procedure and is seldom undertaken until a serious condition of overdraft has occurred. It has, however, been accomplished in the case of some ground-water reservoirs, and will ultimately be accomplished in many others. However, we are still on the threshold of securing a vast amount of information and of acquiring new concepts concerning subjects dealing with ground-water, in spite of the large amount of knowledge already available. Many of our original concepts concerning the safe yield and the behavior of water in ground-water reservoirs are being modified with experience and with increased knowledge.

Basic concepts

In the early stages of development, most laymen and many engineers were of the opinion, or at least acted upon the assumption that ground-water supplies were inexhaustible. While this opinion still prevails in many places, it is generally being replaced by a widespread recognition of the fact that, over a prolonged period of time, it is not possible to produce more water from an underground source than is supplied to such source. This fact leads to the following basic equation in ground-water hydrology:

Total Recharge = Total Discharge

Since the total discharge may consist of natural discharge plus artificial discharge the production equation then becomes:

Total Recharge = Natural Discharge + Artificial Discharge

which indicates that, with a given recharge extending over a prolonged period, production must be at the expense of, and therefore reduce total natural discharge.

If the natural discharge could be completely eliminated as a result of production, the latter could be increased in quantity to a point where it would equal recharge and, under such conditions, safe yield would be equal to recharge. This situation, however, is seldom possible, or at least feasible.

If it is found by investigation that over a prolonged period of time, total discharge (natural + artificial) is in excess of recharge, such excess must have been derived from stored water, which has accumulated within the ground-water reservoir in past years. Thus:

Overdraft = Natural Discharge + Artificial Discharge — Recharge

This reduction of the quantity of water in storage will equal the total overdraft over the prolonged period or the quantity of production which has been in excess of safe yield. Overdraft is usually expressed as an average quantity per year over the prolonged period of time. In other words, the total overdraft over a given period of time would be divided by the number of years in the period, but usually, as discussed hereafter, it is an increasing quantity varying, although not always directly, with increasing production.

The safe yield of a ground-water reservoir is usually defined as:

> that average quantity of water—per unit of time—which can be produced **continuously** from a ground-water reservoir over a prolonged period of time, by pumping or other artificial means of production, without completely depleting the supply of water in such reservoir.

Practical considerations, however, require the addition of the following qualifications to this definition:

(a) without lowering the pressure or free water level in the reservoir to elevations which will cause production to become uneconomical, and

(b) without incurring the threat of intrusion into such reservoir of water of a deleterious character.

Two types of reservoir

Ground-water reservoirs, particu-

USE OF underground water resources in the West will expand and intensify in line with the mounting demands of irrigation, industry and a booming population. In spite of a continuing conservation of surface supplies, the vast stores of water in natural sub-surface reservoirs will need to be studied and developed for perpetual service. In the past there was a tendency to consider them inexhaustible, but from the declining artesian area of New Mexico to the lowering water table in the San Joaquin Valley, the stern lesson of overdraft has been learned. Attention has been re-focused on balancing draft with replenishment, and related phases of the problem that have been little understood.

For taking stock of this important Western resource, it is proper to present basic information on evaluating the permanency of underground supplies, and authoritative discussion of some of the more recent concepts on analyzing safe yields.—Editor.

larly as found in unconsolidated alluvial formations, are of two general types:

(a) **Free water reservoirs,** in which changes in the elevation of the water surface, as evidenced by changes in the water levels of wells tapping such reservoirs, represent changes in the volume of water stored in the reservoir, and

(b) **Confined reservoirs,** in which changes in water level in wells tapping the reservoir represent changes in water pressure in the water containing formations caused by: (1) changes in amount of storage in recharge or discharge areas with which the confined reservoir must be in hydraulic continuity, and/or (2) changes caused by fluctuating rates of production from the confined portion.

The water containing formations in a confined reservoir are overlain by impermeable formations, and are completely saturated with water. The quantity of stored water is constant, except for small changes due to pressure fluctuations that are usually negligible. Such reservoirs, however, must have hydraulic continuity with a free water reservoir (recharge portion) that can receive recharge and transmit the latter to the confined reservoir, which is usually but a portion of an entire ground-water reservoir. They likewise must have the same continuity with a free water reservoir (discharge portion) to provide for discharge from the confined portion.

Taking the entire area overlying a ground-water reservoir, recharge will be derived from the following primary sources:

a. Precipitation falling upon the surface of the recharge portions,
b. Streamflow passing into and over the recharge portions,
c. Subterranean recharge from adjacent ground-water reservoirs, and
d. Water imported to any portion of the reservoir,

while discharge occurs in the following ways:

a. Evaporation from moist soils and transpiration from plants on the surface overlying the reservoir (evapotranspiration),
b. Streamflow passing out of the discharge portion,
c. Subterranean discharge to adjacent ground-water reservoirs, and
d. Water exported from any portion of the reservoir.

Problem of overdraft

Seldom is any effort made to determine the safe yield of a ground-water reservoir until a condition of overdraft has occurred or appears about to occur. The usual signal is a prolonged lowering of water in wells tapping the reservoir. This, however, is not always a definite indication of an existing or approaching condition of overdraft. It may merely be an indication that the regimen of ground-water in a reservoir is adjusting itself to changed conditions due to changing production.

Photos by Los Angeles County Flood Control District

HANSEN DAM in the background was built by the Corps of Engineers and controls flow in Tujunga Wash for discharge on spreading grounds. Changing conditions on the recharge area which affect run-off and percolation are important aspects of yield from the underground storage.

If it were possible to evaluate with reasonable accuracy all of the items from which recharge is derived and also those which constitute discharge, and express these items as average quantities over a prolonged period, the difference between the recharge and discharge items should equal the overdraft for such period. Some of these items, however, particularly underground recharge and discharge, are frequently difficult or even impossible of evaluation, and others may have to be estimated.

Estimating overdraft

If the decrease in storage over a prolonged period can be determined, this will likewise provide a reasonable basis for an estimate of overdraft.

The difficulty usually encountered in making such an estimate is a lack of an adequate quantity of basic data of good quality, extending over the prolonged period selected. This is usually resolved by taking a shorter period, during which an average streamflow and average precipitation approximate the averages of such quantities over the longer period—data as to these items usually being available. The overdraft is then estimated (if possible) for the shorter period, using the difference between the estimated recharge and discharge, and also from the decrease in storage.

If a reasonable amount of basic data of good quality is available, and sound judgment is exercised, estimates made by each method should be in substantial agreement. Frequently, however, it will only be found possible to estimate the overdraft from the change in volume of water in storage and this is complicated by the fact that the changed regimen itself may cause a lowering even when there is no overdraft.

If the sum of the recharge items exceeds the sum of the discharge items, or an increase in storage rather than a decrease, has occurred, it can either be assumed: (1) that the period selected was not a proper one for determining average quantities, or (2) that a lag exists between periods of high recharge and high discharge, and of low recharge and low discharge. This lag will vary with such items as the relation of recharge to total underground storage capacity, transmissibility of material in the reservoir fill, distance and difference of elevation between principal areas of recharge and discharge, etc. Sometimes estimates of overdraft may have to be modified because of this phenomenon of lag.

The solution for a condition of overdraft naturally requires that the safe yield of the reservoir be not exceeded. This calls for increasing the recharge or reducing the natural and/or artificial discharge, or both, until a condition of equality is reached. Customary methods of increasing recharge are spreading water on porous areas in the recharge area, injecting water into wells, or increasing percolation of streamflow through ploughing or other treatment of stream channels.

Reducing the discharge

Reduction of natural discharge may be accomplished by a modification of the pumping pattern, involving increased production near discharge areas, with reduction of production at points distant from locations of discharge, and by reduction of evapotranspiration losses in moist areas. Reduction of artificial discharge may be accomplished through mandatory limitation of production, and/or by encouraging the substitution of surface use of supplemental water to replace existing use of ground-water.

SPREADING GROUNDS are the accepted means of placing more surface water in underground reservoirs. This view shows a spreading area in the Arroyo Seco, operated by the Los Angeles County Flood Control District.

Mandatory limitation of production as a solution of overdraft in an area whose economy has been created, at least in part, through utilization of ground-water will usually result in such large economic losses that the development of a supplemental water supply, even though it be very expensive, will usually be found to be feasible.

A common misconception

A misconception frequently encountered in solving a problem of overdraft is the assumption that the quantity of overdraft to be elminated is the **average** overdraft for a specified period of time. In practice, however, it is usually found that production from a ground-water reservoir has been increasing year by year over the selected period, and that the average overdraft will be considerably less than the figure for the latest year.

As a simple example, assume that over a selected 15-yr. period, the total overdraft was found to be 150,000 ac. ft., or an average overdraft of 10,000 ac. ft. per year. If production was found to be 20,000 ac. ft. per year during the first year of the period, and to be 30,000 ac. ft. per year during the fifteenth year, and average replenishment for the period to have been 15,000 ac. ft. per year, the annual overdraft would have been 5,000 ac. ft. for the first year of the period, and would have increased to 15,000 ac. ft. per year during the last year, when the investigation was made. Consequently, in solving the problem of overdraft, the quantity of 15,000 ac. ft. should be used, rather than the average quantity of 10,000 ac. ft.

Safe yield is not constant

Once the safe yield of a ground-water reservoir has been estimated and production is maintained at a quantity equal to such estimated safe yield, the latter quantity will not always be found to hold constant in the future. It will vary with changing conditions, most of which are beyond the control of the producers from the reservoir or of any agency administering production. Among these changed conditions which will be found to influence the safe yield will be:

a. Changes in the location of production to points closer to the location of natural discharge. These will frequently reduce the latter through reduction of discharge gradient, with a consequent increase in the safe yield.

b. Increases in water surface or pressure level elevations, resulting from reduced production or from increased replenishment. These may reduce underground storage capacity, with consequent reduction of total quantity of streamflow percolation and, because of reduction of the gradient of underground recharge, may also reduce same. On the other hand, outflow gradient may be increased, with resulting increase in natural discharge.

c. Changes in surface cover upon recharge areas from natural vegetation (usually deep rooted) to shallow rooted unirrigated crops. This will increase deep percolation of rainfall and consequent recharge. Changes from shallow rooted to deep rooted irrigated crops in such areas will usually decrease deep percolation of irrigation water applied, with a resulting decrease in replenishment.

d. Changes from rural to urban development on recharge areas which may increase surface runoff, during heavy storms, causing such runoff to pass out of the recharge area, and reduce replenishment. If such urban areas become sewered, export of domestic and industrial sewage to points beyond the recharge area will reduce replenishment.

e. Changes from irrigation to domestic use, which will usually, from an economic standpoint, allow greater pumping lifts with a consequent further lowering of water surface or pressure level elevations. This will result in increase in storage capacity and in inflow gradients of underground recharge, both resulting in increased replenishment. These changes might likewise reduce outflow gradients with a consequent reduction of natural discharge, and an increase in the safe yield.

The above indicate the impermanency of any estimate of safe yield, made at a given date, and also the necessity of revising such estimate from time to time after it has once been made. This in turn calls for the continued collection of necessary data after the initial investigation of safe yield has been made.

The prevailing opinion concerning the solution of a problem of overdraft is that when production is decreased or replenishment is increased in an amount equal to the estimated overdraft, even when the quantity of current overdraft is used, the latter will be reduced to zero. This is frequently not correct, particularly if the estimated overdraft is substantial in amount.

Adoption of either of these remedial measures will usually result in an increased elevation of water surface or pressure levels, which in turn may result in decreased gradients of underground inflow, causing reduction in replenishment, and likewise in increased outflow gradients, thereby increasing both underground and surface outflow. This, in turn, may require an increase in the original estimate of the quantity of overdraft. As a result of this combination of circumstances, it may be found necessary to modify the quantity of water originally estimated as necessary to eliminate the condition of overdraft. Information on this condition will usually develop during subsequent investigations carried on to put in effect the remedial measures.

Movement in the reservoir

Another concept widely held is that a condition of overdraft in a ground-water reservoir can be eliminated solely through increased replenishment or decreased production. This concept rests upon the assumption that the reservoir fill is a homogeneous mass, and that the transmissibility of the permeable formations in the fill is sufficient to allow such replenishment to move to the various parts of the reservoir. These are the locations where production is being made in quantities and at rates sufficient to supply such production without the necessity of increasing water surface or pressure level gradients unduly, with consequent increases in pumping lifts.

There are many ground-water reservoirs where no overdraft is found to occur in the reservoir considered as a whole, yet in certain sections production will exceed replenishment, due to the lack of transmissibility of aquifers. It then becomes necessary to steepen water surface or pressure gradients towards such areas by substantially increasing pumping lifts to produce the required flows of water in quantities and at rates equal to production. When this becomes nec-

Concluded on page 117

CABLEWAY CONCRETE CAME EARLIER THAN 1905

1898 . . .

Editor, *Western Construction:*

I also note with interest the photograph and statement in your October 1952 issue, as did Mr. D. E. Root of Guy F. Atkinson Co., relative to the first cableway used for placing concrete.

I have on the wall of my office several photographs taken in 1898 showing two stationary head towers with main gut, fall-rope carriers and steel open-end skip . . . [The skip] held about two yards of very dry concrete which was tamped by hand with flat iron pads on the end of wooden handles, after the skip was up-ended. Horizontal boiler fed the reversible hoist.

My father is actively present in frock coat and derby which apparently denoted the boss from the men.

The cableway was used on the West Breakwater in Cleveland harbor . . . I still do not believe this was the first ever used. Who knows of another?

S. E. HUNKIN, President
The Hunkin-Conkey Construction Co.
Cleveland, Ohio.

1885 . . .

Editor, *Western Construction:*

We refer to your article on page 163 of your October 1952 issue wherein it is tentatively established that the first job to use a cableway for the overhead placement of concrete was carried out in 1905. We refer also to Mr. D. E. Root's letter published in your November 1952 issue, page 90, wherein Mr. Root calls attention to the construction of League Island Drydock No. 2 about 1905.

Our records are rather complete, and we can give you the following information in this connection:

Our first recorded sale for a cableway as a complete plant was in 1885 and covered an 8-ton capacity cableway shipped to Brandywine Quarry Co. at Wilmington, Delaware . . .

The first traveling cableways were made and sold in 1894 to Charles H. Locher for use in the construction of the Chicago Drainage Canal. These plants had a capacity of 8 tons, with a span of 700 ft. . . .

The plant which Mr. Root referred to was No. 491, sold and shipped in 1905 to the Scofield Company, Philadelphia. This was a traveling type, having a capacity of 5 tons, with a 540-ft. span. The main cable was 2¼-in. diam. cast steel, and the operating ropes ¾-in. This outfit was powered by Engine No. 22630, double cylinder 10 x 12, with double drums and auxiliary conveying spool drum.

It is interesting to note that the cost of this cableway plant, consisting of the hoisting engine complete with all ropes, sockets, sheaves, and other fittings for the wood towers, and the carriage, was $5,100 f.o.b. cars, Brooklyn, N. Y. . . .

Our records also disclose that the following cableways were sold and shipped for dam construction . . . in the West, prior to 1900:

Traveling cableway, 10-ton capacity, 950-ft. span, for the construction of Lower Otay Reservoir, owner Southern California Mountain Water Co., 1898 . . .

Basin Creek Dam, Butte, Montana Water Works, fixed towers, span 890 ft., 6-ton, 1893 . . .

Insofar as placing concrete "by aerial placement," we also find that in 1897 Hunkin Brothers, Cleveland, Ohio, purchased Plant No. 177, a fixed cableway having a span of 500 ft., with a capacity of 2 tons, for the rebuilding of the Cleveland breakwater. The concrete was carried out to the piers anchoring this breakwater by means of a three-chain suspended skip . . .

We are pleased to loan you some very old photographs which may be of some interest . . .

W. G. SCHALSCHA
Lidgerwood Industries, Inc.
New York, N. Y.

COLLECTOR'S ITEMS A LA MODE DE LIDGERWOOD

Short season calls for fast action in building—

MONTANA MOUNTAIN ROAD

Operation techniques of rock plant superintendent avoid downtime — Less maintenance and a boost in production result, assure completion of crushed-rock surfacing before snow flies on high-elevation job

WORKING at 6,000-ft. elevation, portable plant put out 150 tons per hr. Long drive belt kept diesel power away from dust, reduced maintenance problem.

IN THE NORTHWESTERN part of the United States, some of the nation's last primitive areas are being conquered by road builders. Wilderness country still as wild as it was in the days of Lewis and Clark is being penetrated by new roads, which will serve the public in many ways: recreation, logging, and industry.

Diamond Match Co. and the U. S. Forest Service recently cooperated in the construction of such a wilderness road up the Trout Creek Canyon for a distance of 20 mi. south of Superior, Mont. Eventually the sale of timber to Diamond Match Co. will pay for the cost of the highway contract. Union Construction Co. of Missoula, Mont., had the contract for surfacing the new road with crushed rock, and the job is of more than usual interest because working time was short in that area. Crushed material had to be turned out and placed at high speed before winter snow set in.

Diamond Match Co. has under construction near Superior a new match manufacturing plant, whose timber will be hauled by logging trucks on the new highway. In addition, the road will be open to the public for anyone who wants some fine fishing or just a look at some magnificent wilderness country. The road rises 4,000 ft. from the match plant to the summit at the Montana-Idaho line. Eventually, another 20-mi. link is expected to be built down the summit from the state line into Idaho.

The highway was previously graded and blasted along the canyon walls by General Construction Co. Union Construction Co. surfaced the road with from 4 to 10 in. of crushed rock to make a good riding surface. The graded roadbed is 20 ft. wide; the crushed rock blanket is 16 ft. wide. Forest Service specifications governed the production and installation of the crushed material.

All told, Union had to produce 15,000 tons of ¾-in. minus, 30,000 tons of 1½-in. minus, and 32,000 tons of 1-in. minus material. How this was done, at elevations up to 6,000 feet above sea level, is a tribute to the portability and working capacity of their equipment.

Two crushing spreads

Union Construction Co. has built many of the important highways in Montana and Idaho and has been on many a job where bears around camp made cooks hard to get and hard to keep. Its prime concern about the Trout Creek road was the hardness and availability of the rock which had to be crushed, along with conditions of haul.

Early studies showed the rock to be a bluish limestone which appeared to be exceedingly hard. Drillers on the previous contract had used tungsten carbide bits to get the powder holes down. Union's officials feared the worst, so they brought equipment which had been tried and tested on previous jobs.

First, they moved in a Pioneer 46-VE Duplex rock plant. This plant worked at two locations; one about 10 mi. in from the start of the job, and another pit at the Idaho-Montana summit at 6,000-ft. elevation. In addition, a subcontract was arranged with Glenn Geery of Missoula to help speed the rock production job through. Geery also used a Pioneer plant with a considerably longer history. Geery's plant was set up about 8 mi. below the summit in a stream bed where gold was panned many years ago.

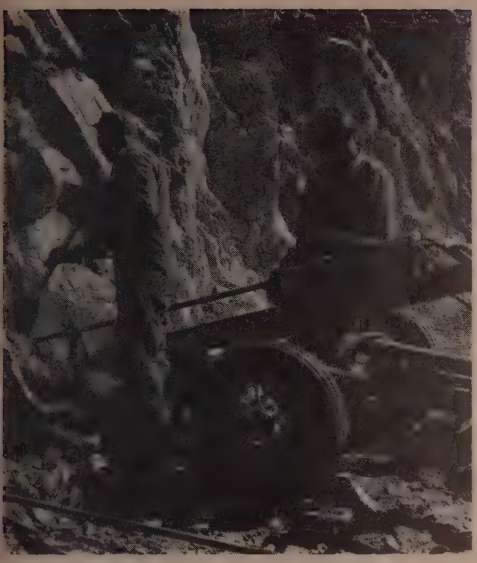
The plus production values built into both plants paid good dividends, according to General Superintendent C. R. Pilcher of Union Construction Co., and the material was turned out in rates as high as 150 tons per hr. in ¾-in. material. The older plant of Geery's was grinding out 130 tons per hr. in 1-in. minus crushing when the job was visited.

Union's operations

At both of Union's setups, quarried stone was crushed to develop the best possible base material. High up on the canyon walls, of course, there was little raw material except solid rock. The Pioneer 46-VE worked this material down to size.

Quarry equipment consisted of a 600-cfm. compressor, two 500's, a 365, and 5 wagon drills. The blue lime rock was indeed so hard that tungsten carbide drill bits had to be used to penetrate it, and even then, they often wore out in less than 80 ft. of drilling. Tungsten carbide bits usually give 500 ft. or more, but this rock was unusually hard and abrasive. The holes were spaced on 5-ft. centers, sprung lightly, loaded with 40% powder, and shot. Surprisingly, the rock broke into fine pieces, usually not over 400 lb. to a chunk.

The broken rock was loaded to a couple of Euclids by a 4-yd. tractor-mounted front-end loader, which hauled it a short distance to the trap. A plate feeder delivered the material to a conveyor which dropped it through a 20 x 36 bull crusher. The



IN-PLACE YARDAGE (left), a hard blue limestone, was drilled on 5-ft. centers, wore out tungsten carbide drill bits in 80 ft. or less.

EXCAVATED YARDAGE (above), nicely broken to about 400-lb. size or smaller, was loaded out to trucks for haul to crushing plant.

entire input then passed to the bottom deck on the Pioneer plant, where everything acceptable to the specifications was quickly removed, leaving only the crushable rock to work on. This feature, according to Pilcher, was one of the most valuable, because it definitely helped to boost output—important on such a hurry-up job—and it reduced equipment maintenance because the fines did not drop through all the remaining parts of the plant.

Basic components in the 46-VE consist of a 10x36 jaw and a set of 40x22 rolls, along with a 3½-deck, 4 x 12 screen. Pilcher did some interesting things with this screen, as we shall see. The screens were interchanged to produce whatever size material was being run, and trucks hauled the finished material away from a 25-ton surge bin to the new road, where it was placed by motor graders and pneumatically rolled.

Dust troubles

Pilcher has a fairly permanent scheme of setting up the plant so it works to its best advantage. For example, he buys a little extra belt for the main flat-belt drive from a 260-hp. General Motors diesel, and sets the main engine at least 100 ft. away from the plant. This distance puts it out of the bad dust, which pays off in reduced maintenance, and puts less wear on the belt itself. A longer driving belt seems to develop less torque at the drive pulley, too.

The plant is fully electrified beyond this main drive. A supercharged diesel-electric set furnishes the power for conveyor motors and so on. Pilcher often gives this big diesel a bit of extra work. He routes its high-velocity exhaust to the stacker conveyor to remove fine dust from the material. On several occasions he has produced acceptable ½-in. minus armor coat chips by this method, from pits which normally would expect to be washed. On the Trout Creek job the specifications called for not more than 12% of 200-mesh material. In the dustiest material, Pilcher put the exhaust blower to work to remove some of the excess fines.

"Stealing" chips

He does another neat trick on road jobs where small tonnages of chips have to be made: he makes them at the same time he runs his base course. The easily changed Pioneer screen decks make this relatively simple. Suppose, for example, a thousand tons of ½-in. chips were needed out of the production of 1-in. minus base course rock. Pilcher simply places a ½-in. screen over the first half of his top deck, and places a standard No. 4 square mesh screen on the second deck. Chips ½ in. and smaller drop through the top deck, and everything smaller than No. 4 passes through the second deck to rejoin the base course material. The chips are then retained on the ¼-in. screen, pass out a side delivery chute to a short stacker conveyor for storage. Pilcher often "steals" 1,000 tons of armor chips over a period of 2 weeks or so while the plant is busy turning out completely acceptable base material.

C. R. PILCHER (right), Union Construction superintendent on the job, has a visit from Lake Hayes (left) of Diamond Match, whose company cooperated in building new road, will haul timber over it.

In fact, intelligent analysis of any pit balanced against what has to be done will often make pay combinations possible where material otherwise might have to be wasted. The 46-VE has easily adjustable jaws and rolls to permit quick changes with varying pit characteristics.

Both Pioneer plants handled the hard rock without undue trouble. The Trout Creek setups were no exception to Pilcher's impressive background of "keeping 'em running," and some of the records he has set with this plant seem incredible even to Union's owners.

At Polson, Montana, for example, Pilcher lost exactly 1½ hr. operating time on a 30,000-ton job of ¾-in. minus material in heavy crushing, and the production rate for that job was maintained at 125 tons per hour. On another 18,000-yd. job, he averaged 123 yd. per hr. in ¾-in. crushing; 156 yd. per hr. on 1-in. minus crushing.

Portability

Pilcher has the plant so portable that it can move to a new location, set up, and be operating in two shifts if the move isn't over 10 mi. In 1951 when floods hit Montana the plant had to turn out 20,000 tons in an emergency from 7 separate pits. It was a job of virtually continuous moves. Pilcher and his men made one of these moves in 11 hr., set up, and again started crushing.

The plant has done well over 500,000 tons of crushing in its short life; 100,000 tons on Beavertail Hill near Garrison, Mont., and other tonnages at Glacier Park, Babb, Kalispell, and considerable work back in the wilderness on the Lolo Road. It is this kind of background which paid dividends at Trout Creek as the construction season of 1952 came to a close.

PRESTRESS: a summary of construction experience in Denver

Thoughtful but increasing use of prestress in Colorado city amounts to "methodical enthusiasm" — Demand for precast, pre-tensioned units has justified commercial manufacturing venture that has already expanded once

GREAT STRIDES in prestressed concrete construction have been made in the Denver area since the collective minds of engineers, architects and owners decided for its acceptance.

In November 1949 Kurt Billig, an internationally known British engineer, presented one of the first discussions of prestressed concrete to Denver engineers and architects. His appearance was under the sponsorship of the University of Colorado. After that first meeting, the consensus seemed to be that the subject was interesting but that the use of prestressing would be a long time coming to Denver (or even to the United States). After all, labor here is high-priced in comparison to that of Europe, and we do not yet have to worry too much about materials being exhausted.

In the following three years, however, a profound change in attitude has occurred, and great interest is now being evidenced among engineers, architects, and contractors in the Denver area. Many meetings of engineering, architectural and student groups have been assembled to pursue the subject.

Abortive starts

Two "fairly serious" attempts were made in Colorado to utilize prestressing before a project was finally awarded. The early attempts sought incorporation of prestressing for part or all of two roof systems; the attempts failed because of lack of sufficient interest and knowledge on the part of the owner. The first was the roof structure over a school gymnasium and auditorium. The owner in this case did not feel he wanted to pioneer with taxpayers' money, and he required a check of the proposed design which would have delayed the bid opening of the project. The second attempt failed because the owner was too optimistic about the amount and type of building that could be secured with the available funds. A complete redesign of this structure was later made.

Late in 1951 and early in 1952 the greatest impetus for growth of the new industry occurred when Jack Perlmutter, of Perlmutter & Sons Co., started developing a manufacturing technique with definite plans for producing prestressed concrete units of all kinds. His faith in the possibilities of the industry and his persistence in overcoming the disappointments involved in selecting satisfactory manufacturing details have resulted in a process and organization which is now capable of quantity production.

The original start was made by building a casting bed 48 ft. long with anchors on either end capable of resisting total stresses up to 175 tons. The casting surface itself was a concrete slab 48 in. wide cast over continuous channels that were integral with the built-up structural steel anchorages. The pre-tensioning system was used throughout. A 60-ton hydraulic jack was used to stress two 7-wire Roebling strands at one time. End anchorages for the strands were cones developed by the company.

A system of stacked plates was used on either end to separate the strands and space them both vertically and horizontally according to the design of the particular member being manufactured. After the strands were placed and stressed to the proper tension, forms were built and braced on the casting bed, and a

The methods and scope of prestressing

IN THE LAST three months, articles in *Western Construction* have told of applications of concrete prestressing in the Pacific Northwest (November, pp. 56 and 74) and in Southern California (December, p. 66). The article on these pages is valuable for the manner in which it surveys the acceptance and growth of the new construction medium in another Western area.

Today, prestressing is gaining acceptance rapidly. The philosophy of its use seems now to be more than merely substituting a prestressed member for one that is not prestressed in a given design. Horizons have been broadened, with prestressed concrete members being designed for functions that would never have gone to reinforced concrete in the first place.

Two general systems of prestressing concrete have been used. In both cases, the idea is to obtain the maximum utilization of the properties of the concrete and the steel. As more fully described in "The A B C of Prestresed Concrete," *Western Construction*, December 1950, p. 66, the stressing of high tensile steel bars or wires in the member introduces an initial compression in the concrete. Thus, when later loaded and working in its intended function, the concrete cannot be brought into a condition of tension without cancellation first of its initial compression. Steel, in tension, and concrete, in compression, are thereby working as they are best suited.

In pre-tensioning, the steel is stressed between anchorages before the concrete is cast. The prestress is transferred to the concrete through bond forces after the concrete has attained a predetermined compressive strength. This system lends itself well to production at a central plant and has the advantage of close control of quality of concrete and uniform labor practices by a trained crew.

The post-tensioning system provides for casting the concrete member first, usually with the steel in place but not stressed. Bond is prevented at this time by lubricating the high-tensile strands or by threading them through light conduit. Transfer under this system is obtained and the steel stressed by jacking against the ends of the concrete member after a specified compressive strength has been reached. This system lends itself to field application where elaborate anchorages are not available. Since transportation of the structural member is not involved, longer spans and heavier loadings may be undertaken.

ery dry 8-sack concrete mix placed, arefully vibrated and finished. Mem-ers were then steam-cured, cables eleased, forms stripped and units re-noved from the casting bed to make oom for the next production cycle. Compressive strengths of concrete up o 6,000 psi. were attained in 24 hr.

Plant provided

After gaining a great deal of know-ow by casting a variety of shapes nd sizes, the company proceeded to lan and build a new plant in north Denver capable of much larger pro-uction capacity both as to size and uantity of units. Perlmutter's activi-ies in this field have now been reor-anized and operations are being car-ied on by a new company under the ame of Prestressed Concrete of Colorado, Inc., organized for the spe-ific purpose of the manufacture and rection of prestressed concrete units.

The new plant includes a 280-ft. asting bed 10 ft. wide which was de-igned and built with intermediate tub columns on each side every 20 t. Behind these can be dropped port-ble anchorages. Stressing is accom-lished by the use of a flexible as-embly with two hydraulic jacks apable of stressing up to a total of 00 tons. This provides for stressing ll the strands or wires in a member n one operation. Equipment neces-ary for the manufacture of post-ensioned members is also installed t the new plant site. A steam boiler as been installed with a steam main unning the length of the casting bed. Multiple valves along the main pro-ide complete flexibility for curing ne unit or the full capacity of the asting bed.

A batch plant with overhead ce-ent silo has been installed, a transit-ix truck provided to deliver the oncrete to the forms, and a 20-ton obile crane is available for lifting nits from the casting bed to tempo-ary storage or to special trailers that ransport them to the site.

In addition to the plant, a test bed as been built capable of testing full ize units up to 60 ft. in length with a aximum load of 275,000 lb. This ervice will be available where a full-ize test is required by specifications, ince at the present time there are no cceptable standard tests established or prestressed concrete design and erformance such as are recognized or other construction materials.

Municipal acceptance

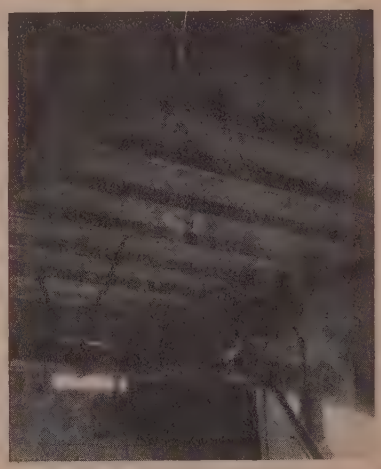
Prestressed concrete units have been approved and accepted for use n the City and County of Denver by he chief building inspector on the asis of performance tests. Denver's uilding inspector and his staff are lways alert to new developments in he construction field, and most co-perative in establishing criteria and ests for new media which may lead o savings for owners. This attitude by those in a position to approve or disapprove has helped appreciably in the development of this fast growing industry.

A great deal of credit for development of prestressed concrete in Denver is due to the cooperation of the firm of Phillips, Carter & Osborn, Inc., which had done the design for most of the prestressed units built or under contract at the present time. The design of the new stressing bed, test bed, and stressing assembly was also done by this firm. Nat Sachter and Ib Falk Jorgensen, Denver structural engineers, have also made designs of units under contract, and other engineers and architects are becoming familiar with design procedure. Considerable research work has been and is being carried on by the engineering school of the University of Colorado.

So far, prestressed concrete units have been installed in five projects in this area and delivery will start shortly on material for five more large contracts.

The first project built in Denver

CLEAR AND OPEN dock area (above) for loading and unloading trucks was achieved by use of 41 ft., 6-in. prestressed beams.



PRE-TENSIONED UNITS (right) by Prestressed Concrete of Colorado, Inc., constitute the entire roof system here. One 30-ft. beam supports twenty 18-ft. channel slabs, gives clear area of 30 x 36 ft.

T-SLAB (below) for roof of Spitzer Electric Co. building is 39 ft. long. The units are getting bigger.

ASSEMBLY LINE is achievement of Prestressed Concrete of Colorado, Inc., its new plant featuring a 280-ft. casting bed for pre-tensioned units. Concrete is batched in background, mixed and moved by transit-mixers to pour site along slab. Set-up shown is for casting five 39-ft. T-slabs.

utilized five 18-ft. beams supporting the center of the garage portion of a 50 x 130-ft. building. It was built in February of 1952.

The second project, a refrigerated meat processing plant for the Plat Packing Co., was built in March 1952. The roof was supported by one 42-ft., four 25-ft., and sixteen 18-ft. prestressed concrete beams furnished by Prestressed Concrete of Colorado, Inc. The cost of unfireproofed structural steel beams was compared to that of prestressed concrete and found to be $300 cheaper. Concrete was chosen, however, because it eliminated maintenance costs which would have been necessary with the other material because of the high humidity present in the meat processing operation. The 18-ft. and 25-ft. members support the roof of the refrigerated section of the plant and provide support for the heavily loaded monorails. The 42-ft. girder provides interior roof support over the dock section (see cut).

Prestressed roof systems

The third project was a small 30 x 36-ft. addition to a feed mixing plant for the Denver Livestock Feeding Co. This was the first all-prestressed concrete roof system built and consisted of one 30-ft. girder across the center and twenty 18-ft. channel slabs spanning from the girder to the end walls. This arrangement provides for a clear area the full size of the building and demonstrates what can be done to provide economical Class 1 construction with few intermediate supports.

In another case three 40-ft. beams were manufactured and delivered to Jones Construction Co. for incorporation in the office portion of a new building for Landes, Zachary & Peterson in Denver. These beams were furnished on short notice and enabled the contractor to complete the building for occupancy much sooner than otherwise possible had it been necessary to wait on steel.

In another case two 28-ft., and four 34-ft. beams were manufactured and installed in a 62 x 120-ft. L-shaped building for the Bowman Biscuit Co.

Roof units for the Spitzer Electric Co. repair garage in Denver are the first being turned out at the new Perlmutter plant. They consist of fifteen 39-ft. T-beams and fifteen 50-ft. T-beams, giving a roof structure of 4,200 sq. ft. These units are designed for vehicle parking.

The prestressed concrete roof structure in place, for the Beatrice Foods Co. refrigerated warehouse in Denver, was awarded to Prestressed Concrete of Colorado, Inc., under a separate contract. In general, this is made up of girders spanning 57 ft. in one direction and double T-beams spanning 23 ft. in the other. A total of 37,000 sq. ft of roof area is costing the owner about $1.40 per sq. ft. This project was designed by Nat Sachter Denver structural engineer.

Another contract is in force for supplying 16,000 sq. ft. of roof for the University Junior High School at Boulder, Colorado, designed by James Hunter, architect. This project consists of 20-ft. and 25-ft. channel slabs.

A new elementary school in Loveland, Colorado, designed by J. K. Monroe, Denver architect, will be provided with 20-ft., 30-ft., and 37-ft. channel slabs and 49-ft. T slabs aggregating 25,000 sq. ft. of roof area.

Twenty-seven prestressed concrete beams are being furnished for the Denver Feed Co. in North Denver to support the roofs of two warehouses 128 x 45 ft. and 100 x 45 ft. Mayer & Osborn are the designers and builders, and Ib Falk Jorgensen designed the prestressed beams.

Some very good prospects seem to be developing for the use of prestressed concrete units in bridges with spans from 30 to 70 ft., and loadings up to H-20, S-16.

Stone-sand in concrete for large dams

. . . Continued from page 67

which the two materials can be withdrawn in controlled proportions for feeding to the rod mill. Most of the recent plants include feeders by which the rate of feed is controlled and this is essential, but without uniform grading the benefits of uniform rate of feed may be nullified.

Control of rate and grading of feed is just as necessary to the production of uniformly graded sand with other types of grinding equipment as it is for the rod mill. A high uniform rate of production not only is essential to uniform production of sand but obviously is very desirable from the standpoint of cost.

Challenge to contractors

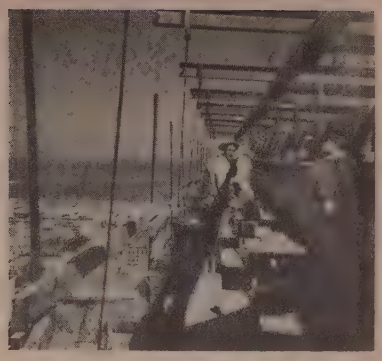
The strict requirements for grading and uniformity of grading of fine aggregate for use in very lean mass concrete for dams are a challenge to the ingenuity of designers of plants to accomplish the desired ends with the utmost economy. Many improvements in design and operating techniques have been made but it is believed that the ultimate in precise control, reduction in waste and economy of production is yet to be achieved. The use of new ideas and new equipment in the most recent plants appears to offer opportunities for producing stone-sand of uniformity of grading never before achieved.

Recognizing the advantages of high uniform rates of production, contractors will no doubt design plants in which control of the flow of material is largely automatic, and dependence on manual control is almost totally eliminated. As is often the case, the stricter requirements for grading and uniformity of grading which first appear to be extremely difficult and costly to achieve finally turn out to be relatively simple, and eventually influence the cost of production favorably rather than unfavorably.

Recent experience has indicated that the plants that have the simplest flow and the fewest pieces of primary equipment have given the best results. The trend in future plant design will be toward simplification, yet with ample flexibility. Contractors have demonstrated remarkable ingenuity in solving this problem of producing stone-sand to date and may be expected to develop plants in the future that will produce an improved product at even lower unit costs.

TIPS on the best use of STEEL SCAFFOLDING

Three basic types of steel scaffold are available — pick the one having proper strength and flexibility for the job — Engineered units have built-in safety but precaution is still necessary



HEAVY-DUTY SUSPENDED scaffold is well suited to masonry work on building exteriors. Rigging and hoisting equipment are designed for heavy loads of workmen and their materials. Job shown is the Robert Driscoll Hotel at Corpus Christi, Texas.

CONTRACTORS are finding that steel scaffolding methods cut costs and speed work with greater safety. In addition to replacement of wood scaffolds for standard uses, they are discovering many other time and labor saving applications. Among the advantages of steel scaffolds over wood scaffolds built on the job are: (1) safety for the worker; (2) speeded construction jobs; (3) lower scaffolding costs; (4) decreased fire hazard; (5) improved appearance; (6) scaffolding designed, built and tested by experts.

Most steel scaffolding equipment can be either purchased or rented. Purchase is usually to a contractor's advantage only if a steady volume of work keeps his scaffolds busy. Many construction firms buy a basic quantity of scaffolding and rent more when needed. Also, many scaffolding suppliers offer complete services including layout, erection, inspection on the job, dismantling and reconditioning.

Built-up types

In general, steel scaffolds for the construction industry fall into three main classifications, built-up, hanging, and rolling scaffolds. Built-up scaffolds are of two types:

A. **Sectional frame scaffolding** is erected from prefabricated welded tubular steel frames of various designs and heights. Width is usually 5 ft. The frames are placed one on top of another and are connected by diagonal cross braces of various lengths to give desired spacing between frames.

Sectional-frame scaffolds are commonly used for bricklaying, stone setting, steeple and tower work, for refacing, plastering and electrical installations. They are also useful on concrete pouring operations where they can support the forms or make a concrete wheeling scaffold.

How to be accident-proof

To get all the safety that is built into sectional scaffolds, follow these recommendations: (1) Observe the manufacturer's instructions regarding maximum load. (2) Use 2-in. scaffold grade lumber, or heavier, for platforms. (3) Tie the scaffold into the building every 20 ft. of height and 25 ft. of length. (4) Install guard rails and toe boards. (5) Use suitable overhead protection against falling objects. (6) While scaffold is in use, do not allow any structural part to be removed without permission from the proper authorities. (7) Use enough bracing to insure stability. (8) Inspect scaffold when it is erected and periodically during use.

B. **Tube-and-coupler scaffolding** has been used on nearly every type of building and for almost all construction trades. It is most versatile because working levels can be established at desired heights by means of couplers. Curved surfaces, extreme heights, uneven ground and building set-backs are no problem with this type of equipment.

Tube-and-coupler scaffolding is erected from only four basic parts: galvanized steel tubes of various lengths joined by fittings locking to form a continuous tube; standard, right-angle couplers for right-angle joints; adjustable couplers for joints at other than right angles; bases, on which the scaffold is erected. The tubes are usually 2 or 2½ in. in diameter and from 6 to 13 ft. long.

All the safety precautions for sectional scaffolds should be followed when using the tube-and-coupler type. Also, check the scaffold after erection to be sure that match marks on the members indicate the joints between connecting tubes are locked.

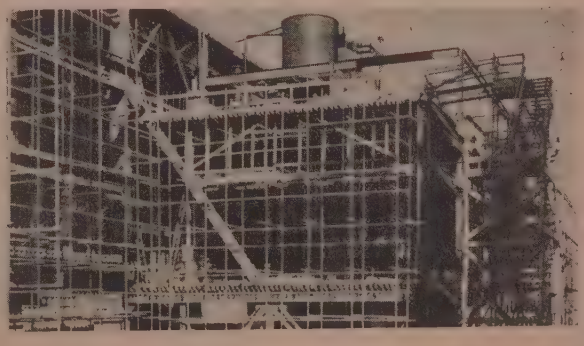
Hanging types

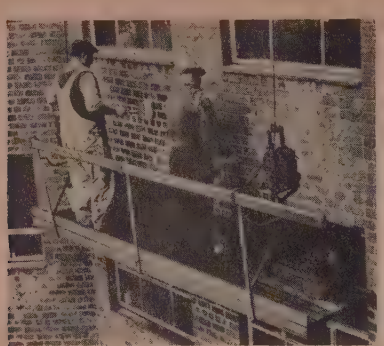
Hanging scaffolds also fall into two types:

A. **Heavy-duty suspended scaffolds** use steel rope wound on a ratchet drum mechanism, as a raising and lowering device. The scaffolds are generally suspended from steel or aluminum outrigger I-beams, with

SECTIONAL FRAME scaffold is illustrated as assembled for masonry work by W. L. & Harry Henson on the Union Oil Co. addition in Seattle. Note how varied frame heights and adjustable legs give level working platforms despite street slope.

TUBE-AND-COUPLER scaffold gives most flexibility in choice of platform levels. Scaffold shown was erected for concrete pouring on Stone & Webster job for Pacific Gas & Electric Co. at its Moss Landing steam plant in California.





LIGHT-DUTY SWINGING scaffold must not be overworked. It is intended mostly for maintenance work by few men with hand tools—glazing, pointing up masonry, painting, etc.

each beam supporting two of the hoist mechanisms. Pairs of drums and their connecting putlogs are spaced not more than 9 ft. apart lengthwise to accommodate 12-ft. planks which deck the platform solid. Standard platform width is 5 ft.

When erecting suspended scaffolds, remember these safety precautions: (1) When work is in progress above, install overhead attachments for protection against falling objects. (2) Inspect the scaffolding, drum mechanisms and wire rope periodically. (3) Use guard rail and keep it in good condition. (4) Install toe boards to prevent falling objects from the scaffold. (5) Where I-beams are rigged over the parapet wall, make sure that it will carry the load of the outrigger and scaffold, or that suitable bench or blocking is installed. (6) Do not overload the scaffold. (7) Overlap planks at least 1 ft. on each side of the putlog. (8) Make sure that the wire ropes are always hung perpendicularly.

B. **Swinging scaffolds** for light-duty service, also employ steel wire rope and a mechanical raising and lowering device. They are fitted with one cable and hoist mechanism at each end of a prefabricated stage that is generally 16 to 22 ft. long and from 20 to 28 in. wide.

For safety when using swinging scaffolds: (1) Test the platform before using by supporting it 18 in. from each end and having two men stand on the middle. (2) Inspect raising and lowering mechanism frequently. (3) Remember that this is a light-duty scaffold for men with hand tools and minimum materials, so don't overload it. (4) Be sure there are at least three turns of wire rope on drums at all times. Do not lower the scaffold below this point. (5) Equip the stage with toe boards and guard rail, properly supported at both ends and in the center.

Rolling scaffolds can be erected from sectional steel scaffolding units or from tube-and-coupler scaffolding components fitted with casters. In addition to these, there are two types section rolling scaffolds are made up of end frames and braces, generally have dimensions of 4½ x 6 ft., and are designed with an interior stairway. Aluminum sectional ladder scaffolds are erected from 2-ft. wide ladder units of various heights. They have innumerable uses.

For basic safety, these suggestions should be followed with rolling scaffolds: (1) Do not erect a rolling scaffold higher than recommended by the manufacturer. (2) Avoid overloading. (3) Keep scaffold from being struck by trucks or other equipment. (4) Erect guard rails around working platforms. (5) Neither roll the scaffold with workmen on it nor allow workmen to pull themselves along on the scaffold.

Want to be a SUPERINTENDENT?

. . . Continued from page 62

jealousy in winter, when men are loafing along on a slow bell, than there is in summer when they're working their guts out to meet near-impossible schedules. It takes a good psychologist to understand that those tough schedules give a man character, and that if other conditions are right he'll feel prouder of having made an impossible schedule than he possibly could of having spent a few easy winter months.

Semantic qualifications and an engineer's thorough appraisal of all the facts may be fine in their place, but they're dynamite for a construction organization if they prevent a superintendent from giving fast, positive decisions. Let an outfit run into unforeseen conditions, such as those on most jobs. If the superintendent looks the situation over and then makes his decision rapidly on what scheme to use getting rid of the trouble, he always commands respect. If he dilly-dallies around for days and weeks, it marks him as a man who lacks experience, and it almost always undermines the efficiency of his organization by losing him the respect he had from his men.

Be cynical?

It may be all right for ministers to believe that all men are good per se, but a construction superintendent will build better human relations and a stronger organization with a much more negative—even cynical—attitude. Men simply are not all nice and civilized. They have jealousies just as apparent to a perceptive superintendent as those of a snarling dog whose supper is threatened by some intruder. Men have hates and angers and fears and insecurities, along with the nobler virtues. The smart manager of men will watch out for unhealthy attitudes and correct them, if possible. Many a good construction man got that way because some fine superintendent headed off his unhealthy attitudes and corrected his mistakes before they could happen.

It may be, if you look at this thing thoroughly, that here is the "secret" of many of the nation's top project managers. Help a man to broaden himself without making it obvious, and sooner or later that man will see comes to love and respect "The Old Man," and to regard him as something of a wizard. He'll obey The Old Man's orders without question in the middle of the night. Here may be one explanation for the respect some men command on their jobs.

It might again be well to note that it took plenty of man-hours of work and interest, and an amazing series of right decisions and advice, to sow the seeds of that respect. Neither should it be forgotten that a good superintendent admits the mistakes he makes, and is quick to assume his full share of responsibility for whatever happens in his organization.

It is the sum and substance of all these things—a man's experience, the organization he builds, the professional excellence he displays, the human contacts he handles, the respect he commands—which go to make up his reputation. They determine whether his job shows a good profit, or a loss. And the superintendent who runs a profitable, harmonious job is the one who invariably gets infinite financial backing and good equipment from his contractor-owners, with a minimum of managerial interference. There are always a dozen ways to do a thing. If a superintendent has built a good reputation, most people will let him do a job his way.

It should be emphasized again that there are no short cuts. Success follows only the somewhat revolutionary concept (for this day and age) that hard work is honorable, is a lot of fun, and gives great satisfaction. Unless a man is willing to devote all his time to his job, he'll never be a successful superintendent.

There are rewards

Assuming that there are those who still are willing to pay this price and live by all the old-time values of life, the life of a top-notch construction superintendent has its rewards, spiritually as well as financially.

For who can doubt that when the President of the United States stood at rostrums dedicating such massive dams as Bull Shoals in Arkansas or Hungry Horse in Montana, the construction stiffs who transformed these projects from paper to concrete commanded considerable respect in the President's mind?

Yes, building a big construction project has its problems, but it also gives its builder something to treas-

When the Navy trains Seabees, it's ANCHORS AWEIGH!

By
LT. DONALD L. LEDBETTER,
CEC, USNR
Naval Construction Battalion Center
Port Hueneme, California

DURING World War II, the Seabees were made up principally of petty officers. Ratings were established at the time of enlistment because most of these petty officers had worked in the construction trades in civilian life and the Navy had no comparable petty-officer rates. At the end of the war most of these men returned to their civilian occupations.

As early as the fall of 1945 the Bureau of Yards and Docks saw the need of training regular naval personnel to replace these skilled craftsmen and established what is now U. S. Naval Schools, Construction, at Port Hueneme, California.

They start from scratch

Most of the personnel coming into the Seabees today are young men fresh from boot camp, with little or no construction experience. The training program of the Naval construction school is designed to introduce them to the techniques of the construction trades. The basic principle of the school is "Learn by doing." The program covers apprentice training for Drivers, Construction Electrician Mates, Steelworkers, Utilities Men, Builders, Surveyors and Draftsmen. In addition, advanced courses for experienced construction personnel are conducted in all subjects except Surveyor. The primary courses are 13 weeks in length. The advanced courses are presented for a period of 15 weeks. About 25% of the school time is spent in the class room, the balance being spent in practical training in the field.

The Driver schools conduct basic training in the operation and preventive maintenance of trucks, crawler tractors with attachments, clam shells, carryall scrapers, cranes with attachments, graders and well drilling rigs. Each student gets from 10 to 15 hr. of actual operating time on each type of equipment.

The advanced course covers self-propelled carryall scrapers, rock crushers, draglines, shovels, back hoes, trenchers and other special construction equipment.

Most of the students assigned to the 13-week basic Drivers course are selected from boot camp because of an aptitude and desire to be equipment operators. About 60% of them have had limited experience in construction work during summer vacations before entering the Navy. The course is divided into one-week sections, each section covering one type of equipment or operation. Classes are scheduled in such a way that skills developed on one type of equipment are further utilized and developed in subsequent operations.

Equipment is assigned to the students at the beginning of the week and students are responsible for "their" equipment. Cleaning, lubrication, field adjustments and servicing are performed by students under instructor supervision.

Basic driving instruction is given on 6x6 2½-ton military cargo trucks. Many students who have never been behind a wheel learn to drive in the first week of truck school. With basic operation, lubrication, safety regulations and rules of the road in hand, the class moves on to two weeks of dump trucks and truck tractors with semi-trailers. At the end of the course, license examinations are given and men who qualify are issued government operator's permits. Two full days are required to undergo the necessary psychological, written, and operational examinations in order to qualify for these permits.

Crane training

After a thorough indoctrination in special safety procedures, hand signals, and operating practices, the class begins crane operation. The first few days are devoted to light hoisting and manipulation of controls. A week of clam shell work follows, then a week of heavy hoisting work into

Continued on page 117

"STEAMING IN COMPANY," these Seabee students in various types of equipment operation work together in a combined class project at Port Hueneme. *Official U. S. Navy photographs*

With heavy traffic on its 4,200-mi. system, this—

Arizona county uses soil cement

Heavily traveled farm-to-market road outside Phoenix provides opportunity for one of the first applications of soil cement to county road construction in the state

By HOWARD SHELP
Maricopa County Engineer
Arizona

WITH AN AREA equal to that of New Jersey, Delaware and Rhode Island, and the largest population of any county in the state, Maricopa County has developed a large mileage of good all-weather roads. But continuing growth in population, together with the development of new agricultural land, has maintained a steady pressure for new roads.

In strengthening an existing road, on which heretofore it had been almost impossible to maintain an all-weather surface, the county has for the first time adopted a relatively new road building tool, soil-cement.

Using our own forces, we have recently completed construction of a 36-ft. wide, 6-in. thick soil-cement base course on 8 mi. of Cotton Lane Road. About 25 mi. northwest of Phoenix, Cotton Lane Road is a farm produce trucking route serving as a storm water channel as well.

Carrying surface drainage from the nearby White Tank Mountains, the roadway has been gradually eroded year after year, until it is now depressed from 2 to 4 ft. below the natural ground profile. Existing soil is primarily a fine sandy loam easily eroded. Use of a 6-in. soil-cement base was selected to provide adequate load carrying capacity, to prevent further erosion of the roadway and to hold an all-weather surface. A 2-in. road-mix bituminous surface course was specified.

Construction of soil-cement base began on November 12, 1952, on a 36 x 2,600-ft. section.

Bulk cement trucked to the project in tankers was spread over the shaped section in the amount of 4% cement by volume, using a Hercules cement spreader. Immediately behind the cement spreader, two Seaman Pulvimixers began dry-mixing the cement and existing soil to a compacted depth of 6 in.

When a uniform dry mix had been accomplished, two trucks mounted with water tanks and spray bars moved in to add water and the rotary mixers began moist-mixing, continuing until the optimum moisture content had been reached.

Moisture control

Tests made of job soil-cement mixtures indicated an optimum moisture requirement ranging from 10% to 12% in order to obtain maximum compacted densities, which ranged from about 123 to 115 lb. per cu. ft. During early days of the work, evening rains provided just about the required moisture, and it was necessary to add water during the moist mix only to compensate for evaporation and to assist in final finishing.

These "chain" operations began on a right hand strip for the full length of the section. As soon as the Pulvimixers had completed the moist mix on a strip sufficiently wide, a sheepsfoot tamping roller began preliminary compaction. The mixers began dry mixing the adjacent strip to the left.

After a few trips through, the sheepsfoot roller had compacted the bottom 4 in., and walked out to within 2 in. of the top. The mixers then moved through once again, adjusted to mix only the top 2 in., thereby removing all compaction planes. This left a smooth even layer of loose material ready for final compaction without further shaping.

Two passes of a multiple-wheel pneumatic roller tightened the loose 2-in. layer sufficiently to prevent "pickup" under the 8-ton steel tandem roller, which obtained final compaction.

The smaller of the two water tanks, equipped with a pressure spray bar, lightly fogged the surface after final compaction and the pneumatic roller was again used to produce a tight, closely knit surface.

Each step in the process was transferred in turn to adjacent lanes on the left, until the full 36-ft. width was completed. Cross section was maintained sufficiently close that final blade shaping was not considered necessary.

Completed base sections were kept moist by sprinkling when necessary until a bituminous curing seal could be applied (approximately .25 gal. per sq. yd. of MC-2). A 2-in. road-mix bituminous surface is to be used as a wearing surface on the completed base.

While the initial soil-cement sections were processed in 2,600-ft. lengths, the average was over 3,000 ft. 30 ft. in width. The daily construction average was in excess of 12,000 sq. yd.

Construction of this project was accomplished without interruption or great inconvenience to traffic. Job construction procedures were worked out by, and direct field supervision was under P. N. Syler, Assistant County Engineer.

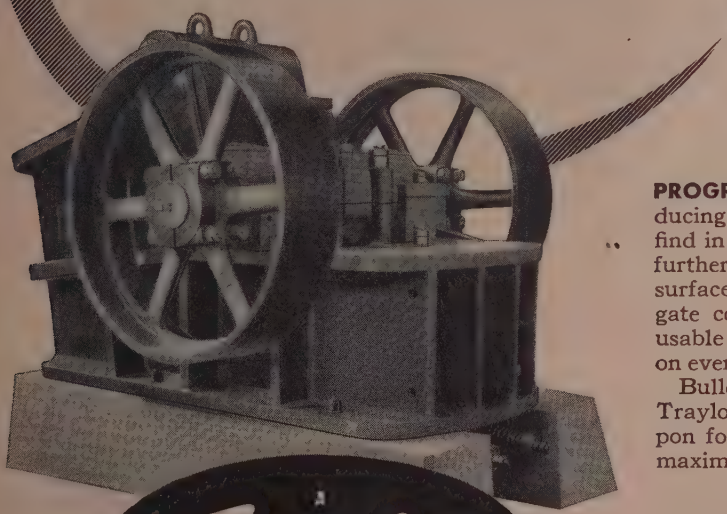
PULVIMIXER (left) gets in on the act twice. After moistened soil-cement mixture is thoroughly worked, the roadway is compacted by sheepsfoot roller. Then the Pulvimixer returns, as shown, to re-work the top 2 in. and remove compaction planes. Next to last step is pass by pneumatic roller (right), followed by steel wheel roller.

more usable aggregate from every ton of rock

TRAYLOR'S CURVED CRUSHING SURFACES

reduce waste fines to cut aggregate costs.

Traylor Jaw Crushers are equipped with Curved Jaw Plates. These plates are designed to apply crushing force in a direct line! This drastically reduces the churning and lifting of material in the crushing chamber. Each zone in the crushing chamber is of increasing capacity. As material is crushed it is free to drop immediately toward the discharge opening.



PROGRESSIVE CONTRACTORS who are producing their own aggregate on the job, will find in any Traylor Jaw Crusher the means to further reduce costs. Traylor curved crushing surfaces have two major effects upon aggregate costs. Not only do they produce more usable aggregate, but they reduce power costs on every ton of material reduced.

Bulletin 4105 gives complete information on Traylor Type H and HB Crushers. Mail coupon for your copy today and see how to get maximum savings on job produced aggregate.

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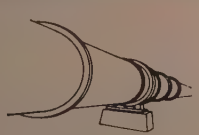
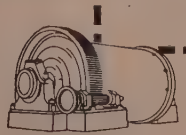
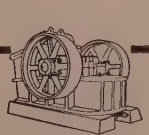
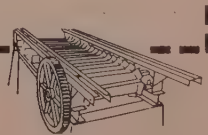
Primary Gyratory Crushers


Rotary Kilns


Secondary Gyratory Crushers


Ball Mills

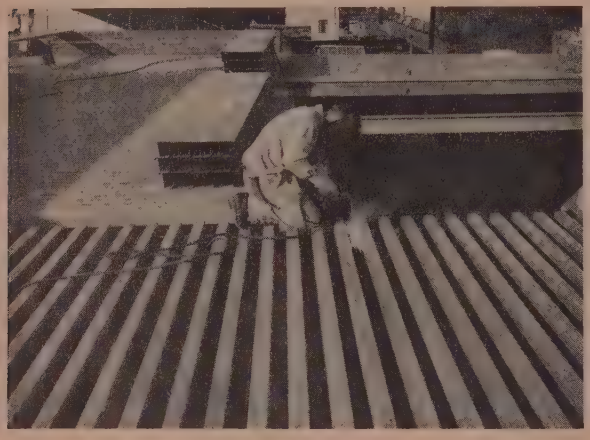

Jaw Crushers


Apron Feeders

HOW IT WAS DONE...

L. A.'s steel ribbed roof for surviving the shakes

FIRST BUILDING in Los Angeles to be erected with steel ribbed roof deck is the new Hostess Cake Bakery for Continental Baking Company in the Slauson-Western district.



This highly functional construction served two main purposes for Van Dyke and Barnes, architect and structural engineering firm who designed the plant. First, no diagonal earthquake bracing was needed; the deck acts as a diaphragm to resist earthquake forces. Second, this type of construction enabled the designers to get away from plaster, for great cleanliness and less maintenance, highly important to the baking industry.

With the ribbed deck, Van Dyke and Barnes were able also to do away with exposed wiring conduits. Wiring for power drops and lighting is carried in girder cells.

Radar detects breaks in P. G. & E. power lines

SUCCESSFUL USE of radar for almost instant location of distant breaks in high voltage electric power transmission lines is reported by Pacific Gas and Electric Company.

P. G. and E. is one of the first utilities in the nation to put the newly-available specialized radar equipment into service. The equipment has been under test on the company's system for several months and winter storms now have provided the first actual operating experience. During a recent heavy snowstorm in the mountains of Trinity County, the repair of a break that occurred on a snow-laden 60,000-volt power line from Shasta County to Eureka was materially speeded. Operators at P. G. and E.'s Shasta Substation near Cottonwood were able within minutes to pinpoint the trouble 75 mi. away, the company said.

Formerly, crews in the field have had to check damaged lines by repeated switching, checking the entire length of line a few miles at a time until the break was found. Now, the radar set sends high frequency impulses along the wire to the point of the break, from where part of the pulse energy bounces back to the sending set. The distance of the break from the transmitting point then is read directly from a dial calibrated in miles.

The instruments have a maximum effective range of 200 mi. They are so sensitive, P. G. and E. engineers say, that the presence of a lineman on a steel tower, washing insulators with a stream of water, could be detected by an operator in a substation miles away.

The company so far has three sets. One is based at Shasta Substation to service three vital transmission lines carrying power over the mountains to Eureka and the entire Humboldt area, as well as other lines bringing power from P. G. and E.'s string of big hydroelectric generating plants on the Pit River.

A second set is based at Drum Powerhouse on the Bear River above Auburn, from where high voltage lines climb the Sierra to a summit connection with power lines serving Reno. The third set will be stationed at Willits for service particularly on a line to Garberville that is subject to snow damage. Additional sets may be installed at other strategic points when more operating experience has been obtained.

P. G. and E. also is testing another type of electronic device intended especially for locating trouble on lower-voltage distribution lines directly serving customers. This device is not yet being commercially marketed.

An experimental set, one of the first half-dozen in the nation, is installed at the company's Kerckhoff Powerhouse in Fresno County. It is hooked to a 12,000-volt line from which numerous tap lines branch to serve rural and other customers over a wide area. Recently someone accidentally felled a tree across one of the tap lines. The location of the break was signalled instantly at the powerhouse and repairs were made quickly.

Expanding use of radio communication is an essential part in P. G. and E.'s constant effort to make electric service as nearly failure-proof as possible and reduce the length of interruptions that do occur because of accidents.

The company now has in operation 58 central radio stations which maintain communication with 717 radio-equipped service cars and trucks, including 18 Sno-cats which can skim over the top of snow, carrying personnel and materials for repairs. Walkie-talkie sets are carried by line crews afoot or traveling on skis and snowshoes. Licenses have been issued to the company for 20 additional base stations which are awaiting installation.

PALISADES CONTRACTORS use Caterpillar DW10 tractor and a John Deere-Killefer offset disk to scarify clay fill material during early construction of Palisades Dam near Irwin, Idaho. The dam involves some 14,000,000 cu. yd. of borrow. Progress in 1952 was described in *Western Construction* last December, included 430,000 yd. of this impervious material.

Everything you want in a road-builder

On the 35-mile access road to Dugway Proving Ground, in Utah, Olof Nelson Construction Co. used several kinds of "Caterpillar" equipment. But the machine that did much of the finishing work and helped complete the contract on schedule was a "Caterpillar" No. 112 Motor Grader.

Here are some of the features that make this unit an all-round road-building favorite:

1. *Every inch of it is "Caterpillar"-designed and built.*
2. *Weight, horsepower and speed are perfectly balanced for top performance.*
3. *Tandem drive assures constant power delivery and traction.*
4. *Mechanical controls provide instant, positive blade action in all conditions.*
5. *Constant mesh transmission makes shifting easy, fast and smooth.*
6. *Operator has a full view of the road, the blade and the job.*
7. *A complete range of blade positions gives the machine maximum versatility.*

The "Cat" No. 112 is built to handle every type of grader job from ditching, bank shaping and scarifying to oil mixing, fine finishing and maintenance. Get the full facts on this money-saving unit from your "Caterpillar" Dealer. He stands back of every machine he sells with genuine "Caterpillar" parts and reliable service.

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WESTERN CONSTRUCTION NEWS

FEBRUARY 1953 ®

American River rise halts channel work at Folsom Dam

CONCRETE PLACEMENT and other work in the American River "hole" at Folsom Dam were suspended for the winter on January 9 when the upstream cofferdam gave way and let the river come through. Two bents of a steel trestle being built across the channel were lost in the first rush of water, and D. E. Stinson, project manager, estimated their loss alone at $350,000.

Actually, work in the area protected by the 40-ft. cofferdam has been done "on borrowed time" since November 1. After that, floods in excess of diversion capacity (9,000 cfs.) are generally considered a normal occurrence. The two months of "bonus" time in the river channel were of particular value to the contractor, who had not been able to divert as early as first planned. As it turned out, nearly six months altogether were available for excavation and concreting in the river channel portion of the site. About 70,000 cu. yd. of concrete were placed during that period, some of it in areas well above high water, where the work will continue even now.

A close watch on the cofferdam as rains swelled the American River flow permitted the evacuation of men and equipment to be orderly. It also resulted in an alarm among residents downstream, who feared a wall of water might descend on them. Actually, the cofferdam was subject to considerable seepage, and final failure was surprisingly fast; but even so the water was not released in one great wave. The initial break was a local one, widening until it embraced the entire width of the cofferdam.

Damage at the power plant site against the right bank and just below the axis of the dam consisted of the loss of five cells of a cofferdam built there for the Bureau of Reclamation. The Bureau's operations at Nimbus Dam, a re-regulation structure 7 mi downstream, were not affected.

THE SEASONS are strikingly illustrated in these shots of the American River at Folsom Dam. Current photo (above) views site from a point below the powerhouse right after failure of the upstream cofferdam on January 9. Two trestle bents were lost along with five cells of powerhouse cofferdam at left. Photo of excavation last October (below) includes cofferdam in background for comparison.

Hells Canyon Dam again before Congress

FULL DEVELOPMENT of the power potential of the Snake River by the construction of a high storage dam, reservoir and power plant at the Hells Canyon site has again been recommended to the Congress by the Bureau of Reclamation.

The Hells Canyon Dam project is proposed for construction deep in the Hells Canyon through which the Snake River flows. The canyon and river form the boundary between Oregon and Idaho and the dam site is midway between Weiser and Lewiston, Idaho.

The dam would be about 740 ft high and would provide a storage reservoir with 4,400,000 acre-feet capacity. The power plant installed at the dam would have 900,000 kw. of capacity. With downstream benefits the project would add 1,124,000 kw. of prime power to the Columbia River system. Cost of the Hells Canyon dam and power plant is estimated at $356,810,000.

Authorizing legislation for Hells Canyon was introduced during the last Congress but hearings were not held until very late in the session.

BOTTLENECKS CHOKING YOUR PROFITS?

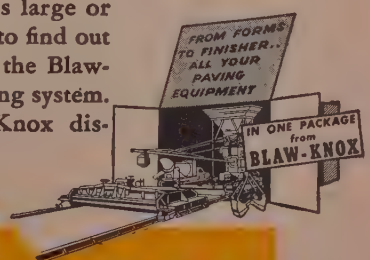
ONE-SOURCE advantages of the "PACKAGE" of concrete paving equipment

With one-source equipment, you have the advantages of one-source maintenance and repair service for *all* your equipment. There's no need to waste time and effort running down the parts or service you need . . . often one phone call to your Blaw-Knox distributor is all that's required, because one Blaw-Knox trained man can service *all* your package equipment. And when he services the machine that needs immediate attention, he can check over all the rest of your equipment to stop trouble before it starts. Preventive maintenance is standard practice when all your equipment belongs to one family. From your Blaw-Knox distributor you get prompt service on genuine factory-built parts as well as expert attention to your problems from men who are experienced on all kinds of construction work, who know "package" operation backwards and forwards and who are trained to help you get the most out of your equipment.

In addition, you get all these other one-source advantages . . . you get every piece of equipment you need *in a package to fit your specific job.* You get it all on one order, in one shipment, with just one financial contact, and backed by one reliable manufacturer who gladly assumes responsibility for the field performance of all your equipment.

When you bid successfully on a contract, your battle starts against weather, supplies and aggravating downtime. Blaw-Knox can't do anything about the weather, but when you use the Blaw-Knox "Complete Package" of equipment and service, you can be sure of licking profit-choking maintenance bottlenecks.

Whether your job is large or small, it will pay you to find out all the advantages of the Blaw-Knox "Package" paving system. Talk to your Blaw-Knox distributor today.



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BLAW-KNOX

Alaska C. of E. suggests bid invitation deposit

UP IN ANCHORAGE, the Alaska District of the Corps of Engineers is inaugurating a welcome policy whereby contractors, subcontractors, suppliers and other interested parties may place an annual deposit of $400 on a fiscal year basis, either in the Seattle Branch Office or the Anchorage Office, for the purpose of drawing plans and specifications without the necessity of placing an individual deposit for each set drawn. Moreover, it will not be necessary to initiate another deposit on July 1 because the present deposit will be transferred to the succeeding fiscal year. In that way the parties involved will be relieved of the necessity of securing individual funds in order to obtain plans and specifications on an individual deposit basis. Firms drawing from both Anchorage and Seattle will be required to place a deposit at each point. The provision of the bid invitations requiring the return of plans and specifications in good condition within 60 days after bid openings will remain in force on plans and specifications issued at either point against the annual deposit. In case the sets are not returned in time a reduction in the deposit will be made in the amount indicated for the specific case involved. This annual deposit is not required and does not affect individual bid invitations but it is intended to be a convenience for interested parties.

Those who now have plans and specifications drawn on individual deposits must return them under the present system since they will not be transferred to the annual deposit.

Better pre-register for the ASCE S. F. convention

CIVIL ENGINEERS of the West are urged to pre-register for the San Francisco Convention of ASCE to be held March 3, 4, 5, and 6. That's the latest word from San Francisco Section and its co-hosts, Sacramento and Hawaii sections. The technical program, the ladies' program, the excursions and social events have all been planned, and the responsible committees have now figuratively begun their trek to convention headquarters, the Fairmont Hotel on Nob Hill, where they will greet their fellow engineers at the first official gathering of the Society in its second century of activity.

Technical sessions will begin on Tuesday afternoon, March 3, and will continue the following afternoon, and will fill the entire day on Friday, March 6. Wednesday morning, March 4, is given over to general sessions, and Thursday to a series of field excursions. Altogether, 20 half-day technical sessions are planned involving 12 divisions: Air Transport, Construction, Power, Engineering Mechanics, Sanitary, Hydraulics, Structural, Highways, Irrigation, Soil Mechanics and Foundations, Surveying and Mapping, and Waterways.

There are now three field trips from which to choose: all-day excursions either to the Pittsburg steam plant being built for Pacific Gas & Electric Co., or to the supersonic wind tunnel under construction for the NACA at Moffett Field, and a half-day excursion to the Naval shipyard at Hunters Point.

Social events of the gathering are headed by the dinner dance scheduled for Wednesday evening, March 4, in the Gold and Nob Hill rooms of the Fairmont Hotel.

All program details for the convention and its accompanying events were published in the January issue of the Society's magazine "Civil Engineering." In addition, forms for pre-registration both for the convention itself and for hotel space were published (pages 88 and 90). Pre-registration will prevent confusion at the convention, and it is the only way to assure space at some of the limited functions—two of the excursions and the dinner dance.

Ladies' activities for the convention week are fully planned, and include tours to outlying areas of the San Francisco peninsula. Among the scheduled stops is one at the new suburban offices of "Sunset" magazine. Friday's feature will be a luncheon and aquacade at the Tonga Room of the Fairmont. Program headliners will be the famous Crystal Plunge swimming team and several Olympic Games performers.

The post-convention tour convenes in Honolulu on Tuesday, March 10. That day will be devoted to business and technical sessions, with three papers to be presented. The following day will be taken up on tours of natural and engineering features of the island of Oahu.

Wind-up of the official agenda will be a genuine luau arranged by Hawaii Section. Hawaiian entertainment will be provided, guaranteed to be authentic and of high quality. Wear your fanciest "aloha shirt" and bring ten dollars, the price for the entire evening, including dinner and "refreshments."

General chairman for the San Francisco Convention is L. A. Elsener. Carl A. Trexel is chairman of the Technical Program Committee. Presidents of the respective host sections are: J. G. Wright, San Francisco; Walter G. Schulz, Sacramento; and George C. Wallace, Hawaii.

RIGHT JOB . . . WRONG CONTRACTOR

When this picture of Big Cliff Dam in Oregon appeared on page 58 of our January issue, the caption under it erroneously "awarded" the contract for its construction to a joint venture of Guy F. Atkinson Co. and Ostrander Construction Co. We have since been reminded by Frederic L. Copeland, vice president of Bates & Rogers Construction Corp., that the work is actually being performed by Consolidated Builders, Inc. This firm is a joint venture of H. J. Kaiser, Kaiser Engineers, Walsh Construction Co., Utah Construction Co., Bates & Rogers Construction Corp., General Construction Co., Pacific Bridge Co., and J. F. Shea Co. Copeland adds that Atkinson and Ostrander "never had anything to do with this job except that they were the second bidder"!

you!

for 6 years, we've been calling our 186 hp, 19 mph rubber-tired tractor a Tournadozer...

this name may have suggested application to dozer work only.

We should have told you otherwise. Actually, over the years, this unit has proved to be much more than a dozer.

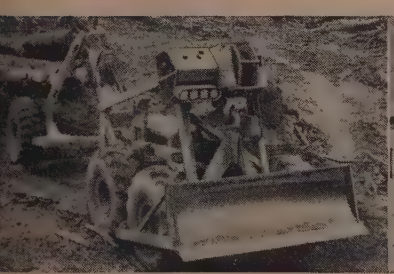
It's an all-purpose tool — just as effective as a pull-tractor, or a push-tractor, or a haul-tractor as it is a dozing-tractor. Its high speeds and fast maneuvering are of even greater advantage on hauling and pushing than on dozing where output requirements and range of operations are limited.

To clarify its many applications, we are re-naming the unit "Tournatractor". We are also revising our price lists to show our price for the tractor unit without the A-frame, blade, and blade controls, so that it will be directly comparable to crawler-tractor prices. On this basis, you will find you can buy a 4-wheel, high-speed, rubber-tired Tournatractor, FOB Longview, Texas, for only $18,840 (with 18.00 x 25 tires). You then can add the matched attachments you want.

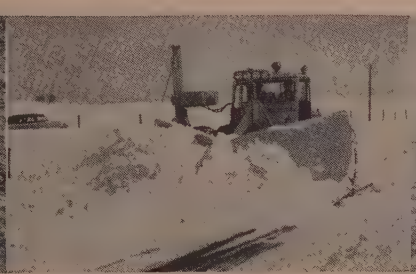
This price structure is similar to that charged for any big, heavy-duty crawler-tractor, but look at the money-making advantages you get with Tournatractor:

1. Power . . . 186 hp.
2. Anti-friction power flow, engine to treads.
3. Speeds forward — to 19 mph.
4. Speeds reverse — to 8 mph.
5. Instant speed change . . . constant-mesh transmission.
6. Go-anywhere, 4-wheel-drive on rubber . . . wider range of work and profit opportunity . . . no planking curbs, no trailer haul.
7. Electric fingertip control steer and shift . . . easier, faster maneuvering.
8. Giant safety air brakes . . . 2822 sq. in. on 4 wheels.
9. Low maintenance . . . elimination of some 500 crawler-track assembly parts that grind and wear in dirt on crawling tractors.
10. Easier operation, less fatigue, easier to get good operators.

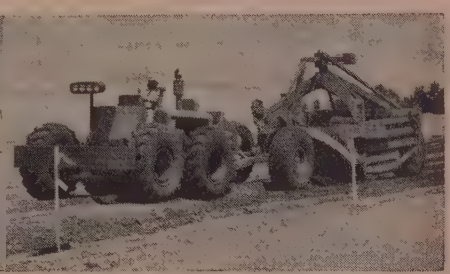
Investigate this rubber-tired tractor . . . it will do 85% of your tractor jobs *twice* as fast as a crawler. Ask your LeTourneau Distributor to arrange a demonstration and prove it on your job. Make your own comparison of production. You'll find the profits with Tournatractor too big to miss. Write or phone today.



67,000-LB. WINCH For skidding logs, pulling mired trucks, etc. Operates at 56 or 113 ft./min., in or out, while rig is in motion or stationary. Can pull from any angle up to 90°.



SNOW PLOW V-type. Mounts on same A-frame as Bulldozer or Angledozer. Has 12'4" clearing width, 6½' clearing height. 9' electric-control Snow Wing available as optional equipment.



FOR SCRAPER OPERATION Double electric PCU operates any cable-controlled scraper. For LeTourneau electric scraper, optional electric jack can replace PCU. Just "plug in" and go to work.

Tournatractor—Trademark Tournadozer, Angledozer—Trademark Reg. U. S. Pat. Off. T-313-G

Seattle, Washington ● **ROCKY MT. Mach. Co.**, *Pocatello, Idaho; Salt Lake City, Utah* ● **SIERRA Mach. Co., Inc.**, *Reno, Nevada* ● **WESTERN Construct. Equip. Co.**, *Billings, Mont.; Missoula, Mont.; Great Falls, Mont.*

R. G. LeTOURNEAU, INC.

Peoria, Illinois

Job accidents take their toll

THESE were the accidents that resulted in deaths on the West's construction jobs during December:

The first fatal job accident at The Dalles Bridge project in Oregon took the life of Arthur Ziesmer, 25. Ziesmer was standing near the edge of an excavation when the bank collapsed.

A freak accident on a pipeline job near Corinne, Utah, killed Milan Gutke, 27. Gutke and another worker employed by the Salt Lake Pipeline Co. were attempting to open a valve on the end of a pipe to clean a main line. Gutke was holding a 2-in. pipe about 2 ft. long in place against the valve while the other worker was hitting it with a sledgehammer. After one of the blows, the pipe flipped into the air and came down to strike Gutke behind the left ear, killing him instantly.

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

At Seattle, W. A. Burke, 32, a rigger, was killed when he fell 90 ft. from a ladder. The accident occurred during the dismantling of a water tower. A metal beam pulled free from the water tower by a crane struck Burke.

At Benicia, Calif., Buford Radons, 29, was crushed to death when his bulldozer toppled off a bank at a quarry. Two cranes were required to lift the machine off his body.

At Helena, Mont., R. T. Plouffe, 35, was electrocuted when the crane he was working on hit a high tension wire. Plouffe was on the boom guiding a cable which was being used to lift a marquee.

At Torrington, Wyoming, David W. Tolton, 29, Bureau of Reclamation employee, was electrocuted as he worked on the ground near a transmission line. Apparently, a piece of pipe conduit he was handling touched a fuse on a 33,000-volt circuit.

How about a vacation with pay?

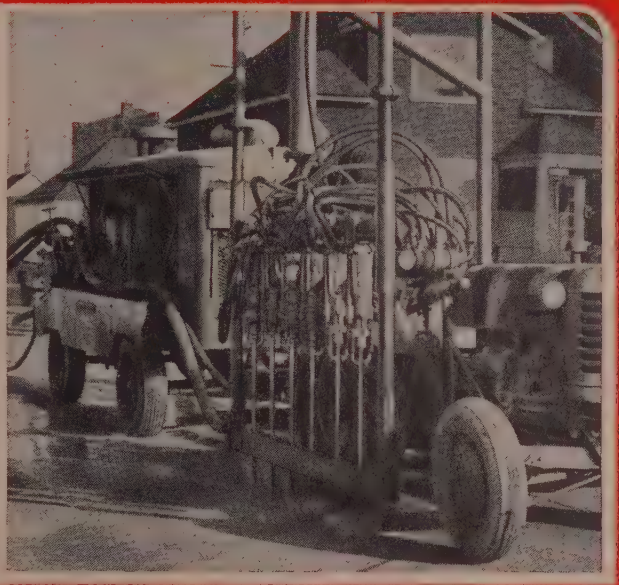
HERE'S A CHANCE to combine vacation with a paying job this summer. Construction jobs costing more than $2,000,000 are scheduled this year at Carlsbad Caverns National Park near Carlsbad, New Mexico, according to Park Superintendent R. Taylor Hoskins. Improvements to be built include two new elevators to hoist people out of the caverns at a rate of 1,440 per hour, and a new public use building.

GM DIESEL
CASE HISTORY No. 5211-4

USER: R.L. Coolsaet Construction Co., Dearborn, Mich.

INSTALLATION: GM Diesel-powered Ingersoll-Rand 600 cfm rotary compressor replacing a 500 cfm compressor, supplies air to a tractor-mounted multiple drill—six drills 12" apart.

PERFORMANCE: Previous Diesel compressor supplied 75 lbs. of air to each drill and took time to build up pressure after each move. GM-powered compressor supplies steady 95 lbs., starts drills immediately and saves 20% in fuel costs. Unit drills 600 lineal ft. per day.



NEW GM DIESEL-POWERED RIG CUTS PAVEMENT-BREAKING TIME IN HALF

R. L. Coolsaet figures his pavement-breaking time is cut right in half with this rig when compared to the old way with one man on each drill. Now he drills six holes at once—gets twelve holes drilled in six feet and moves up for the next series, all in three minutes, and one operator handles the job.

This is another good example of how General Motors Diesel-powered equipment gets work done faster and reduces costs at the same time. Two-cycle operation delivers a smoother, steadier flow of power—gives instant response to overcome sudden load changes. Simple design makes it easier to maintain—lower-cost parts make it cheaper to maintain. Add it up and you'll see why GM Diesels give you power at the lowest cost per horsepower hour—for *any* job.

DETROIT DIESEL ENGINE DIVISION
GENERAL MOTORS • DETROIT 28, MICHIGAN
SINGLE ENGINES . . . 16 to 275 H.P. MULTIPLE UNITS . . . Up to 840 H.P.

It pays to standardize on

GM
GENERAL MOTORS
DIESEL POWER

Write for booklet "A 50,000,000 Horsepower Insurance Policy" that tells you why.

Prestress design course begins at L. A. this month

TO GIVE A SERIES of lectures on design of prestressed concrete structures, T. Y. Lin, associate professor of civil engineering, University of California, Berkeley, will be in Los Angeles during February, March and April under auspices of University of California Extension.

The well-known civil engineer will lecture on consecutive Friday evenings, beginning February 27 from 7 to 9:30 and Saturday mornings from 9 to 11:30 at the University of California Extension Center, 813 South Hill Street.

Lin is chairman of the Committee on Bridge Loadings, ASCE, and chairman of the Advisory Committee on Stress Measurements on Bridges and Pavements, Institute of Transportation and Traffic Engineering, University of California. In the field of prestressed concrete, he represented the University of California while cooperating with the California Division of Highways on the testing of the Arroyo Seco prestressed bridge. He co-labored with Ellison and King, consulting engineers, in the design of the famed heavy prestressed girders for the Barrett-Lick Garage in San Francisco. He is author of a long list of publications in his field.

Information concerning the University Extension lectures is available on request to the Center (TUcker 6123) or U. C. L. A. (BRadshaw 26161) offices of Engineering Extension.

Map shows electric facilities in California

A NEW MAP has been published by the Federal Power Commission showing principal electric facilities in California. The map is the latest in a series covering 25 states and the District of Columbia. The California map, like others in the series, shows the location, capacity and ownership of important generating stations, both hydroelectric and fuel-electric, as well as the location, ownership, nominal voltage, length, conductor size, material and high voltage lines of 22,000 volts or more. Both existing facilities and those under construction are designated. The new map is reproduced in several colors on a scale of 20 mi. to the inch. It is approximately 44 by 22 inches in size. Copies of the California map may be purchased from the Publications Division, Federal Power Commission, Washington 25, D. C., for $1 each. The order number is M-37. Other maps in this series, also available at $1 per copy, are Washington (issued 1948); Arizona, Colorado, Wyoming, Utah, Montana, Idaho, New Mexico, Nevada and Oregon (issued 1949).

Northwest road men will get together this month

THE ANNUAL Northwest Conference on Road Building will be held at Oregon State College on February 26 and 27. Sponsored this year by the Oregon State College School of Engineering and the Student Chapter of the American Society of Civil Engineers, the conference will be directed by Martin P. Coopey, Professor of Civil Engineering and James L. Gray, Instructor in General Engineering.

The conference is an outgrowth of the Oregon State Roads and Streets Conference and the Northwest Conference on Road Building held annually at the University of Washington. Beginning last year, these two conferences were combined to be held each year at alternate campuses, Oregon State College and the University of Washington.

The program will feature nationally known experts in the fields of road construction and maintenance.

Finale at Canyon Ferry

THE FINAL major contract to complete construction early in 1954 of the Canyon Ferry Dam, power plant and switchyard on the main stem of the Missouri River, 17 mi. from Helena, Montana, has been awarded by the Bureau of Reclamation to Eiseman, Seabrook and Elliott, of Chula Vista, Calif., on a low bid of $694,183.50. The 220-ft. high concrete dam, with reservoir storage space for 2,050,000 acre-feet of Missouri River waterflow, will have a power plant of 50,000-kw. generating capacity.

Under the contract, work on the final stages of construction in the power plant will begin February 15, with the first of the three 16,660-kva. generators scheduled to produce power 300 days later; the second in 360 days, and the third in 420 days. Final stages of work on the switchyard will begin not later than July 15.

Major work features in the contract include the installation and testing of three 23,500-hp. hydraulic turbines and three 16,660-kva. generators in the power plant, erecting steel structures for switchyard and furnishing and installing heating and ventilating systems.

The turbines, costing $522,600, are being manufactured by the Newport News Shipbuilding and Dry Dock Co., Newport News, Va., under a Bureau of Reclamation contract awarded in January 1950.

The generators are being furnished by the General Electric Company, awarded the contract in December 1949, on a low bid of $887,074.

Construction began on the unit in the 1948 fiscal year, and work on the dam and power plant was begun in 1949. Total cost of the project is estimated at $29,036,000.

C. of E. has office at Castle Air Force Base

A NEW projects office to supervise its military construction work at Castle Air Force Base at Merced, California, Riverbank Ordnance Plant in Stanislaus County, and other projects in that area, has been established by the San Francisco District, Corps of Engineers, U. S. Army.

According to Colonel Henry Walsh, San Francisco District Engineer, the new office will be known as the Valley Projects Office. It incorporates the activities of the District's existing projects offices at Castle and at Riverbank. Headquarters of the new office will be at Castle AFB, Colonel Walsh said.

Walter J. Campbell, who for the past year and a half has supervised the Corps' rehabilitation and construction program at the Riverbank Ordnance Plant, has been designated by Colonel Walsh as Valley Projects Engineer. Personnel of the Riverbank and Castle field offices are being transferred to the new unit.

CALENDAR OF MEETINGS

February 17-19 — American Concrete Institute, annual convention, at Statler Hotel, Boston.

February 23-26—National Sand & Gravel and National Ready Mixed Concrete Associations, annual conventions, at Fairmont Hotel, San Francisco.

February 25-28—American Concrete Pipe Association, annual convention at Baker Hotel, Dallas.

February 26-27—Northwest Conference on Road Building, meeting at Oregon State College, Corvallis.

March — Arizona Chapter, AGC, annual meeting at Westward Ho Hotel, Phoenix.

March 3-6—American Society of Civil Engineers, national convention, at Fairmont Hotel, San Francisco.

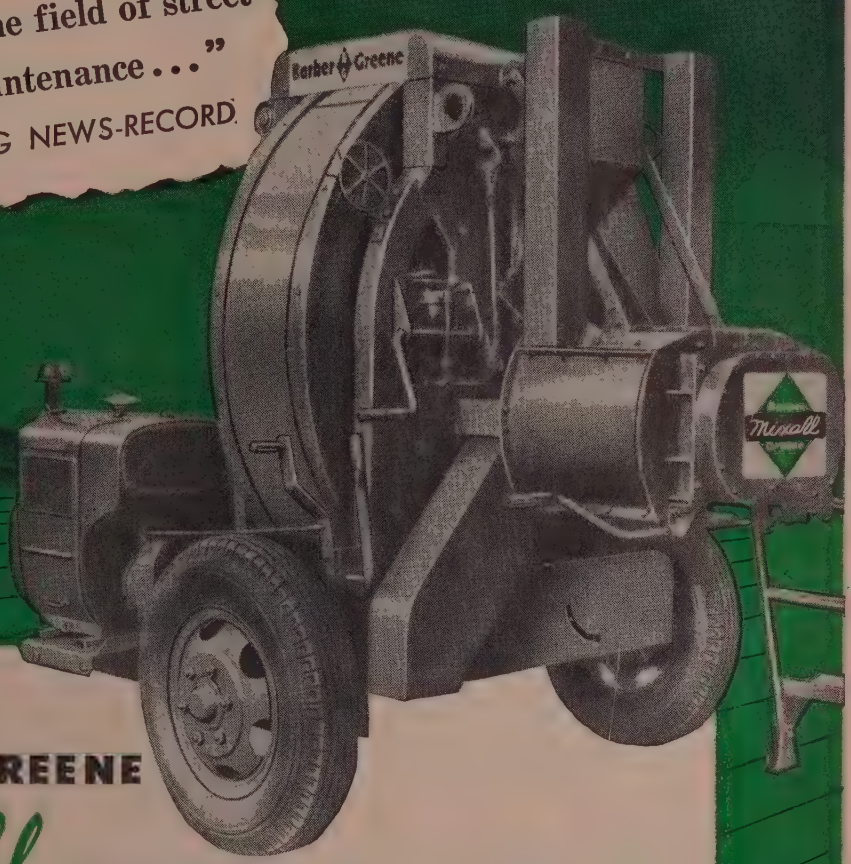
March 23-28—Associated General Contractors, 34th annual convention, at Miami, Florida.

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

1954

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

"Undoubtedly the most significant development in the field of street and highway maintenance . . ."
—ENGINEERING NEWS-RECORD



Barber-
Mixall
Greene

THE NEW BARBER-GREENE Mixall MEETS THE NEED FOR ALL MAINTENANCE AND SMALL PAVING JOBS

The quotation at the top of this page is typical of impartial observers who have seen the new Barber-Greene MIXALL perform. There is widespread agreement among editors, road builders and government officials that the need for a machine capable of on-the-spot production of even the highest type hot mixes has been answered by the development of the MIXALL.

Primarily designed for "stitch in time" maintenance to prevent major break-ups of much needed roads, the MIXALL also opens the market for surfacing of sidewalks, driveways, parking lots, service stations, playgrounds and countless others.

Once you see the MIXALL perform, you'll quickly recognize the business-building possibilities it holds for you. See your Barber-Greene Distributor for the full story—or write for information.

B-G Redi-Fab Series Sectional Truss Belt Conveyors

IN STOCK — IMMEDIATE DELIVERY

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5030 First Avenue, S.
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Kimball Equipment Company
222 West 17th South
Salt Lake City 10, Utah

See your Local Distributor: BROWN-BEVIS-INDUSTRIAL EQUIPMENT CO., Los Angeles 58, California; COLUMBIA EQUIPMENT CO., Spokane, Washington, Seattle, Washington, Boise, Idaho, Portland 14, Oregon; WILSON EQUIPMENT & SUPPLY CO., Cheyenne, Wyoming, Casper, Wyoming; CONTRACTORS EQUIPMENT & SUPPLY CO., Albuquerque, New Mexico; RAY CORSON MACHINERY CO., Denver 9, Colorado; JENISON MACHINERY CO., San Francisco 7, California; WESTERN CONSTRUCTION EQUIPMENT CO., Billings, Montana, Missoula, Montana; KIMBALL EQUIPMENT COMPANY, Salt Lake City 10, Utah; STATE TRACTOR & EQUIPMENT CO., Phoenix and Tucson, Arizona.

ENGINEERS ON THE MOVE

The appointment of **Cmdr. William E. Parker** as city engineer was approved by Seattle's City Council on the first of the year. The post was filled temporarily by **Robert Hubbard,** who replaced **Ralph W. Finke** who resigned last November.

* * *

J. D. McCoy, assistant project engineer on the San Diego Aqueduct's second barrel, has won the Bureau of Reclamation's rarely-given superior accomplishment award. Spokesman for the Bureau, **E. G. Nielsen,** director of Region 3, explained that "Mr. McCoy's work in connection with preconstruction surveys and collection of design data which preceded the start of construction . . . was the key to the rapid progress which has been made on this project." McCoy, then area planning engineer at Escondido, began the preconstruction surveys in November 1951 aided by only three employees. With this small group, one which reached a maximum of 15 employees, he completed the work and forwarded the results to the design office rapidly enough to permit bid openings for the first section last August 22, and the last section on November 20. McCoy joined the Bureau in November 1938.

McCoy

Berrigan

Col. Paul D. Berrigan has been assigned Division Engineer for the South Pacific Division, Corps of Engineers, succeeding **Col. Donald S. Burns** who goes to a European command. Col. Berrigan's first assignment was with the 3rd Engineers in Hawaii, where he served from 1927 to 1930. Since 1951 he was assigned to the Office of the Joint Chiefs of Staff in Washington, D. C., as Army Assistant Director, Joint Logistics Plans Group.

Col. Berrigan's new responsibilities will include the Corps of Engineers' military and civil works construction in California, Arizona, Nevada, Utah and the Territory of Hawaii, plus the civil works construction in those areas of Wyoming, Colorado and New Mexico where the watersheds drain into the Pacific Ocean, and the Klamath River basin of Oregon.

* * *

Audley C. Butler, since 1927 superintendent of Horse Mesa Dam, Ariz., recently retired.

* * *

A California highway construction employee **Milton F. Masters** has been transferred from District 7 to District 5, with headquarters in San Luis Obispo. Masters was resident engineer in District 7 and now is construction engineer at his present appointment.

* * *

Among various changes at Southern Pacific Co., **William M. Jaekle** holds the newly-created position of assistant chief engineer. Jaekle, formerly assistant engineer, maintenance of way and structures, will continue to maintain headquarters in San Francisco. He is succeeded in his former position by **Harry M. Williamson,** who had been division engineer at Portland, a vacancy now filled by **Godfrey J. Lyon.** Two other newly created positions are filled by **Roy B. Chapman,** general superintendent, maintenance of way shops and equipment, and **Joseph A. Holmes,** construction engineer. Both headquarters are in San Francisco. Other appointments are: **Victor R. Cooledge,** formerly of structural design, now engineer of bridges, and **Shirley White** who is now general bridge and building supervisor.

* * *

H. L. Vosse is heading the planning and scheduling department as new department engineer at Kaiser Engineers, Inc., Richland, Wash. Vosse previously had been resident engineer for the Corps of Engineers at the Utah General Depot, Ogden.

* * *

Flood Control Engineer **J. A. Bradley** recently resigned from his post in Orange County, Calif.

* * *

Harold C. Schwalen, Professor of Agricultural Engineering at the University of Arizona, has been elected president of the Arizona Section, American Society of Civil Engineers. Other officers are: **Dario Travaini,** first vice president; **Hanen H. Williams,** second vice president, and **Wilbur L. Heckler,** secretary-treasurer. **J. A. Rau,** retiring president, was named as director. These new officers officiated over the Chapter's membership at a joint meeting in Phoenix on February 6 with the American Welding Society, the host, and the American Institute of Architects. This joint meeting whereby an engineering technical society officially meets with societies in other technological fields is said to be one of the first of its kind in the United States.

Schwalen

Kimball

Stanley Kimball, pictured above, recently has been named assistant resident manager at the Hanford, Wash., plutonium works by Kaiser Engineers Division of Henry J. Kaiser Co. He formerly had been chief construction engineer responsible for joint-venture heavy construction activities at Kaiser Engineers' headquarters in Oakland, Calif. Kimball, a native of the state of Washington, received a degree in civil engineering from Stanford University in 1924. He joined Kaiser at Bonneville Dam in 1934 and moved to Oakland in 1938. Some of the well-known Kaiser projects on which he has been a major figure are, a concrete pier job at Mare Island Navy Yard and the Kaiser Richmond Shipyards.

* * *

State Engineer of California **Arthur D. Edmonston,** has attained life membership in the American Society of Civil Engineers. Edmonston graduated with a degree in civil engineering from Stanford in 1910. In 1924 he became a State employee as engineer in charge of investigations and preparation of reports on the water resources of California. He was directly in charge of the State Water Plan and plans for the Central Valley Project, and California's largest water project, the Feather River Development, owes its inception to him.

* * *

British Columbia reports that **R. A. Hall** of Dawson & Hall, Ltd., Vancouver, has succeeded **J. E. Amundson** as president of the General Contractors' Association of British Columbia. **A. J. Hutchinson** of Mutual Construction Co., Ltd., and **L. J. Bennett** of Bennett & White Construction Co., Ltd., are the new vice presidents. **E. D. Allan, A. J. Armstrong, J. T. Auld, H. H. Johnson, K. A. Matheson, R. C. Pybus, J.**

HOW TO BUILD A PARKING LOT FAST

This busy Caterpillar Diesel HT4 Shovel is clearing land in a hurry for an Ohio Bell Telephone Company parking lot in Cleveland. Contractor is Henry Miesz of South Euclid, Ohio.

The versatile Cat Shovel can get in and out of places bigger specialized equipment can't touch. Because its bucket is wider than any part of the tractor, it works close to walls and trees. The operator enjoys perfect visibility, too: all hydraulic connections are completely enclosed—no hoses or plumbing to interfere. It's a fast shovel . . . one that can raise and dump its bucket at the same time.

There's plenty of strength built into this machine, too. Its frame and mounting and lift arms are all welded and cross braced. The bucket has a heat-treated high carbon steel cutting edge. And there are 11,250 pounds of push at that cutting edge.

Like all Caterpillar machines, this shovel is a rugged, dependable, economical piece of equipment. Your Caterpillar Dealer will gladly demonstrate its advantages. He's the man to see, too, for service and for the genuine Caterpillar parts which guarantee you the kind of quality that's built into every one of these big yellow machines.

CATERPILLAR TRACTOR CO., SAN LEANDRO, CALIF.; PEORIA, ILL.

CATERPILLAR

REG. U. S. PAT. OFF.

DIESEL ENGINES
TRACTORS • MOTOR GRADERS
EARTHMOVING EQUIPMENT

Tucker and **T. A. Turnbull** are members of the board of directors.

* * *

Howard Payne, on leave from the Bridge Dept. of the California Division of Highways to study for a Master's degree in civil engineering at the University of Washington in Seattle, has been awarded the Daniel W. Mead prize for Juniors for his essays on ethics. Payne is a Junior member of the Sacramento Section of the ASCE.

* * *

H. Loren Thompson of Stevens & Thompson Engineers, Portland, has been elected president of the Oregon Section, American Society of Civil Engineers. Other new officers are: **Kenneth N. Phillips**, first vice president; **Gordon L. Burt**, second vice president; **Robert M. Bonney**, secretary, and **Robert T. Mercer**, treasurer.

Thompson *Buell*

A. M. Buell, assistant bridge engineer for the Washington State Highway Commission, has been elected president of the Tacoma Section, American Society of Civil Engineers. **H. J. Whitacre** is vice president and **G. H. Andrews** is secretary-treasurer.

* * *

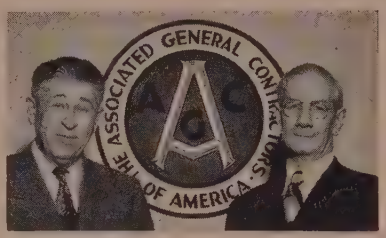
Election results of the Los Angeles Section of the American Society of Civil Engineers put **Trent R. Dames**, senior partner of Dames & Moore, in the presidental chair for 1953. Vice presidents will be **Stephenson B. Barnes**, structural engineer, and **John M. Server, Jr.**, editor-in-chief of *Southwest Builder and Contractor*. **C. Martin Duke**, associate professor of engineering at U. C. L. A. will be secretary. The treasurer, **John C. Merrell, Jr.**, has served the first half of a two-year term. President of the Junior Forum is **Richard C. (Dick) Gerke**, sales engineer for Bethlehem Pacific Coast Steel Corp. **Harold A. Halldin** and **Hugh C. MacDonald, Jr.**, are vice president and secretary-treasurer, respectively.

* * *

President of the Seattle Builders & Contractors Association for 1953 will be **Axel Thornberg**, who succeeds **Hans Floathe**. Other new officers are: **Herbert Dohl**, vice president; **D. A. Kiehlbaugh**, secretary; **Gordon Johnson**, treasurer, and **Lee M. Cannon**, executive vice president. Floathe, **Bernhard Dahl** and **H. E. Forsman** are the Association's new directors.

* * *

New officers of the Northern California Chapter, Associated General Contractors, are as follows: **Dallas**



Dallas Young* (left) and *H. C. Maginn
(see item below)

Young, president; **H. C. Maginn**, vice president, and **Ben C. Gerwick, Jr.**, treasurer. Directors are: **Gordon Ball, Ralph W. Brown, E. L. Clements, John Delphia, Ben C. Gerwick, Jr., Charles L. Harney, A. E. Holt, Jack How, Peter Jacobsen, H. C. Maginn, John F. O'Connell, Gordon Pollock, Felix Siri** and **Dallas Young**.

* * *

Hugh A. Martin, Marwell Construction Co., Ltd., was elected president of the Road Builders and Heavy Construction Association of British Columbia. First vice president is **J. E. R. Wood**, Vancouver construction engineer, and second vice president is **Carl Anderson** of Emil Anderson Construction Co.

* * *

Robert L. Davis, a veteran on the Union Pacific's engineering staff since 1917, retired from his position as office engineer for the railroad's Spokane subdivision.

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Parker D. Shepperd, a Denver civil engineer and registered surveyor, has been forced to retire from business because of blindness. Among his most important work was the preliminary design and estimate on the Grand Lake water diversion project, and, in conjunction with the USBR, the design of the first superelevation of outside curves for mountain highways. Shepperd, 70, sold his business to **E. L. Shaw**, registered surveyor.

* * *

George Thenn joined the staff of the earthquake section of the Pacific Fire Rating Bureau in San Francisco early in December. He will work under the direction of **Karl Steinbrugge** there. Thenn's prior connection, for two and a half years, had been with **Robert D. Dewell**, San Francisco consulting civil engineer.

* * *

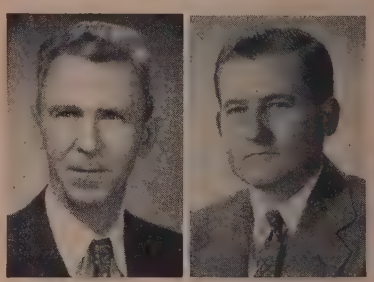
The Corps of Engineers has appointed **Edwin Jay Burke** project engineer for its Clovis Project office of the Albuquerque District. Clovis Project is a multi-million dollar program which will begin at Clovis Air Force Base as soon as an award is given for the initial work. Burke, who graduated from the University of New Mexico in 1949, had been construction engineer at White Sands Proving Ground since 1950.

* * *

The Structural Engineers Association of California has elected its officers for 1953. **John Rinne** is president, **Jack Barrish** is vice president, **Les Graham** is secretary-treasurer, and **John Gould** is a new director.

* * *

George Arthur Sedgwick is the newly-elected president of the Structural Engineers Association of Northern California. Since 1946 Sedgwick has been in charge of structural engineering design with W. P. Day & Associates of San Francisco. Other new officers are: **Michael V. Pregnoff**, vice president; **John M. Sardis**, secretary; **William K. Cloud**, treasurer, and **Robert P. Moffett**, assistant secretary and assistant treasurer. **Robert D. Dalton, Robert D. Dewell, William H. Ellison, John J. Gould** and **J. Albert Paquette** are directors.



Sedgwick *Brown*

W. D. Brown was unanimously elected 1953 president of the Seattle Chapter, Associated General Contractors at its annual meeting on December 9. Brown, general manager of Howard S. Wright Co., previously served as the Chapter's vice president, treasurer, and as a member of the executive board. Other officers elected were: **Olav Boen**, first vice president; **Paul Odegard**, second vice president; **Ray Strand**, secretary, and **Don Clark**, treasurer. These officers will serve on the executive committee with **O. B. Daniels**, immediate past president; **George Teufel**, chairman of the labor committee, **Fred Ness** and **Gordon Mowat**.

* * *

William C. Cassidy, a civilian employee of the Corps of Engineers since 1929, was named a member of the United States Committee of the International Commission on Large Dams. He has been Chief of the Hydraulics Branch in the engineering division of the South Pacific Division of the Corps of Engineers since 1945, and was responsible for studies in connection with the design of eight

dams in the Sacramento District, among them Pine Flat Dam and the Folsom Project. The International Commission on Large Dams promotes research and collects experience in regard to technical problems connected with the design, construction, maintenance and operation of large dams by means of the arrangement of congresses and the publication of scientific documents. Its membership is composed of National Committees, not of individuals, and the central office is in Paris.

DEATHS

James Herbert Warner, 68, retired civil engineer for the Bureau of Reclamation for 22 years, died January 3 at his home in San Jose, Calif. He had been resident engineer on construction of Seminoe Dam in Wyoming and Friant Dam in California.

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Laurance D. Viole, 56, a civil engineer and designer of more than 150 churches and schools in the Los Angeles area, died Dec. 31 in Burbank, Calif.

* * *

Joseph Allison Eller, 71, retired National City, Calif., building contractor, died Jan. 5 in Escondido, Calif.

* * *

Wilburn H. Irish, 56, supervising highway engineer for the California Division of Highways, died Dec. 12 in Grass Valley, Calif. Irish was a major figure in the development of the Los Angeles freeway system, having had charge of highway and freeway location in that area from 1933 to 1947.

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Tim A. Leach, 52, member of Leach Brothers Construction firm, Douglas, Wyo., died Dec. 9 in Cheyenne.

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Herbert L. Cooper, 63, retired California state highway maintenance engineer, died Dec. 29 in an automobile accident near San Ardo, Calif.

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William M. Thomas, 57, retired engineer with the California Division of Highways, died Jan. 1 in Red Bluff, Calif.

* * *

George A. Gray, 51, division engineer for the Great Northern railway at Whitefish, Mont., died Jan. 1 at Whitefish.

* * *

Raymond E. Gauthier, 43, district engineer for Bethlehem Pacific Coast Steel Corp.'s Fabricated Steel Construction Div., Alameda, Calif., died in late December.

SUPERVISING THE JOBS

Construction of the Garvey Reservoir for the Colorado River Aqueduct Distribution System in Monterey Park, Calif., is under a $3,143,695 contract for Morrison-Knudsen Co., Inc., and R. A. Westbrook. **R. A. Westbrook** is heading the job as project manager and **D. J. Westbrook** is superintendent. Other key men are: **B. F. Shultis,** excavation superintendent; **F. J. Alford,** master mechanic; **T. J. Hopper,** office manager, and **D. D. Kaun,** engineer.

OWEN J. DALY, pictured above, is project manager on construction of Idaho's Lucky Peak Dam, an earthfill barrier to be used for both irrigation and flood control.

Robert O. McPhee is superintending construction of a $151,434 prestressed concrete water storage tank in Loveland, Colo., for James B. Kenney, Inc. **K. M. Shaddy** is concrete superintendent and **Robert Harvey** is timekeeper.

* * *

The Dominguez underpass under construction by Webb & White at Long Beach, Calif., is supervised by **Jim Peckinpaugh. Don Smith** is grade foreman and **Bill Oglesby** is truck foreman on this $1,555,929 job. **H. K. Mauzy** is resident engineer for the state. The work is scheduled for completion in the summer of 1954.

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E. H. Hatch is project manager for a Walsh Construction Co. contract for tunnel construction going on near Big Bend in Shasta County, Calif. **L. E. Huntington** is general superintendent, assisted by **O. L. Allen, Wayne W. Welmoth** and **G. W. Herd.** Also on the job are **R. W. McAvoy,** master mechanic; **R. C. Schultz,** chief electrician; **W. F. Logan,** office manager; **R. G. Miller,** project engineer; **K. K. Thomason,** purchasing agent; **J. C. Hester, G. Delp** and **A. E. Wilmoth,** shift foremen, and **John D. Sharpe,** first aid.

* * *

Davis Monthan Air Force Base, Tucson, Ariz., is the site of runway construction nearing completion by John Huggard. On the job are: **F. G. Ray,** equipment superintendent, **Ray Burton,** oiling superintendent, **Jim Schibley,** compaction foreman, and **Frank Schmieder,** office manager.

* * *

Three contracts totaling $4,700,000 are under way for construction of the Colorado Freeway bridge and approaches, Pasadena, Calif., by Guy F. Atkinson Co. **Bob Boyd** heads the work in the capacity of project manager. **Paul Paulson** is general carpentry superintendent for two of the contracts, and **Ray McLellan** holds the same position on the other job. **Brick Marsh** is project engineer, and **Claude "Duke" Fowler** superintends excavation. Carpentry foremen are **Frank Brundage, Dick Hellier, Owen McLeod, Frank Bartley, Arthur Mauther** and **Troy Boles.** Others at work are: **Ermitt Baker,** structure foreman; **Herbert Young, Marino Frati** and **Lowell Kennedy,** labor foremen; **Pete Schalaba,** cement finishing foreman; **Don G. Snyder,** office manager; **Edward Fitzpatrick,** timekeeper, and **Murray Harris,** office clerk. **Robert Lendecke** and **Lewis Steele** are resident engineers for the state. Pipe line subcontractor is Heisler & Woods, who is represented by **Lee Woods,** general superintendent, and **Ed Hanks,** job superintendent.

* * *

Joe Ornelas is superintending construction of the Riviera Club in Gardena, Calif., and **Gerald Jones** is carpenter foreman.

* * *

Angier School, San Diego, is being built at a cost of $500,000 by L. C. Anderson Co. under the supervision of **Ed Shelstead.** Carpentry foremen are **Boyd Poe, Reiny Gangwich** and **Lewellyn Perry. John Carolan** is labor foreman.

* * *

Chris Larson, project manager for all contracts for Golden Construction Co., is heading work at Point Loma, Calif., where a naval electronics training center is going up. **Art Vitus** is general superintendent, **Bob Saunders** is job superintendent, and **W. E. Bennett** is form detailer. This job is expected to be finished next summer.

* * *

Robert Helen is area manager for Healy-Tibbitts Construction Co.'s $2,000,000 contract for the Santa Ana outfall sewer at Newport Beach, Calif. General superintendent is **R. H. Smith** and foremen are **Barney Bissett, Red Workman** and **Harry Digby. Lee M. Nelson** represents the Orange County Sanitary District.

* * *

Jim Hastings, formerly assistant superintendent for Allison-Honer Co.'s contract for Riverside (Calif.) School for the Deaf, is now superintendent for that company and Cox Bros. Construction Co.'s work at Camp Las Pulgas, part of their contract at Camp Pendleton.

ON LOCATION near Irwin, Idaho, are (left) *Carl K. Miller,* superintendent, and *L. D. Burr,* master mechanic on rock and gravel operations for R. E. Rush Construction Co.

Jack Adams is superintendent for R. M. Price Co.'s $500,000 contract for the Compton Creek bridge in Long Beach, Calif. Foremen are **Ed Hayes,** carpentry; **Earl McClellan,** labor, and **Jack Davis,** steel. **H. K. Mauzy** is resident engineer for the state. The job will end some time this month.

* * *

B. W. Horn, project manager; **Newell Jensen,** superintendent, and **Charles Hamilton,** assistant superintendent, are heading construction of a hydroelectric plant on the All American Canal west of Yuma, Ariz. **J. H. Stockton** is pipe foreman and **E. L. Ashby** is iron worker foreman. Pettifer-Clark & Horn holds the contract.

* * *

Construction of Sequoia Junior High School in Fresno, Calif., is directed by **A. A. Hedstrom,** project manager for the contractor, Harris

Load lines and boom lines on this 20-ton truck crane show some of the work Tiger Brand Wire Rope does for MacRae Bros. Contractors, Seattle. Rigged with 110′ of "stick", the crane is moving steel "re-bars" onto Seattle's Alaskan Way Viaduct. Despite steady work on all types of jobs, its load lines last over a year apiece, boom lines about 6 weeks each under constant booming.

Smoother spooling under all conditions is one reason the crane's 5/8″ Tiger Brand lines give such long service, says Operator P. S. Moran, right. Besides working with a hook rig on the $9 million viaduct project, the crane is used as a clam shell and drag line, and for pavement breaking and pile driving service.

Free performance-record forms, available from your distributor to help you check rope costs, are here shown by a Tiger Brand Representative to Job Supt. Ed Ausnes, left, who says: "We use Tiger Brand Wire Rope on all 14 of our truck cranes. It gives us long, dependable service on any job, helps us keep costs down."

MacRae Bros. keeps costs down with Tiger Brand Wire Rope!

For any construction job you handle, rely on tough American Tiger Brand, the wire rope that's rigidly controlled by United States Steel from raw ore to finished product. To get all the stamina engineered into it, you're welcome to the services of a Field Specialist. Contact your local distributor or write Columbia-Geneva Steel, Room 1403, Russ Building, San Francisco 6.

USS

U·S·S TIGER BRAND Wire Rope

Columbia-Geneva Steel Division, United States Steel Corporation, San Francisco

UNITED STATES STEEL

THE FAMILY of **Elmer J. "Bob" Hallead** wishes to locate him. Hallead has been missing since November 17, 1952, at which time he was employed by Stone & Webster as an "electrician's welder" on work at Rock Island Dam, Wenatchee, Washington.

Hallead is described as 5 ft., 7½ in. tall, 46 yr. old, weighing 128 lb. He has dark brown hair, medium complexion. He is the worrying type—always in a hurry. He was driving a light green 1940 Studebaker Commander 4-door sedan, Washington plates, at the time of his disappearance. He carries Social Security No. 710-16-5902.

Anyone knowing where Hallead is working should contact Mrs. Gwendolyn Hallead, Route 5, Wenatchee, Washington.

Construction Co., Inc. **Wayne Hayes** is general superintendent and **E. C. Smallin** is job engineer. Carpentry foremen are **Harold Kincade, F. D. Westcott** and **C. C. Craig.** Swartz & Hyberg, the architects, are represented by **Byron Brodrick.**

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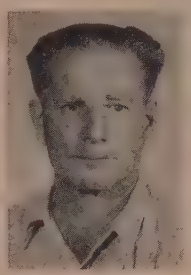

***Ralph Wigle,* superintendent for Claude C. Wood Co. (see item below)**

Ralph Wigle, pictured above, is supervising at two California jobs for Claude C. Wood Co. He is assisted by **Orville O'Rielly** at a commercial rock plant at Clements, and **George Addler** is plant foreman; **Walter Clay,** hot plant foreman; **Frank Gaskell,** batch plant superintendent; **Ralph Miller,** master mechanic; **Harry Richards,** truck foreman; **Harold Baker,** purchasing agent.

Wigle's other job is grading and surfacing from Jackson to Mokelumne Hill. There his assistant is **George Whilby,** and **Everett Welby** is office manager. This latter work was expected to be completed at the end of 1952. Wigle, we are happy to report, has been a subscriber to *Western Construction* for 18 years.

* * *

Work on a new plant going up in Torrance, Calif., for Dow Chemical Co., is headed by **Wayne H. Cox,** superintendent for Bechtel Corp., which has the million-dollar contract. Cox's assistant is **C. R. Cullar. John Cullar** is carpenter foreman; **Wayne**

Reed, cement foreman; **Max Taft,** labor foreman; **William Schellhase,** engineer, and **Dean F. Turner,** office manager. **Lyle Wainwright** is representing Dow Chemical Co.

' ' '

D. A. Parrish & Sons Sewage Engineering, Stockton, Calif., is headed by **M. A. Parrish,** president. **R. L. Bartell** serves as construction superintendent, and **John Day** is estimator, **Bernie Bassett** is dispatcher, **Rex O'Neal** is office manager, **Bud Jensen** is master mechanic, and **Ed Porter** is timekeeper.

AT WORK on Stockton, Calif.'s sewage disposal plant is *E. W. Tuttle* (top left), superintendent for Fred J. Early, Jr. Co., and *Terry Shipman,* representative of J. D. O'Brien, rigging and crane contractor. *G. M. Sumsted* (above) is assistant superintendent for Early.

Reconstruction work on some of the earthquake damage in Bakersfield, Calif., is being done by G. A. Phares, General Contractor. **Scott Woodard** is superintendent and **Audie Woodard** is foreman on remodeling the city hall annex. **Johnny Johnson** superintends work on the Noriega court house, and **Carl Phares** superintends work on the Ray Lobre store.

' ' '

T. J. Foley of T. J. Foley & Sons is heading his company's reconstruction work on the Lan Building in Bakersfield.

' ' '

Russell Wise is supervising road construction at Yuma, Ariz., for Tanner-Heuser & Garnett. Foremen are **Don White, Lyle Fish** and **E. O. Willis. Kenneth King** is office manager for this $500,000 job.

' ' '

Lindgren & Swinerton, Inc., has a $1,300,000 contract for building additional factory space for Crown Willamette Division of Crown Zellerbach Corp. in East Los Angeles. **Gus Klammer** is job superintendent and **F. C. Harp** is general superintendent.

CONTRACTS

Summary of bids and awards for major Western projects

Alaska

$1,136,195—**Baker & Ford Co.,** Bellingham, Wash.—Award for airmen's dormitories, Ladd Air Force Base; by C. of E.

$1,453,000—**Boen-Koon Construction Co.** and **Egge-Cummins Construction Co.,** Seattle—Award for an automotive maintenance facility, Ladd Air Force Base; by C. of E.

$350,000—**Kuney-Johnson Co.,** 235 9th Ave. No., Seattle—Low bid for Fairbanks communication station; by C. of E.

$908,005—**Lease & Leigland** and **M-B Contracting Co.,** 1501 N. 35th St., Seattle—Low bid for two organizational maintenance shop buildings, Ft. Richardson; by C. of E.

Arizona

$1,214,090—**Daum-Donaldson Construction Co.,** 321 S. 24th St., Phoenix—Award for state tuberculosis hospital and senile wards, Phoenix; by State.

$254,001—**Fisher Contracting Co.,** P. O. Box 4035, Phoenix—Award for additional sedimentation and filtration basins, with supplemental chlorination and pumping equipment for Yuma water treatment plant; by Arizona Public Service Co.

$239,448—**Fisher Contracting Co.,** Box 4035, Phoenix—Award for taxiways and electrical installations, Sky Harbor Airport, Phoenix; by City.

$1,682,675—**Peter Kiewit Sons' Co.,** 345 Kieways Ave., Arcadia, Calif.—Award for earthwork, conc. lateral lining and structures, unit 3, Mohawk Distr. System, Gila Project; by USBR.

$122,701—**Kolob Construction Co.,** P. O. Box 1832, Phoenix—Low bid for a 4-span steel girder bridge over Dripping Springs Wash 11 mi. north of Winkelman, plus 1 mi. approach highway; by St. Hwy. Dept.

$224,757—**Royden Construction Co.,** P. O. Box 3707, Phoenix—Low bid for an overpass structure and approaches on Tucson-Benson hwy. 3 mi. east of Benson, Cochise County; by St. Hwy. Dept.

$124,300—**Western Constructors, Inc.,** P. O. Box 1604, Phoenix—Low bid for a 5-span steel girder bridge and approaches crossing Aravapai Creek 11 mi. south of Winkelman; by St. Hwy. Dept.

$254,200—**Young & Smith Construction Co.,** Beason Bldg., Salt Lake City, Utah—Award for repair or removal and replacement of damaged unreinf. conc. lining for Wellton-Mohawk canal, Gila Project; by USBR.

California

$1,050,640—**P. & J. Artukovich,** 13305 S. San Pedro, Los Angeles, and **M. Miller**—Low bid for sewer and water system, Kearney Mesa Improvement District, San Diego; by City.

$3,258,046—**T. C. Bateson Construction Co.,** Lovefield Station, Dallas, Tex.—Award for hangar and parking areas, Castle Air Force Base; by C. of E.

$13,000,000—**C. F. Braun & Co.,** 1000 S. Fremont Ave., Alhambra—Award for synthetic ammonia plant, Brea; by Brea Chemicals, Inc.

$267,660—**R. Flatland,** 1205 Harrison St., San Francisco—Low bid for Mission District traffic signal system, San Francisco; by City.

$401,985—**J. B. Gill Co.,** P. O. Box 851, Long Beach—Low bid for Schedule B, steam generation and distribution, Norton Air Force Base; by C. of E.

$140,585—**M. H. Golden Construction Co.,** 3485 Noell St., San Diego—Award for widening drainage, roadway and electrical construction, North Island Naval Air Station; by U. S. Navy.

$407,805—**Gould & Cross,** 636 Quay Ave., Wilmington—Low bid for 15-m.g. underground reinf. conc. reservoir, Inglewood; by City.

$4,800,000—**Grove, Shepherd, Wilson & Kruge,** 2 Pine St., San Francisco—Award for electric-electronics shop, Mare Island Naval Shipyard; by U. S. Navy.

$782,000—**Haddock Engineers, Ltd.,** 1616 Greenwood Ave., Montebello—Low bid for facilities for aircraft ranges at China Lake, Inyokern; by U. S. Navy.

$417,470—**Lord & Bishop,** P. O. Box 812, Sacramento—Low bid for bypass sewer, 5th and U Sts. to Sewage Pumping Station No. 2, Sacramento; by City.

$573,145—**Madonna Construction Co.,** P. O. Box 910, San Luis Obispo—Award for 2.3 mi. of grading and constructing base, and grading and paving ramps, connections and city streets, to provide a 4-lane divided hwy. on U. S. 101 betw. Marsh St. and San Luis Obispo Creek in San Luis Obispo; by Div. of Hwys.

$3,665,100—**Robert E. McKee, General Contractor,** 4700 San Fernando Rd., Los Angeles—Award for health and receiving hospital, Los Angeles; by City.

$211,444—**M. S. Mecham & Sons,** 11125 Garfield Ave., South Gate—Award for .8 mi. of grading and asph. conc. paving on untreated rock base to provide a 4-lane divided hwy. on Artesia St., Compton and Long Beach, Los Angeles County; by Div. of Hwys.

$123,360—**Joe D. Miller,** 2002 Monterey St., Bakersfield—Award for sanitary sewers, Planz Rd., Bakersfield; by City.

$1,796,760—**Nomellini Construction Co.,** P. O. Box 1177, Stockton—Low bid for general purpose warehouse, Travis Air Force Base; by C. of E.

$141,718—**R C R Corp.,** 2240 Parkway, El Monte—Award for sewage treatment plant at Palmdale; by Los Angeles County Sanitation District.

$251,728—**James E. Roberts,** 187 South G St., San Bernardino—Award for portions totaling about 4.8 mi. of grading and road-mixed surf. on imported base material, betw. 2.6 mi. east of Calexico and Hemlock Canal, Imperial County; by Div. of Hwys.

$359,585—**Ted Schwartz,** Glenbrook Park, Grass Valley—Low bid for relocating a portion of Natoma Canal; by C. of E.

$155,520—**T. E. Sherlock,** 1103 W. 40th Pl., Los Angeles—Low bid for improvements on First St., Main St. to San Pedro St., Los Angeles; by City.

$1,643,500—**Carl N. Swenson Co., Inc.,** 1095 Stockton Ave., San Jose—Award for central and test chamber for 8-ft. supersonic wind tunnel, Moffett Field; by Natl. Advisory Committee for Aeronautics.

$6,142,550—**Ford J. Twaits Co.** and **Morrison-Knudsen Co., Inc.,** 449 S. Beaudry St., Los Angeles—Award for an 8-story police facilities bldg., Los Angeles; by City.

$754,620—**N. P. Van Valkenburgh Co.,** 7699 San Vicente Blvd., South Gate—Low bid for water supply system at Marine Corps Training Center, Twentynine Palms; by U. S. Navy.

$144,350—**Ventura Pipeline Construction Co.,** P. O. Box 1252, Ventura—Low bid for sanitary sewer mains, etc., Solvang; by Solvang Municipal Improvement District.

$1,095,075—**Clarence Ward Construction Co.,** 4841 Harvey St., Fresno—Low bid for Ft. Miller Junior High School, Fresno; by Fresno City Unified School District.

$9,500,000—**Webb & Knapp Construction Corp.,** 270 Park Ave., New York—Award for 140 two-story apartments, San Diego; by Claremont Garden Apartments.

$939,000—**Wonderly Construction Co.,** 2694 Lime St., Long Beach—Award for Ortega and Carpinteria reservoirs and control stations, Cachuma Project; by USBR.

Colorado

$108,771—**Hunt Construction Co.,** Steamboat Springs—Low bid for uranium access rd., 16.4 mi. of grading, structures and surf., State 80, San Miguel and Dolores counties; by St. Hwy. Dept.

$241,325—**Jille & Cannon,** Eads—Award for 60 mi. of rural distribution lines, Prowers, Bent and Otero counties; by Southeast Colorado Power Assn.

$10,000,000—**Swinerton & Walberg Construction Co.,** 2040 South Navajo St., Denver—Award for distribution center in Denver; by Safeway Stores, Inc.

$15,000,000—**Webb & Knapp Construction Co.,** 270 Park Ave., New York—Award for a 22-story office bldg. on Broadway from 17th to Lincoln, Denver.

Idaho

$135,380—**Arrington Construction Co.,** P. O. Box 881, Idaho Falls—Low bid for hot cell and hot cell bldg. at Natl. Reactor Testing Station, Idaho Operations Office, Idaho Falls; by AEC.

$1,077,315—**J. H. Trisdale, Inc.,** Box 779, Redding, Calif.—Award for clearing reservoir area for Albeni Falls Dam; by C. of E.

$2,100,001—**Westinghouse Electric Corp.,** Denver—Low bid for four 30,000-kva. generators for Palisades Dam; by USBR.

$365,145—**Woodall Bros. Co.,** P. O. Box 246, Eagle—Award for grading 8 mi. of Ketchum-Clayton hwy., Custer County; by BPR.

Montana

$205,257—**Bob Gibson** and **Blacktop Construction Co.,** Box 1353, Billings—Award for 8.023 mi. of grading, gravel surf., rd. mix oiling and drainage structures, Belgrade West and Belgrade So. hwy., Gallatin County; by St. Hwy. Comm.

$171,551—**McLaughlin Construction Co.,** 12th and Front, Livingston—Award for a 390-ft. steel and concrete bridge on Livingston-Wilsall hwy., Park County; by St. Hwy. Comm.

Nevada

$490,390—**Gibbons & Reed,** 259 West 3rd So., Salt Lake City, Utah—Low bid for forest rd., south boundary of Nevada Natl. Forest, White Pine County; by BPR.

$771,200—**Isbell Construction Co., Inc.,** S. Virginia Rd., Reno —Award for widening 2.459 mi. of U. S. 40, west of Verdi across California state line, Washoe County; by St. Dept. of Hwys.

$1,064,415—**Lembke-Clough & King,** P. O. Box 1391, Las Vegas—Award for test structures and facilities, Nevada Proving Ground, Mercury; by AEC.

New Mexico

$3,050,126—**J. W. Bateson, Inc.,** Dallas, Tex.—Low bid for 600-ft. hangar, Walker Air Force Base, Roswell; by U. S. Air Force.

$850,210—**Colorado Constructors, Inc.,** W. 39th Ave., Denver, Colo.—Low bid for 3 dams nr. Maxwell, incl. rehabilitation of previous irrigation project facilities, Vermejo Project; by C. of E.

$394,026—**Lowdermilk Bros.,** Box 501, Los Alamos—Low bid for additional parking aprons at Walker Air Force Base; by C. of E.

$293,645—**Hugh McMillan,** Box 1227, El Paso, Tex.—Low bid for access trails and access rds., Holloman Air Force Base, Alamogordo; by C. of E.

Oregon

$1,186,794—**Atkinson Ostrander Co.,** Box 833, The Dalles—Award for 41 bridge piers for a steel cantilever bridge, The Dalles; by Wasco County.

$1,291,685—**Atkinson Ostrander Co.,** Box 833, The Dalles—Award for superstructure of The Dalles bridge; by Wasco County.

$19,996,770—**Baldwin-Hamilton-Lima Corp.,** Philadelphia, Pa.—Award for fourteen hydraulic turbines for The Dalles Dam; by C. of E.

$816,140—**Bay Construction, Inc.,** and **Don L. Cooney Co.,** 1762 Airport Way at Holgate, Seattle, Wash.—Low bid for Schedules I and II, McNary Powerhouse 230-kv. transmission lines, and Schedule II, McNary-Big Eddy 300-kv. transmission lines; by Bonneville Power Administration.

$206,880—**Bonneville Construction Co.,** Idaho Falls, Idaho—Award for 156.17 mi. of telephone lines, Benton, Lincoln and Lane counties; by Pioneer Telephone Cooperative.

$270,655—**Miller & Strong, Inc.,** 3871 Royal Rd., Eugene—Award for 2.7 mi. of Collawash River Rd., Clackamas County; by BPR.

$126,480—**Thompson & Georgeson,** 3256 N.E. Broadway,

Portland—Award for McNary switchyard control house, Umatilla County; by Bonneville Power Administration.

Utah

$404,540—**Ellis W. Barker Co.,** 302-303 Ness Bldg., Salt Lake City—Low bid for sewer treatment plant, Murray; by City.

$570,954—**W. W. Clyde & Co.,** Springville—Low bid for 4.4 mi. of plant mix bit. surf. rd., Mills Fork to Red Narrows, Utah County; by St. Rd. Comm.

$341,596—**Germer, Abbott & Waldron Construction Co.,** Tremonton—Award for 21.95 mi. of a 2-in. road-mixed bit. surf. rd., Bonanza to U. S. 40, Uintah County; by St. Rd. Comm.

$346,990—**Gibbons & Reed Co.,** 259 W. 3rd So., Salt Lake City—Low bid for a 3-in. rd.-mixed bit. surf. rd., 4.4 mi. in Salt Lake and Davis counties; by St. Rd. Comm.

$219,235—**L. A. Young Construction Co.,** Richfield—Award for 10.6 mi. of a 2-in. bit. surf. rd. on State 63 in Sevier and Millard counties; by St. Rd. Comm.

Washington

$1,903,290—**J. C. Boespflug Construction Co.,** 1912 4th Ave. South, Seattle—Award for addition to Harborview County Hospital, King County; by County.

$199,435—**George Chicha Co.,** E. 2817 Sharp, Spokane—Award for replacing filter material by tunneling and backfilling at left abutment of McNary Dam; by C. of E.

$529,091—**Curtis Gravel Co.,** P. O. Box 106, Spokane—Award for relocation of Track Rd. betw. Byron and Prosser, Benton and Yakima counties; by St. Hwy. Comm.

$1,248,055—**Dahlgren Construction Co.,** 1700 21st Ave. So., Seattle—Low bid for Rainier Ave.-Lake Way overcrossing at Atlantic St. approach to Lake Washington Floating Bridge, Seattle; by St. Hwy. Comm.

$284,093—**Electric Machinery Manufacturing Co.,** 1333 N.E. Tyler St., Minneapolis, Minn.—Award for two 4,160-volt generators for Chandler power plant, Yakima Project; by USBR.

$466,180—**Erickson Paving Co.,** 1550 N. 34th St., Seattle—Award for 4.4 mi. of State No. 1, Averd Rd. to Hamilton Rd., Lewis County; by St. Hwy. Comm.

$305,160—**Fiorito Bros.,** 1100 Leary Way, Seattle—Award for clearing State No. 1, E. B. Hamilton Rd. north, Lewis County; by St. Hwy. Comm.

$261,941—**H. Halvorson, Inc.,** E. 4324 Trent Ave., Spokane—Award for aircraft refueling system, Fairchild Air Force Base; by C. of E.

$271,615—**Lewis A. Hopkins Co.,** 2205 Lincoln Ave., Yakima—Low bid for roads, levees and pumping plants, Pasco, Franklin County; by C. of E.

$1,049,095—**Peter Kiewit Sons' Co.,** 1300 Aloha St., Seattle—Award for twin bridges crossing Cowlitz River on State No. 1 nr. Toledo; by St. Hwy. Comm.

$1,895,025—**Max J. Kuney Co.,** N. 120 Ralph St., Spokane—Award for two central heating plants and heating systems in permanent troop facilities area, Fort Lewis; by C. of E.

$1,051,475—**Manson Construction & Engineering Co.,** 821 Alaskan Way, Seattle—Low bid for Fox Island bridge crossing Hale's Passage in Puget Sound, nr. Warren, Pierce County; by St. Hwy. Comm.

$198,166—**C. E. Oneal Co., Inc.,** Box 268, Ellensburg—Award for 3.8 mi. of draining, grading and light bit. surf. on State No. 10, East Wenatchee to Rock Island, Sect. 2, Douglas County; by St. Hwy. Comm.

$1,164,930—**Osberg Construction Co.,** 1132 N. 128 St., Seattle—Low bid for earthwork, pipe lines and structures for Area P-8 laterals, sublaterals and wasteways, Potholes East Canal Laterals, Columbia Basin Project; by USBR.

$146,220—**Charles A. Power,** E. 27 8th Ave., Spokane—Low bid for reinf. conc. cribbing on 0.13 mi. of Riverside State Park Rd., Spokane County; by St. Hwy. Comm.

$1,613,278—**J. A. Terteling & Sons, Inc.,** P. O. Box 1428, Boise—Award for 7.6 mi. of the conc.-lined Chandler power canal, incl. 13 timber bridges, pipe and box culvert, etc., Kennewick Div. of Yakima Project; by USBR.

$1,644,651—**Valley Construction Co.,** 7722 Rainier Ave., Seattle—Award for utilities for an 8-bldg. area, including streets, sewers and water distr. system, Ault Field, Whidby Island; by U. S. Navy.

Safe yield from ground-water reservoirs

. . . Continued from page 76

essary, production may become uneconomical, or intrusion of water of deleterious quality may be threatened. Under such conditions, overdraft may exist within a portion of a ground-water reservoir, while it may or may not exist in the entire reservoir. Reduction of production or increase in replenishment may serve to steepen water surface gradients in free water reservoirs, and thereby increase flow of water to the overdrawn production area.

Effects of increased storage

In confined portions of a ground-water reservoir, an increase in the elevation of the water level in the recharge area, due to increased storage, may cause an increased gradient towards an overdrawn area, this in turn causing increased flow. Such a condition may, at the outset, maintain the gradient, but cause pressure levels to increase in the overdrawn area.

Ultimately, however, a condition of equilibrium will develop where—if production from the area is maintained at a constant quantity—the elevation of pressure levels will be raised and pumping lifts will be decreased. Because of the many factors which are involved in such a situation, it is seldom possible to forecast the results of such increased replenishment or of increased storage in the recharge area.

Alleviating overdraft by spreading out production

One method whereby such a condition of overdraft can frequently be alleviated if not remedied is to spread out production over a greater area. This will provide an increase in the cross-sectional area through which the ground-water moves to the area. Until information can be secured regarding production, after an attempt has been made to solve a condition of overdraft in a ground-water reservoir, there is not always an assurance that the solution adopted, if based solely upon the **quantity** concepts of safe yield and overdraft, will solve the problem.

Consider both rate and quantity

Situations may occur where the **rate** concept, in which the matter transmissibility becomes important, will be found to be very important. If such a physical situation is indicated, a consideration of the **rate** as well as the **quantity** concept of safe yield and overdraft must be included in the solution.

How the Navy trains Seabees

. . . Continued from page 87

blind areas guided only by hand signals. In all, the students service, lubricate and operate 12 makes and models of cranes during this three-week period.

The principles of earth moving are introduced during a week of lecture and field layout covering grade stakes, terminology and surveying. This is followed by three weeks of earthmoving operations with crawler tractors. Caterpillar D-7 tractors equipped with cable operated dozers are used.

The third week is spent on carryall scrapers pulled by Allis-Chalmers HD-14's. By this time the class is skilled enough to construct an earth dam or road. A week of operation and preventive maintenance on motor graders completes the earthmoving phase of the schools.

Where there is construction there must be water, and many times the Seabees must provide their own. To be prepared for this eventuality, student drivers are trained in the principles and terminology of well drilling. In order to prepare the students for any condition, both the percussion and rotary type well rigs are used for instruction.

Macwhyte 6x25F PREformed Monarch Whyte Strand Wire Rope with I.W.R.C.

How many moving parts?

- In this particular rope construction there are 199 individual wires. Each is a carefully designed "moving part."
- Outside wires are one size. Inside wires are another size. Core and filler wires are still other sizes.
- Altogether, 8 different sizes of wire are used, and each has a specified strength, toughness and flexibility.
- Macwhyte has specialized in the manufacture of wire rope like this for over half a century.
- To assure highest quality, all stages of wire manufacture and rope fabrication are closely controlled.
- An exact "breathing space" between each wire is provided in order to increase flexibility.
- Each wire is protected with a film of lubricant that is force-fed *cold* during the fabricating.
- Since any piece of wire rope is a complicated piece of machinery, precision is as important in its manufacture as in the making of a fine watch.
- In designing and manufacturing its thousand and one wire ropes, Macwhyte exercises all the special care that assures long service and low cost to you. May our engineers recommend the right rope for *your* equipment?

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SEATTLE 4..... 87 Holgate Street, Ph: MAin 1715

TRI-DIMENSIONAL

. . . Continued from page 69

is equally offset from each runway, providing excellent visibility along the full length of each strip. The area surrounding the column might have a garden motif. The circular building surrounding the tower is the only structure on the surface of the airport proper. The surface level of this is given over entirely to tractor-tanker garages, pumping equipment and personnel quarters. The topmost rim would provide ample space for semi-open air restaurants.

Feature Number Seven, indicated in four places on the model, deals with service facilities for a large number of operating airlines.

Feature Number Eight is traffic and transportation and its relation to the tri-dimensional airport. With this design surface-type vehicles can be perfectly "insulated" from the aircraft. Four short vehicular tunnels carry traffic to the interior loop system from where it is routed to loading platforms or limited parking areas. A "belt-line" bus should be used between the large exterior parking spaces and the terminal, and high-speed rail cars between the city center and the airport.

Each of the runways is planned to be 300 ft. wide and 6,000 ft. long. The inclined portion of each runway is roughly 2,000 ft., and the elevation of its terminus on the loading apron is at least 100 ft. The control room in the tower is 150 ft. higher. The circular loading apron is 2,400 ft. across and the hub structure is 800 ft. in diameter. Each of the aircraft shown on the model has a wing spread of 250 ft. There are 32 hangars in four large service areas. Each hangar is 250 x 300 ft.

It is the earnest belief of the author of this plan that the present time is crucial to the overall development of the young but vigorous air transportation business. A modern aircraft in flight is really a thing of beauty, perfectly adjusted to the element in which it moves. It is efficient and supremely speedy. Its passenger-mile safety record is phenomenal.

But from the minute it lands on an airport all this changes! It rolls too far on its stilt-like landing gear, and its ground handling methods go backward fifty years. These conditions cannot go on indefinitely. What is gained by expanding the present type of airport when to do so only increases present difficulties? It is hoped that this tri-dimensional airport plan will receive serious consideration not only by those directly associated with the industry, but by all other aviation enthusiasts who optimistically believe that the future well-being of the world may in part be attained by the widest use of the aircraft of commerce.

UNIT BID PRICES

Selected abstracts for Western projects

Bridge

Substructure and superstructure, Richmond-San Rafael toll bridge

California—Marin and Contra Costa Counties—State. Bids were opened December 19 before the Division of San Francisco Bay Toll Crossings. Low bidder for the substructure, at $14,234,550, was a joint venture comprised of Ben C. Gerwick, Inc., and Peter Kiewit Sons' Co. Low bidder for the superstructure, at $21,099,319, was a joint venture comprised of Peter Kiewit Sons' Co., A. Soda & Son, and Judson Pacific-Murphy Corp.

Plans call for a 6-lane structure with a total length of about 4 mi., with a high level crossing over two navigation crossings. The six lanes of traffic will be handled on two levels with three lanes traveling the same direction on each.

Artist's conception of the Richmond-San Rafael Bridge

Unit bids were presented as follows:

SUBSTRUCTURE

(1) Ben C. Gerwick, Inc., and Peter Kiewit Sons' Co.	$14,234,550
(2) Raymond-Pomeroy, a Joint Venture	15,389,115
(3) Pacific Bridge and General Construction Co.	16,429,420
(4) Guy F. Atkinson Co. and United Construction Co.	17,439,972
(5) Merritt Chapman & Scott Corporation	18,067,900
(6) Engineer's estimate	14,562,000

	(1)	(2)	(3)	(4)	(5)	(6)
210,000 cu. yd. struct. excav. (bell pier)	3.00	.60	1.50	2.00	2.00	1.50
2,100 cu. yd. struct. excav. (cofferdam pier)	5.00	3.85	5.00	4.00	4.00	10.00
1,600 cu. yd. struct. excav. (dry land pier)	4.00	8.00	5.00	6.22	7.00	5.00
30,000 cu. yd. blanket fill, in place	4.00	5.00	3.20	3.50	3.00	3.50
557,000 lin. ft. furn. steel piling	7.50	5.10	5.60	6.00	6.20	7.00
5,063 ea. driving steel piles in place	470.00	448.00	840.00	700.00	500.00	270.00
5,100 ea. steel pile splices in place	20.00	30.00	50.00	75.00	62.00	35.00
69,300 cu. yd. Class B portland cem. conc. below elev. +5.00 ft. (bell pier) in place	58.00	97.00	73.00	85.00	98.00	75.00
710 cu. yd. Class B portland cem conc. (cofferdam seal) in place	60.00	150.00	100.00	40.00	125.00	65.00
1,280 cu. yd. Class C portland cement concrete (footing block) in place	58.00	35.00	50.00	38.00	125.00	40.00
18,600 cu. yd. Class C portland cement concrete (struct.) in place	60.00	48.00	70.00	88.00	100.00	55.00
7,000,000 lb. bar reinf. steel in place	.08	.08	.10	.10	.10	.16
476,000 lb. struct. steel (anchor details) in place	.35	.45	.50	.30	.25	.40
174,000 lin. ft. furn. treated Douglas fir piling (fender)	1.70	3.00	2.00	2.75	3.00	2.00
1,448 ea. driving treated Douglas fir piles (fender) in place	50.00	75.00	50.00	60.00	100.00	60.00
900 thousand ft. bd. meas. tr. Douglas fir timber (pier fender) in place	440.00	590.00	500.00	590.00	850.00	550.00
165,000 lb. metal work (timber pier fender) in pl.	.30	.56	.30	.40	.25	.50
Lump sum, engineer's office	$16,000	$35,906	$19,000	$18,500	$45,000	$27,860

SUPERSTRUCTURE

Two cantilever truss spans, each with a 1,070-ft. main span and two 537-ft. anchor arms.

(1) Peter Kiewit Sons' Co., A. Soda & Son, and Judson Pacific-Murphy Corp.	$ 9,777,518
(2) Bethlehem Pacific Coast Steel Corp.	12,850,080
(3) American Bridge Division, U. S. Steel Corp.	12,954,255
(4) Engineer's estimate	10,578,400

	(1)	(2)	(3)	(4)
2,990,000 lb. heat treated eyebars in place in spans	0.3716	0.472	0.457	0.330
3,370,000 lb. structural manganese-vanadium steel in place in spans	0.2733	0.401	0.419	0.330
13,780,000 lb. structural silicon steel in place in spans	0.2717	0.3395	0.368	0.300
10,080,000 lb. structural carbon steel in place in spans	0.2331	0.326	0.323	0.250
2,680,000 lb. structural silicon steel in place in bents	0.2637	0.381	0.356	0.340
1,680,000 lb. structural carbon steel in place in bents	0.2508	0.357	0.322	0.330
2,900 cu. yd. lightweight concrete in place (pavement)	155.81	125.00	95.00	90.00
550,000 lb. bar reinforcing steel in place	0.1306	0.254	0.425	0.18

(Continued on page 120)

UNIT BID PRICES... CONTINUED

SUPERSTRUCTURE
Thirty-six 289-ft. truss spans

(1) Peter Kiewit Sons' Co., A. Soda & Son, and Judson Pacific-Murphy Corp. $11,212,635
(2) American Bridge Division, U. S. Steel Corp. 14,413,385
(3) Bethlehem Pacific Coast Steel Corp. 16,153,940
(4) Engineer's estimate 11,310,690

	(1)	(2)	(3)	(4)
19,100,000 lb. structural silicon steel in place in spans	0.2411	0.333	0.359	0.25
16,980,000 lb. structural carbon steel in place in spans	0.2344	0.295	0.341	0.23
2,010,000 lb. structural silicon steel in place in bents	0.268	0.371	0.383	0.29
4,210,000 lb. structural carbon steel in place in bents	0.2571	0.34	0.3805	0.28
7,100 cu. yd. lightweight concrete in place (pavement)	116.92	95.00	117.00	90.00
1,350,000 lb. bar reinforcing steel in place	0.1306	0.142	0.2255	0.17

SUPERSTRUCTURE
Thirty-six 100-ft. girder spans

(1) American Bridge Division, U. S. Steel Corp. $1,583,773
(2) Peter Kiewit Sons' Co., A. Soda & Son, and Judson Pacific-Murphy Corp. 1,909,024
(3) Bethlehem Pacific Coast Steel Corp. 2,054,945
(4) Engineer's estimate 1,908,300

	(1)	(2)	(3)	(4)
2,650,000 lb. structural silicon steel in place in spans	0.238	0.2922	0.3135	0.28
2,340,000 lb. structural carbon steel in place in spans	0.2047	0.2483	0.3025	0.26
4,200 cu. yd. lightweight concrete in place (pavement)	82.00	113.41	90.00	96.00
910,000 lb. reinforcing steel in place	0.1425	0.0850	0.152	0.17

SUPERSTRUCTURE
All elements combined (two cantilever truss spans, each with a 1,070-ft. main span and two 537-ft. anchor arms, thirty-six 298-ft. truss spans, and thirty-six 100-ft. girder spans).

(1) Peter Kiewit Sons' Co., A. Soda & Son, and Judson Pacific-Murphy Corp. $21,099,319
(2) American Bridge Division, U. S. Steel Corp. 28,052,990
(3) Bethlehem Pacific Coast Steel Corp. 30,014,850
(4) Engineer's estimate 23,720,180

	(1)	(2)	(3)	(4)
2,990,000 lb. heat treated eyebars in place in spans	0.349	0.426	0.4555	0.307
3,370,000 lb. structural manganese-vanadium steel in place in spans	0.2565	0.388	0.3855	0.307
35,530,000 lb. structural silicon steel in place in spans	0.2391	0.33	0.338	0.281
29,400,000 lb. structural carbon steel in place in spans	0.2173	0.2935	0.3295	0.240
4,690,000 lb. structural silicon steel in place in bents	0.2468	0.344	0.37	0.298
5,890,000 lb. structural carbon steel in place in bents	0.2356	0.3245	0.365	0.289
14,200 cu. yd. lightweight concrete in place (pavement)	102.72	84.00	102.00	81.00
2,810,000 lb. bar reinforcing steel in place	0.1081	0.1425	0.178	0.17

Water Supply

Final section of the San Diego second barrel

California—San Diego County—USBR. Low bidder on Schedule II for construction of the San Diego County section of the second barrel of the San Diego Aqueduct was S. A. Healy Co., Chicago, Ill. Work involves excavation and the furnishing and laying of concrete pipe. The company's total bid of $6,798,101 was low for the three schedules. Peter Kiewit Sons' Co., Steve P. Rados, Inc., and B. J. Ukropina, T. P. Polich and Steve Kral, Arcadia, Calif., offered a joint low bid of $1,571,904 for Schedule I, and they were also low for Schedule III with a bid of $2,160,890. Unit bids submitted for Schedule II were as follows:

	Schedule I	Schedule II	Schedule III
(1) S. A. Healy Co.	$1,715,594	$2,869,252	$2,213,255
(2) Engineering Constructors	(no bid)	2,998,534	(no bid)
(3) Peter Kiewit Sons' Co., Steve P. Rados, Inc., B. J. Ukropina, T. P. Polich, Steve Kral	1,571,904	3,128,970	2,160,890
(4) Winston Bros. Co.	1,941,488	3,341,321	2,563,070
— Bressi & Bevanda	1,968,683	3,420,259	2,454,853
— A B C Construction Co.	1,973,404	(no bid)	2,382,218
— Johnson Western Constructors	2,162,636	(no bid)	(no bid)
— L. E. Dixon Co., W. E. Kier Construction Co., Inc., The Arundel Co., Harry L. Foster	2,004,077	3,634,082	2,694,878
(5) Engineer's estimate	1,729,406	2,929,724	2,266,345

Stipulations: (1) All or none. (2) None. (3) All or none.

	(1)	(2)	(3)	(4)	(5)
45,000 cu. yd. excav., stas. S1303+34 to S1282+00, S1233+00 to S1185+00, S737+00 to S682+00, S661+00 to S652+50	2.60	2.05	2.42	3.10	2.50
55,000 cu. yd. excav. stas. S1282+00 to S1233+00, S1185+00 to S1090+00, S770+00 to S737+00	1.15	1.55	2.42	2.70	1.50
11,000 cu. yd. excav. stas. S1090+00 to S1067+00	2.65	2.90	2.42	4.00	4.50
62,000 cu. yd. excav. stas. S1067+00 to S859+00	1.20	1.90	2.42	2.90	1.00
28,000 cu. yd. excav. stas. S859+00 to S770+00	1.85	2.05	2.42	3.70	2.00
12,500 cu. yd. excav. stas. S682+00 to S661+00	3.20	4.15	2.42	4.00	1.20
160,000 cu. yd. backfill	.32	.90	.75	.50	.40
9,500 cu. yd. consolidating backfill	2.10	1.95	1.85	2.10	2.00
19,000 cu. yd. compacting backfill	2.10	3.75	4.15	2.70	3.00
35 acres scarifying right-of-way	40.00	40.00	40.00	48.00	40.00
35 acres seeding right-of-way	65.00	32.00	50.00	27.00	75.00
130 sq. yd. dry-rock paving	12.00	12.00	25.00	17.00	8.00
280 cu. yd. concrete in structures	110.00	90.00	100.00	90.00	80.00
24,000 bbl. furnishing and handling type II cement	4.10	3.75	4.50	3.90	4.50
2,500 bbl. furnishing and hdling type V cement	4.70	4.30	4.60	4.40	5.00
14,000 lb. furn. and placing reinf. bars in structs.	.15	.18	.20	.20	.10
110 lin. ft. furn. and erect. 48-in. diam. conc. pipe for shafts for blow-off structs.	55.00	53.00	46.50	60.00	50.00
210 lin. ft. furn. and erect. 48-in. diam. std.-str. conc. culv. pipe for shafts of structs.	50.00	46.00	38.00	55.00	40.00

(Continued on page 122)

LOAD SAND, SNOW, ROCK OR SILT WITH EIMCOS

The Eimco 104 is a heavy-duty machine for handling materials such as rock, sand, gravel or snow. Use it for digging basements, ditches or building roads. For loading trucks in tunnels, quarries or sand and gravel pits.

The Eimco moves forward to load and back to discharge. This straight line movement speeds up the job and reduces maintenance costs.

The Eimco is an ideal tool for heavy-duty loading jobs.

EIMCO

THE EIMCO CORPORATION

The World's Largest Manufacturers of Underground Rock Loading Machines

EXECUTIVE OFFICES AND FACTORIES — SALT LAKE CITY 10, UTAH, U. S. A.

BRANCH SALES AND SERVICE OFFICES

NEW YORK, 51-52 SOUTH STREET • CHICAGO, 3319 SOUTH WALLACE STREET
BIRMINGHAM, 612 - 31st FAYETTE AVE • DULUTH, MINN., 218 E. SUPERIOR ST.
EL PASO, TEXAS, MILLS BUILDING • BERKELEY, CALIF., 637 CEDAR STREET
KELLOGG, IDAHO, 307 DIVISION ST. • LONDON W. 1, ENGLAND, 190 PICCADILLY

IN FRANCE, SOCIETE EIMCO, PARIS, FRANCE
IN ENGLAND, EIMCO (GREAT BRITAIN) LTD., LEEDS 12, ENGLAND
IN ITALY, EIMCO ITALIA, S.P.A., MILAN, ITALY

UNIT BID PRICES . . . CONTINUED

		(1)	(2)	(3)	(4)	(5)
32	lin. ft. furn. and erect. 72-in. diam. std.-str. conc. culv. pipe for shafts of structs.	50.00	50.00	68.00	70.00	70.0
27	covers furn. and placing precast-conc. covers, 4 in. thick	50.00	45.00	60.00	50.00	50.0
4	covers furn. and placing precast-conc. covers, 6 in. thick	65.00	65.00	70.00	70.00	70.0
38	nozzles furn. and install 20-in. diam. nozzles with covers or blind flanges	875.00	880.00	905.00	930.00	450.0
13	nozzles furn. and installing 6-in. diam. nozzles	220.00	205.00	220.00	210.00	100.0
20,000	lb. furn. and installing cast-iron pipe and fittings	.65	.40	.60	.22	.4
3,000	lb. furn. and installing steel pipe and fittings	.50	.65	.60	.35	.6
1	valve furn. and installing 20-in. gate valve	$1,350	$1,750	$2,000	$2,000	$1,75
10	valves furn. and install. 6-in. 200-lb. W.O.G. globe valves	180.00	120.00	150.00	110.00	125.0
3	valves furn. and install. 6-in. 300-lb. W.O.G. globe valves	320.00	200.00	200.00	185.00	250.0
10	valves furn. and installing 4-in. gate valves	70.00	95.00	100.00	100.00	70.0
6	valves furn. and installing 4-in. std. air valves	190.00	210.00	200.00	220.00	200.0
4	valves furn. and installing 4-in. ex.-hvy. air valves	330.00	225.00	220.00	220.00	325.0
9,000	lb. furn. and install miscl. metalwork	.55	.55	.70	.45	.6
230	lin. ft. furn. and erecting chain-link fence	6.00	7.00	7.00	3.30	4.0
310	lin. ft. furn. and laying conc. pipe, symbol B48NC25	23.50	23.55	24.70	27.00	24.4
520	lin. ft. furn. and laying conc. pipe, symbol B48NC50	24.50	24.35	24.70	27.00	25.2
144	lin. ft. furn. and laying conc. pipe, symbol D48NC50	26.50	26.25	26.85	29.00	27.1
590	lin. ft. furn. and laying conc. pipe, symbol B48NC75	25.50	25.20	25.25	28.00	26.0
144	lin. ft. furn. and laying conc. pipe, symbol A48NC100	25.50	25.20	26.10	28.00	26.0
800	lin. ft. furn. and laying conc. pipe, symbol B48NC100	26.50	26.10	27.15	29.00	27.0
180	lin. ft. furn. and laying conc. pipe, symbol A48C125	27.00	26.55	27.30	30.00	28.1
990	lin. ft. furn. and laying conc. pipe, symbol B48C125	27.00	26.95	27.70	30.00	28.4
490	lin. ft. furn. and laying conc. pipe, symbol D48C125	29.00	28.75	29.95	32.00	30.4
510	lin. ft. furn. and laying conc. pipe, symbol A48C150	27.50	26.95	27.50	30.00	28.4
680	lin. ft. furn. and laying conc. pipe, symbol B48C150	28.50	28.15	28.80	31.00	29.8
560	lin. ft. furn. and laying conc. pipe, symbol A48C175	27.50	27.30	28.05	30.00	28.8
440	lin. ft. furn. and laying conc. pipe, symbol B48C175	29.50	29.25	29.80	30.00	29.7
670	lin. ft. furn. and laying conc. pipe, symbol A48C200	28.50	28.40	29.05	30.00	30.1
1,640	lin. ft. furn. and laying conc. pipe, symbol B48C200	29.50	29.30	30.10	32.00	30.2
190	lin. ft. furn. and laying conc. pipe, symbol C48C200	30.50	29.95	30.75	33.00	31.1
1,000	lin. ft. furn. and laying conc. pipe, symbol A48C225	29.00	28.85	29.45	32.00	30.4
3,750	lin. ft. furn. and laying conc. pipe, symbol B48C225	30.00	29.65	30.40	33.00	30.8
360	lin. ft. furn. and laying conc. pipe, symbol C48C225	31.00	30.85	31.55	34.00	31.8
144	lin. ft. furn. and laying conc. pipe, symbol D48C225	32.00	31.80	32.35	35.00	33.0
1,340	lin. ft. furn. and laying conc. pipe, symbol A48C250	30.00	29.65	30.40	33.00	30.6
2,540	lin. ft. furn. and laying conc. pipe, symbol B48C250	31.00	30.40	31.05	33.00	31.4
1,060	lin. ft. furn. and laying conc. pipe, symbol C48C250	32.00	31.70	32.25	35.00	32.9
260	lin. ft. furn. and laying conc. pipe, symbol D48C250	33.00	32.65	33.20	36.00	34.0
1,120	lin. ft. furn. and laying conc. pipe, symbol A48C275	31.00	30.30	30.95	33.00	31.3
1,030	lin. ft. furn. and laying conc. pipe, symbol B48C275	31.50	31.15	31.75	34.00	32.4
96	lin. ft. furn. and laying conc. pipe, symbol C48C275	33.00	32.50	33.00	35.00	33.9
1,840	lin. ft. furn. and laying conc. pipe, symbol A48C300	31.50	31.15	31.95	34.00	32.1
4,550	lin. ft. furn. and laying conc. pipe, symbol B48C300	32.00	31.85	32.45	35.00	33.0
4,590	lin. ft. furn. and laying conc. pipe, symbol A48C325	32.50	32.10	32.65	35.00	33.2
4,670	lin. ft. furn. and laying conc. pipe, symbol B48C325	33.00	32.60	33.15	36.00	33.7
260	lin. ft. furn. and laying conc. pipe, symbol C48C325	34.50	33.85	34.40	37.00	35.5
190	lin. ft. furn. and laying conc. pipe, symbol D48C325	36.00	35.30	35.55	38.00	36.9
170	lin. ft. furn. and laying conc. pipe, symbol E48C325	38.00	37.25	36.35	40.00	37.6
3,380	lin. ft. furn. and laying conc. pipe, symbol A48C350	33.50	33.00	33.45	36.00	34.3
2,770	lin. ft. furn. and laying conc. pipe, symbol B48C350	34.00	33.35	33.80	36.00	34.6
144	lin. ft. furn. and laying conc. pipe, symbol C48C350	35.00	34.50	35.10	37.00	36.2
4,170	lin. ft. furn. and laying conc. pipe, symbol A48C375	34.50	33.85	35.15	37.00	35.1
4,820	lin. ft. furn. and laying conc. pipe, symbol B48C375	35.00	34.05	34.55	37.00	35.3
530	lin. ft. furn. and laying conc. pipe, symbol C48C375	36.00	35.25	35.70	38.00	36.8
144	lin. ft. furn. and laying conc. pipe, symbol D48C375	37.00	36.40	36.90	39.00	38.5
1,930	lin. ft. furn. and laying conc. pipe, symbol B48C400	35.00	34.65	35.20	38.00	36.3
670	lin. ft. furn. and laying conc. pipe, symbol C48C400	37.00	36.00	36.50	39.00	37.8
510	lin. ft. furn. and laying conc. pipe, symbol D48C400	38.00	37.15	37.60	40.00	39.1
1,210	lin. ft. furn. and laying conc. pipe, symbol B48C450	37.50	36.75	36.90	40.00	38.2
1,520	lin. ft. furn. and laying conc. pipe, symbol B48C500	39.50	38.70	38.70	42.00	40.1
1,600	lin. ft. furn. and laying conc. pipe, symbol B48C550	41.50	40.45	40.75	43.00	42.5
400	lin. ft. furn. and laying conc. pipe, symbol C48C550	41.50	40.50	40.80	43.00	42.7
670	lin. ft. furn. and laying conc. pipe, symbol C48C600	42.50	41.85	42.10	45.00	44.0
1,930	lin. ft. furn. and laying conc. pipe, symbol C48C650	44.50	43.75	43.80	46.00	45.7
520	lin. ft. furn. and laying conc. pipe, symbol D48C650	45.50	44.50	44.65	47.00	46.3

Dam

Alterations to Arrowrock Dam in Idaho

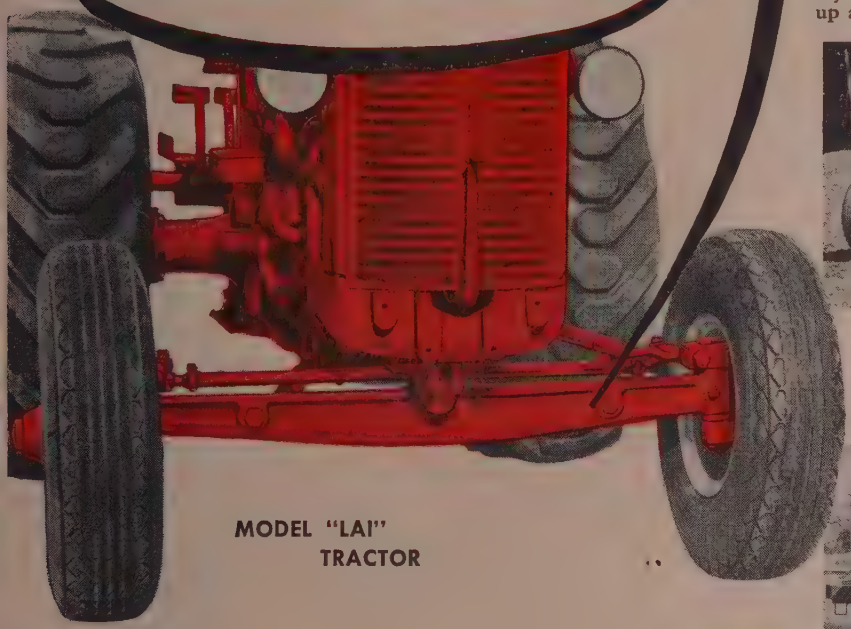
Idaho—Boise Project—USBR. Morrison-Knudsen Co., Inc., Boise, submitted $110,594, the low o
only two bids, for alterations to Arrowrock Dam. Unit bids were as follows:

(1) Morrison-Knudsen Co., Inc. $110,594
(2) Vernon Bros. Co. 125,597
(3) Engineer's estimate $77,16

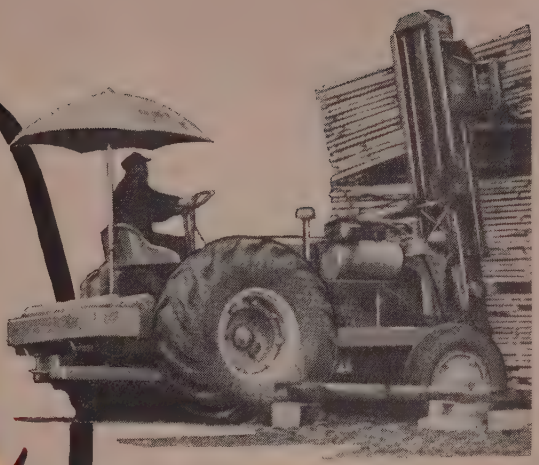
		(1)	(2)	(3
4,500	cu. yd. excav., common, for access road	1.50	.90	1.0
1,400	cu. yd. excav., rock, for access road	3.00	4.00	2.5
160	M. gal. watering access road embankments	3.00	2.00	5.0
24	roller hrs. rolling access road embankments	7.00	14.00	12.0
120	cu. yd. special placement and compaction of selected fill	4.50	3.00	4.0
280	cu. yd. gravel blanket	4.50	5.00	5.0
550	cu. yd. riprap	8.00	8.00	7.0
70	lin. ft. furn. and laying 16-ga., 18-in. diam., corru. metal pipe	5.50	5.50	5.0
95	cu. yd. removal of existing concrete	105.00	57.00	30.0
170	lin. ft. drilling holes for anchor bars and grouting bars in place	3.20	2.00	3.0
18,500	lb. furn. and placing reinf. bars	.19	.25	.2
340	bbl. furn. and handling cement	7.50	7.50	5.5
190	cu. yd. concrete in structs.	100.00	120.00	90.0

(Continued on page 124)

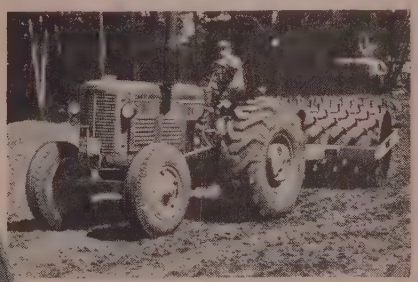
Built to Bear BIG LOADS



MODEL "LAI" TRACTOR



Big lifts of lumber are brought from saw rig to storage yard at Marquette, Michigan. Hydraulically operated loader levels to pick up and put down load, tilts back to carry.



Sure-footed traction of the "LAI" Tractor pulls sheepsfoot roller preparing grade for new paving of Highway 6 at a relocation in New Jersey.

Scraping up cinders and loading them into truck at Stoughton, Wisconsin. Same "LAI" Tractor and loader with hydraulic lift and dump also stock-piles materials, loads trucks during snow removal.

This new, extra-strong front axle makes the Model "LAI" Case Tractor more than ever the ideal power plant for loaders and other front-end equipment. Strong spindles, slanted toward tread center, and more extensive use of anti-friction bearings along the steering train give gratifying ease of handling, even under heavy loads and in soft footing. With compact construction and short wheel-base the Model "LAI" Tractor offers a happy combination of capacity with maneuverability.

Like all Case Industrial Tractors the mighty Model "LAI" has a heavy-duty, moderate-speed engine that picks up heavy loads comfortably, lugs through hard pulls at reduced speed with seldom a gear shift. It has a heavy-duty transmission with big, strong gears and short, sturdy shafts cradled in tapered roller bearings, adjustable from outside. From its Case-built magneto to its large-capacity hydraulic brakes it is built to make hard work seem easy, year after year. For full information on the Model "LAI" or any of the three smaller Case Industrial Tractors, call your Case industrial dealer. J. I. Case Co., Racine, Wis.

Superior Equipment Co., Phoenix, Ariz.; Hayward Equipment Co., Los Angeles, Calif.; Growers Tractor & Implement Co., Sacramento, Calif.; Contractors Machinery Co., San Francisco, Calif.; Lake County Equipment Co., Lakeport, Calif.; Electric Tool & Supply Co., San Bernardino, Calif.; Contractors Equipment & Supply Co., Fresno, Calif.; Liberty Truck & Parts Co., Denver, Colo.; Western Equipment Co., Boise and Idaho Falls, Idaho; Hilton's, Inc., Las Vegas, New Mexico; Farmers Machinery & Supply Co., Reno, Nevada; Foulger Equipment Co., Salt Lake City, Utah; Wortham Machinery Co., Cheyenne, Rock Springs and Casper, Wyoming; Montana Powder & Equipment Co., Helena and Billings, Montana; Columbia Equipment Co., Portland, Oregon; Hanford Farm Supply Co., Hanford, Calif.; Growers Equipment Co., Salinas, Calif.; Star Machinery Co., Seattle, Washington.

CASE

UNIT BID PRICES ... CONTINUED

	(1)	(2)	(3)
40 cu. yd. concrete in plugs	90.00	80.00	50.00
Lump sum, installing gallery entrance doors	150.00	200.00	400.00
4,100 lin. ft. reaming and cleaning existing foundation drains	3.00	3.00	1.00
55 lin. ft. drilling holes in downstream face slab	13.00	25.00	10.00
16,000 lb. furn. and installing metal pipe, fittings, and valves	1.00	1.50	.75
1,300 lb. furn. and installing drainage sump metalwork	1.50	1.00	.70
4,000 lb. installing pump units and float control	1.00	.50	.30
700 lb. furn. and installing grating and handrailing	1.20	1.50	.70
Lump sum, furn. and delivering hosecart equip.	300.00	600.00	500.00
Lump sum, removing 3 existing 25-kva. distribution transformers	350.00	500.00	150.00
100 lin. ft. removing existing ¾-in. conduit	.90	.30	.35
300 lin. ft. removing exist. No. 10 AWG insulated elect. wire from conduits	.25	.10	.05
600 lin. ft. removing exist. No. 6 AWG insulated elect. wire from conduits	.28	.12	.05
1,200 lin. ft. remov. exist. No. 6 AWG insul. elect. wires from trident supts.	.30	.22	.07
Lump sum, removing exist. exposed lighting conduit, wire, and wiring devices at gallery entrance	250.00	500.00	50.00
Lump sum, installing 50-kilowatt engine generator	$1,200	700.00	$1,500
Lump sum, installing three 50-kva. distribution transformers	550.00	$1,200	500.00
Lump sum, installing circuit breaker and safety switch	120.00	$1,000	40.00
Lump sum, installing motor-control equipment	250.00	700.00	100.00
60 lb. furn. and install. No. 4 AWG bare, stranded copper grounding wire	4.00	3.00	2.50
1,400 lin. ft. furn. and install. ¾-in. exposed elect. metal conduit	1.00	2.50	1.00
500 lin. ft. furn. and install. 1 and ¼-in. exposed elect. metal conduit	1.30	2.75	1.50
800 lin. ft. furn. and install. 1½-in. exposed elect. metal conduit	1.40	3.00	1.75
3,300 lin. ft. furn. and install. No. 12 AWG, type-RW 600-volt-insulated, electrical wire	.15	.50	.15
400 lin. ft. furn. and install. No. 10 AWG, type-RW 600-volt-insulated, electrical wire	.16	.60	.20
1,500 lin. ft. furn. and install. No. 4 AWG, type-RW 600-volt-insulated, electrical wire	.30	.70	.40
2,400 lin. ft. furn. and install. No. 2 AWG, type-RW 600-volt-insulated, electrical wire	.35	1.00	.60
Lump sum, strengthening of spillway channel bridge	$8,300	$9,200	$5,000

Tunnel

Gateway Tunnel on Utah's Weber Basin Project

Utah—Weber Basin Project—USBR. First work on Utah's Weber Basin Project has begun with the award for construction of the Gateway Tunnel to Utah Construction Co., Salt Lake City, on the basis of a low bid of $2,486,613. The work, which is located near Ogden, includes primarily the excavation and concrete lining of 3.25 mi. of tunnel with a 9.33-ft. diameter horseshoe-shaped section and open-cut excavation at the inlet and outlet portals. Unit bids submitted were as follows:

(1) Utah Construction Co. $2,486,613
(2) Grafe-Callahan Construction Co. and Floyd Shofner 2,752,337
(3) Gibbons & Reed Co. 2,789,518
(4) Peter Kiewit Sons' Co. 2,938,317
— The Arundel Corp. 3,140,608
— S. A. Healy Co. $3,217,510
— G. L. Tarlton Contracting Co. 3,327,680
— J. A. Jones Construction Co. 3,343,517
— The Shea Co. 3,405,958
— S. S. Magoffin Co. 3,484,343
(5) Engineer's estimate 3,202,207

	(1)	(2)	(3)	(4)	(5)
9,900 cu. yd. excavation in open cut	3.58	10.00	4.25	2.00	3.00
64,000 cu. yd. excavation in tunnel	22.56	23.00	25.50	28.80	30.00
250 sq. yd. excavation for tunnel enlargement	48.34	49.00	55.00	20.00	50.00
823,500 lb. furn. and install. perm. steel tunnel supports	.12	.16	.15	.11	.22
143,000 lin. ft. installing perm. steel tunnel supports	.04	.07	.09	.03	.10
10,300 lin. ft. furn. and install. tunnel roof support bolts	1.45	4.00	1.25	2.00	3.00
355 M.b.m. furn. and erecting perm. timbering in tunnel	242.00	238.00	150.00	200.00	320.00
1,720 lin. ft. drilling feeler or pilot holes ahead of tunnel excavation	2.10	1.00	1.00	4.00	1.50
1,720 lin. ft. drilling grout holes through conc. tunnel lining	2.10	1.15	1.00	4.00	2.50
2,900 lb. furn. and placing grout pipes and connections	.97	1.38	1.00	.35	1.15
8,600 cu. ft. pressure grouting	3.22	2.75	2.50	3.00	3.00
25 cu. yd. reinforced concrete at tunnel ends	73.00	70.00	100.00	60.00	80.00
17,500 cu. yd. concrete in tunnel lining	25.78	39.90	35.00	38.00	39.00
26,900 bbl. furn. and handling cement	7.25	3.50	7.00	3.75	4.50
4,700 lb. furn. and placing reinf. bars	.22	.28	.16	.10	.20
66 lin. ft. placing rubber water stops in joints	5.00	4.15	3.50	2.00	2.00
9,400 lb. furn. and installing weep pipes in tunnel lining	.72	.27	.75	.35	1.00
12,000 lin. ft. constructing 8-in. diam. tunnel drain	8.00	6.00	5.00	6.00	4.00

Streets and Highways

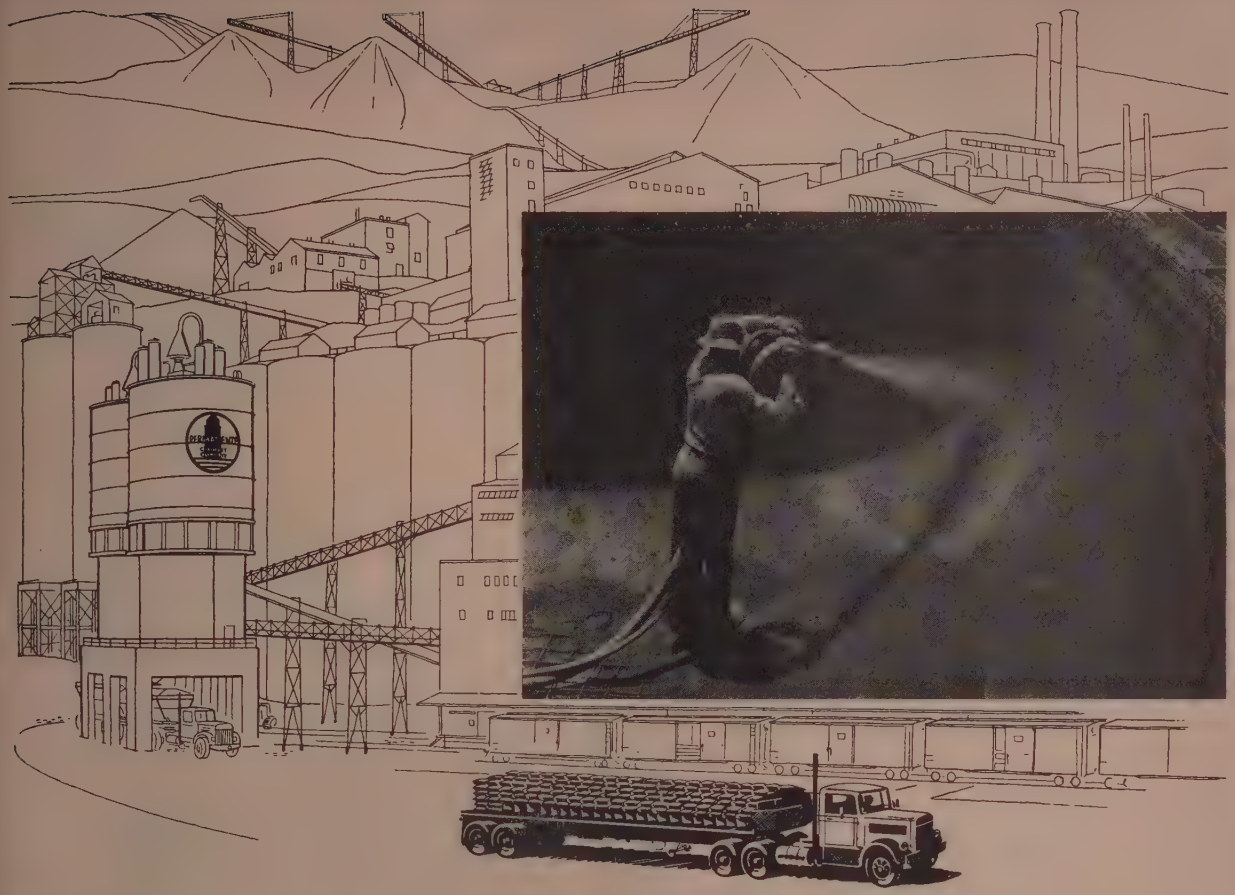
Plant-mix surfacing on untreated rock base

California—Orange County—State. Sully-Miller Contracting Co., Long Beach, with a bid of $237,405, was low bidder before the California Division of Highways for 4.3 mi. of grading and surfacing with plant-mixed surfacing on untreated rock base and B.S.T. to be applied to untreated rock base on the shoulders, on Bristol St. and Palisades Rd., between Delhi Rd. and MacArthur Blvd. Unit bids were submitted as follows:

(1) Sully-Miller Contracting Co. $237,405
(2) R. J. Noble Co. and R. J. Noble J. V. 246,167
(3) J. A. Thompson & Son $255,275
(4) Griffith Company 266,871
(5) Clyde W. Wood & Sons, Inc. 313,285

	(1)	(2)	(3)	(4)	(5)
226 sta. clearing and grubbing	16.40	30.00	25.00	28.00	20.00
44,600 cu. yd. roadway excavation	.61	.70	.65	.75	1.00
9,370 cu. yd. ditch and channel excav.	.86	.64	.55	.63	1.00

(Continued on page 126)



Dependable Delivery

For Efficient Gunite Operations

One of Gunite's most potent selling factors is speed of placement. Permanente Cement Company, with the co-operation of leading Gunite contractors, has perfected a delivery system that places sacked cement on the job well in advance of the deadline—to maintain a steady flow of materials into the pumping system.

PERMANENTE HIGH-EARLY STRENGTH PORTLAND CEMENT produces concrete that is particularly well adapted to gunite placement. It sets up quickly and attains a strength in 24 hours comparable to that attained in seven days by ordinary cement. Permanente High-Early, applied by Gunite, is widely used by Pacific Gas & Electric Company to maintain the canals that feed its wide-spread hydro-electric system.

PERMANENTE CEMENT COMPANY

On the job - On time

PERMANENTE
CEMENT COMPANY

PERMANENTE, SANTA CLARA, YOSEMITE AND KAISER BRANDS OF PORTLAND CEMENT AND PERMANENTE LIME PRODUCTS

OAKLAND • PORTLAND • SEATTLE
ANCHORAGE • FAIRBANKS • HONOLULU

UNIT BID PRICES... CONTINUED

		(1)	(2)	(3)	(4)	(5)
87,300	sq. yd. compacting original ground	.02	.02	.05	.035	.07
Lump sum,	dev. wat. sup. and furn. wat. equip.	$1,650	$5,700	$1,000	$1,400	$10,000
2,560	M. gal. applying water	1.90	1.20	1.75	1.80	1.40
226	sta. finishing roadway	8.50	6.00	12.00	8.50	15.00
51,460	ton untreated rock base	1.895	1.82	2.00	2.00	2.40
322	ton liquid asphalt, SC-3 or SC-4 (B.S.T.)	22.50	19.00	23.00	21.00	20.22
140,080	sq. yd. preparing, mixing and shaping surface (B.S.T.)	.09	.08	.16	.12	.10
62	ton liquid asphalt, SC-2 (pr. ct.)	26.50	22.00	25.00	25.00	24.50
10,000	ton mineral aggregate (P.M.S.)	3.62	4.25	4.15	5 00	4.10
500	ton paving asphalt (P.M.S.)	3.62	4.25	4.15	5.00	17.00
22	ton asphaltic emulsion (sl. ct.)	50.00	26.00	30.00	30.00	35.00
198	cu. yd. Class "B" P.C.C. (implement crossing)	20.00	20.00	26.00	18.50	21.00
347	cu. yd. Class "A" P.C.C. (structures)	56.18	55.00	55.00	55.00	66.00
39,290	lb. bar reinforcing steel	.138	.135	.11	.12	.14
860	lb. misc. iron and steel	.70	.70	.50	.45	2.00
296	lin. ft. 12-in. C.M.P. (16 ga.)	2.98	2.65	3.00	3.50	3.85
14	lin. ft. 15-in. C.M.P. (14 ga.)	3.82	4.40	3.25	4.50	4.00
508	lin. ft. 18-in. C.M.P. (16 ga.)	3.82	4.40	3.80	5.00	5.00
122	lin. ft. 24-in. C.M.P. (14 ga.)	4.80	6.40	5.60	7.00	5.40
10	lin. ft. 29-in. x 18-in. C.M.P. arch (14 ga.)	4.95	8.00	6.50	8.00	7.00
372	lin. ft. 30-in. C.M.P. (14 ga.)	5.50	8.00	6.75	8.50	6.20
20	lin. ft. 30-in. C.M.P. (12 ga.) to be installed by jacking method	25.00	16.20	25.00	25.00	17.50
108	lin. ft. 48-in. C.M.P. (12 ga.)	11.10	16 00	14.30	16.00	14.80
70	lin. ft. 84-in. C.M.P. (8 ga.)	33.30	40.00	45.00	45.00	40.00
33	lin. ft. salvag. exist. pipe culverts	2.00	1.00	3.00	1.25	3.00

Gravel surfacing in Utah

Utah—Beaver County—State. Parson & Fife Construction Co., Brigham City, with a bid of $207,886, was low before the State Road Commission of Utah for 13½ mi. of gravel surfaced road on State 21 between Frisco and Wah Wah Summit. Unit bid prices were as follows:

(1)	Parson & Fife Construction Co.	$207,886	— Strong Co. $251,618
(2)	Marion J. Hess	219,051	— J. M. Sumsion & Sons 268,453
(3)	W. W. Clyde & Co.	219,548	— Thorn Construction Co., Inc. 271,912
(4)	Sorenson Bros. & England Bros.	219,918	— Young & Smith Construction Co. 290,459
(5)	Reynolds Construction Co.	243,538	(6) Engineer's estimate 225,865

		(1)	(2)	(3)	(4)	(5)	(6)
79,000	ton gravel surface, Type "A"	.60	.60	.72	.65	.65	.65
20,000	ton gravel surface, Type "A" stockpiled	.48	.55	.57	.50	.50	.60
27,000	cu. yd. selected material base course	.42	.50	.48	.55	.50	.80
3,000	ton cover material, Type "A" in stockpile	2.00	2.00	2.00	2.00	2.00	2.50
196,000	cu. yd. unclassified roadway excav.	.24	.26	.22	.27	.35	.25
50,000	sta. yd. Class "A" overhaul	.02	.02	.02	.015	.02	.02
5,000	yd. mi. Class "B" overhaul	.20	.15	.15	.15	.15	.20
1,450	hr. rolling, tamping roller	8.00	9.00	10.00	9.25	10.00	8.00
430	hr. rolling, pneumatic tire or power roller	6.00	6.00	7.00	6.00	7.00	6.00
2,294	lin. ft. 24-in. corrugated metal pipe	5.00	6.00	5.20	5.25	5.10	5 20
218	lin. ft. 30-in. corrugated metal pipe	5.96	7.00	6.35	6.50	6.50	6.40
264	lin. ft. 36-in. corrugated metal pipe	9.25	12.00	10.35	9.75	10.00	10.00
196	lin. ft. 48-in. corrugated metal pipe	15.00	16.00	14.20	14.50	15.60	13.70
226	lin. ft. 60-in corrugated metal pipe	25.00	30.00	26.60	24.00	25.00	21.75
126	lin. ft. 72-in. corrugated metal pipe	30.00	31.00	32.00	29.00	33.00	28.60
64	lin. ft. 84-in. corrugated metal pipe	43.50	37.00	41.10	40.00	45.00	38.50
2,000	cu. yd. excav. for structs., unclassified	2.00	2.00	1.50	1.85	1.00	1.50
1,000	cu. yd. small ditch excav.	.50	1.00	.60	.75	1.00	.50
240	hr. mechanical tamping	5.00	5.00	5.00	5.00	10.00	4.00
100	acre clearing and grubbing	30.00	20.00	25.00	25.00	20.00	50.00
2,000	cu. yd. loose riprap	4.00	3.50	4.50	1.75	5.00	2.50
20	cu. yd. grouted riprap	15.00	15.00	29.00	12.00	20.00	50.00
60	ea. moving utility poles	5.00	10.00	25.00	20.00	20 00	10.00
150	ea. right-of-way markers	6.00	7.00	6.00	5.50	7.00	5.25
1	ea. F. A. P. marker	25.00	30.00	30.00	25.00	25.00	20.00
Lump sum,	furn. construction signs	500.00	500.00	500.00	500.00	$1,000	500.00
100	cu. yd. excav. for structs. (unclassified)	5.00	2.50	2 00	3.00	2.00	5.00
201	cu. yd. concrete, Class "A"	80.00	77.50	70.00	85.00	85.00	80.00
31,040	lb. reinforcing steel	.15	.15	.14	.16	.16	.15

Grading and asphaltic concrete paving in Oregon

Oregon—Lane County—State. Inter-City Sand & Gravel Co., Eugene, with a bid of $251,647, was low before the Oregon State Highway Department for grading and asphalt paving on the Springfield section of the McKenzie Highway. Unit bids were submitted as follows:

(1)	Inter-City Sand and Gravel Co.	$251,647	(5) Grimstad & Vanderveldt $296,466
(2)	Acme Construction Co.	263,050	(6) Erland & Blickle 295,146
(3)	Hamilton and Thomas	275,229	— J. N. Conley 334,855
(4)	Central Heating Co. and F. L. Sommers	284,123	

		(1)	(2)	(3)	(4)	(5)	(6)
All specified	clearing and grubbing	$7,500	$7,500	$7,000	$4,500	$2,000	$3,000
450	sq. yd. removal of pavement	1.50	1.00	1.00	1.00	1.00	1.20
320	lin. ft. removal of curbs	1.00	1.00	.20	1.00	.30	.60
4	only removal of catch basins	20.00	25 00	15.00	20.00	20.00	35.00
1	only removal of manholes	35.00	50.00	40.00	30.00	50.00	25.00
6,400	cu. yd. structural excav., unclassified	1.50	2.00	2.00	3.50	2.00	4.00
23,500	cu. yd. general excav., unclassified	.60	.70	70.00	1.00	.35	.75
78,000	yd. sta. short overhaul	.02	.02	.03	.02	.02	.02
800	cu. yd. sta. long overhaul	.50	.60	.50	.50	.50	.80
2.18	mi. finishing roadbed and slopes	$1,000	850.00	700.00	$1,000	500.00	600.00
240	cu. yd. furn. and placing topsoil	2.00	3.00	2.50	3.00	2.50	4.00
1,550	lin. ft. 6-in. perf. metal drain pipe, coated	1.75	1.60	1.80	1.65	1.70	1.70
6,400	lin. ft. 8-in. perf. metal drain pipe, coated	2 00	2.10	2.30	2.15	2.20	2.40
560	cu. yd. ¾-in. - 0 backfill in drains	4.00	3.50	3.00	3.00	4.00	3.50
1,300	lin. ft. 18-in. concrete pipe	3.00	3.40	3.25	3.10	3.00	3.60
70	lin. ft. 24-in. concrete pipe	4.15	4.65	4.00	5.00	5.00	5.00
1,900	lin. ft. 8-in. sewer pipe	1.25	1.20	1.40	1.40	1.00	1.80

(Continued on page 128)

UNIT BID PRICES... CONTINUED

		(1)	(2)	(3)	(4)	(5)	(6)
380	lin. ft. 10-in. sewer pipe	1.50	1.56	1.70	1.75	1.50	1.90
2,040	lin. ft. 12-in. sewer pipe	1.75	1.85	2.00	1.85	2.00	2.10
1,330	lin. ft. 18-in. sewer pipe	2.75	3.15	3.10	3.00	3.10	3.80
2,950	lin. ft. 24-in. reinf. sewer pipe	4.15	4.65	4.20	4.50	4.75	5.50
3,070	lin. ft. 30-in. reinf. sewer pipe	5.65	6.25	6.00	6.25	6.25	8.00
450	lin. ft. salvaging culvert pipe	2.00	2.00	1.00	3.00	2.50	1.50
130	lin. ft. ½-in. galvanized iron pipe	.75	.40	.50	1.50	.25	.35
230	lin. ft. ¾-in. galvanized iron pipe	.75	.50	.60	2.00	.35	.42
380	lin. ft. 1-in. galvanized iron pipe	1.00	.65	.70	2.00	.60	.51
70	lin. ft. 1¼-in. galvanized iron pipe	1.25	.80	.85	2.00	1.00	.75
50	lin. ft. 1½-in. galvanized iron pipe	1.50	.90	.95	2.00	1.25	.90
4	only 1-in. control valves	25.00	6.00	12.00	7.00	20.00	17.50
1	only 1¼-in. control valves	25.00	10.50	16.00	15.00	24.00	22.50
6	only ½-in. drain valves	4.00	6.00	8.00	5.00	12.00	12.50
42	only pop-up sprinkler heads, non-revolving	5.00	5.50	4.60	7.00	3.00	6.25
45	only concrete catch basins	60.00	75.00	70.00	60.00	80.00	75.00
25	only concrete manholes	225.00	175.00	200.00	150.00	300.00	175.00
3	only adjustment of manholes	50.00	50.00	20.00	50.00	50.00	50.00
4	only adjustment of catch basins	20.00	25.00	15.00	50.00	30.00	25.00
900	cu. yd. conc. curbs and gutters	37.00	33.00	50.00	40.50	45.00	33.00
800	only ¾-in. x 18-in. dowell bars in gutters	.40	.75	.60	.50	.50	.75
210	sq. yd. 4-in. conc. walks and surfacing	3.00	3.15	3.60	4.00	3.60	3.15
30	lin. ft. 1-in. electrical conduit	1.00	1.00	1.60	1.00	.80	1.30
31,400	cu. yd. selected roadbed topping	.45	.50	.45	.60	1.50	.70
50,000	yd. mi. hauling roadbed topping	.20	.25	.22	.20	.12	.30
3,100	cu. yd. ¾-in. - 0 material in leving course and shoulders	2.25	2.25	3.00	2.80	3.00	3.00
700	M. gal. sprinkling	2.50	2.50	3.00	2.00	3.00	3.00
430	cu. yd. ¾-in. - 0 material in binder course	4.00	3.50	4.00	4.00	5.00	4.00
70	ton RC-3 asphalt in binder course	42.00	48.00	42.00	42.00	50.00	42.00
10,400	ton Class "B" asphaltic concrete	6.40	6.50	6.40	6.40	7.00	6.40
46	ton RS-1 emulsified asphalt in seal coat	43.00	50.00	43.00	43.00	50.00	43.00
280	cu. yd. aggregate in seal coat	5.00	5.50	5.00	5.00	5.00	5.00
170	lin. ft. asphaltic conc. traffic markers	1.00	1.50	1.00	1.00	1.25	1.00
8,000	sq. ft. preparing soil and seeding	.05	.02	.03	.05	.02	.05
12	lb. grass seed, Highland Bent	2.00	1.50	1.50	2.00	2.00	2.50
20	lb. grass seed, Creeping Red Fescue	2.00	1.00	1.60	2.00	1.00	2.50
2	cwt. commercial fertilizer (6-10-4)	10.00	5.00	6.00	5.00	10.00	20.00

Miscellaneous

Irrigation system and planting along Oregon highway

Oregon—Multnomah County—State. Western Golf Course Supply Co., Portland, submitted a low bid of $30,316 before the Oregon State Highway Department, for constructing an irrigation system and sowing grass seed on the Harbor Drive section of Pacific Highway West in Portland. Unit bids were submitted as follows:

(1) Western Golf Course Supply Co. $30,316
(2) Portland Construction Co. 32,873
(3) Heceta Landscape Co. 34,871
(4) Ernest Ferrante & Co. $39,232
(5) Sprague McDowell 44,645

		(1)	(2)	(3)	(4)	(5)
3,000	lin. ft. ½-in. galvanized iron pipe	.36	.42	.35	.46	.53
5,400	lin. ft. ¾-in. galvanized iron pipe	.48	.50	.42	.52	.65
8,100	lin. ft. 1-in. galvanized iron pipe	.57	.60	.50	.67	.69
3,950	lin. ft. 1¼-in. galvanized iron pipe	.73	.70	.65	.85	.87
2,550	lin. ft. 1½-in. galvanized iron pipe	.85	.80	.80	1.02	.98
3,950	lin. ft. 2-in. galvanized iron pipe	.98	1.05	1.15	1.45	1.35
400	lin. ft. 2½-in. galvanized iron pipe	1.30	1.60	1.95	1.85	2.10
2	only ¾-in. control valves	7.25	9.00	11.00	9.95	18.40
12	only 1-in. control valves	8.90	13.25	15.00	12.40	19.80
14	only 1¼-in. control valves	12.00	15.25	19.00	16.70	22.30
20	only 1½-in. control valves	15.00	19.00	21.00	21.70	24.45
40	only 2-in. control valves	21.00	22.00	26.00	26.70	29.90
60	only ¾-in. quick-coupling hose valves	6.25	4.30	5.00	7.59	8.30
40	only ½-in. drain valves	8.00	10.00	11.50	4.60	14.80
650	only sprinkling heads, pop-up, non-revolving	4.10	4.00	5.25	6.60	7.75
60	only sprinkling heads, pop-up, revolving	12.00	20.00	15.00	15.00	12.60
200	only shrubbery heads	1.40	.95	3.50	6.60	7.15
6	acre preparing soil and seeding	950.00	$1,150	$1,390	871.20	$1,635
400	lb. grass seed, Highland Bent	.73	.80	.90	2.10	.95
600	lb. grass seed, Creeping Red Fescue	.67	.75	.90	1.90	.84
250	lb. grass seed, Kentucky Blue	.77	.85	.85	1.80	1.10
70	cwt. inorganic fertilizer, 10-6-4	3.00	4.00	6.00	6.75	4.20

Plant-mix surfacing of garage yard

California—Los Angeles County—State. Griffith Co., Los Angeles, submitted the low bid of $14,094 before the California Division of Highways, for grading and plant-mixed surfacing at Shop 7 Yard in the North Hollywood section of Los Angeles. Unit bids submitted were as follows:

(1) Griffith Co. $14,094
(2) Schroeder & Co. 15,101
(3) A. A. Edmondson $16,069
(4) McGinnis & Gautier, Inc. 17,817

		(1)	(2)	(3)	(4)
680	cu. yd. roadway excavation	2.10	2.30	3.00	1.00
70	cu. yd. structure excavation	4.00	2.80	2.00	4.00
10,850	sq. yd. preparing subgrade (Class "B" Method No. 2)	.18	.185	.25	.27
Lump sum, dev. water sup. and furn. water equip.		300.00	270.00	400.00	134.03
25	M. gal. applying water	4.00	2.30	1.00	6.00
1,750	ton mineral aggregate (PMS)	4.25	4.50	4.52	5.48
92	ton paving asphalt (PMS)	4.25	4.50	4.50	5.48
11	ton liquid asphalt, SC-2 (pr. ct.)	40.00	43.50	39.80	30.00
5	ton asphaltic emulsion (sl. ct.)	65.00	85.00	78.00	100.00
12	cu. yd. Class "A" P.C.C. (tree wall wells)	50.00	66.00	40.00	75.00
28	cu. yd. Class "B" P.C.C. (gutters)	30.00	36.50	40.00	65.00

Battery additive passes the acid test

THE FUTURE now looks brighter for Pioneers, Inc., of Oakland, Calif., manufacturer of Battery AD-X2, a product designed to prolong the life expectancy of lead acid storage batteries. The additive was noted in *Western Construction* in February 1951, p. 83, in an item describing plans of Pioneers, Inc., to expand its facilities which include production of the additive and also the reconditioning and sale of junk batteries after treatment with Battery AD-X2. Since that time, however, the product has had its acceptance effectively barred by adverse comment from the National Bureau of Standards, which has taken a dim view, reflected in test results, of many battery additives.

Now, however, privately sponsored tests of Battery AD-X2 have been conducted and the results made public by the Senate Small Business Committee. The tests were done at Massachusetts Institute of Technology and at Catholic University; they were better conceived and executed than previous tests, and their results show conclusively that Battery AD-X2 works as claimed. The investigators, however, like the product's inventor and manufacturer, Jess Ritchie, do not yet know why.

Generally, the results are that treated cells in any chosen battery show larger capacity than untreated cells, that treated cells show a reduction in sediment, that treated cells show less liquid loss under similar charge condition, that treated cells operate from 2 to 5 deg. Fahrenheit cooler, that they give higher hydrometric readings, that they show a higher electrolyte conductivity, and that the negative plate is distinctly softer.

Many other battery additives have been developed which effectively render the hardened lead sulfate of the negative plate softer, thereby making the job of charging easier. However, these additives also cause electrode material to shed, and relief is only temporary: the charge won't last.

Battery AD-X2 does not have this eventual adverse effect. As claimed, it does reduce the harmful effects of sulphation and extend the life expectancy of mechanically sound lead storage batteries, and it does encourage redeposition of shed materials through electrophoresis.

AIR-BORNE SUPPLIES FOR ALCAN

MOST SPECTACULAR PHASE of Alcan's project in British Columbia is "air-lift" by helicopter, supporting an isolated mountain-top camp with everything from lumber to chocolate bars. Here helicopter brings in supervising engineer as International TD-24 crawler tractor crew "gases" up with can of diesel fuel previously dropped.

NEW LITERATURE

201

Technical bulletin on high tensile steel bolts

Detailed information on high tensile steel bolts for structural joints is contained in a 12-page technical bulletin (101) available from **Pittsburgh Screw and Bolt Corp.** Recommended for building and bridge construction, the bolts are said to exceed both cold and hot-driven rivets in fatigue strength, yet to save costs on installation and maintenance. In addition to technical data, the booklet presents specifications on the assembly of structural joints where the bolts were used. Put key number on coupon for your free copy.

202

Concrete air-entraining fully described

What questions you might have about concrete air-entraining are probably answered in this comprehensive booklet being offered by **A. C. Horn Co.** Pointing out that controllable entrainment of air in cement marks one of the big strides forward in concrete engineering, the booklet explains what it is, how it is done, and its advantages. Tables show test results on bond strength, bleeding, freezing and thawing of concrete.

203

Bulletin on Telsmith jaw crushers

Complete specifications and dimensions of nine sizes of the Telsmith jaw crushers are contained in a bulletin offered by **Smith Engineering Works.** Sectional views show the general construction of these heavy duty crushers and a table of specifications gives capacity of each model.

204

Pump catalogs available

Descriptive folders on the complete line of self-priming centrifugal contractors' pumps are offered by **Gorman-Rupp Co.** Illustrated are models ranging in capacity from 2 in. to 10 in., pumping 240,000 g.p.m. Performance and pump selection tables are included to assist in choosing the proper pump for different jobs.

205

Free 100-page ephemeris and almanac

The 1953 edition of **W. & L. E. Gurley** ephemeris, including an almanac listing 28 selected stars for determining azimuth by stellar observations, is now being offered. This 100-page, pocket-size booklet includes definitions of astronomical terms, descriptions of observation methods, and examples of reducing data for determining a true meridian. Tables abridged from the American Ephemeris and Nautical Almanac and the Bureau of Land Management include: sun's apparent declination and equation of time for each day of the year; mean refractions in altitude and declination; azimuth of polaris at elongation and all hour angles; logarithms of numbers and conversion tables of decimal parts, arc to time and time to arc.

206

Sprayweld process explained

The Colmonoy Sprayweld process, which combines the advantages of welding and metallizing, is discussed in a bulletin by **Wall-Colmonoy Corp.** The bulletin describes and illustrates

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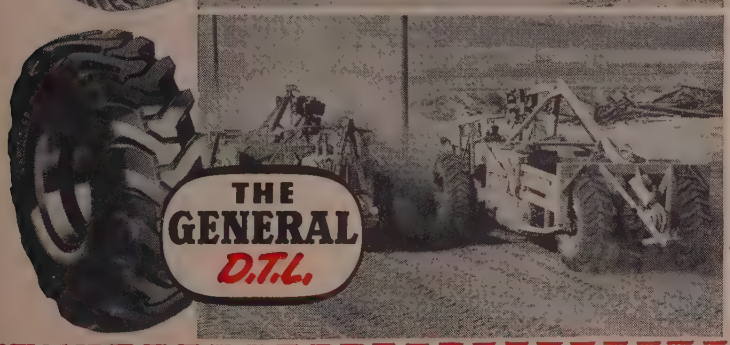

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latest developments in the Company's equipment that enable powdered hard facing alloys to be fusion-bonded to metal parts, providing a non-porous, wear, heat, erosion and corrosion-resistant surface.

207

Torque converter drive

Twin Disc Clutch Co. offers a bulletin (501) explaining how its truck-type, three-stage hydraulic torque converter drive improves performance, prolongs equipment life and prevents operator fatigue. The bulletin describes application to on-highway and off-highway units of torque multiplication where the truck operation involves constant climbing and descending of steep grades.

208

Roofing data available

Said to be the most complete compilation of roofing data for architects, contractors and engineers is this manual offered by **Philip Carey Manufacturing Co.** Included in the 80 pages is all information necessary for the specification or erection of bonded built-up roofs. New and changed specifications can be added to the spiral-bound manual to keep it up-to-date.

209

Sewer plant equipment

The Dorr Co. has available a 24-page book (6400) on its Dorrco bar screen and Sulzor disintegrator. Photographs and detail drawings in this attractive bulletin show installation views of both the screens for shallow and deep channels, and the heavy duty, axial flow pump disintegrator.

210

Details on dump bodies

Now is the time to prepare for next spring's construction projects and you may be thinking about new or additional equipment to widen your field. **Galion Allsteel Body Co.** has a catalog (L-6512) on its line of dump bodies, hydraulic hoists and end-loaders. Outstanding feature of this catalog is a reference table which makes selection an easy matter. Engineering diagrams and complete technical data information are included.

211

Rust inhibitor described

Use of the rust inhibitor, Banox, in conjunction with salt for clearing streets and roads of snow or ice is described in a folder by **Calgon, Inc.** Folder text describes how action of this material protects metal surfaces of vehicles, bridges, etc., against corrosion during winter months.

212

For your picture collection

An attractive, miniature album of 15 colored photographs, spiral bound, shows Cummins powered equipment

in action. Titled "Winning the West by Repowering" the album is offered free by **Watson & Meehan.** This is the second of a collection of Western industrial shots published by Northern California and Eastern Nevada Cummins Diesel dealers.

213

How the Government did it

Governmental Graders is the subject of a booklet published by **Caterpillar Tractor Co.** especially for the use of contractors engaged in local-rural road work. The booklet (30469) tells how cities, counties and other governmental groups applied the three sizes of Cat motor graders to their maintenance problems. A full page is devoted to a table of repair costs compiled from public records.

214

CO protective device

Contractors involved in tunnel, garage, foundry or industrial plant projects where carbon monoxide is a threat will be interested in a folder 201 describing the **Taller & Cooper** carbon monoxide detector. Functional description, installation instructions and component parts are illustrated.

215

Cat tractor-scraper bulletin

"They get around in a hurry" says **Caterpillar Tractor Co.** describing their DW 1 tractor and No. 21 scraper in a bulletin (30505) now available. Action pictures show how this equipment moves big loads over long hauls at high speeds.

216

New conduit described

A new flat-sided conduit for underground power and communication circuits is dealt with in a bulletin just issued by **Soapstone Duct Co.** Also illustrated and described is the company's standard round conduit, spaces and other accessories for underground duct systems.

217

Hose information

A catalog describing five grades of air hose and a new catalog on four types of water suction hose has been published by **B. F. Goodrich Co:** Both books give specifications, materials and methods used in construction, as well as recommended uses.

218

Fireproof construction

Basic details of 32 approved fire retardant constructions using lightweight plaster or concrete made with perlite aggregate are included in a folder now available from **Perlite Institute.** Construction details are given for applying fire protection to columns, floors, ceilings and partitions and technical data is compactly arranged for quick reference.

219

Controlled earthmoving

Here's a new 8-page publication (30529) featuring **Caterpillar Tractor Company's** No. 12, 112 and 212 motor graders and shows some of the many construction uses for these machines in diversified fields.

220

Asphalt plant folder

A new, illustrated brochure (525) issued by **Standard Steel Corp.** describes the important improvements and special features of the recently introduced RB series of Standard's asphalt plants. The RB salient points such as the sectionized mix lining, extra large dryer capacity and oversized elevators are explained. They are available in 500 to 6,000-lb. batch capacities.

221

No rust paint described

Offered by **L. Sonneborn Sons, Inc.,** are three pieces of literature on their S.R.P. rust prevention paint. A general discussion of the product which can be used either as a preventive or as a paint over already heavily rusted surfaces is the subject of one booklet, while the summary of performance test data on both interior and exterior use is shown in a companion piece. A folder shows the seven attractive finishes available.

222

Concrete curing compound described

Description of the original process for concrete curing is contained in a folder offered by **Hunt Process Co.** Information on application, advantages and recommended uses are given for the four compounds: clear for natural color; cure and bond breaking for precast construction; black for cure and waterproofing and the pigmented process for temperature control.

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Please list below key numbers of items in which you are interested

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_____ _____ _____

Name_____

Address_____

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Position_____

Organization_____

NEW EQUIPMENT

More information on any of the items in this section may be obtained by using coupon on page 133.

223

Precision power saw can be used under water

For undersea sawing, here's an air-driven power saw which serves the purpose, as well as being suitable for other types of jobs. The Wright Precision Power Saw has been on the market for over two years, and is currently being used by the U. S. Engineers, Marines and Navy. The 15-lb. tool is the only saw with reciprocating blades which enables it to do precision cutting. The saw was designed primarily for normal functions above water but it has been used successfully for pile cutting under water operated by only one diver. It has an adjustable handle enabling it to cut in any position. Blades can be changed on the job in three minutes. Balanced, reciprocating action eliminates bucking and kicking in this lightweight instrument. Manufactured by **Wright Power Saw and Tool Corp.**

224

Improved plant meets strict specifications in producing 200 tons per hour

Cedarapids Master Plant, a newly engineered and improved volumetric-type bituminous mixing plant designed to supply specification mix in large volume has been announced by **Iowa Manufacturing Co.** This continuous-

mix plant consists of two units, the improved Model MM Master Mixing Unit and Model MGC Master Gradation Control Unit, combined into a complete plant. The Master Mixing Unit is offered with a choice of a single shaft or twin shaft pugmill, and both can produce up to 200 tons per hr. Both models feature highest volume below the center line of the shaft, assuring better, faster mixing with less power required. Accurate controls continually police the quality of the material to meet the strictest specifications. The Gradation Control Unit of the Master Plant can be replaced by Model TEF Transfer Elevator and Feeder Unit for production of single aggregate hot mixes. A bulkhead-type aggregate feeder is available for the Model MM Mixing Unit to produce single aggregate cold mix. The plant is fully enclosed to minimize dust and heat loss, and it is highly portable for fast moving from job to job.

225

Mini-Breaker replaces small fuses to give permanent circuit protection

Readers should welcome news of Mini-Breaker, an inexpensive new permanent protective device against overloads and short-circuits. It is the first such device to meet the design, safety and performance requirements of Underwriters' Laboratories, Inc., to be listed as "Circuit Protector" by that organization. It fits like an ordinary expendable fuse in any standard Edison base fuseholder. It may be easily installed in a few seconds without the use of additional equipment or special wiring when applied to branch or main circuits of corresponding 15, 20 or 30 ampere ratings, and electrical service can be restored by pressing in and releasing its shock-proof reset button. Designed primarily for direct fuse replacement use on existing residential, commercial and industrial circuits, Mini-Breakers may also be applied as original circuit protective equipment in new buildings as well as on a wide range of electrically operated machines and appliances, according to the manufacturer. Mini-Breaker is now being produced in 15, 20 and 30 ampere ratings for AC service to 125 volt maximum. Manufactured by **Mechanical Products, Inc.**

226

New abrasive blades cut tough materials

To simplify cutting tough materials such as stone, metal, plastic, and synthetic hardboards, a new set of equipment, consisting of a high-speed, kick-proof electric saw and three types of abrasive blades, is now on the market. The three abrasive blades, each in a different color for easy identification, eliminate the problem of choosing which is right for cutting a particular substance; for tests in the manufacturer's laboratory proved that only the three types of blades were necessary to cut, score or grind al-

(Continued on page 136)

"...On the feet of Individuals."

Society advances on the feet of individuals. We Americans live under the highest standard ever achieved because we believe in and are permitted currently to practice three of the cardinal principles of progress—Invention, Research and COMPETITION.

Nineteen basic inventions influence our pattern of life today. Each one was created to satisfy a fundamental need for improvement—a modern means of competing as against outmoded procedure. Each one, such as the electric light, the telegraph, the amplifying tube, the induction motor, created a new industry in which numerous companies strove in free competition for the maximum share of business.

For example, since Thomas Edison invented the incandescent filament lamp in 1880, the electric light industry has grown to an annual volume of $501,500,000 in light bulbs alone; in May, 1906 the Wright Brothers received the patent for their flying machine; the value of aviation manufactures in 1951 in the United States alone was estimated at $3,350,000,000 and in February, 1952, records show a $10½ billion backlog of orders.

More rapid still is the growth of the radio-television industry which today produces some $230 million worth of home radio sets and $1,570,800,000 in television sets. In every case, employment and sales volume grew enormously and the public enjoyed huge personal benefits.

Side by side with Invention came Research, exemplified by the competition of intelligent men questing for new materials, new methods, new processes, new scientific truths. Current advertisements tell of hundred-year tests to assure better materials for the future, technology that produces metals to withstand almost inconceivable heat, machines calculating 20,000 times faster than the mind of man, medicines that cure "incurable" diseases, food processes that cook, sterilize and pack hundreds of cans a minute. And in every case, the public enjoys huge personal benefits.

This is what James A. Decker undoubtedly had in mind when he wrote the line, "Society advances on the feet of individuals." These "individuals" are you and I, all our countrymen, benefiting every day from Invention, Research—and from COMPETITION.

Developing inventions, marketing products, and pursuing scientific research require substantial investments. A grave danger to their future now looms. In 1951, corporation net profits suffered a loss of 21% over the previous year. The reason—taxes too high, government controls and policies that interfere too greatly with private industry. If this continues, financial resources will dwindle, competition will be stifled.

Without free competition, American progress stops. No country can long exist when its government calls all the shots. We need competition to assure progress for people.

★ ★ ★

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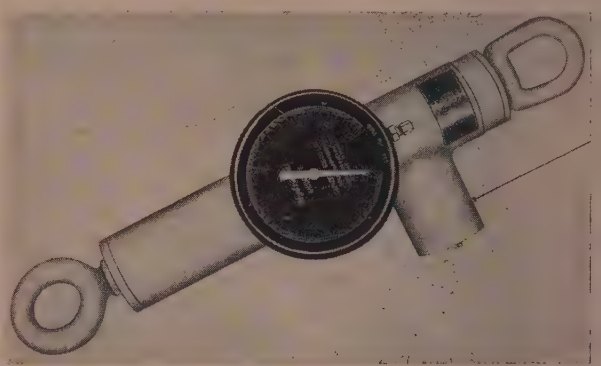
THE COMPETITIVE SYSTEM DELIVERS THE MOST TO THE GREATEST NUMBER OF PEOPLE

most any problem material. The blades are reinforced and semi-flexible to reduce danger of breakage. Not only does the abrasive edge produce a quick, clean cut, but the side of the blade can also be used as a grinding wheel. According to the manufacturer, the blades may be used effectively on any electric saw, though he does recommend the adaptability of his own product. Manufacturer is **Porter-Cable Machine Co.**

227

Hydraulic device measures hoist loads —safely and accurately

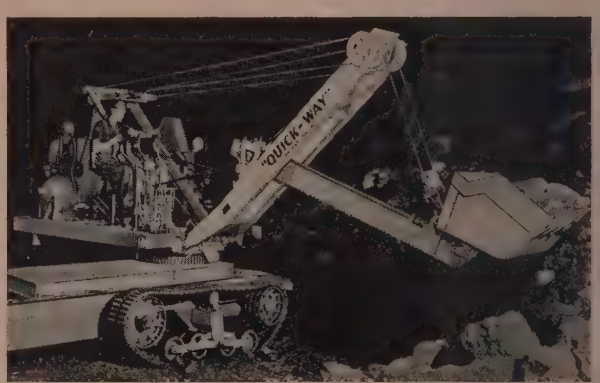
Hydra-Set, a load-weight actuated, cylinder-and-piston link between hoist and load, is a new and inexpensive hydraulic development which is now being used by the Army and Navy for accurate positioning and weighing of hoist loads. The velocity of descent is under positive con-



trol at all times, and accuracy of movement within one thousandth of an inch requires no special skill. Hydra-Set placed precision control of lowering or positioning is in the hands of the man directing the operation. The result means increased safety to both personnel and equipment. The unit is manufactured in standard models with capacity up to 20 tons, and the 20-ton capacity model weighs only 100 lb. and can be handled, installed and operated by one man. It is available with or without easily visible dial gauge which automatically indicates the weight of each load. Manufactured by **Mefco Sales and Service Corp.**

228

Front dump shovel for difficult materials in underground areas



This front dump shovel which will handle large rocks and materials which will not dump through a conventional shovel bucket has been especially designed for underground work in mines where low overhead clear-

ances and maximum dumping heights are required. It is the full-revolving modified "Quick-Way" Model "L" powered by a diesel engine with exhaust scrubbers for underground work, and mounted on a diesel-powered M-52 Half Truck with exhaust scrubbers. The front dump, 5/8-yd. shovel attachment is cable controlled throughout and equipped with positive automatic cable crowd utilizing rack and pinion on twin dipper sticks. The manufacturer can also furnish a similar attachment for mounting on any standard Model "L" unit for work in quarries and other places where overhead clearances are not involved. Manufactured by **"Quick-Way" Truck Shovel Co.**

229

Rotary scraper now on the market slices earthmoving costs

The Miller Rotary Scraper is a machine with a revolutionary new design which eliminates drag and loading pressure by lifting the earth away from the cutting blade as it scrapes. This is accomplished by special steel vanes rolling forward, constantly clearing the blade of earth and depositing it in the hopper. The manufacturer claims that the advanced design can cut earth moving costs as much as one-half. The new scraper has double cutting action making it possible to cut harder ground, in many cases without the necessity of ripping. However, its design makes it ideally suited for loading and spreading such light materials as sand, salt and gypsum. It is particularly suited for the construction of dams, ponds and for road building. Another feature of the scraper is that it will dump its load while stopped, and in a single pile. This machine is available in five different sizes. Manufacturer is **The Miller Rotary Scraper.**

230

All-bolted steel framing for economical construction

A new all-bolted steel framing system for construction and maintenance work recently has been introduced. The line includes a wide range of concrete inserts, pipe rollers and clamps, and other fittings suitable for such applications as tunnel framing and the hanging of fluorescent lighting fixtures. Easily installed and completely adjustable, this Flexa framing system consists of a series of specially designed components for the economical construction of all kinds of frames, hangers and racks. There is also a series of cold rolled steel channels, case-hardened serrated nuts and a number of fittings. According to the manufacturer, the unusual serrated nuts in this line eliminate the need of drilling or welding, and the concrete inserts provide a load-carrying capacity of 2,000 lb. per lin. ft. Moreover, the system's components are said to be completely re-usable and adjustable, and ideal for either permanent or temporary installations. Manufacturer is **Flexa Steel Products, Inc.**

231

Dodge's new trucks handle hauling needs

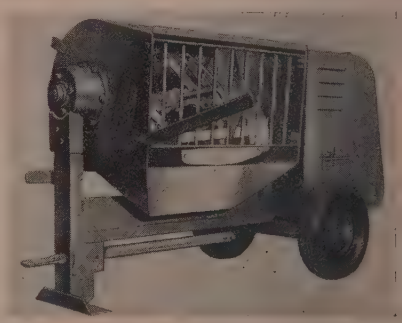
Increased power, three entirely new engines, improved brakes and a self-shifting transmission for some light models are among the many special features and improvements in the new B-4 Series of Dodge "Job-Rated" trucks. According to the manufacturer, these trucks meet approximately 98% of all hauling needs with seven engines ranging from 100 gross hp. in the ½-ton to 171 gross hp. in the 4-ton models; gross vehicle weights ranging from 4,250 to 40,000

lb., and gross combination weights ranging up to 60,000 lb. New driving ease is provided by Truck-o-matic transmission with gyrol fluid drive available for the ½- and ¾-ton models. The manufacturer is the first to offer on conventional trucks such a transmission with four speeds forward, plus one reverse speed, and which requires no gear shifting in normal driving. Higher power output means higher speed, and further increases in trouble-free engine life are assured by numerous changes and improvements. Improvements in pick-up bodies are features of these new trucks. Manufactured by **Dodge Division, Chrysler Corp.**

232

Plaster-mortar mixer for inside operation

Morspeed model 3 M-PT, a new 3- to 4-cu. ft. plaster-mortar mixer, answers the demand for inside, room-to-room mixer operation. The manufacturer states that this mixer was



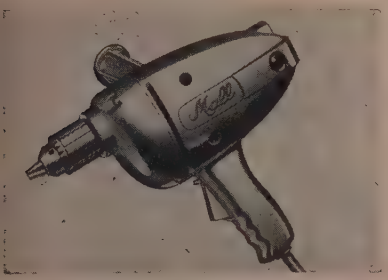
developed to provide a smaller machine with the refinements of design found on large 6-cu. ft. models. A compact, low slung frame permits a lower, 37-in. charging height, high speed trailing and easy spotting. The 4-cu. ft. drum capacity provides for increased bulk in the newer, lightweight plasters. Four adjustable mixing blades with end-to-end, hoe-type mixing action produce a more uniform plaster. Neoprene seals protect the self-aligning shaft bearings

against grit seepage, thus reducing maintenance. Bag splitter and hinged safety grill are standard equipment. A roller chain drive reduces vibration, contributing to quiet, trouble-free operation. This new Morspeed is available with either gas engine or electric power. Manufactured by **Gilson Brothers Co.**

233

MallDrill model 127 has varied applications

The portable power MallDrill model 127 is designed for both heavy- and light-duty operations. Its Universal AC-DC motor, hardened



heavy-pitched gears, self-lubricating bearings, geared chuck, built-in trigger-type switch, contoured bar handles and a spindle speed of 500 rpm. combine for efficient results, according to a recent company survey. It is applicable for grinding and drilling. For polishing and sanding the same MallDrill Model 127PS is available with the same equipment except geared clutch, plus backing pad, bonnet and three assorted discs and adapter. Manufactured by **Mall Tool Co.**

234

Ingersoll-Rand's JR-38 jackdrill

The JR-38 jackdrill, manufactured by **Ingersoll-Rand Co.**, is an air-leg rock drill combination designed as a completely integrated unit and as

such is the first of its kind offered to the rock drilling industry, according to the manufacturer. Its most radical innovation is a built-in air coupling between the drill and the feed leg, thus doing away with the third hose necessary in previous combinations. The control valve for feed leg pres-

sure is built into the backhead of the drill where it is always convenient to the operator. Moreover, feed leg pressure can be shut off with the throttle valve which controls the operation of the drill, thus eliminating feed leg pressure adjustment every time the drill is moved. The backhead is designed so that flushing water is turned on when the throttle is opened. This drill can be used either as a drifter, stopehammer or jackhammer.

235

Flat-sided conduit for underground duct systems

A flat-sided design is featured in this soapstone non-metallic conduit for concrete-encased underground

power and communication circuits, especially for those which do not require wide spacing between ways. According to the manufacturer, flat sides permit multi-way duct systems to be built up quickly and accurately without the use of spacers required with round conduit. The new conduit has the same characteristics as the manufacturer's round conduit which has been used for over 25 yr. when encased underground systems are specified. Manufactured by **Soapstone Duct Co.**

236

Holt Equipment Co. introduces heavy-duty dozer

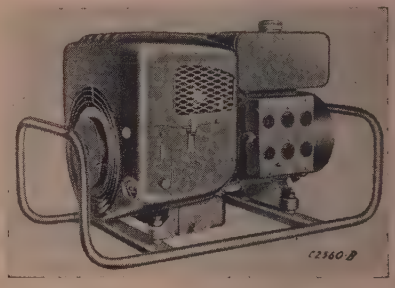
Holt Equipment Co. has added a heavy-duty dozer to its equipment line; one which will handle tougher and bigger jobs than the company's previous models. Improved design

and use of Ductilite, a new alloy developed by International Nickel Corp., reduces weight at vital balance points while maintaining the strength of steel. Actual weight reduction in the frame is nearly 1/5, resulting in less strain on the tractor itself. Because of its balanced, work-engineered construction, the Holt Heavy Duty will cut upkeep and operation costs and actually prolong the life of the tractor, according to the manufacturer. The new model is controlled by an improved finger-tip control hydraulic system which may be used for other equipment when the dozer blade is disconnected. It is available in models to fit most popular crawler-type tractors.

237

Onan's 5,000-watt, 180-cycle plant for work tools

Model 5CK-185M, a portable 5,000-watt, 180-cycle, 3-phase gasoline en-



gine-driven electric plant, designed to operate high-frequency electrical work tools, has been announced by

D. W. Onan & Sons, Inc. The plant provides independent power for 180-cycle electric tools where no standard power is available for conversion, or power for lights or emergency operations as well. It is powered by the lightweight Onan CK two-cylinder, 4-cycle, air-cooled gasoline engine. Standard equipment includes a mounted 4½-gal. fuel tank and a carrying frame. The unit is manually started. It can also produce up to 2,000 watts, 115-volt DC and remainder of total output in 230-volt AC.

238

Here's a floodlight that ignores the weather

Here's a self-contained floodlight projector which burns ordinary kerosene or #1 diesel fuel oil. No cables or other obstructions are necessary, nor are batteries or generators. This

Tilley Floodlight Projector gives a light of 5,000 mean reflected candle power and is sufficient for about 40 burning hr. Weather does not affect its operation, because it is completely wind and rain proof. A reliable source of light for emergency operations, this floodlight projector is available either with or without a 5- to 8-ft. telescopic tripod with revolving base. Weight, 22 lb.; overall height, 26 in. Priced, with tripod, at $85.00 f.o.b. Chicago. Manufactured by **Tilley Lamp Co.**

239

Double magnifier for duplex slide rules

Good news for eyesore slide rule users is this new P.E.G. Duplex Magnifier which permits accurate readings on both sides of the rule simultaneously. A special version made up for pocket-sized rules has a magnifying power of 3 times. Four other sizes of the instrument are available for the following slide rule widths: 1-15/16 in., 1⅝ in., 1-9/16 in., and 1⅜ in. These magnifiers have a magnifying power of 2½ times. Although the magnifier consists of two lenses, bulkiness is eliminated because of its folding feature which permits it to be carried flat in a scratch-preventive chamois bag. Genuine precision-ground glass lenses are featured. **Flatto Management Co.** is the manufacturer's sole representative.

240

Three newest models of plaster and mortar mixers

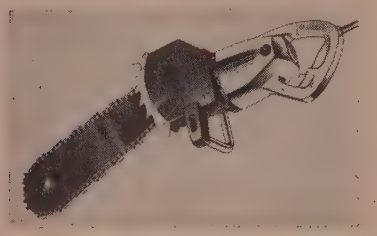
Three new models of plaster and mortar mixers (Series 100, 120 and 160), recently have been introduced by **Muller Machinery Co.** All three incorporate the paddle shaft seal originated by the manufacturer, who claims that this seal gives positive bearing protection and also guarantees it for the entire life of the mixer. Series 100 is the 3½-ft. model, replacing the company's recently discontinued 3-ft. model. It is Muller's smallest size mixer. Series 120 is the 6-ft. model. The 6- to 8-ft. heavy duty model is Series 160, intended for large jobs where extra capacity is desirable. A larger model, the Standard 9-ft. model with full 3-bag capacity is also available. Each of these mixers

is available with a selection of different motors to supply the power.

241

Low-priced electric chain saw tackles the toughest wood

Porter-Cable Machine Co. announces its new 18-lb. Model 110 electric chain saw which can tackle the toughest wood cutting jobs. More-



over, its low price makes it within the purse range of non-professional users. An exclusive feature of the Model 110 is the design of the log-gripping teeth which hold the saw against the work and enable the machine to spike and feed itself completely, thereby eliminating the need to jam or push the saw into the wood. The saw is powered by a standard Universal AC-DC 115-volt motor which develops 10 amps. A special 230-volt motor is also available, as are two portable electric generators driven by gasoline motors to provide an independent source of power in remote locations. The hard-chromed rust-resistant teeth run at 1,400 ft. per min., assuring a clean smooth cut on all hard and soft woods. It may be used for felling, bucking, limbing, topping, flush cutting, notching, or undercutting.

242

Gledhill sprayer gives weeds a double-whammy

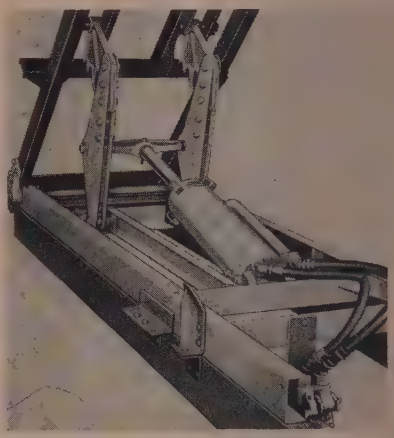
An effective means of permanently destroying weeds and brush by chemical application is this roadside sprayer, introduced by **Gledhill Road Machinery Co.** The low pressure system,

20- to 30-lb. pressure, eliminates the danger of damage to adjacent crops and gardens. This new sprayer does the job, and when growth is not accessible to the spray boom, the hand boom with its 50-ft. hose can be used. Two sizes are available, of 135 and 235 gal. each.

243

Model 770 hydraulic hoist fits wide range of trucks

Model 770 hydraulic hoist, manufactured by **Galion Allsteel Body Co.**, has been redesigned to make it suit-



able for installation in a wider range of motor trucks. According to the manufacturer, the 950-lb. new model with a load capacity of 10 to 13 tons, is ideal for most medium-duty operations. Its dump angle is 50 deg., with a mounting height of 14⅝ in. It is recommended for use on 8- to 12-ft. dump bodies.

NEWS of DISTRIBUTORS AND FACTORY BRANCHES

MAIN OFFICE of Western Construction Equipment Co. at 505 North 24th St., Billings, Mont. The distributorship now handles R. G. LeTourneau, Inc, products throughout Montana. President *H. M. Doolen* heads the company, assisted by *D. W. Doolen*, vice president, *L. J. Klinger*, sales and service manager and *H. M. Doolen, Jr.*, parts manager. This well-known distributorship has another office in Missoula.

Hunter Mfg. Co. appointment

Hunter Manufacturing Co. has appointed William C. Avery field engineer for 11 Western states. Avery, formerly Hunter's Midwest sales engineer with headquarters in Chicago, now has headquarters in San Francisco, and will set up additional dealers and distributorships in the West, western Canada and Alaska. Hunter Manufacturing Co. manufactures the Hunter Cargo Cooler and a complete line of gasoline burning heaters for diesel and gasoline-powered trucks, trailers and construction equipment.

Cat switches in Northwest

Caterpillar Tractor Co. announces the appointment of William M. Pratt as district representative with headquarters at Walla Walla, Wash., replacing R. E. Ehni who has been transferred to Seattle. Pratt will work with Braden Tractor & Equipment Co., Walla Walla; Bunting Tractor Co., Boise; Empire Machinery Co., Pendleton, Ore.; Inland Machinery Co., LaGrande, Ore., and Nez Perce Tractor & Equipment Co., Lewiston, Idaho. Ehni will now work with Collins Machinery Co., Seattle; Finning Tractor & Equipment Co., Vancouver, B. C.; Northern Commercial Co., Seattle; Murphy-Campbell Co., Tacoma, Wash., and Barnett Implement Co., Mount Vernon, Wash. Seattle's former district representative, T. A. Hopkins, is now with Peterson Tractor & Equipment Co., San Leandro, Calif., as industrial sales manager.

Distributors for Warner & Swasey Co's Gradall Earthmover

Leonard Motor Co. of Albuquerque has been appointed New Mexico distributor for Warner & Swasey Co.'s Gradall Earthmover. Leonard Motor will sell and service the novel, labor-saving truck-mounted machine which performs a variety of precision earth-moving and construction jobs. Rocky Mountain Machinery Co., Salt Lake City, will be the Earthmover's distributor for Utah and bordering counties in Idaho and Wyoming.

White makes major changes

Following the move to transfer Sterling manufacturing operations from Milwaukee to the White factory in Cleveland, White Motor Co. announces the consolidation of sales and service facilities of White and Sterling White in the West. Sterling headquarters in Los Angeles have been moved to White's branch at 400 East Washington Blvd., where a modern, spacious service department is available. Likewise Sterling headquarters in San Francisco and Portland are transferred to White facilities. In San Francisco the new million-dollar White regional headquarters has just been completed at 5th and Brannan streets. Portland facilities will be increased with the addition of a new building. Besides these three major changes, Sterling parts and service will be available at any White branch, distributor or dealer throughout the 11 Western states.

Distributor for steel framing system

Enterprise Commercial Co., 1268 Folsom St., San Francisco, has been appointed distributor for Mult-A-Frame, a fully-locking, mechanically-assembled, multi-purpose steel framing system, manufactured by Ainsworth Manufacturing Corp., Detroit. The versatile equipment is designed to build anything from simple shelving to complicated pipe-and-conduit support systems.

Continental Air Filters, Inc., appointment

Sanford Mechanical Equipment Co., Oakland, Calif., is the recently appointed sales representative of Continental Air Filters, Inc. E. C. (Sandy) Sanford is at the helm.

NEWS of MANUFACTURERS

Miller Research Engineers opens new plant

Miller Research Engineers announces the completion of a new plant at 450 South 92nd St., Milwaukee, Wis. The new facilities are not only larger but promote more efficient and improved operations for employees in the office and on the assembly line. The firm manufactures Miller Tilt-Tops, farm machinery and construction equipment trailers.

Caterpillar appointment

Jack H. Gill is new assistant manager of the industrial division of the general sales department of Caterpillar Tractor Co. Gill, a company employee since 1937, was most recently an engine sales consultant in the general sales department.

U. S. Steel Co. now Corp.

As of the first of the year, United States Steel Co. has announced that all business will be conducted in the name of United States Steel Corp. The move was made in order to simplify the large steel concern's corporate structure. As a matter of law, the surviving corporation will succeed to all of the properties and rights and assume all of the obligations of the company eliminated as a result of the merger. Accordingly, payments and other obligations called for under purchase agreements or subcontracts previously entered into will be fulfilled as required except that such action will be taken in the new name. Consolidated Western Steel is a general operating division of United States Steel Corp.

Kaiser appointment

J. M. Cosgrove, Kaiser Steel Corp.'s Northwest district sales manager at Seattle, has been appointed to the newly created position of manager, tin plate sales, at the company's home office in Oakland, Calif.

Olin promotion

D. T. Marvel, sales manager of Olin Metals Division of Olin Industries, Inc., since 1950, has been appointed the company's vice president for sales. In his new capacity Marvel will have responsibility for sales, advertising and sales promotion, and marketing activities of the operating divisions administered by F. S. Elfred, executive vice president. Another company announcement is the appointment of C. L. Whittemore, Jr., as marketing manager.

Blaw-Knox promotions

John D. Jessen and H. P. Cerutti have been promoted at the steel form department of Blaw-Knox Co. Jessen is manager and chief engineer of the department, and Cerutti has succeeded Jessen in his former status as assistant chief engineer.

Sales mgr. for hoist manufacturer

Leo M. Brown, formerly assistant sales manager at St. Paul Hydraulic Hoist, is now sales manager. He is succeeding William F. Keeton, who resigned to start his own business. St. Paul Hydraulic Hoist manufactures truck dump bodies and hoists, Pax-All refuse loading bodies, Frate-Gate elevating end-gates and Truck Patrol underbody maintenance blades.

Sales mgr. for Colorado Fuel & Iron

R. E. Metzger, with the company since 1945, has been appointed manager of tubular sales for Colorado Fuel & Iron Corp. The announcement is a preliminary step to the operation of a new seamless tube mill at Pueblo, Colo., now scheduled to start production in early autumn, 1953. The mill is strategically located to serve principal oil and gas producing centers of the nation.

New president for Chicago Pneumatic Tool Co.

Guy J. Coffey is the new president of Chicago Pneumatic Tool Co. Coffey, with the company since 1933, was elected vice president in charge of sales and a director in 1945. He succeeds W. L. Lewis, who died last June. H. A. Jackson, chairman of the board, has been acting president since that date and will continue as chairman and chief executive officer. Other newly-elected officers are Thomas P. Harris and James F. Huvane, vice presidents, and Thoman F. Noonan, assistant comptroller.

Timber Structures resignation

W. J. Van Arnam, president of Timber Structures, Inc., recently resigned. The presidential vacancy has not yet been filled, although Joseph L. Heinz, assistant secretary-treasurer, was elected to the board of directors to fill the vacancy in that position.

C.I.T. Corp. opens in Portland

C.I.T. Corp., industrial finance organization, has opened offices in Portland, serving constructors in the Northwest. Carl H. Anderson has been named assistant vice president and is in charge of the new office.

Changes at Trailmobile

Fred Rahe, head of sales management division of Trailmobile, Inc., has been promoted to assistant manager of fleet sales with headquarters in New York City. Finis H. Haskins takes over Rahe's former position.

Agent for concrete and concrete products

George C. Alden of Portland now handles specialties pertaining to concrete and concrete products industries. Alden's former connection was with Transit Mixed Concrete Co., Pasadena, Calif.

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Baby, it's cold outside (without your union suit)

Alaska is one place where people just don't talk about "June in January." Winter's realities are more consistent and long lasting up there. Apparently we get a little forgetful in this regard Stateside, and so do some of the construction men who read what we say, and what is said in other papers and magazines. The result for the last two years has been an early rush to the Alaska construction scene, and a lot of resulting disappointment when jobs didn't turn up right away. Ben I. Perkins, Executive Secretary of the Alaska Council of Carpenters, has this to say on the subject:

"At least 500 carpenters left Anchorage in the 1952 construction season without obtaining work. This same situation will prevail in 1953 and will perhaps be worse because of the magazine, radio, television, and newspapers, advertising and glamorizing Alaska as a place for wage earners to make a quick fortune.

"January 1, 1953, there weren't 50 carpenters working in the Anchorage area, where 1,700 carpenters make their homes. This condition has prevailed since October 1952 and will continue through March in spite of what has been said by officials of the U. S. Army about construction continuing on through the winter months . . .

"Your only true source of information on conditions in any area is your labor union, and in this instance the Employment Security Council of Alaska."

Twenty-five years ago in *Western Construction*

"**Robert M. Morton,** chief engineer of the Division of Highways, Department of Public Works, California, has resigned, and **C. H. Purcell,** for the past seven years district engineer at Portland for the U. S. Bureau of Public Roads, has been appointed to this important position by **Bert B. Meek,** director of Public Works."

* * *

W. A. Bechtel of San Francisco was elected president of Associated General Contractors when that organization held its annual convention in January.

* * *

California's highway commission was noted to have "at least $25,000,000 annually to spend," and Governor Young was quoted as having stated "I believe the State Highway Division is now receiving as much money for highways as can be spent economically." [The California highway budget for the coming fiscal year 1953-54 totals $169,970,000.]

Moisture control on an acreage basis

We often refer to our Western region as "the arid West." By and large it is; and this characteristic has in turn shaped the character of construction. Our highways are built in long chunks that begin and end 'way out in the sticks; our agriculture has called for irrigation works that look like the famous canals of Mars; high dams stud our mountain gorges.

But we hedge a little, too. We also note that the West is a region of extremes. Elevation, yes. Topographic character, yes. And climate, too. We may be arid generally, but we include the Pacific Northwest, acknowledged to be the wettest portion of the whole country.

Now we see that the U. S. Weather Bureau is trying on a limited scale to make the wet spot wetter. "Rainmaking" experiments are being undertaken this winter and spring in southwestern Washington, and will be continued next fall.

Always before, the idea has been to increase rainfall in dry areas where it is most needed. The weather bureau isn't yet convinced about the positive effect of rainmaking, though; and they point to the fact that no one can bring water from a cloudless sky. The seeding is always carried out on clouds of a type containing moisture that might fall naturally.

Therefore, the weather bureau is conducting its experiments in country where there are more "rainable" clouds to work with. They'll correlate records of natural rainfall in two areas for the past several years; and then they'll use one of these areas as an untreated, or "control," area while they seed the other. Comparison of rainfall records then may be expected to show up the feasibility of rainmaking.

Construction contractors, especially those running projects in southwestern Washington, may wonder if this weather bureau activity can be expected to drown out their work. And, if so, to what extent? Can they claim legitimate delays? Most important, can they get paid for possible lost progress?

You'll be able to answer a lot of these questions after reading an article in *Western Construction* next month. Recalling Guy F. Atkinson's concern a year ago over the effects of rainmaking in Santa Clara County, California, on his Navy work at Moffett Field (January 1952, p. 104), we looked up an expert on the subject. The result is "Rainmaking—It worries contractors," by Ray K. Linsley, Jr., former chief of the hydrology section of the weather bureau in Washington, D. C., now assistant professor of hydraulic engineering at Stanford.

This article by Linsley gives the background and some of the theory of rainmaking, which should be called "artificial nucleation." From it you can pretty much draw your own conclusions about the efficacy of rainmaking operations; but Linsley has some definite suggestions, too.

17 copies, please

A great amount of an editor's work involves paper. Engineers and contractors get their share of paperwork, too. But there are times we feel we have the advantage.

This thought was reinforced recently when the mail brought in a full set of contract documents from the USBR. The Bureau wanted to buy a new truck crane for its Boulder City, Nevada, operations.

The 24 separate sheets of paper involved are not in the least augmented by inclusion in the contract of the trade-in of a used truck crane. The length and breadth of the paperwork generally relates only to the new crane sought. Two sheets constitute the Invitation, Bid, and Award, with special provisions included on three continuation sheets. Ten further pages list in detail the specifications for the crane. Five sheets more form a questionnaire whereon a bidder may note the specifications of his unit for comparison with the government specifications. An additional page quotes the standard paragraph concerning renegotiation of contracts. Another page (two sides) sets forth supplemental conditions and terms relating to delivery, discounts, etc. Finally, a two-sheet, four-page standard form contains the general provisions.

All of this, just to obtain one convertible, full-revolving type truck mounted crane (including fully equipped tool chest) when the specs themselves state that "the equipment and component parts shall be essentially the standard products of the manufacturer . . ."

By THE EDITORS