WESTERN CONSTRUCTION

1954—The West's biggest highway construction year

THIS ISSUE provides an interchange of "idea" material among Western contractors and engineers — to help meet a challenging situation that demands sharpening up old ideas and thinking up new ones, in . . . . .

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ANNUAL HIGHWAY ISSUE

JUNE 1954

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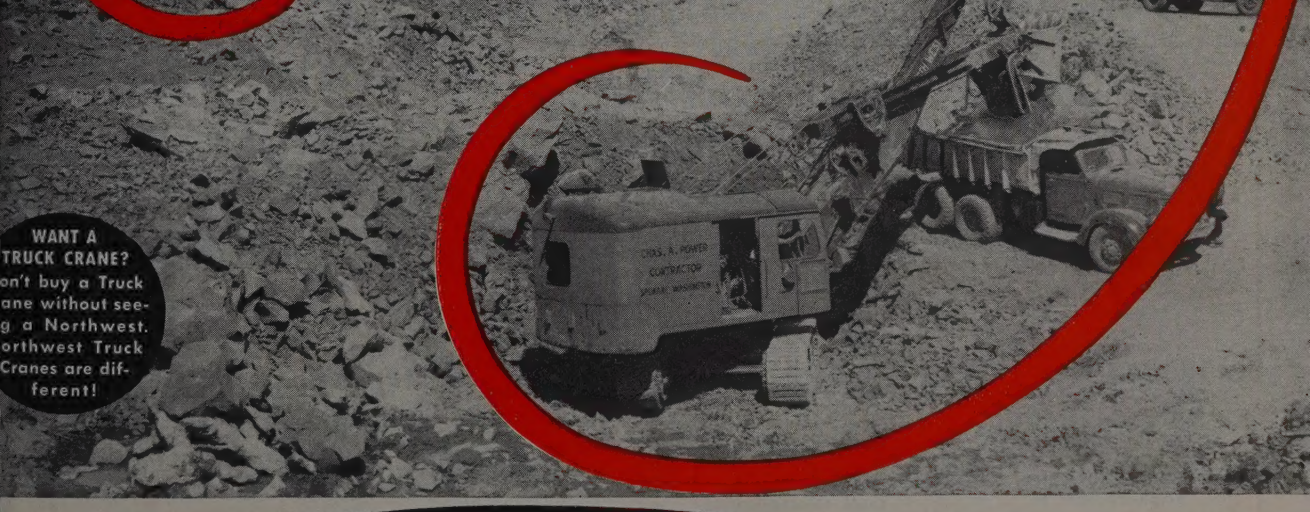

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WESTERN CONSTRUCTION

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FRONT COVER

DIRT MOVING—lots of it. Steep country—lots of that, too . . . and probably heavily timbered. That's what Western highway contractors are tackling this season as they go to work on the biggest highway construction program of all time.

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WESTERN CONSTRUCTION

Editorials

Funds vs. feasibility

A particularly good bit of engineering thinking as applied to highway planning was set forth at the Northwest Conference on Roadbuilding in Seattle last winter. The speaker was Keith F. Jones of Port Townsend, engineer for Jefferson County, Washington. He used the instance of a specific project as a framework for his talk on bridge economics, but within that framework he spoke decisively on a more or less philosophical aspect of engineering.

Too often, according to Jones, does the civil engineer for a public body fall into the trap of pleading "insufficient funds" as the reason for failure to program certain improvements eagerly sought by citizens or supervisors. It is true that a public works agency may be so short of money that many entirely justifiable projects have to be deferred. But the reason is not simply that of money.

Engineers must acquaint the public with the processes of justification of work. It would then be evident that the apparently slighted project did not have high enough justification. In highway planning, even without resort to the formality of an inventory or rating, the conscientious engineer exercises his judgment to achieve the same end, which is assignment of priorities for doing certain work.

The engineer's own question of himself, relative to a particular job, is not, "Have we the money?" Instead he asks, "Is it feasible?" By this means alone does he determine justification for the work. He is then able to place the job in its proper position of priority, and it is another problem entirely to find the money. Properly expressed for lay understanding, these same questions and their answers should be presented to the public representative upon inquiry. Confusion would be avoided, and the engineer's professional techniques favorably demonstrated before the public eye.

WANTED: Engineering cost data

Costs are the basis for sound civil engineering design and for sound construction practice in the field. "Project feasibility"—the popular phrase has come to embrace both physical possibility and economic practicability. Engineers and contractors alike give careful thought to matters of feasibility in their respective approaches to a job, and historic costs of past work are used by both as precedent in contemplating future work.

At present it may be wondered which has access to the more accurate figures, engineer or contractor. A characteristic of bidding on public work this year has been the significant departure of bids from the engineer's estimate. Competitive factors must be considered here, but the end result remains: some state highway departments have accumulated sufficient "savings" on contract lettings this year to permit programming additional work.

To be sure, costs are the stock in trade of the contractor. But they are no less important to the engineer. *Western Construction* has recognized this fact for many years with its regular publication of selected bid abstracts. The Oregon State Highway Department has recognized the value of costs, examining them on various bases to provide accurate planning and design precedent for coming projects. This year, as in the Highway Issue of 1953, *Western Construction* again presents much of the Oregon data in tabular form for the benefit of readers in all the 11 Western states.

A fund of realistic cost information is the keystone of sound engineering practice. It is not enough to know bid figures, say, for a yard of concrete in place. There are too many variations in affective factors from job to job, to say nothing of profit and unbalancing elements that are included. Essential to realistic engineering design are up-to-date figures for construction tasks involved in placing the same yard of concrete—forming, pouring, finishing, curing, stripping, stoning, etc.

Western Construction therefore recommends a receptive attitude on the part of contracting and engineering firms that may be approached for cost information that would be helpful in design. The progress of civil engineering has long been predicated on the free interchange of information; in fact, *Western Construction* and many other publications have come into existence to serve that need. It is in the best interests of the West that costs, a vital element of engineering, not be coveted by a few. Those few can progress only as does the entire region.

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1954 — THE WEST'S BIGGEST HIGHWAY CONSTRUCTION YEAR

The West's highway engineers

. . . are now in the field pushing ahead the biggest program of highway construction ever undertaken in the region. A record $350,000,000 volume in state highway contract work this year was indicated by this publication in January. The figure has been borne out by events, and the spectacular has been added by such things as California's advertising for $11,500,000 in projects during one week at the start of the season.

The West's highway administrators

. . . are now tackling the job of planning for even bigger seasons yet to come. These are assured by Congressional passage of a bill authorizing a record $966,000,000 in federal air for each of the fiscal years 1956 and 1957. For the eleven Western states this amounts to $156,000,000 each year (see table)—plus a big share of the $91,000,000 slated exclusively for federal forest roads. The matching basis for most of this money is as in the past, but interstate route funds will be on a 60% federal-40% state basis. Thus, the new legislation clears the way for at least $256,340,000 in federal aid work alone each year for the Western states.

The West's highway contractors

. . . are boosting the in-place highway achievement, measured in miles, by bringing to every job an unprecedented combination of sharp estimating, productive equipment, competent supervision and efficient labor. The result is a net dollar saving that can be applied to additional badly needed highway construction.

THESE are the principal encouraging notes. Others are the achievements of individual Westerners in highway engineering technology, the cooperative and progressive spirit of the region as represented by the WASHO Test Road, the confident undertaking of bond issue programs to hasten the day of Western highway adequacy, and the continuing search at every level for rational bases of highway programming.

Discouraging notes are equally apparent, for they are tied in closely: manpower, sorely needed to execute

FEDERAL AID BILL FOR HIGHWAYS, FISCAL 1956 AND 1957

STATE	FEDERAL AID Primary	Secondary	Urban	Subtotal	"Population" funds[1]	"Sec. 21" funds[2]	INTERSTATE Subtotal	Total
Arizona	$ 4,711,000	$ 3,208,000	$ 671,000	$ 8,590,000	$ 643,000	$ 1,319,000	$ 1,962,000	$ 10,552,000
California	14,459,000	7,444,000	15,339,000	37,242,000	5,676,000	4,070,000	9,746,000	46,988,000
Colorado	5,668,000	3,786,000	1,434,000	10,888,000	711,000	1,588,000	2,299,000	13,187,000
Idaho	3,883,000	2,731,000	332,000	6,946,000	643,000	1,087,000	1,730,000	8,676,000
Montana	6,326,000	4,352,000	406,000	11,084,000	643,000	1,770,000	2,413,000	13,497,000
Nevada	4,067,000	2,718,000	131,000	6,916,000	643,000	1,137,000	1,780,000	8,696,000
New Mexico	5,121,000	3,518,000	566,000	9,205,000	643,000	1,433,000	2,076,000	11,281,000
Oregon	5,385,000	3,763,000	1,384,000	10,532,000	816,000	1,509,000	2,325,000	12,857,000
Utah	3,621,000	2,396,000	731,000	6,748,000	643,000	1,014,000	1,657,000	8,405,000
Washington	5,207,000	3,479,000	2,604,000	11,290,000	1,276,000	1,461,000	2,737,000	14,027,000
Wyoming	3,928,000	2,662,000	188,000	6,778,000	643,000	1,099,000	1,742,000	8,520,000
West	$62,376,000	$40,057,000	$23,786,000	$126,219,000	$12,980,000	$17,487,000	$30,467,000	$156,686,000
U. S.	$315,000,000	$210,000,000	$175,000,000	$700,000,000	$87,500,000	$87,500,000	$175,000,000	$875,000,000*

[1]Apportioned according to total population, with a minimum of ¾ of 1%.

[2]Apportioned according to Sec. 21 of the Federal Highway Act: 1/3 based on area, 1/3 based on total population, and 1/3 on post road mileage; with a minimum of ½ of 1%.

*Plus $81,000,000 for roads on federal lands, $8,000,000 for the Inter-American highway, and $2,000,000 for the Rama Road in Nicaragua.

swollen construction programs; public support, needed to raise the figure of highway fund authorizations even higher (and, what is more, to follow up by insisting on appropriations); cost trends, broken only temporarily by contractor competition while materials and labor prices continue to rise.

Among the foregoing, the two opposing points most closely related are (1) the search for rational means of highway programming and (2) the need for public support of further augmented financing. A bridge between the two is provided by the relatively new highway engineering tool known as the sufficiency rating system. Sufficiency ratings had their birth in the West, being so named in Arizona after adaptation by that state of a procedure of establishing priorities developed by Karl Moskowitz, then of the Bureau of Public Roads.

Adoption of the general principles of sufficiency rating has been widespread during the past eight years, and now 7 of 11 Western states recognize the system. Notable is sufficiency rating utilization at the county level also in Colorado. And in California, where the state itself does not subscribe to the formalities of sufficiency rating, a form thereof has been developed for county use by a private firm of engineers.

What is the promise of sufficiency ratings? The answer is not apparent in the methods and reports themselves, for they are only a written formalization of procedures that are natural to the civil engineer. They are not so much a means of determining highway needs as of showing them; hence, a state like California (which programs according to so-called deficiencies) can actually proceed quite logically on its highway program without being counted among the subscribers to sufficiency ratings.

Sufficiency ratings show highway needs. They are a means toward the end of raising highway revenues to where they should be. They use the engineer's favorite working and reporting medium—figures—to draw a picture of highway finance needs that is understandable to legislators and highway users. This function is felt by one user group to be important enough to warrant special attention. The National Highway Users Conference has established a "Golden Milestone" award, and among the five co-winners this year are the Western states of Colorado and Washington. The Colorado award was based specifically on the 1953 sufficiency rating study report of the Colorado Department of Highways.

Such single items as sufficiency ratings also serve well to illustrate how broad has become the onetime civil engineering specialty known as highway engineering. Within highway departments there are individual engineers—and whole sections—devoted to sub-specialties. The old familiar "line" functions (design, materials, construction and maintenance) have been augmented by those of planning, right-of-way and administration.

Western Construction has traditionally been "for" the line functions, because they are most consistently concerned with civil engineering technology and construction achievement. It is for design and construction men—field and office—that this annual Highway Issue is designed, in accordance with the keynote statement appearing on the magazine cover.

But, as the occasion of every highway conference today proves, the needs and interests of highway engineers today are broad. There will be questions for the man who has reviewed a new adaptation of emulsified asphalt, and questions for the speaker on design criteria for expressway structures. But there will be whole independent discussions generated by someone's urgent question as to how to float a highway bond issue!

So, in this Highway Issue *Western Construction* is pleased to acknowledge the entire broad functional range of the highway engineer. We're "for" all the elements necessary to sound Western highway development.

And, planning and financing (often together) have come to be a major phase of highway development. It has logically enough fallen to civil engineers to prepare the information from which adequate highway financing measures can be drawn. The measures themselves, involving various forms of taxation against a variety of tax bases, are for determination by the general public and their elected representatives. But ultimately it is the highway engineers of the West—working with or without such tools as sufficiency ratings, but always with their unique judgment and talents—who will determine the future of the West's highways.

Sufficiency rating is the idea, but the —

Road adequacy and priority study

. . . for counties goes one step further: Formula permits computing economic priority for construction or maintenance — Rational approach of Kings County makes sense to engineers, and county supervisors, too

MONEY FOR county roads just doesn't go far enough, but a valuable new tool for proper allocation is now becoming available. Kings County has just completed an investigation and analysis called a "road adequacy and priority study." This investigation was undertaken to determine the efficiency of the county road system and the relative adequacy of road sections and bridges—all on a rational engineering and economic basis. The technique represents an entirely new approach to the county road problem, particularly since it develops data for future planning and programming of improvements.

By
H. E. CARLSON
Road Commissioner
Kings County
California

and
G. E. NICHOLS
Road Planning
Associate
Porter, Urquhart
& Beavin

How it began

The original impetus for Kings County came in 1952, when an interim committee of the California legislature asked all California's county road commissioners to do two things: (1) evaluate critical deficiencies in their road systems and (2) estimate the cost of bringing roads and bridges to adequate design standards. Deficiencies in Kings County were then found to be about $6,000,000. With an annual road department budget of just under $1,000,000, the question then facing the board of supervisors became "What roads and bridges should be fixed first?"

Realizing that this question implies assignment of work priorities on some basis, the board began thinking in terms of an engineering survey. In order to clarify the aims of such a survey, three basic needs were set forth:

(1) How and where to spend construction funds
(2) How and where to spend maintenance funds
(3) How to balance construction and maintenance funds

Even without outside help, nearly every road department has a general plan for development of at least some sections of its roads. But, too often, primary needs for the entire system are based on year-to-year decisions. So, to the three needs listed above, Kings County added a fourth: a planned road program based on engineering and economic data. There were a number of observations to confirm this need.

First, funds being spent on maintenance so outweighed those going into new construction that it appeared impossible to satisfy new construction needs in the foreseeable future. Second, maintenance costs were not known in sufficient detail to permit proper programming.

Physical data were not available. There were no records covering the condition of roadways and bridges, nor what were the reasons for their condition. Life expectancies were not known.

In the past, due to lack of money to spend on thorough roadbed engineering, some failures had occurred. There was good reason to think that additional investigation and engineering would be profitable.

Maintenance cost on certain road sections was disproportionate to the traffic volume carried, as well as to the cost of complete reconstruction. Construction cost elements were not being evaluated according to economic principles.

Because of the deficiencies listed above, the Kings County supervisors and the senior author of this article proposed a study to correct the omissions in information. The detailed scope of study could be covered by the following points:

(1) Graphic or tabular presentation of (a) condition of roads and structures, and (b) a recommended priority for improvement.

(2) Estimated costs to guide the supervisors and road commission in budgeting funds for improvements on a basis of economic priority.

(3) Projection of data and recommendations as a basis for a 5-yr. improvement program.

(4) Provision for continued updating of information, year by year, to maintain the 5-yr. master program.

(5) Presentation of the information in such a form that the overall picture of current and future planning might be placed before the public.

Search for information

Steps were taken to determine methods of procedure in initiating such a study as that outlined. The Institute of Transportation & Traffic Engineering at the University of California and the Bureau of Public Roads were both helpful in supplying information concerning about 22 states that have made studies of the type variously known as "sufficiency rating," "adequacy rating," etc. However, the groundwork for King County's undertaking seemed to be a rural road inventory made by the Highway Planning Survey of the state Division of Highways in cooperation with the Bureau of Public Roads and the county itself. This inventory involves traversing each road in a county and recording geometric and physical aspects of the roadway and bridges. From this field data, the Highway Planning Survey develops pertinent maps and tabulations relative to the rural road system of the county.

Contact was made by Kings County with Porter, Urquhart & Beavin. This consulting firm had two of its men in California, Bruce D. McCreary and Harold C. Green, already pioneering in the planning

of county roads as it might be based on road adequacy and priority study. With county and engineering firm now working together, the Kings County study was begun.

In order to determine the average daily traffic for each road, mechanical and personal counts were taken, and adjustments were made for seasonal variations. Records for the various roads were then divided into five different groups, depending on daily traffic: 0-50 vehicles per day, 50-100, 100-400, 400-1,000, and 1,000-4,000. The standard to which each type of road should be constructed was then adopted for each traffic grouping. These design standards are very close to the standards adopted by the County Engineers' Association of California.

Next step in the program was obtaining information beyond that furnished by the State's rural road inventory. Additional physical data obtained by field inspection and measurements included:

(1) Right-of-way width
(2) Measured differences in gradient
(3) Passing sight distance
(4) Stopping right distance
(5) Rated surface condition according to points (rather than poor, fair, or good)
(6) Adequacy of surfacing
(7) Foundation type
(8) Drainage
(9) Accident factor
(10) Community service

With the design standard and the physical data known, it becomes a problem of dividing the road section into elements necessary to arrive at the road's adequacy, namely: geometric design, physical design, safety, and the amount of service which the road renders to the community.

Geometric design adequacy

This rating with a par value of 40 points consists of evaluating the right-of-way width, roadbed width, surface width, gradient, alignment and stopping sight distance on the basis of rating tables and curves.

Physical design adequacy

This rating with a par value of 25 considers surfacing determined from its present condition, width, estimated surface and foundation life. It is evaluated on the basis of native soil classification, observed foundation failures, width, and estimated future life. Drainage is also considered with relationship to the design cross-section.

Safety

Safety component with a par value of 15 considers accident factor, alignment, consistency, and maximum safe speed. Accident records are evaluated, noting the number of fatal injuries and property damage accidents per mile, alignment in consistencies per mile and the safe driving speed. The latter is determined by observing actual driving conditions per road section, and then assigning a maximum safe speed which is related to the design standard speed.

Service

Under this section, service with a par value of 20 is related by classifying the routes as to type of travel. The service of the particular road to the county and area is evaluated by its strategic location within the county and the resulting importance to the county.

It is now possible to determine the adequacy rating by comparing the existing road, as determined by the physical road inventory, to the design standard, determined from traffic volume. The result is a road adequacy point rating which can range from zero for the worst possible condition to 100 for a completely adequate section.

At this time it is sufficient to say that factors considered in the rating of bridges are width, condition, and structural adequacy.

This is Kings County

KINGS COUNTY, where the road adequacy and priority study was first applied, is in the Central (San Joaquin) Valley of California. It covers about 1,380 sq. mi., of which 95% is flat, valley floor terrain. The county therefore presents rather uniform conditions to be incorporated in any inventory or rating study.

Primarily an agricultural community (cotton and grain), Kings County has a population of about 50,000 and a motor vehicle registration of about 28,000.

The road system encompasses some 1,060 mi., of which 800 were considered "rural" for the recent study. About one third of the county area (in the southeast) lies in the Tulare Lake Basin and thereby constitutes a critical road foundation problem, since a variable thickness of plastic clay overlies the basin area.

Traffic groupings discussed in the accompanying article apply to the following mileages:

Daily Traffic	Miles
0- 50	100
50- 100	150
100- 400	360
400-1,000	120
1,000-4,000	70

The road department administrated by H. E. Carlson includes about 75 men. All maintenance work is performed by these forces. New construction is done both by contract and by force account.—Editor.

After the adequacy ratings were completed, it was necessary to determine which roads with very low point ratings should be constructed or improved first. Therefore, a priority schedule which would include the economics of highway construction was required.

From oiling records and experience, average annual maintenance costs for each road section were estimated. Construction costs to bring critically deficient roads and bridges up to design standards were estimated. From this data it was possible to figure on an economic basis what to do with a bridge or road section—to maintain or construct.

An economic rating study includes the following steps:

1. Estimate annual maintenance costs per mile of existing roads
2. Assign construction costs per mile for the several road design standards
3. Compute annual cost of construction to improve the road to required standards, together with annual maintenance costs thereof

The economic study is then concerned with the determination of an economic ratio, obtained by dividing the present annual maintenance cost by the annual cost if the road were constructed to the design standards.

Earning capacity

The next step was to compute the earning capacity of the road by distributing earned highway revenues on an annual vehicle mile basis, resulting in a revenue index. Finally, to determine whether the investment for the road improvement is solvent, a feasibility factor is obtained by dividing the earning capacity by the annual cost.

Priority ratings for road sections, sub-sections and bridges were then fixed by dividing the economic ratio by the adequacy rating and multiplying the result by the feasibility factor. Planning and budgeting problems now become nil because the most deficient road with the highest economic justification would be No. 1 on the priority list.

Conclusions

Making a road adequacy and priority study may sound like a complicated procedure that is too costly to consider. If the failure of only one section of road, or the cost of overdesign is considered, the procedure will pay its own way in savings. To be fully effective, the study must be kept current year by year.

The Kings County study was approved by the planning board of supervisors and was carried on under the direct supervision of H. E. Carlson, Road Commissioner, by G. E. Nichols, Road Planning Associate, on loan to the county from Porter, Urquhart & Beavin, consulting engineers.

Idaho PLANS its bridges

. . . and the Sandpoint bridge is a good example - 20 years of planning and design – Here is a thorough review

By A. J. SACHSE
Senior Resident Engineer
Idaho Department of Highways

THE PLANNING of a new bridge across the Pend Oreille Lake in the Panhandle of Idaho dates back even before the construction in 1933 of the existing 10,319-ft. untreated timber bridge. Route studies, foundation investigations, considerations of foundation, construction methods and costs unparalleled in the history of the Idaho Department of Highways were required.

The bridge site is located south of Sandpoint, Idaho; a town of 4,265 population situated across the only natural outlet for travel from north Idaho, northwestern Montana and a part of central Canada via U.S. 2, 10-A and 95 Highways to Spokane and the Inland Empire. This bridge site determined the highway plan within this transportation hub and has a major effect on local traffic as well.

First route studies

Early studies, made prior to the construction of the existing bridge, were largely confined to a routing extending from Algoma on U.S. 95 Highway to a point on U.S. 2 near Dover, crossing the river at its narrowest point at what is known as the Springy Point — Rocky Point site. This proposed plan met with so much opposition due to up-setting the development of the town, by-passing the business section, and increasing the travel distance to Sandpoint from the area southeasterly from Springy Point. This resulted in the bridge of 1933 being built alongside a then existing bridge, without federal participation, in order to retain conditions.

In 1944, a new deck was needed on this long wooden structure. Also, the need for early replacement of the entire structure, as well as the construction of a route through Sandpoint, became urgent. At this time the study was resumed on an expanded scope to cover the entire section of highway from the southerly end of the bridge—through Sandpoint—to the junction of U.S. 95 and 2 with U.S. 10-A north of town.

These studies established that a large percentage of traffic crossing the bridge stopped at Sandpoint. It resulted in the adoption of a location extending from the southerly end of the present bridge, to the sandy point opposite the railroad bridge, and then up Sand Creek along the westerly side of the Northern Pacific Railroad tracks. This last section lies between the railroad and the business section of town. The route was feasible providing that a portion of the stream bed could be economically filled. The route would have practically no cross traffic, access would be limited by topography to a few strategic points, ideal connections to the business section of the town could be provided, and the distance for travel from areas south of the river would not be changed. The terrain indicated minimum right-of-way costs.

Foundation studies

The first extensive foundation investigations along this adopted route were made in 1945, when a contract was let for the exploration of the entire river crossing. The work consisted of the putting down of 5,000 lin. ft. of wash borings at 200- to 400-ft. intervals across the 8,000 ft. of river width. This was done adjacent to the railroad and highway bridges and at the Rocky Point—Springy Point site. Holes were put down to a maximum depth of 130 ft. below ground. It was determined that (a) foundation material was a medium-stiff, blue clay having a highwater content in the entire section of stream bed explored, (b) a sand cover 8 to 10 ft. in thickness existed along the proposed centerline, and (c) compact gravel substratum existed along the southerly 2,000 ft. of centerline.

After the existing bridge had been redecked in 1946, investigations were discontinued until about 1950 when some small, undisturbed clay samples were obtained for a check on the moisture content. Also, a few 5-in. undisturbed samples were obtained at various locations and depths to 80 ft. to determine shearing strength of the clay and its ability to support a fill 30 ft. high. These tests indicated that the material's supporting power was marginal. Counter-balancing might be necessary.

During the summer of 1951, fifty-three 3-in. undisturbed samples were taken for laboratory determination of shear strengths. In addition, 250 in-place determinations of shearing strengths were made with a specially built device that measured the force required to rotate two 2" x 4" plates set at right angles to each other and carefully pressed into the clay. Strengths were determined at approximately 200-ft. intervals along the entire area which might be filled and at vertical intervals of 10 ft. to a depth of 90 ft. Also, the depth of sand cover was determined over the entire area from which material for hydraulic filling might be obtained. These data showed that (a) ample sand was available for the fills, and (b) the shearing strength of the clay varied from 400 to 500 psi. near the surface of the clay to 1,000 psi. at 70 to 90 ft. below ground surface. There was no great variation in the latter item with the location along centerline.

North fill — Fig. 1

Analysis of shearing stresses under fill load dictated the use of counterbalancing side berms to obtain an adequate factor of safety against foundation failure in shear. The absence of borrow sources on the north side of the river, and the necessity of placing a large portion of the fill under water dictated the

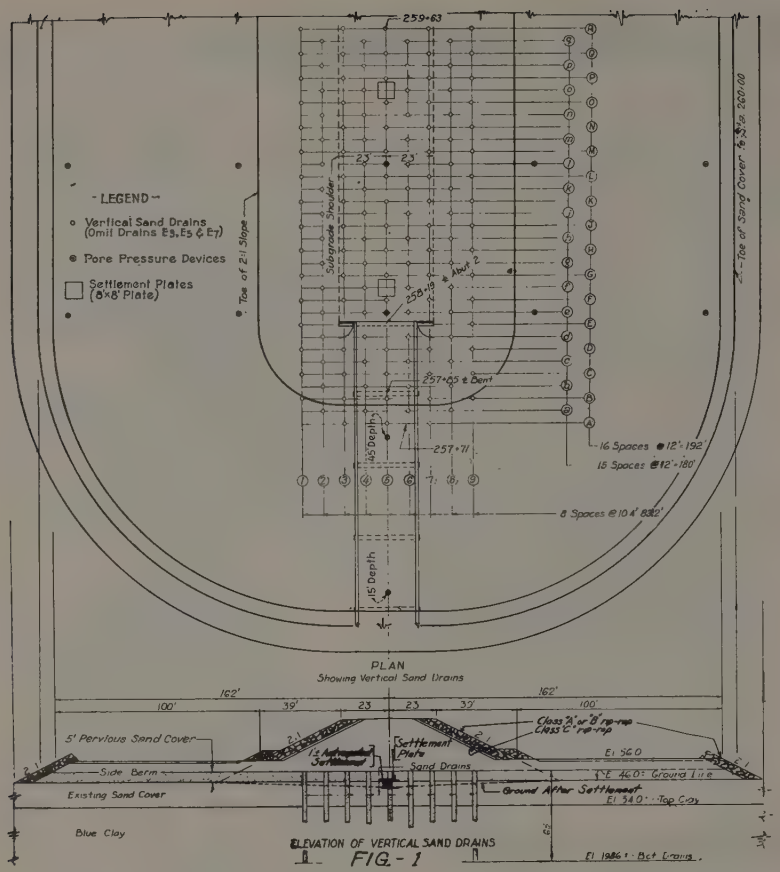


FIG. - 1

use of hydraulic fill on the project.

The fill cross-section shown in Fig. 1 can be constructed by two methods. One is to confine the hydraulically placed material directly within the inside rip-rap lines. The other is by first placing the required quantity of material between the confining sideberm rip-rap, when water is at lake storage level, and then shaping material to the required section during the low water period.

Rip-rap was designed for the size and thickness required to resist wave action, including consideration of wave heights from various directions, and erosion due to current around the end of the fill. Three classes of rip-rap are called for. Class A has 25% of the volume in stones over 5 cu. ft. in size, placed around the point of the fill and in regions of maximum wave action. Class B has at least 30% of the volume in stones over 3 cu. ft. in size placed along the remaining portions of the fill. Class C is to consist of free draining sand, gravel, or rock spalls having at least 40% of the material retained on a ¼-in. sieve placed under the heavier rip-rap on the fill slopes and over the side and end berms. This is to prevent loss of the fine hydraulically filled material through the coarser rip-rap and to prevent washing of berms.

A 5-ft. layer of free draining sand cover and a grid of vertical sand drains 18 to 24 in. in diameter, extending approximately 60 ft. below ground, will be provided under the end 200 ft. of the roadway fill. This will hasten consolidation of the foundation material and permit earlier construction of the north end of the bridge. It reduces the amount of consolidation that will be obtained after the bridge is in place.

A sytem of devices for measuring pore pressures will be installed along the entire fill section. These will indicate the magnitude of built-up pressures and serve as a guide in controlling the rate of filling. The specifications call for placing the fill in such a manner as to maintain a maximum safety factor for stability of embankment. This requires that fill be placed in lifts not to exceed 5 ft. in thickness should pressures in excess of 10 psi. develop. In addition to the pore pressure devices, 8- x 8-ft. settlement plates will be placed on the ground surface at 300-ft. intervals to measure consolidation and provide a basis of payment for material placed below existing ground surface.

Major items in the fill construction are: 120,000 cu. yd. of rip-rap of the various classes; 530,000 cu. yd. of embankment in place; 9,800 lin. ft. of vertical sand drains; 22,000 cu. yd. of pervious sand blanket; and a lump sum item for the mobilization and demobilization of equipment. This lump sum item was included as a separate bid item in order to have mobilization costs separate from the cost of actual construction should the length of the fill and bridge be changed during construction.

Late bid results

H. G. Palmberg has submitted a low bid of $664,255 for construction of the 1.1-mi. north fill section.

Test piles

The length of bridge and the location of the point of change from bridge to fill was largely determined from a comparison of the estimated costs of fill and bridge. The contract provides for changes in major quantities, within certain limits, should the actual costs warrant them.

Complete data on the type of foundation material along the entire 8,000 ft. across the main channel were on hand from the 1945 borings. The special tests for the bridge required the driving of eight 90-ft. piles and four load tests. This was done to determine the length of pile required in the southerly 2,000 ft. of channel and the bearing that would be obtained with various penetrations in the remaining portion of the channel. Three piles were driven in the southerly 2,000 ft. of channel to confirm the depth to the gravel substratum and that ample bearing could be obtained during driving in this area. The remaining five piles were driven at 1,000-ft. intervals in the remaining portion of the channel. These piling were driven to various penetrations, allowed to set up, and then restarted to determine their approximate load bearing capacity before load tests were applied. Load tests utilized two 8- x 60-ft. steel boat salvage tanks available at the site. These were connected with steel beams, floated over the pile, and then the pile loaded against these tanks with a 100-ton calibrated hydraulic jack. Tests determined that little bearing value would be obtained during driving. However, there was a rapid gain in bearing value during the first 24 hr. of set-up period and a pronounced decrease in the rate of gain in strength after that time.

Bridge bents

The design of the bridge was determined by foundation conditions and an analysis of the costs of various types of construction. Consultations were held with the bridge division of the U. S. Bureau of Public Roads and an analysis made of the relationship between foundation cost

and span length and weight and cost. It was decided to adopt 35 ft. as the out to span length and that some form of precast concrete construction which would not require falsework would be used.

Pile type plus weight and cost considerations resulted in the adoption of a 14-in. concrete-filled, steel-shell pile in the region where ample bearing could be obtained during driving. Piles terminating in clay will be composite, made up of 38 ft. of concrete-filled, steel shell supported by timber piles of a length up to 90 ft. The head of a timber pile will set against a ¾-in. steel plate welded to the bottom of a concrete-filled, steel shell. The timber pile will then be held in place by an additional 2½ ft. of steel-shell pile. Splices will be located approximately 10 ft. underground when piles are driven to grade. Timber piles will be untreated. Composite piles will provide for a penetration up to 110 ft., a strong section for the projecting portion, and will be relatively light in weight and low in cost.

The sub-structure for all three alternates is similar. The south 2,000 ft. of the bridge, where the foundation material is granular, will be five-pile bents. The outside piles of each bent will be battered 1½ to 12 and the next row will be battered ¾ to 12. Every seventh span will be a tower span with no longitudinal bracing anywhere except here. The caps will be poured-in-place, reinforced concrete.

The foundation material on the north two-thirds of the bridge is fine clay with a blanket of fine sand on top. Because of difficulty in obtaining pile capacity, additional piles are added to the bents and the required penetration set between 80 and 110 ft. The number of piles per bent varies from 6 to 8 over this portion of the structure.

Span design — Fig. 2

Final design of the span resolved itself into three alternate types shown in figure (2). Alternate No. 1 called for precasting an entire span except the curbs and then transporting and lowering the span into place. It would be poured at the site and would weigh approximately 70 tons. Alternate No. 2 called for precasting six inverted U-shaped sections, transporting them to the site, and placement by crane or other means. Sections would weigh 14 tons each and would be precast at a remote yard. Alternate No. 3 called for precasting and placing stringer stems only and then supporting forms between stems and pouring the deck end beams, and curbs in place.

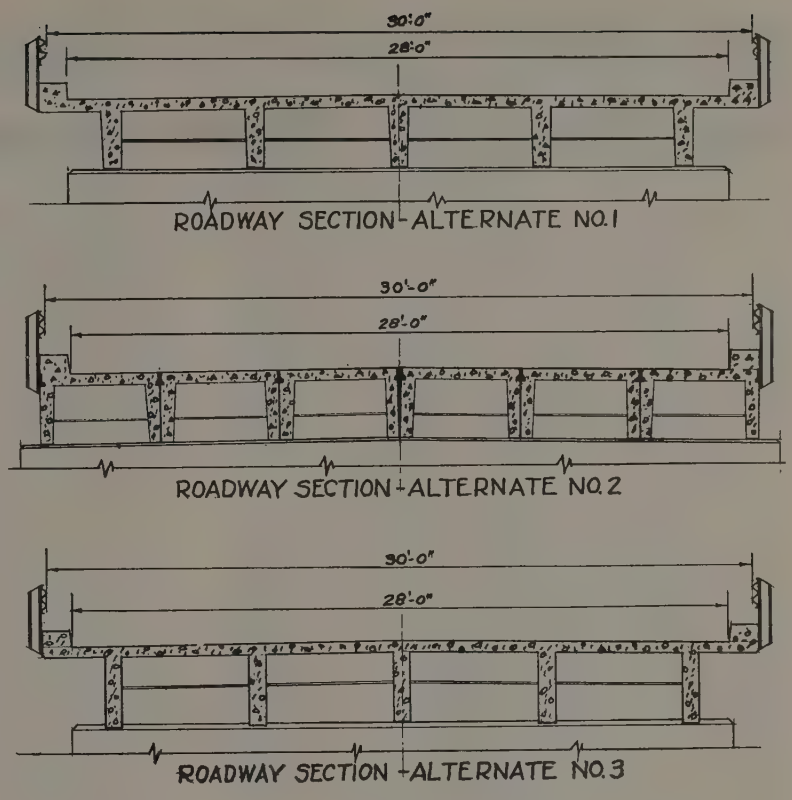


Fig. 2

Each of the alternates had merits which would appeal to various contractors. It was decided to include all three plans and to permit the bidders to choose any one of the three on which to place their bid. Low bid was obtained on Alternate No. 1 which requires a minimum number of parts and handling. It permits all finishing and details, except installation of the rail, to be completed at the casting location.

The bridge will be made up of 154 spans at 35-ft., 25 spans at 17-ft. (half spans across towered bents which will be placed between every set of 6 spans at 35-ft.) and one 82-ft. span located across deeper water near the southerly end of the bridge for navigation and towing. Roadway width will be 28 ft. curb to curb with two 1-ft. wide curbs. A beam type guard rail is fastened to steel posts spaced 30 ft. apart. The structure will be level along the northerly 2/3 of its length. The southerly 1/3 will be on a 0.4% grade to provide extra clearance for navigation and to blend with the approach grade.

Closely associated with this project were E. V. Miller, state highway engineer, and Walter Albrethsen, bridge engineer.

SANDPOINT BRIDGE: PRINCIPAL QUANTITIES AND LOW BIDS FOR EACH DECK ALTERNATE

Item	Unit	Alternate No. 1[a] Quantity	Alternate No. 1[a] Price	Alternate No. 2[b] Quantity	Alternate No. 2[b] Price	Alternate No. 3[c] Quantity	Alternate No. 3[c] Price
Concrete, Class A, precast	cu. yd.	5,430	$58.30	7,330	$60.00	2,200	$54.50
Concrete, Class A, poured in place	cu. yd.	1,200	58.30	875	70.00	4,530	61.50
Metal reinforcement	lb.	1,476,000	0.105	1,688,000	0.11	1,664,000	0.105
Structural steel	lb.	226,000	0.23	237,400	0.24	226,000	0.17
Steel beam handrail for concrete structures	lin ft.	11,806	3.66	11,806	4.50	11,806	3.50
Furnish timber piles, untreated	lin. ft.	73,000	0.95	82,500	1.10	73,000	1.23
Furnishing steel shell piles	lin. ft.	58,100	4.80	64,500	5.50	58,100	5.10

[a]Bid by Peter Kiewit Son's Co. and LeBoeuf Dougherty (low bidders for total contract at $1,135,332).
[b]Bid by George Chicha Co.
[c]Bid by Cascade-Austin Co.

HIGHWAY COSTS: Competition has brought them down

THIS YEAR the states reporting their highway cost data and indices to **Western Construction** total three—California, Oregon and Washington. As in the past, the Bureau of Public Roads composite mile index is also included on the chart below; and with its national basis tending to introduce compensating factors where they exist, this last curve is the smoothest and therefore provides the best trend line. Western regional factors are of high importance to engineers and contractors in this part of the country. So, to this extent the individual curves for Western states are the most authoritative.

A phenomenon of last year has repeated itself in 1954—with added emphasis by its magnitude. This is the first-quarter drop in the indices from the level of the preceding quarter. The occurrence in 1954 is the more notable for following an entire year that was characterized by remarkable stability of the indices. Particularly is this true in California, where the total fluctuation during 1953 was only 1.6 points. The first-quarter drop a year ago was attributed by Oregon to excellent weather rather late in the preceding fall. This had permitted completion of projects beyond original expectations, with the result that contractors were "hungry" earlier than was to be expected. The drop this year is another story. It is best presented in the following reviews from two of the states, Oregon and California. First, Chester E. Paulsen, Cost Analyst for Oregon:

"The present composite index, 186.0, is 86% higher than in 1940 but is 21.2 index points below the high of 207.2 reached in the fourth quarter of 1952, a decline of 10.2%.

"The reduction in [federal] government construction has caused a shortage of work for many contractors, who are now concentrating their efforts on procuring state highway work. Competition is very keen, as there is not sufficient work for all contractors, many of whom developed large organizations during the war boom years. An average of 40% more bids was received on contracts awarded in 1953 and the first quarter of 1954 than were received in like periods of 1952. It is not uncommon now to receive from 15 to 25 bids on the more desirable projects.

"There is a surplus of construction equipment, operators and labor, and an adequate supply of materials, repair parts and supplies. Fringe payments for labor have been curtailed, labor efficiency has increased, and gray market prices for materials have been eliminated. The prices of some equipment, materials and supplies have softened with evidence of further softening. All these changes have helped to reduce construction costs.

"Construction wage rates increased 13% in 1953 and 3% in 1954. About 38% of the highway construction dollar is expended on labor, and the 16% increase in the wage rate has increased the total construction cost about 6%. The impact of the higher wage rate at a time when contract bid prices are going down is being met by more operation and the use of larger and more modern equipment which requires less labor.

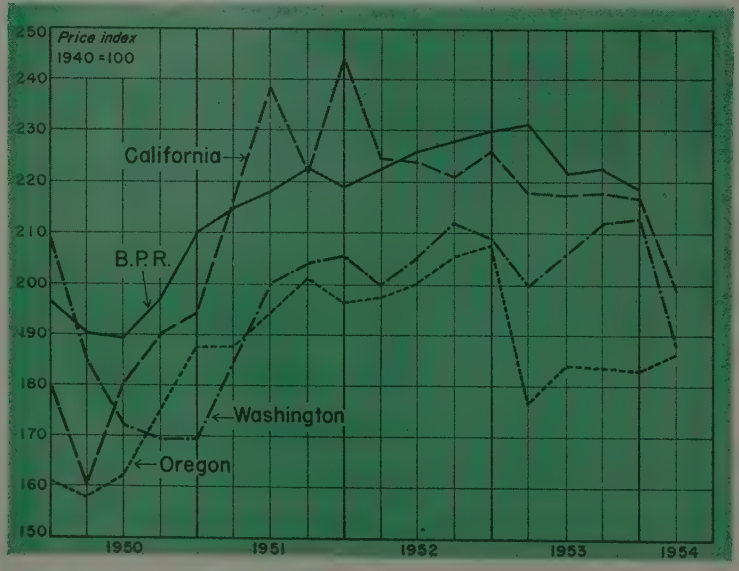
"Bid prices and price trend should hold near the present level for the next few months unless there is a major disturbance in our national economy."

Big increase in bidders per job

Richard Wilson, Assistant State Highway Engineer in California, notes the same general causative factors, but he emphasizes contractor competition: "This drop is not a surprise; it almost could be seen coming in the steady increase in competition among bidders.

"The California Division of Highways awarded 466 highway and bridge contracts with a value of $101,900,000 during the calendar year of 1953. For bids opened during the month of January 1953, the average number of bidders was 5.5; by June 1953 the average was up to 6.0; in July it was 6.2, August 6.9, September 6.4, October 7.6, November 7.4, and December 7.6. During this steady rise in the average number of bidders, highway construction costs were hovering about on a level.

"During the first quarter of 1954, the Division of Highways opened bids for 119 contracts, with a construction value of $27,200,000, and the average number



WESTERN HIGHWAY COSTS 1950 - 1954

DOWN they go in the first trend reversal in four years. Latest Bureau of Public Roads index value (not shown) adds emphasis: 212.3 for the first quarter of this year.

of bidders rose to 9.5 per project, while construction costs dropped 8.0%.

"The level of costs during 1953 was maintained in the face of increases in labor costs resulting from continued demands of labor for higher wages and increased fringe benefits. The drop in bid prices and the jump in the average number of bidders during the first three months of 1954 is further indication of an increasing hunger on the part of contractors.

"Contractors with experienced and well integrated organizations wish to keep them intact; to do so requires continued income and to keep the pay estimates coming in contractors reduce their prices. Many have heavy equipment obligations which must be met regularly and going work is necessary to provide tne funds to meet such obligations.

"Another item which continues to be an influence is availability of materials and equipment. Bidders over a period of years have included various factors in their prices to cover delays or premiums in securing materials and equipment. With production near an all time high, such factors become unnecessary.

What goes into a cost index?

Components of the cost indices maintained by the three states are comparable. California uses eight; they are: roadway excavation, untreated rock base, plant-mix surfacing, asphaltic concrete pavement, portland cement concrete pavement, concrete structures, bar reinforcing, and structural steel. Oregon's basis includes grading, crushed rock surfacing, bituminous macadam surfacing, asphaltic concrete, cement concrete, and concrete bridges and structures. Washington has the most detailed breakdown: common excavation, unclassified excavation, rock excavation, ballast, crushed stone base, crushed stone surfacing, asphaltic concrete pavement, cement concrete pavement, bridge concrete, reinforcing steel, and structural steel.

These elements have not varied consistently. Instead, marked concurrent rises and falls of individual items have ordinarily balanced each other to minimize overall fluctuation of an individual state's index. It is apparent that something unusual has happened recently to account for the pronounced downturn early in 1954. In California the net index drop of 8% reflected drops of 6.25% for roadway excavation, 10.8% for plant mix, 11% for structural concrete (down from an all-time high), 9.4% for structural steel, and 12.4% for reinforcing steel. Three items went up: 8.1% for rock base, 0.8% for PCC pavement, and 6.9% for asphaltic concrete.

Oregon's experience with its individual components was roughly in line for the same period. Overall comment in this regard by Oregon follows: "All components have increased since 1940, but not in direct proportion. For example, asphaltic concrete pavement has increased 21% while concrete bridges and structures have increased about 176%. The trend on asphaltic concrete pavement reflects a reduction in construction cost due to the elimination of headers, made possible by an improved finishing machine available in 1944, larger paving plants and more efficient operation. The trend on concrete bridges and structures reflects the extremely high prices for form lumber, ready-mix concrete and large amounts of high-priced hand labor."

A definitely encouraging tone marks the conclusions of Richard Wilson in California. He defers to the possibility of international developments that might result in large scale federal construction and a return to federal control of materials. Otherwise, he says, "In view of the continuing increase in competition it is the opinion of this department that the 8% drop in the California index during the first quarter of 1954 marks a definite break in high construction costs. As long as general production remains at high levels and materials and equipment are readily available, continued lower costs may be expected."

AVERAGE CONTRACT COST FOR COMPONENTS OF OREGON HIGHWAY CONSTRUCTION IN 1953

Figures given are per mile of highway, except as noted for Bridges and Structures.

All figures include 12½% for engineering and contingencies.

GRADING—Common Excavation

	Width of Grade in Feet			
Cut & Fill	30	34	38	46
2-Foot	$ 2,530	$ 2,850	$ 3,185	$ 3,815
5-Foot	6,950	7,725	8,550	9,945
10-Foot	15,885	17,505	19,095	22,305
15-Foot	26,850	29,260	31,625	36,430
20-Foot	39,785	42,975	46,135	52,535
25-Foot	54,660	58,715	62,675	70,690
30-Foot	71,605	74,360	81,310	90,775

(Note: Average cost of excavation $0.26 per cu. yd. Cost per mile includes overhaul, truck haul, finishing roadbed and slopes, and rounding cutbanks.)

GRADING—1/3 Solid; 2/3 Common

	Width of Grade in Feet			
Avg. Cut & Fill	30	34	38	46
2-Foot	$ 3,655	$ 4,115	$ 4,560	$ 5,490
5-Foot	9,990	11,115	12,270	14,260
10-Foot	22,805	25,090	27,370	31,975
15-Foot	38,510	41,920	45,370	52,260
20-Foot	57,065	61,605	66,165	75,290
25-Foot	78,390	84,150	89,865	101,335
30-Foot	102,660	109,510	116,300	130,120

(Note: Average cost of excavation $0.46 per cubic yard. Cost per mile includes truck haul, overhaul, finishing roadbed and slopes, and rounding cutbanks.)

GRADING—2/3 Solid; 1/3 Common

	Width of Grade in Feet			
Avg. Cut & Fill	30	34	38	46
2-Foot	$ 4,755	$ 5,370	$ 5,960	$ 7,150
5-Foot	13,010	14,520	16,005	18,615
10-Foot	29,760	32,735	35,665	41,690
15-Foot	50,225	54,685	59,185	68,100
20-Foot	74,385	80,330	86,270	98,245
25-Foot	102,325	109,710	118,630	132,045
30-Foot	133,910	142,825	151,740	169,660

(Note: Average cost of excavation $0.65 per cubic yard. Cost per mile includes overhaul, truck haul, finishing roadbed and slopes, and rounding cutbanks.)

GRADING—Solid

	Width of Grade in Feet			
Avg. Cut & Fill	30	34	38	46
2-Foot	$ 6,370	$ 7,190	$ 7,945	$ 9,565
5-Foot	17,440	19,430	21,395	24,870
10-Foot	39,815	43,785	47,780	55,700
15-Foot	67,190	73,190	79,090	91,070
20-Foot	99,575	107,520	115,470	131,270
25-Foot	136,800	146,815	156,750	176,700
30-Foot	179,205	190,860	202,955	226,950

(Note: Average cost of excavation $0.85 per cubic yard. Cost per mile includes truck haul, overhaul, and finishing roadbed and slopes.)

CRUSHED ROCK OR GRAVEL SURFACING

Compact	Top Width in Feet				
Thickness	26	30	34	38	42
2 Inches	$2,800	$3,230	$3,650	$4,085	$4,515
4 Inches	5,640	6,495	7,355	8,195	9,045
6 Inches	8,550	8,825	11,115	12,400	13,665
8 Inches	11,505	13,220	14,925	16,640	18,335
10 Inches	14,510	16,630	18,760	20,900	23,030

(Note: Average cost $2.15 per cubic yard. Two sizes of crushed rock used when depth exceeds 2 in. The average cost per mile includes 25% allowance for key shrinkage and compaction, and 30 gal. of water per cubic yard of crushed rock.)

CRUSHED CINDER SURFACING

Compact Thickness	Top Width in Feet 26	30	34	38	42
1 Inch	$1,135	$1,305	$1,480	$1,655	$1,825
2 Inches	2,270	2,615	2,960	3,305	3,650
3 Inches	3,430	3,955	4,475	4,995	5,515
4 Inches	4,600	5,290	5,980	6,675	7,365

(Note: Average cost $1.70 per cubic yard. The average cost per mile includes 30% allowance for shrinkage and compaction, and 40 gal. of water per cubic yard of crushed cinders.)

SHOULDER ROCK SURFACING

Compact Thickness	Top Width in Feet (Each Side) 2	4	6	8	10	12
1 Inch	$ 210	$ 425	$ 635	$ 845	$1,060	$1,280
2 Inches	430	845	1,280	1,705	2,150	2,580
3 Inches	650	1,280	1,910	2,565	3,210	3,840
4 Inches	865	1,730	2,565	3,430	4,285	5,130
5 Inches	1,100	2,140	3,220	4,285	5,350	6,410

(Note: Average cost $2.35 per cu. yd. Two sizes of crushed rock used when depth exceeds 3 in. Average cost per mile includes 25% allowance for key shrinkage and compaction, and 30 gal. of water per cu. yd. of crushed rock.

TOPPING—Pit Run Gravel or Talus

Compact Thickness	Width in Feet 26	30	34	38	42
3 Inches	$1,655	$1,905	$2,145	$2,405	$2,660
6 Inches	3,355	3,850	4,360	4,860	4,360
9 Inches	5,100	5,850	6,600	7,355	8,105

(Note: Average cost $0.95 per cubic yard. Cost per mile includes 20% for shrinkage and compaction.)

TOPPING—Pit Run Cinders

Compact Thickness	Width in Feet 26	30	34	38	42
3 Inches	$1,370	$1,580	$1,790	$2,000	$2,205
6 Inches	2,790	3,200	3,620	4,030	5,450
9 Inches	4,235	4,855	5,480	6,105	6,730

(Note: Average cost $0.73 per cubic yard. Cost per mile includes 30% for shrinkage and compaction.)

OIL MAT SURFACE TREATMENT

Average Thickness	Width in Feet 18	20	22
Spec. 0-9 ¾-in.	$3,015	$3,350	$3,680
Spec. 0-11 1¼-in.	4,970	5,510	6,060
Spec. 0-30 ⅜-in.	1,420	1,575	1,730
Spec. 0-31 3/16-in.	930	1,025	1,135

Based on Average Bid of:

Preparation of base	$200.00 per mile
Aggregate in place	3.75 per cu. yd.
151-200 asphalt in place	41.00 per ton
Cutback in place	45.00 per ton

(Note: If a binder course is required add $1,000 per mile.)

ROAD MIX SURFACE TREATMENT

	Width in Feet 18	20
2 inches thick	$5,000	$5,500
2½ inches thick	6,000	6,600

(Note: Cost per mile includes preparation of base, tack coat, aggregate, RC-3 cutback, mixing, finishing and seal coat.)

DRAINAGE AND IRRIGATION
Including Box Culverts and Siphons

Location	Average Cost per Mile
Eastern Oregon	$2,510
Central Oregon	2,050
Willamette Valley	3,240
Coast (Mountains)	6,700

Average cost of drain and culvert pipe per lineal foot in place including structural excavation and backfilling

4-in. concrete drain pipe	0.90
6-in. concrete drain pipe	1.00
8-in. concrete drain pipe	1.30
8-in. concrete sewer pipe	1.50
12-in. concrete culvert pipe	2.70
18-in. concrete culvert pipe	4.40
24-in. concrete culvert pipe	5.70
36-in. concrete culvert pipe	12.30
12-in. corrugated metal culvert pipe	3.80
18-in. corrugated metal culvert pipe	5.50
24-in. corrugated metal culvert pipe	7.45
30-in. corrugated metal culvert pipe	10.75
36-in. corrugated metal culvert pipe	14.10
48-in. corrugated metal culvert pipe	21.20
Catch basins, each	87.00
Manholes, each	235.00
3x3 concr. box culverts per ft., incl. wingwalls	23.20
4x4 concr. box culverts per ft., incl. wingwalls	32.75
5x5 concr. box culverts per ft., incl. wingwalls	40.75
6x6 concr. box culverts per ft., incl. wingwalls	50.50
8x8 concr. box culverts per ft., incl. wingwalls	65.50
9x9 concr. box culverts per ft., incl. wingwalls	75.00

ASPHALTIC CONCRETE PAVEMENT

Compact Thickness	Width in Feet 18	20	22	24
2-Inch	$ 7,965	$ 8,840	$ 9,720	$10,620
3-Inch	11,950	13,275	14,580	15,930
4-Inch	15,930	17,710	19,440	21,240
5-Inch	19,845	22,070	24,300	26,505

(Note: Based on Class A, B, C, D and E asphaltic concrete in place at $5.90 per ton. One cu. yd. equals 4,000 lb. The cost per mile includes 5% for shrinkage and compaction.)

BITUMINOUS MACADAM WEARING SURFACE
Penetration Type

Type	Thickness	Width in Feet 18	20	22	24
B-2	2 Inches	$6,725	$7,475	$8,225	$8,965
B-3	2½ Inches	8,555	9,505	10,455	11,405
B-11	3 Inches	9,180	10,205	11,230	12,260

Based on Average Bid of:

Preparation of base	$200.00 per mi.
Aggregate in place	3.75 per cu. yd.
Asphalt in place	41.00 per ton
Cutback in place	45.00 per ton

(Note: If a tack coat is required an additional 15 tons of asphalt and 150 cu. yd. of aggregate would add $1,000 to the cost per mile.)

PORTLAND CEMENT CONCRETE PAVEMENT

Thickness	Width in Feet 18	20	22	24
Standard 8-inch	$43,700	$48,600	$53,400	$58,200
Standard 7-inch	39,700	44,100	48,600	52,900

(Note: Average bid price $3.50 per sq. yd. 8-in. standard concrete pavement. The average cost per mile includes 8% for sand cushion, dowels, tie bars, expansion and contraction joints as per standard specifications.)

MISCELLANEOUS CONSTRUCTION

Cement rubble masonry	$50.00 per cu. yd.
Dry rubble masonry	16.00 per cu. yd.
Rock parapet walls	16.00 per lin. ft.
Riprap	6.00 per cu. yd.
Concrete curbs	1.60 per lin. ft.
Concrete sidewalks	3.50 per sq. yd.

BRIDGES AND STRUCTURES
(Cost per Lin. Ft.)

	Under 20 ft. in height	20 to 25 ft. in height	Over 25 ft. in height	Varied heights
Composite treated timber trestle	$225.00	$240.00	$250.00	.....
Composite I-beam span	290.00	325.00	350.00	.....
Steel trusses—120-ft. span	.....	.....	.....	$325.00
Steel girders—60- to 90-ft. span	.....	.....	.....	375.00
Concrete arches—200-ft. span	.....	.....	.....	600.00
Concrete viaducts	300.00	340.00	375.00	.....

Western state highway departments get rid of used equipment

. . . in various ways—Here's how it is done in each state as reported by the equipment or maintenance engineer or superintendent of each state

STATE HIGHWAY DEPARTMENTS in the West have the common problem of disposing of their old highway construction maintenance equipment when it gets to the point where it is no longer economically advisable to operate. Believing that information on how this equipment was disposed of would be of interest to highway engineers everywhere, the editors of **Western Construction** wrote to the chief maintenance engineers of the 11 Western States and the Alaska Road Commission for this information.

We asked, specifically, how often each department disposed of this equipment, how much money is involved in the turnover annually, what kind of equipment is involved, how much money it brings, and who buys the old equipment. Excerpts from the replies we received follow.

ARIZONA

Justin Herman, superintendent of equipment of the Arizona Highway Department, had this to say:

"Our old or obsolete equipment is sold at public auction, and we hold a sale semi-annually as a rule. The price the equipment brings varies from time to time; however, we realized more on our last sale (held January 20, 1954) than we expected.

"We do trade in some of our units and get fair trade-in allowances. For instance, we traded in two 14-yr.-old shovels, a Bay City and a Link-Belt, on two new four-wheel-drive end loaders. We received about $4,000 for the Bay City and about $2,500 for the Link-Belt.

"At our public auctions, we sell all types of equipment: graders, tractors, trucks, passenger equipment, and all other miscellaneous items pertaining to our department. The buyers include used equipment firms, auto and truck-wrecking firms, farmers, ranchers, and junk dealers."

CALIFORNIA

Earl E. Sorenson, equipment engineer for the California Division of Highways, replied as follows:

"Sales are held at Sacramento headquarters shop and nine of our district shops. All such equipment is sold by sealed bids which are publicly opened and read, usually on the third Tuesday of the month at 3 p.m. To date, we have required no bidders' deposits with the bids." These sales are advertised in daily newspapers having a major circulation in the area where each shop is located.

"At our Sacramento Headquarters Office, we maintain a list of some 600 prospective bidders to whom we mail notices of pending sales. This list is divided into groups, enabling us to send notices to the particular part of the state where the sales are to be held. Where bidders wish to receive notices of all sales, they are accommodated. These notices, as well as the newspaper ads, list each piece of equipment by number, type, model, and age. If the unit is unserviceable, or has been damaged in an accident, it is noted in the advertisement.

"Other state departments, counties, cities, or political subdivisions may purchase this equipment prior to its being advertised for sale, and by direct negotiations.

"Sales are held when we have accumulated sufficient equipment for disposal to justify the cost of advertising and handling. An approximation of the intervals between sales would be from 30 to 60 days.

"All types of construction and maintenance equipment, as well as miscellaneous articles which have become surplus or obsolete, are included in these sales. The larger and more numerous items consist of passenger cars, trucks, tractors, graders, rollers, mowers, shovels, cranes, asphalt equipment, and other miscellaneous smaller types.

"Last year's receipts from sales of this kind exceeded $300,000. The percentage of the purchase price which we receive when selling equipment in this manner varies considerably, depending on the type of equipment and the demand for it, as well as fluctuations in the second-hand market. In other words, popular items which are in common use, such as cars, conventional trucks, and construction machinery sell at a relatively good figure, whereas specialized items such as four-wheel-drive trucks, asphalt car heaters, asphalt boosters, and oil-patching equipment sell comparatively cheap. A fair approximation of the recovery would be from 10 to 20% of the original cost, which is the basis upon which we depreciate our equipment."

COLORADO

F. E. Cummings, superintendent of maintenance equipment for the Colorado Department of Highways, had this to say about his Depart-

ment's equipment disposal methods:

"We do not have a set time for sale of our obsolete equipment, but we do hold sales on condemned and obsolete equipment on an average of once a year in each division. The 1½ to 2-ton trucks are generally sold under sealed bids, as are most of the tractors; but the four-wheel trucks and motor graders are, for the most part, cut up and sold for junk, since there is not much sale demand for this kind of old equipment.

"Most of the equipment, which sells for about 10% of new cost, is sold to individuals of used equipment dealers. Money involved in this turnover annually for maintenance equipment and old cars amounts to about $60,000. This is as close a figure as I can give regarding the sale of old, obsolete equipment, since the price varies from time to time owing to the condition of the equipment when condemned and sold as well as the fluctuation in used car and equipment prices."

IDAHO

All of Idaho's used equipment, mobile and otherwise, is sold by sealed bids to the highest bidder. The Equipment Division determines what equipment should be disposed of, based upon obsolescence and mounting maintenance cost. The list is then certified by the State Board of Examiners and authorized for sale. The purchasers, in most cases, turn out to be small contractors, used parts dealers, and small used car dealers.

Tom Pethnick, equipment supervisor for the Idaho Highway Department, made this report:

"Idaho holds its annual clearance sale at the Department's lot in Boise. This year, some 300 contractors, farmers, junk dealers, and others paid $7,500 for motor graders, pull graders, sedans, material spreaders, rollers, and a shovel mounted on a truck.

"We figure we're doing well if we can get rid of them for 5% to 10% of what we paid. They've all seen their day, and they're not worth repairing any more.

"Prospective buyers usually have a month to look over the equipment before submitting sealed bids. The money goes into the department's fund for general highway use, including new equipment.

"Most of the buyers are after spare parts. They have a broken-down grader of their own, and buying another one for a few dollars they can do a little salvaging and save themselves a lot of money. Junk dealers can often turn a bargain when no one else is interested, and a good many farmers can't afford to buy new equipment.

"We seldom have any complaints. As a matter of fact, most of our customers keep coming back."

MONTANA

W. E. Bawden, maintenance engineer for the Montana Highway Commission, answered thusly:

"Once each year we write to our division maintenance engineers throughout the state and request that they transmit a list of all obsolete and/or unserviceable equipment, materials, and supplies which are in their respective divisions. We then tabulate this information and send a complete list covering the entire state to all of our division engineers. They look it over and advise us whether or not they wish any of the equipment, materials, or supplies listed as surplus by the other divisions.

"If any division engineers request articles listed by another division, we arrange for their transfer. After all division engineers have had the opportunity of selecting from the listed articles, we retabulate the list and request our state purchasing agent to dispose of the remaining surplus to the highest bidders.

"Prices received for obsolete equipment have a wide range. It is estimated that the annual turnover in money is $10,000."

NEVADA

C. C. Blaker, equipment engineer for Nevada Department of Highways, answered our request as follows:

"The Nevada Department of Highways turns in old equipment on the purchase of new, with an average of $250,000 per year expended in the purchase of new and trade of old equipment.

"Old trucks have an average life of 8 yr. before they are disposed of. Motor graders last for 10 yr., crawler tractors for 8 yr., and pickups turned in average 80,000 mi. of service and 6 to 7 yr. of age, while sedans run for 90,000 mi. and 6 to 7 yr. of age. The 12 rotary snow plows have an undetermined life, since their work is seasonal and they're used very little if at all in three out of every four winters. Nevada owns machines in this category which have been purchased between 1936 and 1951.

"Oil distributors, also seasonal, are used for four months each year. Machines in this class have purchase dates ranging from 1941 to 1951. There are seven 1,200 to 1,500-gal. Etnyres on trucks and 30 Rosco, Littleford, and Standard Steel 300 to 400-gal. trailer types.

"The state owns 36 rollers, purchased between 1940 and 1953. All are used each year and none is on the disposal list at present.

"For the last 3 yr., the department has purchased all equipment through the state purchasing director on a competitive bid basis with turn-in of old equipment involved. Prices quoted on old units are often fantastic, yet the final analysis shows no great difference between the high and low bid.

"The Department of Highways recently bought 14 pickup trucks outright at $1,290 each through the purchasing director. The 14 old units that were replaced were sold at public auction and brought an average of $300 each. This is $20 per unit better than we have done on deals involving one to four units and a trade for each.

"A recap of the purchases and trades to dealers in the past shows an average trade-in value on all types of equipment of 16%."

NEW MEXICO

Ira B. Miller, maintenance engineer for the New Mexico State Highway Department, had this to say:

"This department at present is operating under a policy of using all equipment until such time as it is no longer economical or feasible to repair. When the equipment reaches this state, it is used for parts to repair other equipment of the same type in most cases. We occasionally dispose of a piece of equipment to county commissioners for use by county forces. However, this is unusual and does not represent a large portion of equipment taken from service.

"The above refers only to heavy construction equipment. The department trades off automobiles when they reach approximately 70,000 mi., pickups when they reach 100,000 mi., and dump trucks when they are no longer feasible to repair or when they have reached approximately 125,000 mi.

"In 1951, we traded in 27 automobiles at an average return to us of $1,073. In 1952, we traded in 28 automobiles which returned to us $1,130 each. During 1953, we traded in 7 automobiles with a return to us of $1,040 each.

"During 1951, 49 pickups were traded in at an average return of $421 each. During 1952, 36 pickups were traded in at an average return of $375 each. In 1953, 31 pickups were traded in at an average return of $412 each.

"During 1951, 33 dump trucks were traded in at an average return of $596 each. During 1952, 15 dump trucks were traded in at an average return of $517 each. During 1953, 15 dump trucks were traded in at an average return of $115 each."

OREGON

E. A. Collier, maintenance engineer for the Oregon State Highway Department, made this report:

"Oregon sells worn out maintenance equipment and scrap materials

on sealed bids at quarterly intervals. Cash received from these sales totaled $41,750 for equipment and $6,800 for scrap materials in 1953.

"Good competition comes from farmers, contractors, cities, counties, and used equipment and junk dealers. The number of bidders on each item ranges from 3 to 12.

"In these 1953 sales, there were 215 pieces of equipment bringing an average price of $195 each. There were 26 cars which brought from $600 down to $85 with an average return of $190. There were 64 trucks and pickups sold from $790 down to $85. Other items included 35 asphalt kettles, 9 trailers, 2 rollers, 13 front end loaders, 16 snow plows, 3 mowers, 4 graders, and miscellaneous truck bodies, boilers, and obsolete parts.

"Most of the equipment sold was bought in pre-war times when prices were lower, so returns on sales ran from 10% to 30% of original cost. There's been a considerable drop in prices for scrap and old equipment during the last six months. During 1951 and 1952, sales totaled $146,000."

UTAH

Verne Gillman, equipment superintendent for the Utah State Road Commission gave us this report:

"If inspection shows repair costs would exceed estimated service remaining on old maintenance equipment, it is sold to highest bidder or junked, after first being advertised in local newspapers by State Finance Department. Financial reports are not available."

WASHINGTON

J. L. Stackhouse, maintenance engineer for the Washington Department of Highways, reported as follows:

"There are a number of worn out or obsolete items, such as hand tools, pumps, parts, old lighting plants, and the like which are considered maintenance equipment that are disposed of by sale as junk to the highest bidder.

"Practically 100% of automotive equipment is disposed of by trading in to dealers on new units. Following is a tabulation of the items disposed of during the biennial period, 1951-1953. This may be considered the normal rate of replacement of the mobile equipment of the department for a 2-yr. period:

Type	No. of units	Ave. age yr.	Inv. cost	Ave. trade-in all.
Passenger cars	175	4½	257,000	25%
Station wagons and carryalls	37	6	65,000	17%
Panels	10	7	18,000	17%
Pickups	25	7	37,500	20%
Trucks (all types)	111	8	360,000	25%
Tractors, crawler	3	10	25,000	15%
Trailers (all types)	23	15	17,000	10%
Rollers	6	15	12,000	12%
Power graders	7	12	55,000	23%
Distributors	6	12	9,600	9%
Road brooms	6	10	3,500	10%
Pull graders	10	15	20.000	10%
Highway mowers	4	10	7,000	10%
Rotary plows	3	15	32,000	5%
½-yd. power shovels	1	11	12,500	30%

Wyoming's tabulation for 1953

Quan.	Item	Average cost	Average use	Average trade
25	Truck, 2-ton	$ 2,615	75,450 mi.	$1,176
12	Truck, 2½-3 ton	3,493	82,820 mi.	1,261
8	Shovel loaders, track	5,525	4,930 hr.	2,615
10	Motor graders	7,655	7,910 hr.	7,013
1	Rotary snow plow	17,102	9,300 hr.	5,577
1	Shovel, gas	10,117	4,460 hr.	5,050
3	Sweepers	918	800 hr.	450
2	Tractors, track	6,086	5,400 hr.	4,282
4	Semi-trailer, asphalt	4,723	189,690 mi.	1,033
1	Hot-mix plant	15,234	3,570 hr.	5,625
2	Asphalt heater, trailer type	1,184	5,245 hr.	583

WYOMING

R. J. Templeton, purchase and equipment engineer for the Wyoming Highway Department, made this report:

"Disposal of old maintenance and construction equipment with a resale value is made by trading on similar equipment to regular road machinery dealers. Otherwise, it is scrapped or sold at a nominal figure to towns or county road departments if it is of value to them. Disposal is made primarily on a mileage or hourly depreciation basis with age, condition, repair expense, and obsolescense given due consideration.

"The useful life of each type of equipment is estimated from our experience in obtaining the greatest use before major repairs become necessary.

"All purchased equipment is made by the purchasing equipment engineer, who issues bid invitations to all interested dealers. The invitations contain the description and location of property to be traded and specifications of the equipment item to be purchased. All bids are received and checked by the purchasing equipment engineer prior to the meeting of the Highway Commission, which must approve all purchases in excess of $1,000. In all cases, awards are made to the low bidder unless it is found that his bid is irregular, specifications have not been met, or previous experience has shown that his product has proven unsatisfactory for our use.

"Specifications are drawn so that no dealer who sells equipment of the type and size desired is excluded from bidding.

"The original cost of 69 items of equipment which were traded in during 1953 was $306,728.01. Trade-in allowances received on these 69 items amounted to $167,054.73. Due to price increases since the war, trade-in values of some equipment items have approximated the original purchase price."

Elsewhere in this article is a tabulation of original costs, trade-in allowances received, and amount of use received from equipment items traded in during 1953.

ALASKA

A. F. Ghiglione, Commissioner of Roads for Alaska, made this report of the practices followed by the Alaska Road Commission:

"The Alaska Road Commission is an agency of the federal government under the jurisdiction of the Office of Territories, Department of the Interior. As such, disposition of all property must conform to the federal rules and regulations governing this action.

"Briefly, these rules and regulations require that we first circularize other agencies of the Department of Interior in Alaska, advising them of the property ready for disposition. If there are no interested agencies, the property is declared excess to our needs and turned over to the General Services Administration for disposition.

"We have not had much equipment to dispose of in recent years, since our policy has been to assign depreciated equipment to remote and isolated areas for use by local settlers on a cooperative basis in constructing and maintaining trails and access roads. We have recently set up a firm schedule of depreciation and will dispose of equipment when it has outlived its useful life or is no longer economically serviceable.

"It would be of no interest to any person or agency in the Continental United States, since transportation charges would be prohibitive. Occasionally, we dispose of old pickups or dump trucks through sale to the highest local bidder after clearance with General Services Administration. These units are usually acquired for very nominal sums by farmers, homesteaders, and other interested parties."

TIMBER BRIDGES — Where to use them

By CHARLES H. WOODWORTH
Assistant Chief Engineer
Timber Structures, Inc.

ACCEPTANCE OF TIMBER for construction of bridges has made a complete cycle, and is again finding increasingly widespread favor among engineers and road building bodies.

Abundant, almost universally available and easily worked, it was man's first bridge-building material, and its use goes back to pre-historic times. Later, because of certain recognized shortcomings, timber for a time was replaced to some extent by steel and concrete. With the perfection of preservative treatments, connection devices and detailing techniques, however, these shortcomings have been overcome, and today timber is recognized as a completely adequate and genuinely economical material when properly used.

Mere massiveness and longevity in a structure do not necessarily constitute good engineering. These two qualities must be weighed against the finished cost of the structure and its ability to perform the required service for the least total cost.

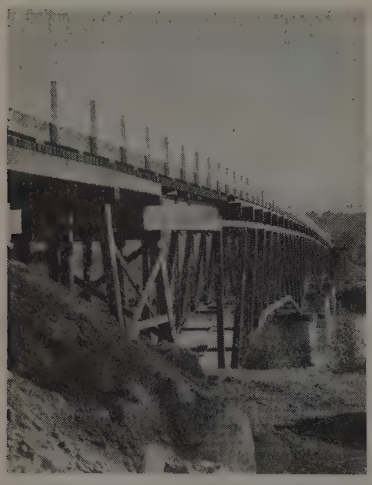
Modern traffic conditions and requirements change too rapidly to justify the building of bridges for an indefinite period of time. There are notable exceptions, but traffic authorities feel that most roadways will require relocation or drastic changes within 50 yr. of their construction. So a bridge built to last for hundreds of years is in most cases a costly luxury that is likely to be abandoned as impractical or obsolete long before it becomes structurally unsound. Such a bridge, to the extent of its over-design, is poorly engineered no matter how long it may stand.

If you apply this test of good engineering to modern timber it becomes apparent that here is a truly excellent material. Glued laminated timbers, for example, can be of any desired length and section. Yet, being formed of thoroughly seasoned material, they are dimensionally stable and free from seasoning action.

Time-proven preservative treatments safeguard the timbers against termites and decay. Advanced design of connection devices provide connections equal to the strengh of the timbers themselves. And timber is now being detailed with as much exactness and precision as any other structural material, producing structures of fully determinable characteristics.

Utilizing these engineering values, bridge designers are now achieving permanence with timber at minimum costs. The idea that timber bridges are suitable only for the backwoods country is as definitely outdated as the old fashioned spring tonic of sulfur and molasses.

Examples and case histories



1. Deck truss bridge

We at Timber Structures, Inc. were asked last year by J. Neils Lumber Company to build a timber bridge to span the Kootenai River at Libby, Montana, that would last for 75 yr. Normally this is considered an unusually long time for a treated bridge; but by the adoption of a style of truss that eliminates tight pockets where moisture can collect and penetrate, we developed a deck truss design which might even outlast the steel used for connecting the joints. As the accompanying pictures indicate, the design did involve the use of a considerable amount of steel—in fact, has jokingly been called the "timber connected steel truss." But it did the job economically and provided a bridge that will serve its allotted 75 yr.

This particular bridge was designed to carry a loaded logging truck of 100 tons total weight over three spans of approximately 155 ft. each. Perhaps the most interesting aspect of this bridge is that practically all action perpendicular to the grain of the wood has been eliminated. The bearing of the floor beams on the top chord is the only such action in the bridge. Since wood is at least four times stronger parallel to the grain than perpendicular to it, the importance of the advanced design is obvious.

The bridge was erected, by an ingenious method, by the Blair Company of Spokane with Rod Harris supervising. All erection of the trusses was done from a sectional pontoon barge carrying a truck crane, and was accomplished piece-by-piece by cantilevering members from the shore and mid-river piers.

Preservative treating was done by the J. Neils Lumber Company in their new plant at Libby, Montana.

The bridge has proved exceptionally stiff, and has deflected less than anticipated. Camber built into the trusses has absorbed all this slight deflection.

2. Bowstring truss

Single-span, bowstring-type trusses have been used to good advantage for heavy truck loadings such as the Calawah River bridge built for the Rayonier Company in the Olympic Peninsula country of Washington. This bridge was designed for a truck load of 115 tons to be carried on a span of 120 ft.

A popular adaptation of the bowstring truss bridge spans Gordon Creek in Multnomah County, Oregon. The main portion of the truss and all bracing are placed below the roadway, eliminating the outriggers normally used to stabilize the top chord. This improves the appearance of the bridge, and provides better traffic visibility. Glued laminated floor beams are used to support a 24-ft. roadway, and both top and bottom chords also are glued laminated. The top chord is continuous, being straight between panel points with a relatively sharp radius at the panel points to eliminate the eccentricity moment developed in a constant radius chord.

Bowstring truss bridges are among the most adaptable of all types, and are suitable for spans of from 50 to over 200-ft. Loads may be comparatively heavy, and site conditions rarely prove unduly critical for this installation.

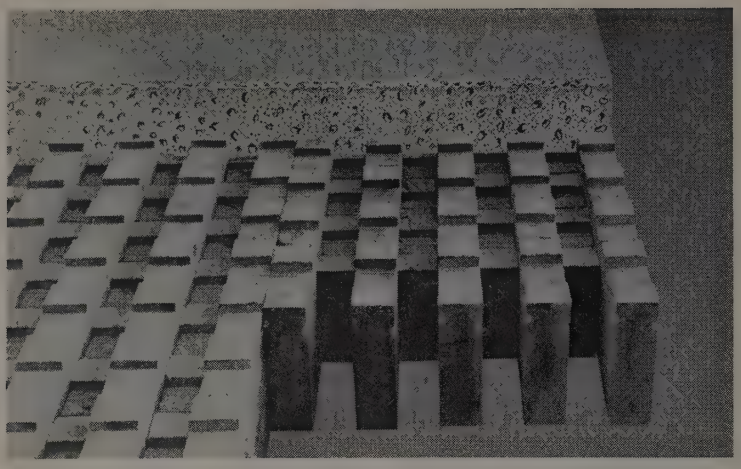
3. Trestle bridge

This is a refinement of the much used trestle, converted by shop detailing and precision fabrication into a carefully engineered unit. Glued laminated stringers are ideal for this structure since they are readily available in any length and section. Many trestle bridges, such as this one, have a composite deck, railing and sidewalks of concrete. They have the appearance of an all-concrete bridge along with the economy of engineered timber construction.

4. Deck arch

Ideal for site locations where canyon walls of rock give proper resistance to the horizontal thrust, the deck arch type combines high deck and low piers. The bridge shown here near Reedsport, Ore., spans 120 ft. and has a roadway width of 20 ft. Arches, columns, and bracing were pressure treated with Wolman salts. The deck arch bridge is adaptable for wide spans and heavy loadings. Arches are placed directly beneath the loads, relieving most of the strain on the deck.

(Continued on page 76)



5. Composite deck

Another recent development is a system of composite girder bridges using a concrete slab as an integral part of the girder system. In this section of a composite deck, the timbers serve as tension members and the concrete roadway serves as a compression member. Shear is developed by dapping and by longitudinal grooves near the top of each lamination.

The composite girder is not new, but the use of glued laminated timbers broadens the field of use by permitting longer spans and greater clearances over the waterway. It also minimizes formwork costs.

6. Girder bridge

A comparatively recent development at Timber Structures, Inc. is a complete range of girder bridges of from 15 to 75 ft. span using glued laminated timber girders to support a laminated wood deck. Such a bridge is quickly erected with a minimum of heavy equipment. Engineering costs on this type of structure are exceptionally low, and there is practically no jobsite assembly. Almost any loading or roadway width can be provided by varying the section and number of supporting girders, and where center piers are permissible, the girder bridge can be erected on a curve.

7. Prefabricated falsework

Cost and construction time of concrete and stone bridges are sharply reduced by use of prefabricated falsework and arch centering which replaces the usual forest of shoring timbers. This falsework at Bar Harbor, Maine, is precision fabricated to engineering detail, and is adaptable for either one-time or repetitive use. Shipped knocked down, it is easily and quickly assembled, requiring a minimum of assembly space at the jobsite.

Colorado Department of Highways reports on—

Using the Kelly Ball to test concrete

Direct comparison between old slump cone method of testing concrete consistency and Kelly Ball reveals new method is simpler, faster to use

By BEN F. HAYNES
Urban Materials Engineer
Colorado Department of Highways

WE HAVE USED the Kelly Ball in direct comparison with the slump cone for 267 tests on 6 projects of the Colorado Department of Highways' Denver Valley Highway covering a time period from April 1953 to January 1, 1954.

The procedure for making these comparative tests was as follows: Using an 18-qt. galvanized pail, with dimensions 14 in. in diameter at the top, 10 in. in diameter at the bottom, and 9 in. deep, we filled the pail from the approximate middle third of a transit-mix concrete load as it was being discharged. The concrete was then struck flush at the top of the pail and the Kelly Ball was immediately placed on the surface of the concrete and the reading recorded to the nearest 1/4 in. The concrete in the pail was then stirred and aggitated with a tamping rod and hand scoop, and a Standard AASHO T-119-42, Sec. 4 slump cone test of the concrete was made and recorded to the nearest ¼ in.

All concrete was Colorado Department of Highways' Class "A," 6 sacks per cu. yd., air-entrained, using type II cement. All concrete was batched at Central Mix Concrete Batching Plant and hauled to the project site in transit-mix trucks. The distance of haul varied from 1 to 6 mi. and air temperatures varied from 15 to 96 deg. F. The tests represent the work of three different operators.

Reaction to the use of the Kelly Ball was very favorable with both the highway engineers and the contractors. Since I have worked on the development of equipment for meas-

Here's the background of the Kelly Ball

THE ARTICLE "Is the slump cone on its way out?" which appeared in the July 1953 issue of Western Construction has created quite a stir in the construction field. It described a method of simplified field tests to determine the consistency of concrete (in place of the old slump cone test) which has been invented by J. W. Kelly, professor of engineering at the University of California at Berkeley. Professor Kelly called his gadget the Penetrator, but it has come to be known, far and wide, as the Kelly Ball.

The Colorado Department of Highways has been experimenting with the Kelly Ball since April 1953. After the story appeared in Western Construction, the Department asked for permission to reprint and distribute it to all field forces with the possibility of changing Colorado's present slump cone method of concrete control.

This present article is a summary report of some of the field engineers' recent experiences with and opinions of the Kelly Ball.—Editor.

uring the workability of concrete, I believe the Kelly Ball is an improvement over the slump cone. It is much simpler to use, faster, and easier to keep clean.

A conservative estimate of the time required for a test would be about one-third of that required for the slump cone test. The results of our tests would indicate that we should multiply the Kelly Ball test reading by 2.34 to give a comparative slump value. The literature that we have read about the Kelly test stated that the reading should be taken to the nearest 1/10 in., perhaps we should mark our Kelly Ball to 1/10-in. gradations. At present it is graduated to ¼-in. markings.

We used the 18-qt. pail because it met the least dimension requirements noted in the Kelly Ball literature. It also made it possible for one man to make the test without using excess time and effort and it is practical to handle this type of container on all projects, also it is not always possible to take Kelly Ball tests in the actual concrete of walls and beam sections.

I believe we should obtain additional test data using different mixes and aggregates in other districts of the Department, with the thought in mind of adopting this simple method of measuring the workability of concrete.

There may be variation in the Kelly Ball reading with different types of aggregates due to certain buoyancy properties inherent in the sand and/or rock particles. As for instance, a sharp sand and broken rock particles may have a high supporting value due to internal friction, whereas a sand and gravel with rounded surface would offer less support, the water-cement ratio being the same in each case. Therefore it may be well for the laboratory to determine a correlation for each design mix, with a check correlation run in the field at the start of production.

Air entrained concrete, as used by the Colorado Department of Highways in the Denver area, contains about 33% sand by weight of total aggregate. This sand usually has a fineness modulus of 2.75 to 2.90. This concrete, without air, would have to contain about 40% sand by total weight of aggregate to be workable or placeable at a 4-in. slump or less.

When air-entrained concrete is being used in transit-mix concrete and for some reason the concrete arrives at the project without the entrained air, the mix is usually very harsh and unworkable due to the low sand content.

In my opinion, the Kelly Ball shows this condition better than the slump test. If the Kelly Ball is placed on this harsh concrete, it will show a very low reading, indicating poor workability. But if a slump test is made on the same concrete, many times it will show considerable subsidence or falling apart. It is true that this is not a true slump test, but many times it has been recorded as such. For this reason, I believe that the Kelly Ball will show more consistent results than the slump cone, and it affords a quick method for spotting an unsuitable batch of material.

What other Colorado engineers say

OTHER COLORADO HIGHWAY DEPARTMENT engineers, both field and staff, had this to say about the Kelly Ball.

K. S. White, district materials engineer for District No. 2—

"We have used the Kelly Ball for testing more than 1,000 cu. yd. of concrete. While this is probably considered to be a limited experience, we have found good correlation with the slump cone. The slump cone has always been a clumsy and laborious method of measuring the slump. The Kelly Ball affords a fast and reliable test that does not demand an expert to use and in our opinion should be adopted as standard procedure."

J. E. Casey, district engineer at Durango—

"Our opinion is that the Kelly Ball method should be adopted as standard for field control. We believe it is a much more representative test of consistency and, because of the simplicity of the test, many more tests can be made, thus allowing for closer control."

A. H. Bunte, staff materials engineer, in a recent memo to district engineers—

". . . We think this Kelly Ball test has merit, especially in air-entrained concrete. If you are interested, we recommend that you submit a requisition to the laboratory for this equipment."

Jay J. Houston, project engineer—

"During construction of the concrete girder bridge at Sta. 240 plus, Project S 0072(1), Longmont-East, the Kelly Ball was used to determine the slump of the concrete and proved very satisfactory.

"During the first several tests, comparisons were noted between the standard slump cone and the Kelly Ball. Upon the multiplication of the direct reading of the Kelly Ball by the factor of two, as given in the article taken from **Western Construction** dated July 1953, very similar results were obtained. Since the Kelly Ball method was so much faster and simpler, the remaining consistency tests were all determined by the use of the Kelly Ball, with only occasional checks with the standard slump cone.

"Quoting from the article as mentioned above: 'The concrete man be in a container, in a wheelbarrow or cart, or in forms, so long as the least essential dimension is 12 in. and the depth is at least 6 in.'

Jack E. Miller, district material engineer—

"The Kelly Ball was used in lieu of the slump cone on two projects with very good results. Test checks were made with the Kelly Ball against the slump cone and the results were very close. The men who have used the Kelly Ball like it much better than the slump cone because of the ease with which the tests can be made and the time saved in making tht tests."

Laurence C. Bower, district engineer, and Edward W. Oviatt, district construction engineer—

Both have advised the Department that they concur in the reports made by Houston and Miller, and they heartily recommend that the Kelly Ball method should be adopted as a standard test.

W. J. Walsh, staff construction engineer—

"We have not yet adopted the Kelly Ball as a standard method of test; however, it looks like we probably shall in the not too distant future. For the present, we are feeling our way and permitting our field engineers to use this method of test after some correlation with the slump test has been made for a specific aggregate.

"Personally, I feel that the use of the Kelly Ball in lieu of the slump cone has a great deal of merit and believe it should be adopted as a standard method of testing."

Hub of the Los Angeles freeways

THE $1,500,000 four-level traffic interchange structure, about one-half mile westerly of Los Angeles Civic Center, is where the Hollywood Freeway crosses the Harbor Freeway-Arroyo Seco Parkway (one being a continuation of the other). It has been referred to as the "Hub of the Freeway System."

In this structure, the basic feature is that the four separate roadway levels are so arranged as to pass one another at one point in a single-bridge structure. The two freeways intersect at approximately right angles. The Hollywood Freeway is on the top level, the Harbor Freeway-Arroyo Seco Parkway on the third level, with two pairs of interchange roadways occupying the second and lowest levels. In this manner, all the necessary traffic movements are adequately provided for with a minimum amount of turning movements.

In view of the topographic features of the vicinity, the four-level type of design was a natural and logical system to adopt. Any other system of interchange such as the standard four-leaf clover design would have involved much more disruption of the existing Los Angeles street pattern. As designed, the structure has only the lowest level below the ground surface, the second level approximately at ground surface, and the third and fourth levels above. This type of design caused very little disturbance of the existing city storm drain system.

The building of the approach fills presented no problem because considerable volumes of excess excavation occurred nearby. The overall result was a comparatively inexpensive and economical type of construction. In practice, the design appears to be working out satisfactorily with very few complaints regarding difficulties that motorists have had in utilizing it.

Importance of new design

It should be emphasized that the four-level traffic interchange system has introduced a new method of handling exchange traffic between freeways that is greatly simplified over the conventional types of interchange systems. For example, the four-leaf clover type requires a three-quarter turn or 270-deg. loop to the right for a left hand turn, as compared to the 90-deg. loops of the four-level structure. There is also a serious overlap of acceleration and deceleration traffic with resulting conflict and confusion on the clover-leaf type.

NEW FOUR-LEVEL traffic interchange structure provides maximum efficiency in less land area than conventional four-leaf clover traffic interchange.

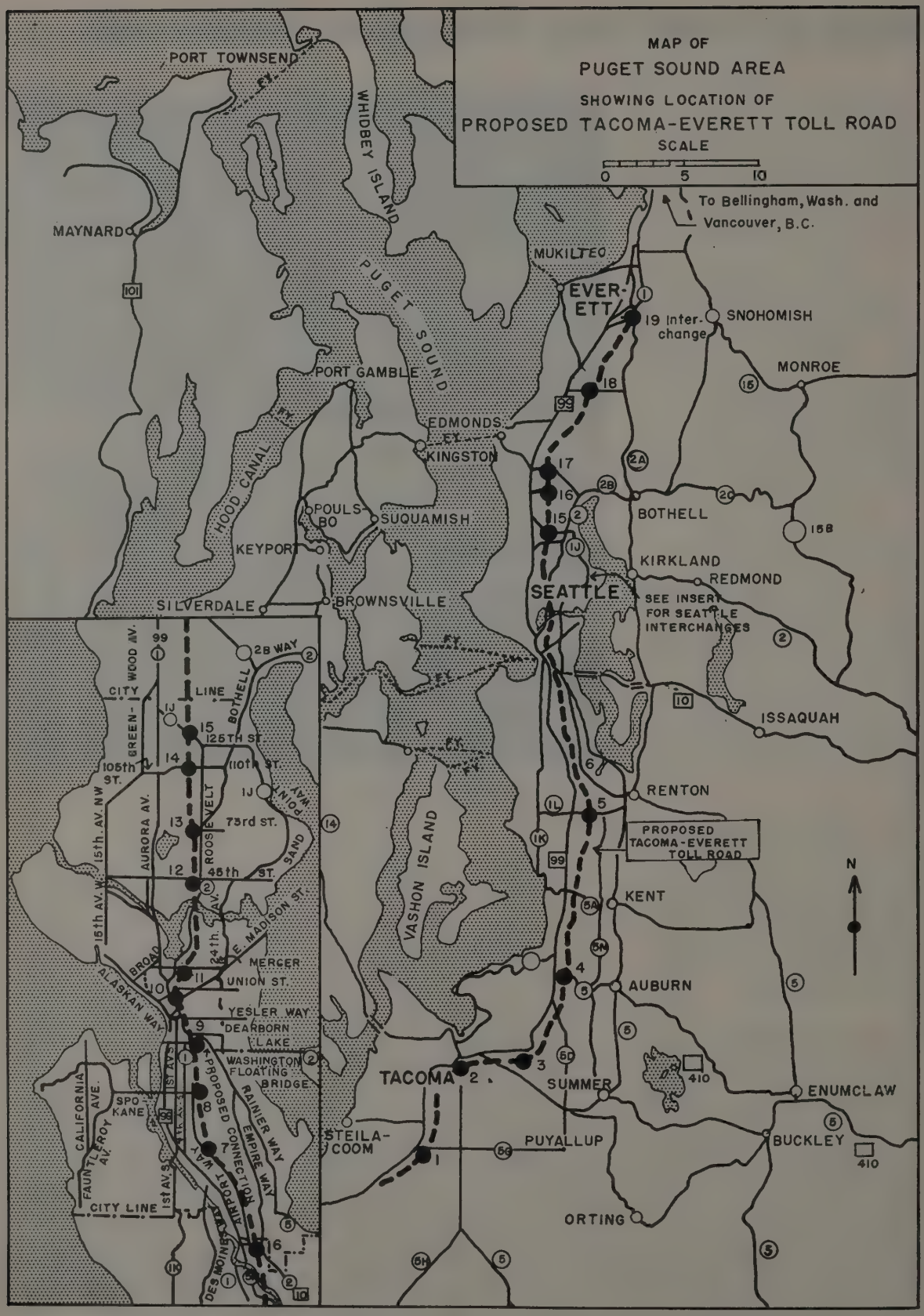
Other types of interchange systems employ reversing curvature and circuitous travel for some of the traffic movements, together with numerous bridge structures, all of which are detrimental to smooth and economical operation. The four-level traffic interchange system eliminates these objectional features by providing a simple turn for all traffic movements in the direction in which each wishes to go, and without excess distance over that which would be required in ordinary highway travel.

The original design of the four-level structure was worked out some 10 yr. ago. Design criteria followed policies of the AASHO that were in effect at that time. Minimum radius on interchange roadways was 300 ft. maximum grade 8%, lane widths on main freeways 12 ft., and lane widths of 13 ft. on the interchange roadways. The design speed for interchange was 35 mph. and the roadways have been posted for this speed.

If the structure were being designed today, in the light of tremendous traffic volumes now using the freeways, some changes would without doubt be made. All of which, however, would cause greatly increased costs. The design, as of today, would include flatter radius curvatures for the interchange roadways and an establishment of grades thereon not to exceed 5%. It is doubtful if the design would include additional traffic lanes.

Already overloaded

Traffic counts taken at various locations and at various times indicate a traffic volume of 250,000 vehicles per day. This is considered to be a capacity traffic load, all of which goes to prove that additional traffic facilities of equal standard are needed, not 10 yr. from now but right now. In other words, there is the need for many more freeways dispersed throughout the Los Angeles Metropolitan Area than the State is now building.


MAP OF
PUGET SOUND AREA
SHOWING LOCATION OF
PROPOSED TACOMA-EVERETT TOLL ROAD
SCALE
0 5 10
To Bellingham, Wash. and Vancouver, B.C.
PORT TOWNSEND
WHIDBEY ISLAND
MAYNARD
MUKILTEO
EVERETT
19 Interchange
SNOHOMISH
MONROE
PUGET SOUND
PORT GAMBLE
EDMONDS
KINGSTON
HOOD CANAL
POULSBO
SUQUAMISH
KEYPORT
BOTHELL
KIRKLAND
REDMOND
SEATTLE
SEE INSERT FOR SEATTLE INTERCHANGES
SILVERDALE
BROWNSVILLE
ISSAQUAH
RENTON
PROPOSED TACOMA-EVERETT TOLL ROAD
VASHON ISLAND
KENT
AUBURN
TACOMA
SUMMER
ENUMCLAW
PUYALLUP
BUCKLEY
STEILACOOM
ORTING
CITY LINE
MERGER
UNION ST.
YESLER WAY
DEARBORN
LAKE
WASHINGTON FLOATING BRIDGE
PROPOSED CONNECTION
RAINIER WAY
EMPIRE WAY
ALASKAN WAY
AURORA AV.
GREENWOOD AV.
BOTHELL
125TH ST
110th ST.
105th ST.
73rd St.
45th ST.
24th
E. MADISON ST.
SAND POINT WAY
ROOSEVELT
BROAD
15th AV. NW
15th AV. W
1st AV. S
CALIFORNIA
FAUNTLEROY AV.
SPOKANE
DES MOINES
N

TACOMA-EVERETT TOLL ROAD

Preliminary study shows that 85¢ buys you a fast 65-mile ride through congested traffic in the Seattle area

WASHINGTON may soon join the toll road movement. A recent report by Coverdale and Colpitts to the Washington Toll Bridge Authority indicates the facility could be built.

Four steps toward completion of the new toll facility were suggested. The first was that financial consultants be engaged to review the results of the preliminary study. After the report of the financial people was made, the next step would be the completion of engineering work, soils investigation, and design of the new roadway. The third step would involve completion of traffic surveys in sufficient detail to demonstrate to investors the soundness of the proposed revenue bonds. The fourth step would be the sale of bonds and construction of the toll road.

Cost of facility

Total cost of the 65.1-mi. facility is estimated to be $158,168,000, including cost of all interchanges and toll collection booths, as well as the cost of the other facilities necessary to administer the proposed road. Cost from Ponders Corner, 4½ mi. south of Tacoma to Pacific Avenue in Tacoma, was estimated at $11,141,000; cost from Pacific Avenue in Tacoma to Duwamish Junction in south Seattle was estimated at $27,475,000; for the section through Seattle from Duwamish Junction to the Snohomish County Line, the estimated cost was $112,885,000 and for the section from the county line to the end of the toll road south of Everett, the cost was estimated at $6,667,000.

Route of toll road

The proposed new toll road would start at Ponders Corner about 4½ mi. south of Tacoma. It would run east of the present U.S. 99 and roughly parallel to it until entering Tacoma. Then it would go due north on 56th Street in Tacoma, make a wide curve northeasterly to Portland Avenue and then run due east to the town of Milton. From Milton the road would take traffic in a northerly direction to Duwamish Junction south of Seattle.

In Seattle, the route runs west of and parallel to Airport Way until it reaches Judson Street. Then it swings westerly to go parallel to 6th Avenue until it reaches Seneca Street. From there, it would go north diagonally across Union Street, Pike Street and Olive Way. It would parallel Eastlake Avenue on the east and would swing easterly to Harvard Avenue and East Howe Street. Then it would run north to East 75th Street and would cross the Lake Washington Canal by a bridge starting at Harvard Avenue and Shelby Street and ending at 6th Avenue and 42nd Street. It continues north to 75th Street and 6th Avenue, swings west to 85th Street and Sunnyside Avenue and then runs due north to about 1¼ miles north of the King-Snohomish County line near Hall Lake. It would continue northerly, terminating about 2 miles south of the south limits of the City of Everett.

Design of toll road

Except for a section in Seattle, the toll road would be built with four lanes, each 12 ft. wide. The median separating each two lanes of opposing traffic would be either 24 or 36 ft. wide, allowing extra lanes to be built, if necessary, in the future. From the Union Street interchange to 85th Street in Seattle, the toll road would consist of three roadways, two with three lanes of 12 ft. each, and a third middle roadway of two lanes of 12 ft. each which would be used as a reversible roadway.

Thus, eight lanes would be available for traffic north of the central business district in Seattle. The middle two lanes would be used to carry the peak loads of traffic. If the extra two lanes were needed for north-bound vehicles, that traffic could be routed over the roadway. On the other hand, if the peak load were going south, south-bound traffic could take the middle two lanes.

Trucks and cars would have easy grades and curves to negotiate. None of the grades would be over 3% and curves would be limited to 2 degrees. Width of right of way would be 300 ft. from Ponders to the south city limits of Seattle, 150 ft. through Seattle, 250 ft. through King County after leaving Seattle and 300 ft. through Snohomish County to Everett.

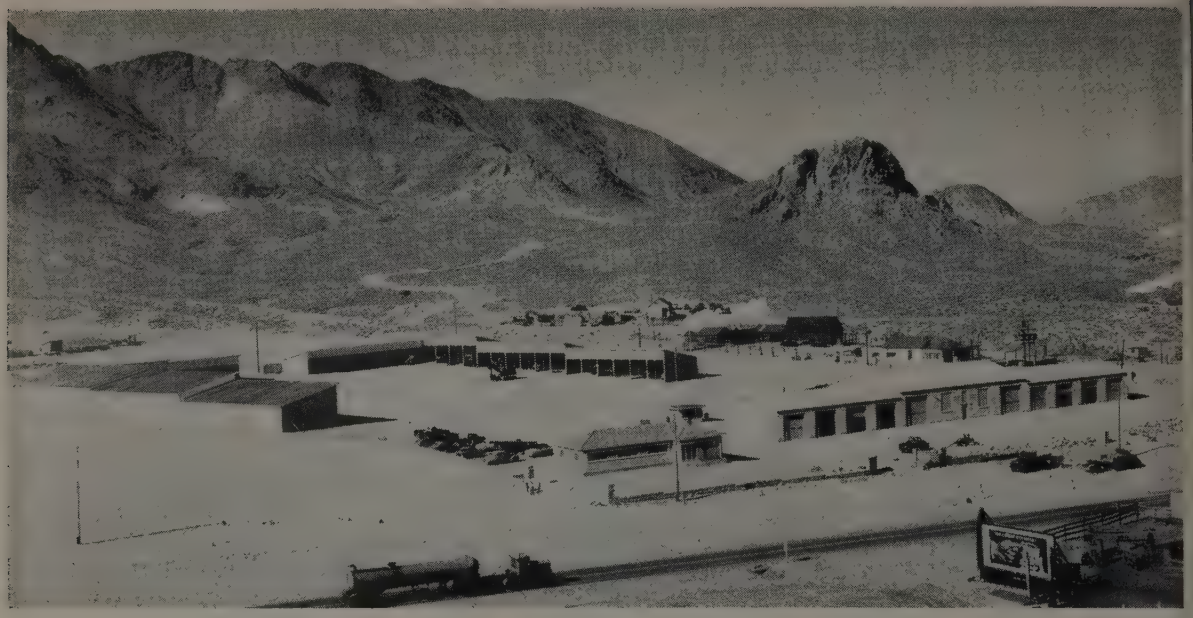
Revenue from tolls

Net revenue for the entire project from south of Tacoma to the vicinity of Everett was estimated at $415,169,000 for the years from 1958 through 1983. For the section from the south city limits of Seattle to Snohomish County line, estimated revenue was $337,839,000 for the same period. This indicates a ratio of estimated revenue over estimated costs of 2.62 and 2.99 respectively. Ordinarily a ratio of 1.5 is considered favorable, and the higher the ratio, the better the rate of interest. Thus, the prospects for selling the bonds are considered to be excellent.

It was estimated, too, that a force of 155 toll collectors for 24 hr., year around operation, would be required as well as a 45-man police force. Maintenance costs were estimated at $5,000 per mi. No estimate, however, was made on the possibility of revenue to be gained from concessions granted for sales of gasoline and oil and other services.

The engineers estimate that the average motorist will save 32 min. between Tacoma and Everett, if he uses the tall road rather than existing facilities. He would save 18 min. of that time between Tacoma and Seattle and 14 min. between Seattle and Everett.

Tolls will be relatively cheap. For 85 cents, a passenger car can travel the entire 65 miles of highway. That is at the rate of 1.3 cents per mi. The average passenger car travels on the New Jersey Turnpike at 1.5 cents per mi. The average truck could drive the Tacoma-Everett toll road for $1.38, or 2.1 cents per mi., compared with about 3.3 cents per mi. on the New Jersey Turnpike.



Nevada conquers design problems

. . . of desert isolation, sloping ground surface in building new highway division headquarters at Tonopah—Terraced sheds form hollow square along gradient, provide equipment area and permit simple roof design

By JACK R. COONEY
Architect
Nevada Department of Highways

DESIGN AND CONSTRUCTION of a new division headquarters, including shop and office buildings, for the Nevada Department of Highways at Tonopah presented a number of problems due to the varying types and sizes of equipment to be housed, the sloping surface of the ground, and the isolation of the site.

This installation, known as Division Five Headquarters, is intended to accommodate around 60 permanent maintenance and administrative employees who are responsible for maintaining 800 mi. of primary and secondary highways in the west central part of the state. Division boundaries range from Walker Lake on the north, Austin on the east, Beatty on the south, and the California border on the west and south. In addition to the permanent personnel, 30 to 40 engineering and construction men work out of the Division during periods of highway construction.

Numerous functions were assigned to this division; all of them were given prime consideration in the designing of the installation.

A thorough study of the different functions of the division, and the space required for each, determined in general the size of the buildings, and to some extent the general arrangement. Economy of construction, always a factor, influenced our choice of construction materials, although permanence, economy of maintenance, fire resistance, and other factors were given equal consideration.

An office building for the accounting, administrative, engineering, and drafting functions was necessary. A shop building, to include space, equipment, and facilities for the repair and maintenance of all types of roadbuilding and maintenance equipment was of equal importance. Next, storage space and shelter for some 100 pieces of equipment had to be provided, as well as warehouse and storage space for a large variety of bulky items.

On a tract fronting 400 feet on U. S. 95 and extending some 600 feet in depth, the buildings were arranged in a hollow square, with office building and main shop building across the front and storage sheds and warehouse space at sides and rear. The large quadrangle thus formed provided ample space to maneuver and park equipment and vehicles. Work started in July 1953 and was completed in January 1954.

The main shop building, 226 ft. long, has a center shop section, 82 x 55 ft., flanked at each end by a wing, 38 x 72 ft. Each of the wings is divided laterally into four 18 x 36-ft. stalls or rooms, each with a 12 x 12-ft. steel overhead door. Doors between the stalls make all areas readily accessible.

The central shop section has four steel overhead doors, each 14 x 14 ft., allowing ingress and egress for the most ponderous pieces of equipment. Doors are so located that equipment can be driven in one side of the building and out on the opposite side. A 6-ton capacity gantry crane traverses the center of the shop area. In addition, a heavy-duty Weaver twin-post hoist is located strategically in the main shop. This unit has proved to be particularly effective for preventive maintenance. An additional Weaver hoist is located in the grease room.

The eight stalls formed by the wing section are equipped to serve as machine shop, blacksmith shop, grease room, car wash, car painting, carpenter shop, and sign shop. Location of the various stalls was determined by the flow of work and

the overlapping functions, as with machine shop and blacksmith shop, carpenter shop and paint shop, and so on.

A wing at the rear of the main shop area houses the heating plant, parts room, office, and rest room.

Heat is provided by steam to unit heaters located in all areas of the building. Steam supply lines are run in the attic space.

The individual stalls serve a dual purpose, providing night storage for vehicles and equipment in inclement weather. The severe winters in this area make it necessary to provide heated storage to assure instant starting of heavy equipment. All available floor space is so utilized in cold weather, and the elimination of freeze-ups is expected to result in reduced maintenance costs.

Equipment storage facilities are provided in an arrangement of open front sheds at the rear of the site. The U-shaped arrangement, with all openings on the inside, has already proved very satisfactory. Fifty-six stalls of varying widths and heights permit the storage of even the largest pieces of equipment.

A refueling station with both gasoline and diesel pumps, located in an isolated position in the yard, is approachable from two sides. Thus, two vehicles can refuel at once.

The office building, modern in treatment, is a single-story block and frame structure of 1,800 sq. ft. in area. The structure contains offices, drafting rooms, rest rooms, and storage on the main floor. A basement provides additional storage space and a furnace room. The office building is heated with forced warm air through under-floor ducts and floor registers. Fluorescent lighting was used in offices and drafting rooms.

The project posed a number of problems of design, due to the divers types and sizes of equipment to be housed as well as to the sloping surface of the site. The solution was a system of terraced sheds following the gradient of the site and permitting a roof of simple design.

Construction materials generally were chosen for appearance and permanence, as well as economy.

The main shop building has footings, floors, bond beams, and architectural detailing of reinforced concrete. All walls and partitions are light gray pumice block.

Exterior walls are 12 in. thick, of 8 x 16-in. units. Interior walls and partitions are 8 in. thick, of 8 x 16-in. units. The roof is of corrugated transite panels on steel roof trusses. Roof trusses over the main shop section have a clear span of 55 ft., eliminating the need for columns and providing an unobstructed working area of 55 x 80 ft. Ceilings are ½-in. sheetrock panels with joints taped. All ceiling areas are insulated with 3-in. rigid rock wool batts. All windows are steel commercial projected type with double strength glass.

Electrical wiring for lighting and power circuits is run in metal conduit in attic spaces or under floor slabs as is most practical.

A 5-hp. air compressor, which operates the Weaver hoists, also supplies compressed air to all parts of the building for a variety of purposes.

An intercommunicating system with stations located strategically about the installation permits supervising personnel to maintain close contact with all employees.

To complete the installation, an attractive fence of cut stone and chain link wire is presently being erected.

A construction project such as this, being located some 240 mi. from Department headquarters, entails numerous problems of design and engineering which, by their remoteness, are difficult to solve. In this, the architects were ably assisted by our division engineer at Tonopah, Denton Hays. Throughout the period of the design and construction, we worked under the direction and guidance of Huston D. Mills, state highway engineer and W. T. Holcomb, assistant highway engineer. Others of the Highway Department staff who provided invaluable assistance on the project were A. G. Kinne, engineer of design; E. T. Boardman, chief bridge engineer; and C. C. Blaker, engineer of equipment.

General contractor on the work was W. W. Weichmann of Reno.

The project was designed by Ardean Fialka and the author, both on design staff.

Robot mathematicians replace surveyors

THE LAYING OUT of a tract or subdivision by modern methods involves a great number of calculations which require the use of trigonometric functions for their solution. More and more of the slow manual work formerly done by surveying crews in the field has been shifted to the office in the form of more complicated problems for computation. This fact, coupled with the general shortage of trained computers, has led to the need for mechanization of the entire computational scheme.

The IBM Scientific Computing Service at Los Angeles now makes available to engineers a rapid and economical system for the computation of 10 different trigonometric subdivision engineering and survey problems. Use is made of the inherent speed with which information can be supplied to electronic computers through the use of IBM mark-sense cards. Pencil marks on the cards provide an electrically conductive path between closely spaced brushes or electrodes that are mounted in the computers. The latter then proceed to make thousands of computations a second and out comes the answer.

The saving resulting from the utilization of this service varies from problem to problem, but the average saving would be about 40% of manual costs. The mark-sense card forms an excellent permanent record for the firm having the work done. Speed of solution, considering delivery-in to delivery-out time, compared with manual processing time would run about 1 to 10.

At present, service is offered three times weekly on all of the 10 types of problems mentioned below, with the answers generally available during the afternoon of the same day the mark-sense cards are delivered to IBM. However, The Los Angeles office is the only one in the Western states which has the Electronic Calculator required for this work. In the future, other offices will undoubtedly have such equipment available, but until then, it is possible to contact the local IBM service bureaus and have the mark-sense cards mailed by them to the Los Angeles office. Use of air mail service makes this a well worthwhile program for all engineers in the Western states.

The problems for which this computing service is presently available are the following:

1. Survey traverse closure
2. Arc length
3. Forced closure—example, determination of the description of a single side of a tract or lot when everything else is known.
4. Area of circular segment
5. Law of sines operation
6. Tie calculation—this computation is used to reduce from "center line" to "property line"
7. Double-meridian-distance area calculation
8. Hypotenuse computation
9. Curve lay-out calculation
10. Missing side of right triangle

IBM plans to extend this type of service in the near future to include traverse closure carrying coordinates. Other triangulation problems such as the three-point problem, the least square adjustment of quadrilaterals, and the reduction to center are also being considered.

Are you getting good compaction?

Washington has a new method for measuring in-place density of highway soils—Herb Humphres shows and tells how it works

CONVENTIONAL METHODS of measuring the in-place density of soils and granular materials are time-consuming and oftentimes subject to considerable error. Presently used methods, such as measuring volumes by use of oil or calibrated sand, have one or more of the following shortcomings, namely (1) suitable only for application to a small range of hole sizes, (2) subject to considerable error when surface of ground is rough, (3) accuracy affected by vibration or temperature, (4) cannot readily check densities of successive lifts by merely extending depth of same hole, and (5) require lengthy calculations and correction factors for final answer.

In an attempt to overcome these deficiencies, the Washington Densometer has been developed. The basic principle of the instrument is the same as that used in some other methods, namely that of inflating a rubber balloon with fluid until it fills the excavated hole and measuring the volume of the hole by measuring the amount of fluid so required. However, the apparatus is unique.

The device uses a closed system with a cylinder and piston to activate inflation and deflation of the balloon. This permits extremely rapid operation plus the direct reading of volumes in cubic feet from the calibrated piston rod. By the inclusion of known-volume rings, rapid and accurate measurements of holes varying from 0.000 cu. ft. up to 0.500 cu. ft. can be made.

By HERBERT W. HUMPHRES
Senior Materials Engineer
Washington Department of Highways

THE NEED for a fast, accurate means of determining the field density of in-place granular base course and surfacing materials, as well as of subgrade soils, has become critical in recent years in the highway construction field. Widespread application of moisture-density control specifications to insure uniformity of roadbed construction requires that field control methods be sufficiently rapid that control data can be made available to the engineer and the contractor during the compaction process and without causing delay to the progress of the job.

This is particularly critical in projects utilizing equipment-train methods of construction, such as soil cement or cement stabilized base projects, where each phase of operation is integrated in time and order with other operations. The rapid progress of such projects does not allow sufficient time for determining field densities during the compaction phase using presently accepted standardized test methods. This has resulted in actually running "control" tests after a section of road is completed; the data serving primarily as a "record" to serve as a guide in future work. Often, the end result is a considerable waste of "rolling time" for compaction equipment, or, in some cases, the need to disrupt the progress of the job because of the necessity of re-processing a completed section.

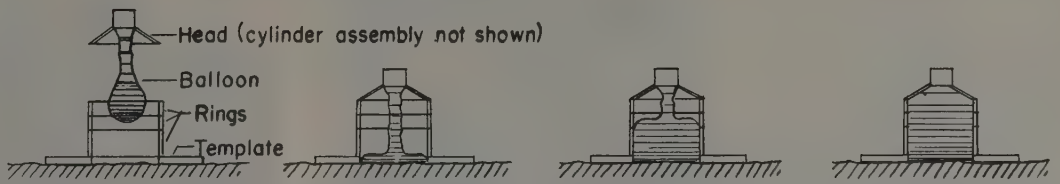
Other phases of highway work have also been curtailed by the inadequacies of presently accepted standard field density test methods. In the field of research, this department has begun a long-range program of investigation of base course and surfacing materials.

A considerable number of roadway pavement failures can be explained only in terms of failure of the granular surfacing materials and base courses. To determine what correction steps are required, it is necessary first to determine whether the deficiencies are in the materials themselves, or are a result of the manner of placement and/or alteration of physical characteristic due to traffic.

Extensive field studies will be required to find the correct answers, and one phase of these field investigations involves determination of field densities both during the construction period and after various periods of traffic. The large volume of such data required dictates the need of field density equipment that is both accurate and rapid. Presently accepted methods are not suitable for such studies for the reasons stated below, and this is one of the primary reasons the Washington Densometer was developed.

In 1952 the department reviewed the several existing methods generally accepted by various agencies for determining field densities, and

SEQUENCE ILLUSTRATING CHARACTERISTICS OF DENSOMETER DURING OPERATION



A.

Balloon being lowered into rings for initial reading. Approximately 1 liter of fluid in balloon.

Condition of balloon with apparatus clamped in place prior to inflation.

During inflation. Note how balloon fills from bottom up.

Completely inflated. Record initial reading (IR). Deflate balloon and remove Densometer from rings.

B. Remove rings, dig hole, and leave out ring or combination of rings whose volume most nearly equals the estimated hole volume. Sum of volumes of rings left out = ring constant.

C.

Balloon being lowered into hole. Rings not on template.

Condition of balloon prior to inflation. Fluid in balloon causes bottom of hole to be filled without trapping air.

During inflation, filling from bottom allows balloon to fill voids displacing air upwardly and out vents.

Hole and head completely filled. Record final reading (FR).

D. Calculate volume: (FR + ring constant) − IR = volume of hole.

Note: The sketches above show a hole volume of approximately 0.2 cu. ft. and all rings were omitted for the final reading. For smaller holes, one or more of the rings would be used during the final reading. The purpose of the rings is to cause the balloon to be inflated to approximately the same degree for both the initial and final readings.

found that each method possesses one or more of the following shortcomings:

1. Require too much time for operation, exclusive of time required to dig hole.
2. Suitable only for application to a small range of hole sizes close to the size of hole for which the apparatus is calibrated.
3. Do not provide for initial surface reading, which introduces appreciable error when surface of ground is rough.
4. Accuracy seriously affected by outside influences such as vibration, humidity, temperature, etc.
5. Will not permit checking densities of successive lifts by merely extending the depth of the same hole.
6. Requires frequent recalibration to insure accuracy.
7. Require a level surface for successful operation.
8. Not suitable for use in clean granular materials.
9. Danger exists of trapping air in bottom of holes dug in fine-grained soils.
10. Require lengthy calculations and correction factors for final answer, which increases the possibilities for errors.

Design principle

With these deficiencies in mind, development of the Washington Densometer was started. Successive improvements in design have resulted in a device that has none of the shortcomings listed above. The principle utilized is the same as that used in some other methods; namely, that of inflating a rubber balloon with fluid until it fills the excavated hole and measuring the amount of fluid so required to determine the volume of the hole.

Flexibility of equipment

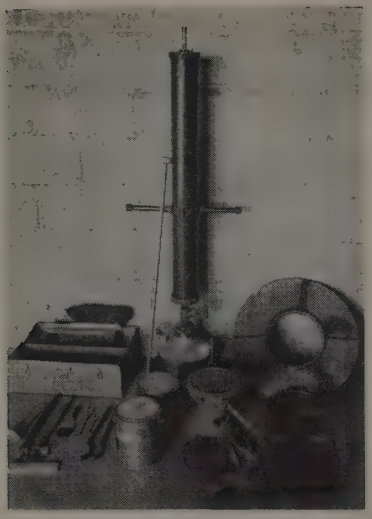
However, to the writer's knowledge, the apparatus is unique in the method of application of this principle. The use of a closed system with a cylinder and piston activating the inflation and deflation of the balloon permits extremely rapid operation and the direct reading of volumes in cubic feet from the calibrated piston rod. The inclusion of known-volume rings permits the use of large-size balloon for both small and large holes without loss of accuracy. The purpose and use of these rings are illustrated above.

Advantages of Densometer

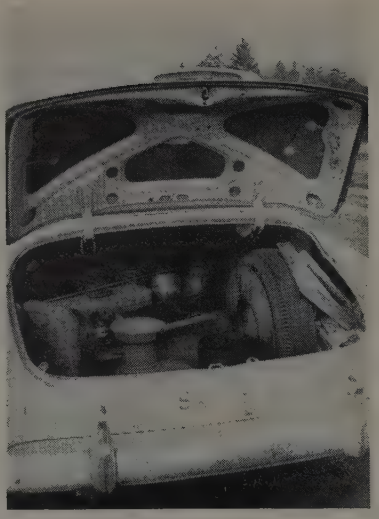
In summary, the following features and advantages are found in the Densometer method of measuring hole volumes:

1. Operation time is sufficiently short that "wet densities" can be determined in from 10 to 20 min., depending on the time required to dig the hole. Of the total time consumed, only about 3 min. are required for setting up the Densometer and making the necessary readings.

2. An "initial reading" that will account for variations in roughness of the original ground surface at the hole site is taken, which in-



IN THE LABORATORY you see the complete field kit including all necessary tools.



ON THE WAY to the job the kit has been easily fitted into a car trunk.

IN THE FIELD it's easy to set up and get complete results in 15 minutes.

creases the accuracy of the determination.

3. Volumes of holes from 0.000 to 0.250 cu. ft. can be measured with equal accuracy. (Actually, this volume can be doubled by recharging the cylinder during the operation.) The large capacity of the device makes it applicable for determining densities in coarse, granular base materials as well as in fine-grained soils.

4. The balloon membrane is very thin, and the size of the balloon is such that it fills the excavated hole without being stretched appreciably. These features, coupled with the fact that the balloon is lowered into the hole in such a manner that the hole is filled from the bottom up, insure that air is not trapped and that practically all pits and voids in the hole walls are filled.

5. Successive determinations on any number of thin layers can be made in the same hole. Holes up to 18 in. in depth have been tested; however, the anticipated maximum depth of hole is about 22 in.

6. Results obtained are of equal or greater accuracy than those obtainable by presently accepted standard field methods.

7. Once calibrated, no further calibration is necessary. Little field maintenance is required, except for periodic bleeding off air and occasional replacement of the balloon. These procedures have been simplified to a point where very little operational time is lost.

8. Readings are made directly in cubic foot units, which greatly simplifies calculations.

9. The apparatus is of such size that it can be carried in the trunk of a passenger car, and is sufficiently light that one man can carry it with no difficulty.

To verify the accuracy of the Densometer and to determine its adaptability to actual field conditions, a series of both laboratory and field tests were performed.

1. A series of readings was made on the same hole site by two different operators. It was found that the apparatus exhibits a very definite stopping point when the piston is depressed; that an operator will repeat his determinations accurate to less than 0.0002 cu. ft.; and that two different operators can repeat each other's determinations with equal accuracy.

2. A container whose volume was accurately determined by precise water-filling methods was checked with the Densometer. The volume determined agreed exactly with the true volume on two trials, and varied 0.0001 cu. ft. on one trial. Different operators were used for the third trial. This accuracy greatly exceeds that required for field density tests.

3. A series of parallel tests was run with the sand-volume method and the Densometer. It was found that if extreme care was used in calibrating and operating the sand-volume apparatus, and if an "initial ground surface reading" was made with the sand-volume apparatus, close comparative results were obtained. The Densometer consistently gave slightly larger hole volumes for the same hole, and the difference increased as the roughness of the hole surface increased. This indicates that the Densometer more completely fills the voids than does the sand.

Check with sand method

The Densometer was used for field control of compaction of cement treated base material and granular base course material on five different projects. On one project parallel determinations were made with the sand-volume method. On this project results of the two methods agreed very closely (plus or minus 0.004 cu. ft. for holes approx. 0.10 cu. ft. in volume) except occasionally when construction equipment working nearby vibrated the ground while running the sand-volume determination. Differences then increased to a maximum of 0.0015 cu. ft. Intermittent checks made on the other projects gave similar results. Speed trials using the two methods showed that it was possible to complete two determinations of wet density using the Densometer while completing one with the sand. The trials included the time required to clean the hole and re-fill it with fresh cement-aggregate mix and the time required to calculate results.

Further time comparisons

An alcohol-burning method of drying the samples was correlated with oven-drying, and was used on the grade to determine moisture content in conjunction with the Densometer. With two men and using this procedure, it required approximately 10 to 15 minutes to determine the "wet density," and an additional five minutes to determine the "dry density." At no time was it necessary to delay the operations of the contractors for density information. It was consistently possible to check at least one density, and sometimes two or three densities in each 400 to 800-ft. section of roadway before the rollers were needed on the next section. It was found possible to complete a "wet density" determination for each

(Continued on page 96)

TRAFFIC CONTROL is vital— for narrow bridge alterations

By G. D. GARDNER

Resident Engineer
District V, Division of Highways
San Luis Obispo, California

NOT AN INTERSECTION, but the need for positive one-way traffic control on a lonely, high-speed stretch of U.S. 101 in southern Monterey County, California, resulted in state specification of this signal system. In operation for the first six months of 1954, it afforded protection for crews of Bos Construction Co., working on a $87,769 contract for adding width and superelevation to the approach spans of a 2-lane bridge over the Salinas River.

Signals and signing were vital to the work, as the contractor's equipment completely filled half the bridge width. It would have meant certain disaster for opposing vehicles to meet anywhere on the bridge. Accordingly, the following warnings were provided at both ends:

Sign	Distance from signal (in feet)
"Slow"	2,640
"Detour Ahead"	1,970
"Caution—One-Way Bridge —Traffic Signals Ahead"	1,320
"Slow—Signal Ahead"	850
"Danger—Bridge Under Construction"	350
"Construction Zone—Drive Carefully"	150
"Stop Here For Signal"	50

The sequence as set up was constant at all hours. However, the intervals were adjustable and were changed from the original planned sequence to fit traffic conditions.

One-way traffic control signal sequence

NORTHBOUND	SOUTHBOUND	TIME
Red	Green	60 seconds
Red	Amber	3 "
Red	Red	57 "
Green	Red	60 "
Amber	Red	3 "
Red	Red	57 "
	TOTAL CYCLE	4 minutes

Generally, this control system functioned properly. A very few cars failed to stop at the signal, but travel through the remaining 150 ft. to the actual project limits enabled them to see the bridge itself, realize the impossibility of going on, and pull off beside the bridge abutment. A more frequent occurrence was that of a car first stopping, then going on before the signal changed to green. It may be said of these drivers that, having stopped, they were at least cautious when they jumped the gun!

Here's what had to be done

Scope of the work included increasing superelevation of the roadway on both approach spans, and adding to the roadway width at the west end only. Originally 4%, the super has been built up to 8%. The added deck width has the effect of decreasing curvature of the west approach span. Th maximum change in alignment is a little over 6 ft.

Pictures on these pages show how the added width was gained. The outside surfaces of the original girders were roughed up and ⅞-in. hooked anchor bolts installed at 5-ft. centers. These supported ⅝-in. hangar bolts for the contractor's 4 x 6-in. needle beams, which cantilevered out to support formwork for the new concrete. Longitudinal strength for girder forms was provided by 2 x 6's on 6-in. centers.

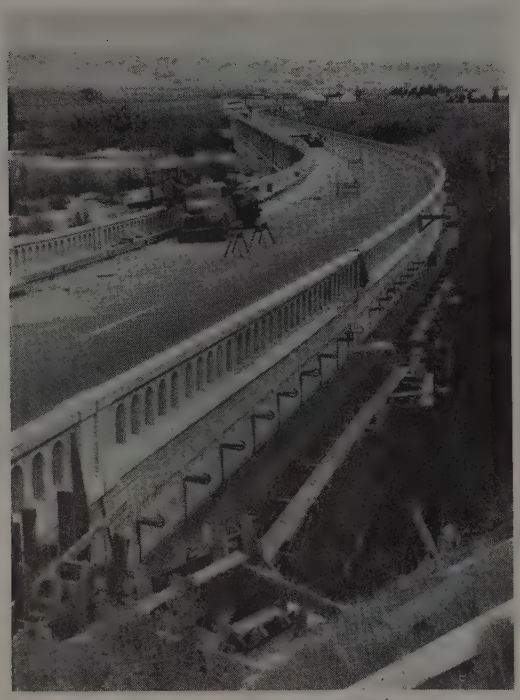
Designed for widening

There was no provision for bond between the new and old concrete. However, mechanical ties were provided. Girders are tied by the ⅞-in. hooked anchor bolts mentioned above, placed at 5-ft. centers. New and old deck concrete is tied by hooked bars installed in the edge of the old deck at 18-in. centers. These bars had been placed in the original bridge for the purpose of tying in a future widening.

After girder forms had been stripped, deck forms were installed. Posts placed on the needle beams supported this form work. Deck joists were 2 x 4's on 1-ft. centers.

Curb and rail sections are 7 ft. long, fastened to the deck with 1-in. bolts on 3½-ft. centers. The contractor used a small truck crane to move the rail from its original position while the deck was being widened. At the end of the work, a scaffold truck with two differential pul-

Here's how Bos Construction tackled the widening job

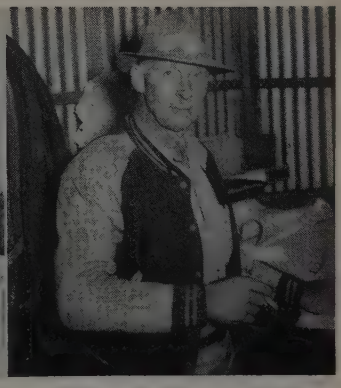


CURVED approach spans were site of major work. At this stage, west end only was involved; so signal for oncoming traffic control was placed on bridge itself, at far end of truss span. Girder soffit forms for extra width have been built on needle beams in foreground.

SCAFFOLD hung from truck was handy for many jobs. Here, extra girder and deck have been finished, curb sections are back in position (set on wedges), and contractor is dry packing under them.

FORM DETAIL shows hangar bolt suspension of needle beams for girder and deck forms. Note 2x6's under girder soffit. Scaffolds at this stage were built up from below.

NEW LANE WIDTH and change in alignment is evident as grout pads are placed under relocated curb.



ELOF HAGLUND bossed the show for Bos Construction Co. of Berkeley. The whole job took just 6 months.

leys was used to relocate each section.

Bolts for the curb sections are secured to the deck in one of three ways: (1) through cored holes in the new deck, (2) screwing into existing pipe sleeves with tapped plates anchored in the old concrete (where the curb had been raised for superelevation only), or (3) anchoring to the old concrete by means of cinch anchors.

For access to the work when erecting or stripping needle beams and forms, the contractor relied heavily on two suspended scaffolds cantilevered from frames on the beds of two trucks. They were also used when removing and resetting anchor bolts, grouting curbs, painting bolt heads, and finishing exposed concrete surfaces. To get farther under the bridge on form construction, planking was laid to bridge between a suspended scaffold and longitudinal timber hangars slung from long bolts dropped through the bridge deck.

The total effect of the job is added safety to traffic. Particularly is this true at the west end, where the curve of the bridge approach has been flattened and the immediate adjoining section of highway realigned to match the new curvature. The work was done under the jurisdiction of District V of the Division of Highways, E. J. L. Peterson, District Engineer.

The author was resident engineer, with D. E. Delvey as assistant. Hooper Knowlton was bridge department representative. For Bos Construction Co., Elof Haglund was superintendent.

Shoulder to shoulder paving of 2-lane highways

. . . . THE PROS AND CONS are summarized below in an article by R. E. Livingston, adapted from his paper delivered this year at the Colorado Highway Conference. Because this subject is so vital in Western highway planning today, the editors looked for supplemental comment from other states. Here are two of the replies:

. . . from Utah

W. L. Anderson, assistant chief engineer for the road commission states:

"For the past several years, we have adopted this practice, and are thoroughly convinced that the beneficial results far exceed the additional cost. Where full-width paving is not provided, we found numerous edge failures of our bituminous surfacing. It is nearly impossible to keep a rut from forming adjacent to the pavement, which, in stormy weather, collects moisture and softens the base material adjacent to the edge, resulting in failures. It eliminates entirely the necessity for blading of shoulders and edge failure repairs.

"Many of our roads, where full-width treatment is provided, have required practically no maintenance, where adjacent roads with similar surface and base design require periodic shoulder grading and considerable edge failure repairs. On roads of 32 ft. width and more, it provides paved 2-lane passing lanes if one shoulder is obstructed by a disabled or stopped car.

"Our initial cost amounts to approximately $500 per mile per foot-width of shoulder on road-mix surfaces and $900 for plant-mix surfaces. However, over a period of years, it is our belief that the saving in maintenance required on full-width paving, the added convenience to traffic, and added safety will more than pay for the additional cost.

"Many of the accidents reported are of cars hitting a soft shoulder or a shoulder with a rut adjacent to the pavement, which throws the car out of control. This type of accident was entirely eliminated with full-width paving."

. . . from Nevada

J. D. Meacham, construction engineer for the highway department states:

"We have been paving two lane highways full width for the past 13 yr. and have used this method on all construction projects since World War II. Our primary highways are constructed either 32 or 40 ft. wide including shoulders (width depending on amount of traffic) and all secondary highways are either 24 or 26 ft. in overall width.

"The same type of base and surfacing are used for the full width, that is the shoulders are paved the same as the travel lanes. Most of our primarys are paved with 2½ in. of plant mixed asphalt and the secondarys with 2 in. of road mixed asphalt, base thickness depending on soil conditions.

"On primary roads, a width of 24 ft. or two 12-ft. travel lanes are sealed with a high viscosity emulsified asphalt and covered with ½-in. maximum stone chips or screenings. The two shoulders are given a flush seal of the same asphalt without the chips, thus giving both a different color and surface texture between the travel lanes and the paved shoulders. Generally, secondary roads are given a flush seal of MC-2 asphalt the full width.

"This method prevents water from seeping under the edges of the pavement particularly where snow is bladed onto the shoulders where it melts and softens the shoulders and the base under the edges of the paving. Further, it eliminates the constant work of blading the gravel shoulders made necessary by traffic, particularly heavy dual tired trucks which often travel with the outer tire on the gravel shoulders on narrow pavement.

"We find that this method of paving the shoulders practically eliminates the prevalent failure of pavement in the outside wheel track caused by moisture seeping under the pavement edges."

COLORADO evaluates the pros and cons . . .

By R. E. LIVINGSTON
Planning and Research Engineer
Colorado Department of Highways

A ROAD IMPROPERLY built in the first stages of construction will ultimately result in the loss of the money expended, and hence becomes poor economy. It has been found repeatedly that when a road has been built too narrow for the job it must perform—and then widened—the expense of widening is always disproportionate to the additional width provided. If the required amounts of money for complete construction are not available, it would appear to be good judgment to build the foundation of the road to the proper standard, including its drainage, and then place the proper pavement system on it at a time when funds are available. In this way there is never any question that the road, when completed, will be adequate in design to the volume of traffic which will use it.

The author is sometimes led to believe that the only reason a shoulder is built on a highway is because Grampa did, and what was good enough for Grampa should be good enough for us. Actually there are a number of excellent reasons for the construction of an adequate shoulder. From a structural standpoint, it provides edge support to the wearing surface, and to the entire pavement system. It provides assurance against displacement of the wearing course and its underlying foundation through the masses of material of which it is constructed. From a traffic service standpoint the shoulder provides a place for disabled vehicles to be moved out of the lane of high-speed traffic. In order to fully utilize the paved surface, we must have a minimum of 3 to 4 ft. outside of that area to assure the normal driver that he has clearance from fixed obstructions. This includes the drop that extends from the shoulder point into the ditch.

Consider the matter of shoulder-to-shoulder paving as opposed to the construction of a paved surface for the travel lanes with gravel shoulders. A logical approach would be to put down in sequence the items that are in favor of the all-paved section and those that are opposed to it.

In favor of —

1. A fully-paved section eliminates rutting at the edge of the pavement and the trapping of water. It seems fundamental that if we trap water at the edge of the pavement, infiltration of that water must weaken the underlying foundation at the point

of greatest stress, and we should expect failure at that point.

2. Paving of the shoulder area eliminates the loss of gravel from the shoulder area. It also eliminates the constant expense of blading shoulder material to preserve the shape of the typical section.

3. Shoulder-to-shoulder paving provides full drainage of the crown section, nullifying infiltration of surface moisture except through cracks in the wearing course itself. Recent studies indicate that the placement pattern of vehicles changes radically with this type paving. They tend less to drive in well-defined channels, resulting in less rutting in the normal outside wheel track. There is substantial reason to believe that, on the normal paved section, the rutting in the outside wheel track is approximately three times as severe as it is on the inside wheel path.

4. The capacity of the fully-paved section by actual count is greater than a gravel shouldered section, presumably because of the freedom of movement. The volume of traffic on some sections of the state of Arizona 44-ft. Interstate Section indicates a capacity equal to a 4-lane road. This should not be taken as a direct capacity figure since it occurs only during periods of maximum traffic density.

Opposed to—

1. The costs of a fully paved section are substantially greater than the section constructed with paved travel area and granular shoulders. An analysis of costs on the 44-ft. Interstate Section in Colorado indicates that an additional cost of approximately $13,000 per mile might be expected. Figure 1, immediately below, shows a part section of the "Type A" standard in Colorado with a granular shoulder area 10 ft. in extent on both sides. This area is

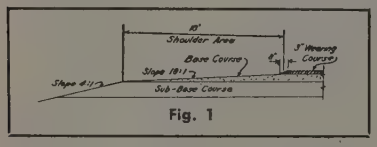


Fig. 1

the one in which the additional $13,000 would be required if the full depth of a 3-in. hot-mix asphaltic pavement were extended from the normal paved area to cover the shoulder area.

2. The cost of construction could be decreased if the depth of the pavement on the shoulder areas were less than the normal travel lanes. For instance, if only 1-in. of pavement was used on the shoulder area, the additional cost per mile for the two 10-ft. shoulders would be approximately $4,300 for bituminous work plus $1,000 for foundation courses for a total of about $5,300 per mile.

Figure 2 shows a part section of the "Type B" standard in Colorado. The shoulder areas being only half as wide, the cost would be approximately 50% of that required on the Interstate System shown in Figure 1. Specifically, extending the 3-in. wearing course across the shoulder would cost about an additional $6,500 per mile. If only the top inch, the cost would be about $2,200 per mile.

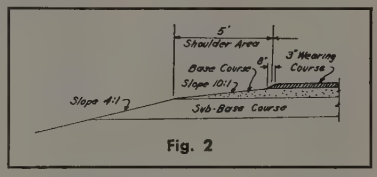


Fig. 2

3. Traffic control on the fully-paved section is made more difficult because of the greater area of maneuver which is provided. The accident experience has been very bad in Arizona because of the 4-lane use of a section designed for 2-lane traffic. Part of this accident experience has resulted from some of the bridges not being full width and jamming in the vicinity of the bridge approaches at peak density periods. If bridges were built full-shoulder width, regardless of their length, the accident experience might be substantially better.

It is believed that traffic control devices can be designed which would be effective on the 44-ft. section. Traffic engineers have only recently been faced with this 2-lane control on a section wide enough for 4-lanes, and hence the methods of control are only in the formative stages. The traffic controls must become sufficiently common to have wide public acceptance if they are to be effective. Traffic control on sections of 30 ft. and less should not be substantially different from those used on anv 2-lane section.

Conclusions—

The above statement of the pros and cons of the two methods of design and construction would seem to indicate that the structural benefits of the fully-paved section outweigh the negative aspects. We are then faced with the decision regarding the finance problem involved on the narrower sections up to 30 ft. wide. It would appear that the savings in maintenance effort and replacement of gravel shoulders would overcome the original cost expenditure in a short period of time. For roads of this class, it would seem

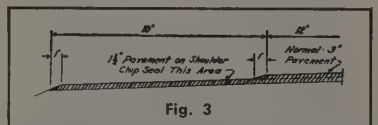


Fig. 3

highly desirable to immediately undertake the construction of a fully-paved section. Bridges, regardless of length, should be shoulder-to-shoulder width plus additional width for clearance. A heavy chip seal should be provided for distinction between the normal travel lane and the shoulder area. This also creates a rumble to encourage the return of the vehicle back to the normal lanes.

There are two methods of construction which would have application to the 44-ft. Interstate Section. In Figure 2, the 4-to-1 shoulder slope is extended upward to an intersection with the crown slope of the normal pavement. There is 1½ in. of pavement over the entire shoulder area. This posed some difficulties from a construction standpoint. It would require that after placement of the first 1½ in. of the normal pavement, the shoulder area would have to be brought up to precise elevation, and then the final 1½-in. course run from shoulder-to-shoulder. Any tracking of the paved area between the laydown of the first course and the second course would present difficulties.

Figure 4 shows a suggested method of paving the shoulder which would not run into the difficulties above. The entire foundation would

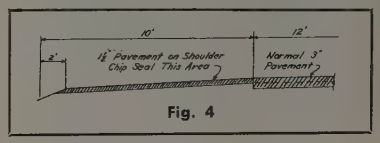


Fig. 4

be primed, and a 1½-in. course laid from shoulder-to-shoulder. A second 1½-in. course would be superimposed on the normal lanes. With a coarse chip seal on the shoulder area plus the difference in elevation between the normal lanes and the shoulder, traffic controls would become simpler and construction procedures would be improved.

In both Figures 3 and 4, it must be assumed that the heaviest moving loads would be the ones using the 1½ in. thick shoulder area. The economies of this construction as compared to this potential damage is something that will have to be decided after more experience has been gained. A second possibility is that on heavy grades, where truck traffic would be inclined to move to the shoulder for faster moving vehicles, the full thickness of the pavement could be extended to this area. Discussion above on the shoulder pavement of the 44-ft. section has taken into account no consideration of the cost of that construction.

There are 4,000 mi. of the Federal Aid Primary System in Colorado. If a cost of $5,000 per mile for shoulder paving were expended, it would amount to $20,000,000. That amount is equal to the cost of 200 mi. of 2-lane construction without paved shoulders. In deciding the matter, highway administrators are going to be faced with the decision of accepting a smaller mileage with an improved design or the lesser mileage of the old design.

HEAVY EQUIPMENT versus "MOVING MOUNTAIN"

An earth glacier was forcing the Northwestern Pacific railroad sideways 4 ft. every 24 hr., but heavy dirt moving equipment handling 10,000 cu. yd. a day won the battle

MATERIAL WAS BULLDOZED down face of slide at left, lifted over the tracks by shovels, and further bulldozed to river's edge.

IT RECENTLY TOOK five weeks of day and night heavy equipment operation to stop a moving hillside that threatened to interrupt Northwestern Pacific's railroad service to Eureka, Calif. During the height of the fight, 600 ft. of track was being pushed sideways by the "earth glacier," an average rate of 4 ft. per 24-hr. period.

This line provides the only railroad connection to Eureka. It follows the Eel River along a winding canyon through the Coast Range and is the only feasible route there. The same unstable ground condition exists on the opposite wall of the canyon, so, there was no alternative but to stop the hillside movement.

The area involved rises eastward from the track at a 35% slope for about 6,000 ft. to an elevation of 1,700 ft. above the river. It is 600 ft. wide where the track rode across it close to the river, and more than twice that wide farther up the slope.

Two well defined streams of water, and their tributaries, have their origins within the limits of the slide area. Another stream of greater magnitude and from a larger watershed formerly entered the slide area from the northerly rim. This last stream is about 500 ft. in distance and 170 ft. in elevation above the track. When the railroad was constructed in 1914, this stream was diverted into a rubble masonry ditch and into a notch cut into the top of a large pinnacle near the tracks known as Abbott Rock.

The winter of 1937-38 brought a major movement that tied up the railroad for 73 days. This completely obliterated the masonry ditch mentioned above, allowing water from the stream to enter the slide. Control of the slide was brought about by installation of an elaborate system of drains installed in its upper reaches.

Corrective measures in 1938

As part of the permanent, corrective measures undertaken in 1938, the stream, which formerly ran in the masonry ditch, was diverted from the slide area by a 5 x 6-ft. diversion tunnel 850 ft. long. This tunnel began in the upper reaches of the stream bed beyond the slide area. A suitable intake was installed to keep out boulders and debris, and from here the tunnel dropped away on a 45% grade, then on a 12.5% grade for about 500 ft. to emerge from the face of Abbott Rock 500 ft. above the Eel River. A branch tunnel was also constructed from the main tunnel, 4 x 6 ft. in section and 170 ft. long, providing drainage for water from a diversion ditch that had been extended across the slide.

Whether these drainage installations were broken before the earth movement this year, or as a result of the movement, is not certain. Flow of the water was changed as the surface of the slide took on the characteristic form of mud glaciers, with lateral terminal morains, and with rolls and pressure ridges forming valleys and hummocks. Water spread out from the streams to form shallow ponds or to sink into the cracked and broken ground.

The railroad first noticed the earth glacier coming to life when some track settled in the last week of February, and earth began to move on the upper side of the track. The long axis of the slide was generally at right angles to the track, and as the moving mass approached the track it broke around the north end of a sandstone bluff on the southerly side, and a large pinnacle of rock, Abbott Rock, rising to a height of 160 ft. above the track, on the northerly side.

The slide consisted of earth breccia, sandstone fragments, ground-up shale, blue mud, and huge rocks—

EARTH GLACIER lies to right of rock outcrop, extends upward 6,000 ft. to the left (and east) into the clouds.

the latter floating along in the moving mass. The larger portion of these great rocks were not visible on the surface, but were exposed only when the smaller materials were eroded by the river at the toe of the glacier, or when encountered by the railroad excavators.

For three weeks, the single track of the Northwestern Pacific rode sideways on the moving earth an avearge of about 4 ft. a day and had to be pulled back and reballasted daily. Power shovels and bulldozers transferred as much as 10,000 cu. yd. of earth in 24 hr. from one side of the track to the other.

Because the slide was in a part of the canyon accessible only by railroad, machines and men were rushed in by work trains, and they started removing the advancing earth and throwing it across the track. The advanicng face of the glacier was kept a safe distance from the track at all times, with an extra margin to take care of those periods when operations were slowed by storms.

Heavy equipment

The available equipment consisted of one 1¼-yd. shovel, two work trains with two ditchers and a stream crane equipped with an orange-peel bucket, and four bulldozers. These were doubleshifted to excavate and move the slide material. An extra gang was engaged on a double shift basis to pull back and reballast the track and keep the railroad open with minimum delay to trains. Train operation was altered to give the men a maximum of working time without train interference during daylight hours. Passenger trains operate in this area only at night and were little affected after the first few days.

As the glacier pushed farther down, its lower portion deepened near the track until the embankment in places was 10 to 20 ft. high. Another shovel and four additional bulldozers were brought in, these latter riding on top of the slide and pushing the material across the track. The shovels and ditchers were used in cleaning up to restore the track to service. While the work at the track was going on, available men were put to work ditching and draining the water off the slide and restoring the damaged drainage system. Ponds were emptied, cracks were filled, and main water courses were cleaned to expedite the runoff of storm water. However, the heaving and rolling action of the ground was continually changing the contour and adding to the difficulties.

Battle is won

By continually keeping at it and installing about 2,500 ft. of 4 to 12-in. diameter pipe, this being in addition to the several thousand feet of pipe installed in 1938, the men finally succeeded in draining the surface water from the slide. The movement of the earth slowed. With clearing weather, the drying of the surface became evident. At the track it was possible to shrink the working force and to reduce the equipment down to a single shovel and two bulldozers. The almost stationary earth was cut back more to increase the margin of safety in case the slide became active again.

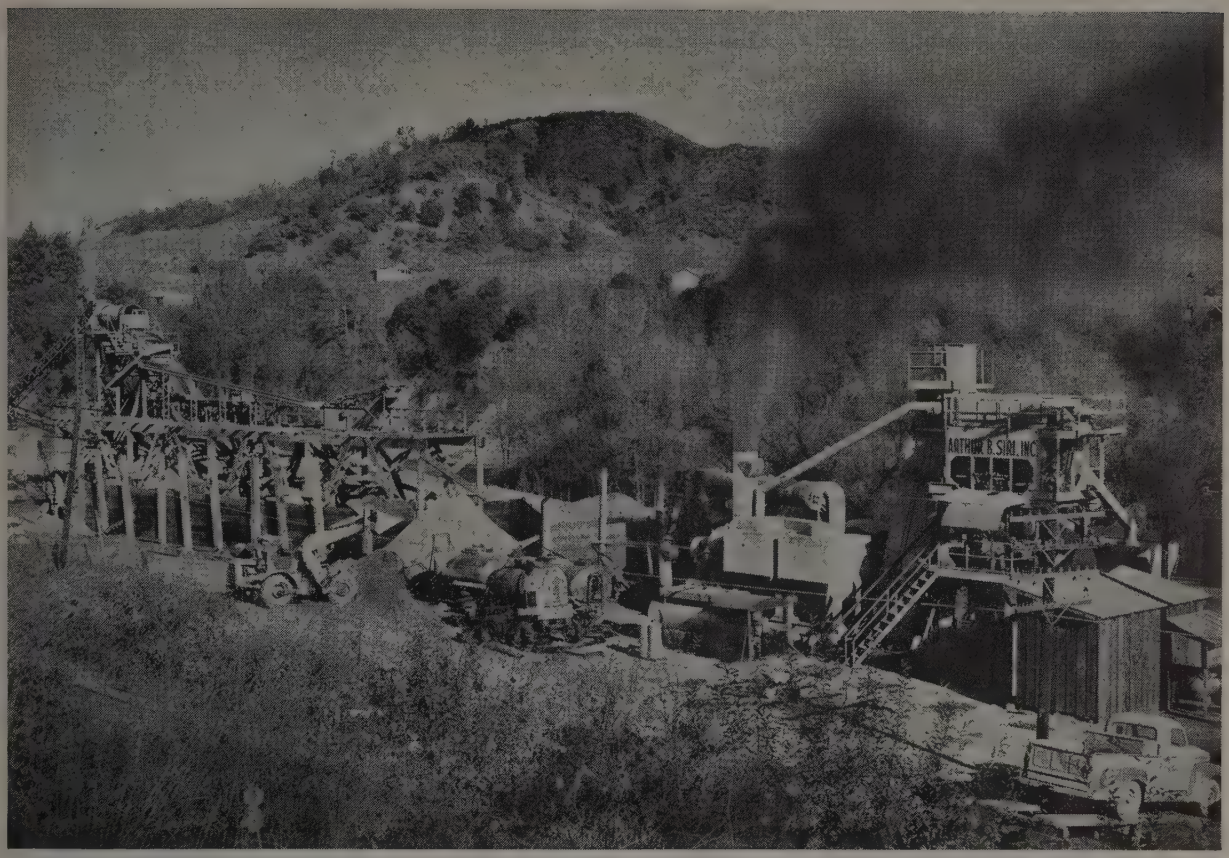
It now appears the earth glacier has been fought to a standstill. Later when the slide is dry enough for machines to move over it, an extensive system of surface ditches will be constructed. The rough and cracked surface will be smoothed down with bulldozers to prevent formation of ponds and to expedite the run-off of storm water.

This operation was under the general supervision of G. L. Morrison, Vice President and General Manager of Northwestern Pacific; the workmen were directed by Albert L. McHenry, Division Engineer for the same railroad, and by Charles E. Neal, General Track Supervisor, and Fred Monroe, Drainage Engineer, both of Southern Pacific.

ABOVE, drainage water cascades from tunnel in Abbott Rock, part of work done in 1938. BELOW, up on the face of 1954 slide, men work to repair the broken drainage system and install new pipes in an effort to stop the earth movement.

No state license— 6 months in jail

JAIL DOORS CLOSED behind Joseph Brown of Oakland, who was found guilty of contracting without a state license and was sentenced to serve six months in the county jail. He was brought to trial following a complaint entered by an investigator for the State Contractors' Board. It was alleged that Brown agreed to perform a remodel job for $4,894, but that the final cost was $22,448.23. Brown contended that he was working as an employee for the owner. The court found that his services were solicited and secured through his advertising as a construction contractor.



Plant of Arthur B. Siri, Inc., near Ukiah, Calif.

Powerful jacks aid cable replacement

IT ISN'T OFTEN that you see a 500-ton block of concrete being handled 200 ft. up in the air. That was the situation recently while replacing worn counterweight cables on the San Mateo bridge across lower San Francisco Bay.

After 25 years of daily use, the thirty-two 1⅞-in. diameter cables in each tower were showing signs of deterioration. The method used to replace these cables involved four of the highest capacity hydraulic jacks yet used on the Pacific Coast for construction work. Five days were required for the changeover operation in each tower for a total of ten working days.

First, two heavy links of 1½ x 18-in. plate steel were connected to each of two sides of the concrete counter-weight with 6-in. dia. pins. Original design of the bridge had included provisions for this connection. In the upper end of the links, two more 6-in. dia. pins were inserted which rested on specially designed, heavily-ribbed, box girders, each made of two 24-in. 100-lb. I-beams.

The hydraulic jacks rest on two girders, 4 ft. deep, that are part of the original tower construction. The lifting procedure then is that the jacks bear up on the 24-in. girders, the girders transmit the load to the links, and the links lift the 500-ton concrete counterweight.

California state specifications intended the use of four hydraulic jacks operated from one mechanically operated pump. Payne Construction Co. obtained permission to change this to two sets of two jacks each with two manually operated pumps. It is interesting to note that jacks of the capacity required for this operation were not available as a stock item in the West, but had to be ordered from Rogers Hydraulic Inc. of Minneapolis by the W. P. Wooldridge Co., successful sub-bidder on this item. Each jack has a 150-ton capacity, 7½-in. stroke, and 6½-in. diameter ram. Adjustments can be made on the pump to operate one or both of the jacks and also at any of three different manual pumping pressures.

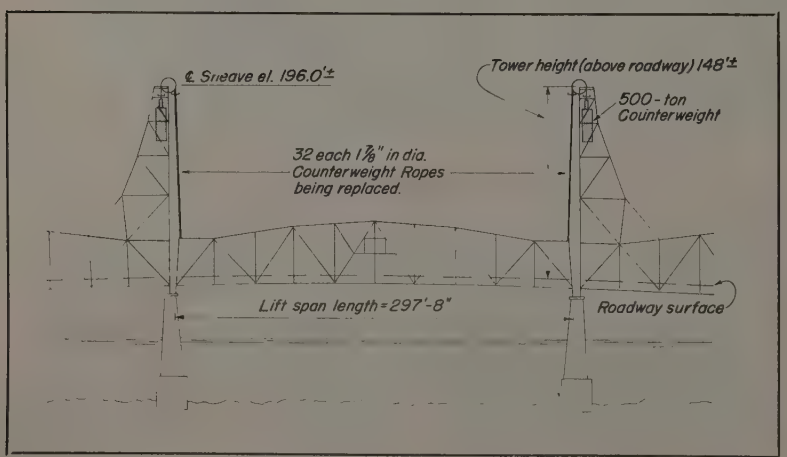
The counterweight had to be lifted 18 in. This would line up another pin hole in the links that would provide secure anchorage for the weight during cable changes. Field observations showed that operations of one jack at a time in ½-in. increments produced the best results. As the gain was measured, additional shims were added between the bearing girder and the lifting girder. Racking of the beams or undue movement of the counterweight was not observed by this method as compared to using all four jacks at once.

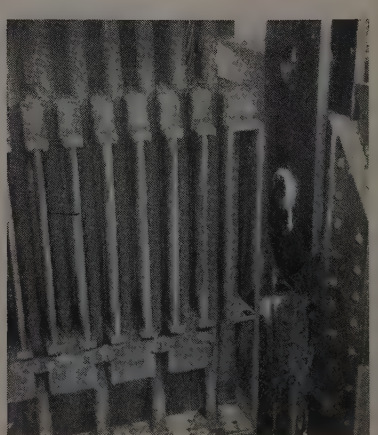
Also interesting is the change in specifications required on the 64 replacement cables, each 157 ft. long. The original type wire rope is no longer manufactured. The chemical and physical characteristics of wire rope have been greatly improved in the last 25 years, so permission was obtained from the state to alter their repeat of the original 1928 specifications. The new rope is improved plow steel, 1⅞-in. diameter, has 6 strands of 19 wires each, and regular lay. It has a fibre core, impregnated with a rust prohibitive lubricant. Manufacture of this item was made by Bethlehem Pacific Coast Steel Corp.

The Payne Construction Co. of Oakland obtains many unusual jobs, such as this one, and handles them efficiently. Rod Harrison was job superintendent and Bill Kumero the foreman. W. B. Piper is state resident engineer.

100 TONS is registered, equal to 6,000 psi. on ram surface.

JACKS ARE SEATED (above) on bearing girder of the bridge tower and lifting the special girder that supports the plate links and concrete counterweight. Below, counterweight has imbedded steel anchorage to which cables are attached at left and lifting links at right.

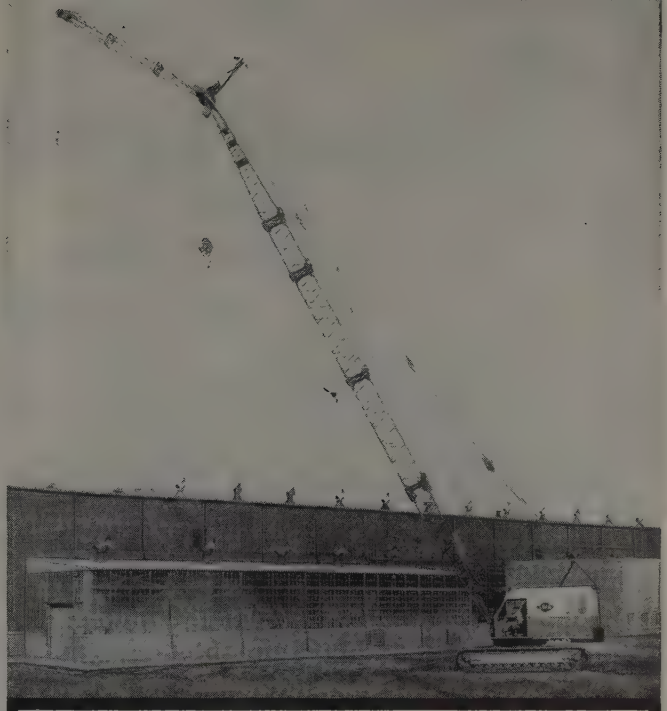




LIMA *introduces...*

TYPE 703-SC 50 TON CRANE

with extra stability and easy portability



The new LIMA Type 703-SC is designed to give you unequalled crane performance for tough lifting jobs. Each part is engineered to meet the most rigorous operating requirements.

Even more important to *you* . . . Lima's long experience producing the very finest construction equipment is responsible for these important *bonus benefits* with the Lima Type 703-SC:

Greater Stability — Extra-wide, extra-long, heavy duty crawlers insure maximum stability at all times. The result is greater load capacity.

Unequalled Portability — The Type 703-SC is designed with portability in mind. Its removable side frames are an important factor in transporting it over state highways having weight limitations. The Type 703-SC is also available with wagon or truck mounting to provide maximum mobility with minimum travel time between jobs. Wagon mounted crane is powered by one engine—including travel—with one operator. Truck mounted crane requires two engines; one for travel and one for operating machinery.

Investigate the outstanding performance you can get from the Lima Type 703-SC 50 ton crane. Send today for Bulletin No. 73-SC-A which gives full details—specifications, operating capacities, etc.—or call your nearby Lima distributor.

. . . a type and size for every job

COMPARE ! NO OTHER MACHINE GIVES YOU AS MUCH AS LIMA:

1. Bronze bushings in tread, idler and drive rollers are protected by piston-ring type dirt seal rings and retainers.
2. All gears, smaller parts and shafts which are subject to extra wear are flame or induction hardened for longer life.
3. Main machinery is placed well back of center of rotation to eliminate excess counterweight.
4. Anti-friction bearings, used at all important bearing points, reduces destructive friction, fuel consumption and lubrication requirements.
5. Big capacity drums and sheaves lengthen cable life by reducing the need for double wrapping and sharp bends in cable.
6. Machine cut propel and swing gears and roller chain power take-off are enclosed in a sealed oil bath for dirt elimination and smoother, quieter operation.
7. Crawler side frame assemblies are easily removed to comply with most highway limitations when trailing machine from job to job.
8. Full air controls on travel, hoist, swing and boom hoist, result in smoother, more precise operation, minimum maintenance and less operator fatigue.
9. 3-Way compensating valve—Loads can be snubbed or held in position through a compensating control valve, which permits simultaneous swing clutch and swing brake operation.
10. Conical hook type rollers—Weight is evenly distributed on the roller paths through six hook type conical rollers, four in front and two in the rear.
11. Removable side frames—Crawler side frames can be removed to meet most highway weight limitations when it is necessary to trail machine, or to keep within certain rail clearances.
12. For maximum stability—crawlers are 18' 6" long—14' 2" wide.

DISTRIBUTORS—Our Seattle Office, 1932 First Avenue South, Seattle 4, Washington; Feenaughty Machinery Co., 112 S.E. Belmont St., Portland 14, Oregon; Feenaughty Machinery Co., 600 Front St., Boise, Idaho; Smith Booth Usher Company, 2001 Santa Fe Avenue, Los Angeles 54, California; Modern Machinery Co., 4975 Third Avenue South, Seattle 4, Washington; Alaskan Distributor, Western Tractor & Equipment Co., 2230 First Avenue South, Seattle, Washington; Shriver Machinery Company, P. O. Box 1270, Phoenix, Arizona; Heiner Equipment & Supply Co., 501 West 7 South, Salt Lake City, Utah; Bay Cities Equipment, Inc., 2606 Cypress Street, Oakland 7, California; Cheyenne Truck & Equipment Company, 621 Central Avenue, Cheyenne, Wyoming; Acme Iron Works, Culebra Avenue at Expressway, N.W., San Antonio, Texas; Cascade Industrial Supply, Highway 99, So., Redding, California; Contractors Equipment & Supply, P. O. Box 456, Albuquerque, New Mexico; Modern Machinery Company, 4412 Trent Avenue, Spokane 2, Washington; Faris-Moritz Equipment Company, 1095 South Jason Street, Denver, Colorado; McGaraghan Supply Company, 529 Broadway, Eureka, California

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Construction Equipment Division
LIMA, OHIO, U.S.A.

GOOD COMPACTION

• • • continued from page 86

pass of a roller were over 600 ft. long without interfering with the roller operation.

On one of the above projects, it was necessary for one man to work alone temporarily. Using the Densometer and the alcohol-burning method of drying, he was able to make six complete dry density determinations in three hours. These tests were made in an eight-inch lift of 1-in. minus clean crushed gravel. On several occasions on this project, tests were made on successive four-inch layers in the same hole with excellent results.

Thirty checks in 8 hr.

The Densometer has been used to check the densities of crushed stone surfacing, top course, on several projects to furnish data for the research project mentioned earlier. Three densities were taken at each of several sites at different offsets from center line. The alcohol-burning method was used for determining moisture content. Moves at about 3000 ft. were made between test sites. It was possible to make up to 30 complete field dry density determinations per 8-hr. day under these conditions. Results were very consistent and logical. Occasional comparisons with the sand-volume method gave good results and verified the accuracy of the Densometer.

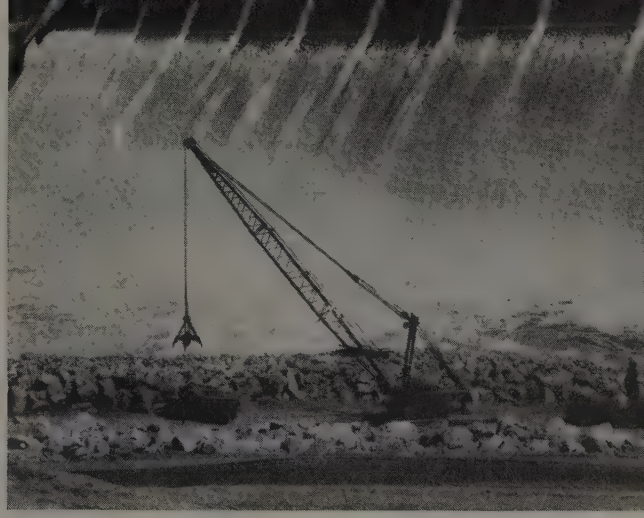
In actual field use, the Washington Densometer has proven itself to be considerably faster, equally or more accurate, and extremely more versatile than other existing accepted types of equipment designed for measuring in-place hole volumes in soils.

General acceptance

The accuracy, versatility, and speed attainable with this equipment have greatly increased the practical degree of actual control possible on controlled compaction projects. The range of material types for which control can be considered practical has been broadened considerably, and the effectiveness of various types of rollers on thin or thick lifts of soil can now be readily investigated.

Maintenance requirements of the equipment during use have proven to be practically negligible. The balloon mortality rate is lower than anticipated, with replacements being required only after the equipment has been stored unused for considerable time.

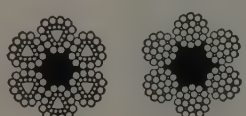
Reception by field inspectors, resident engineers, and contractors has been very favorable.



PROVING EXTRAORDINARY SERVICE—A Hercules Flattened Strand crane rope delivered 18 months service, compared to 6 months for ordinary rope. It performed equally well as a clamshell bucket rope. On a hot ladle crane it outlasted round strand rope by 4 to 1, and still tested at higher-than-rated strength. It was chosen for its super strength to haul the car on the continent's largest cableway at Kitimat.

Can Flattened Strand solve your special wire rope problem?

Hercules Flattened Strand is a special kind of wire rope that provides extraordinary service on special kinds of jobs.



Flattened Strand Round Strand

The key to the difference is the triangular shape of the strands. Notice how the strands support each other; how the rope circumference is almost perfectly round; and how the core is smaller. There is 10% more steel in Hercules Flattened Strand than in round strand ropes of the same diameter. That means *10% more strength* and *10% greater safety*. Flattened Strand wears longer and more evenly . . . and is easier on sheaves and equipment.

If you can use this Super-rope, you'll soon begin saving time, labor, money. Why not investigate?

Because Leschen pioneered and perfected Hercules Flattened Strand wire rope, Leschen is your best source of additional information. Ask your Leschen man, or write for "The Flattened Strand Story."

LESCHEN WIRE ROPE DIVISION
The Watson-Stillman Company
(A SUBSIDIARY OF H. K. PORTER COMPANY, INC.)
St. Louis 12, Missouri

LESCHEN
HERCULES Red-Strand
WIRE ROPE

WESTERN CONSTRUCTION NEWS

ARIZONA

PAINTED ROCK DAM—The proposed Painted Rock dam near Gila Bend came closer to the start of actual construction with the news that the Corps Engineers had asked that the 118,300-ac. site be withdrawn from the public domain. Congress authorized construction of the $25,000,000 project in 1950. It would be an earthfill dam rising 174 ft. from the bed of the Gila River and would be 4,700 ft. long. The project's main purpose would be to protect the 75,000-ac. Wellton-Mohawk reclamation development near Yuma from flash floods. Plans for the project are now being drawn up under a $140,000 appropriation, with start of actual construction contemplated for some time in the 1955 fiscal year.

BIDS ON EIGHT school projects for the Navajo Indian Reservation, to cost between $2,000,000 and $3,000,000, have been asked by the Indian Bureau, according to Wade Head, area director. The contract will be let June 7.

YUMA BRIDGE—Plans are being made for construction of a $1,000,000 concrete and steel bridge across the Colorado River at Yuma under the joint sponsorship of Arizona, California, and the U.S. Bureau of Public Roads. The bridge will be 35 ft. wide, 800 ft. long, and have a dividing strip down the center and 5-ft. walks on either side. Arizona's share of the project, $250,000, will have to be allocated by the Highway Commission in the next budget which will be adopted in June.

EXCAVATION RECORD—Stewart Construction Co. has excavated 30,000 cu. yd. of earth in 13 working days on the foundations of the new 9-story, $4,000,000 First National Bank of Arizona building in Phoenix, according to Sidney McMullin, job superintendent.

ADDITIONAL DORMITORY FACILITIES on the campus of Arizona State College at Tempe Ave. are being constructed by Ed Wasielewski Construction Co., which holds a $369,375 contract to build 16-dormitory houses for organized campus groups on a 15-ac. tract near the college. Kemper Goodwin is the architect.

RECENT MAJOR CONTRACT AWARDS and low bids in Arizona include a low bid of $170,107 by **Bentson Contracting Co.** of Phoenix for 5.4 miles of grading and drainage, concrete curb and gutter, and widening two bridges on a new alignment of US 80 in Maricopa County. **Fisher Contracting Co.** of Phoenix submitted a low bid of $248,974 for 3.2 mi. of grading and drainage on the Pine-Winslow highway in Coconino National Forest. **Givens Construction Co.** of Phoenix submitted a low bid of $109,453 for 3.1 mi. of grading and road-mix surfacing of the East Flagstaff highway.

B. L. Gustafson of Phoenix submitted a low bid of $338,301 for 7.2 mi. of grading and plant-mix surfacing on a new alignment of US 66 starting 4 mi. northeast of Holbrook. **Dale F. Payne** of Phoenix submitted a low bid of $132,278 for 14.5 mi. of grading and subgrade preparation on the Clear Creek road beginning 10 mi. south of Winslow. **San Xavier Rock & Sand Co.** of Tucson submitted a low bid of $125,926 for construction of a 3-span steel girder bridge on a new alignment of US 80 located 26 mi. southeast of Tucson. **M. M. Sundt Construction Co.** of Tucson submitted a low bid of $285,682 for 8.9 mi. of grading and plant-mix surfacing on a new alignment of US 80-90 starting north of Tucson.

HIGH-STRENGTH BOLTS ON GOLDEN GATE

Ironworkers use torque wrench to check design torque on high-strength bolt which connects gusset plate to diagonal in new bottom lateral system being installed on Golden Gate Bridge over San Francisco Bay by Judson Pacific-Murphy Corp. Bethlehem Pacific furnished 190 tons of these bolts to do the job.

CALIFORNIA

BAYSHORE FREEWAY — The San Francisco section of the Bayshore Freeway should be complete by late 1955, according to Herbert S. Miles, assistant district engineer. Construction costs on the 7-mi. section will go beyond $23,500,000, with another $20,000,000 being spent in buying rights-of-way.

DUTCH TREAT—The State Water Project Authority, now investigating the possibility of erecting a salinity control barrier in San Francisco Bay, is planning to use the services of a Dutch engineer as a special consultant. Raymond A. Hill, chairman of the board of consultants employed by the Authority, would like to obtain the services of I. C. Biemond, director of the City Water Works of Amsterdam, The Netherlands, an expert on land reclamation, water conservation, and prevention of the pollution of fresh water lakes formed by barriers. The sum of $9,500 has been set aside for Biemond's services and expenses during a two-month period of consultation. The only question remaining is whether he will accept the job.

ORANGE COUNTY BREAKWATER — A 20-mi. breakwater along the Orange County coast to shelter and protect the beach from storms and to provide for offshore oil operations has been proposed by the Orange County Coast Association.

ETIWANDA STEAM PLANT—Southern California Edison Co. dedicated its new $41,200,000 steam plant in San Bernardino County with an open house. The plant, which has a capacity of 265,000 kw., is built with an outdoor operating deck to provide economical operation and maintenance. Cooling water comes from the Metropolitan Water District aqueduct which runs

Profit Insurance

J. H. Trisdale, Inc., of Redding, Cal., was awarded the contract on this tough road-building job in Shasta County, Cal. It called for moving more than half a million yards of dirt and building an 18-foot road of crushed rock through nearly eight miles of hilly country. County-supervised, with funds supplied by the U. S. Bureau of Roads, the road will reopen to mining and recreation an area that was flooded by Shasta Lake. This Caterpillar No. 12 Motor Grader, shown bank shaping, is one of a fleet of Trisdale's Cat* machines on the job. When it comes to costs, you can count on Caterpillar equipment. These rugged, fast-working machines can be your insurance that a really tough operation stays on the profit side of the ledger.

Largest motor grader in the Caterpillar line, the No. 12 delivers a full 100 HP to the blade. You can get the *most* out of the No. 12 because of its precise balance between power, weight and working speed. Only Caterpillar Motor Graders are built entirely by a single manufacturer. There's no compromising, no "making do" with available components.

Of all the motor graders ever built by Caterpillar, 99% are still on the job! A look at the rugged construction of the No. 12 will show you why. For example, the box-section circle weighs 35 pounds per foot—the strongest circle on *any* grader!

Your Caterpillar Dealer will demonstrate the features that make Cat Graders fast and easy to operate: wide range of blade positions, unobstructed operator vision, constant-mesh transmission, anti-creep controls. Whichever Caterpillar Grader you select, your nearby dealer is a single, *dependable* source for parts and service.

Caterpillar Tractor Co., San Leandro, Cal.; Peoria, Illinois, U.S.A.

CATERPILLAR

*Both Cat and Caterpillar are registered trademarks

under the station property. This station is the company's first inland steam plant.

DEFICIENT COUNTY ROADS—One-third of California's 67,000-mi. county road system is in such bad condition that it will require $561,-567,000 to bring it up to modern standards, according to the Senate Committee on Highways, Streets, and Bridges. The group recommended that counties use more of their funds for road purposes.

GEORGE AIR FORCE BASE at Victorville is due for more than $5,000,000 worth of airfield paving, fuel storage, and dispensing facilities, improvement of communication and navigation aids, and general construction if a recommendation of the House Armed Services Committee in Washington goes through.

CARBON CANYON DAM—The $5,000,000 Carbon Canyon Dam, long seen as a partial solution to Orange County's flood control problem, should be built by the county instead of waiting for the federal government to act, according to directors of the Associated Chambers of Commerce of Orange County. County water officials say that local plans for flood control are impossible without completion of the project.

AMERICAN RIVER PROJECT—The Sacramento Municipal District has applied to the Federal Power Commission for a preliminary permit on a proposed $16,000,000 power development on the South Fork of the American River near Placerville. This is part of the District's plans for an $80,000,000 American River development, water rights application for which is now pending before the state engineer. The new project, to be called White Rock, will consist of arch concrete dam 130 ft. high, 9 mi. of tunnel, and a 46,000-kw. power plant.

POWER PURCHASE PROPOSAL—Pacific Gas & Electric Co. has offered to purchase all existing power transmission lines, switch yards, and substations of the Central Valley Project at their present value and to market all project power through the 46-county P. G. & E. transmission distribution network under state-regulated rates. The offer was made by Robert H. Gerdes, P. G. & E. vice president and general counsel, to the Hoover Commission Task Force on Water Resources and Power holding a hearing in San Francisco. The Commission is investigating ways and means of bringing about economy and efficiency in government by the elimination of duplication and waste in governmental services, and in eliminating non-essential services, functions, and activities in competition with private enterprise. Gerdes said the transfer of these facilities to P. G. & E. would save the federal treasury over $3,000,000 a year and in addition would create about $800,000 a year in new federal taxes and more than $600,000 a year in state and local taxes. This working partnership between private enterprise and federal reclamation activities would be in accordance with a statement of policy made in the 1953 report of the House Committee on Appropriations on the Central Valley Project.

NEW BAY BRIDGE—Preparation of plans for the southern crossing of San Francisco Bay, second biggest project ever undertaken by the state, moved into high gear when the last legal obstacle to construction of the project was removed by Secretary of the Army Stevens. This came about when the Army granted a permit for construction of a 6-lane tube and bridge to run from 3rd and Army streets in San Francisco to Bay Farm Island in Alameda County. Estimated cost of the job is more than $200,000,000. Permission for this crossing had been withheld for some time because of possible interference with seaplane approaches to the Alameda Naval Air Station.

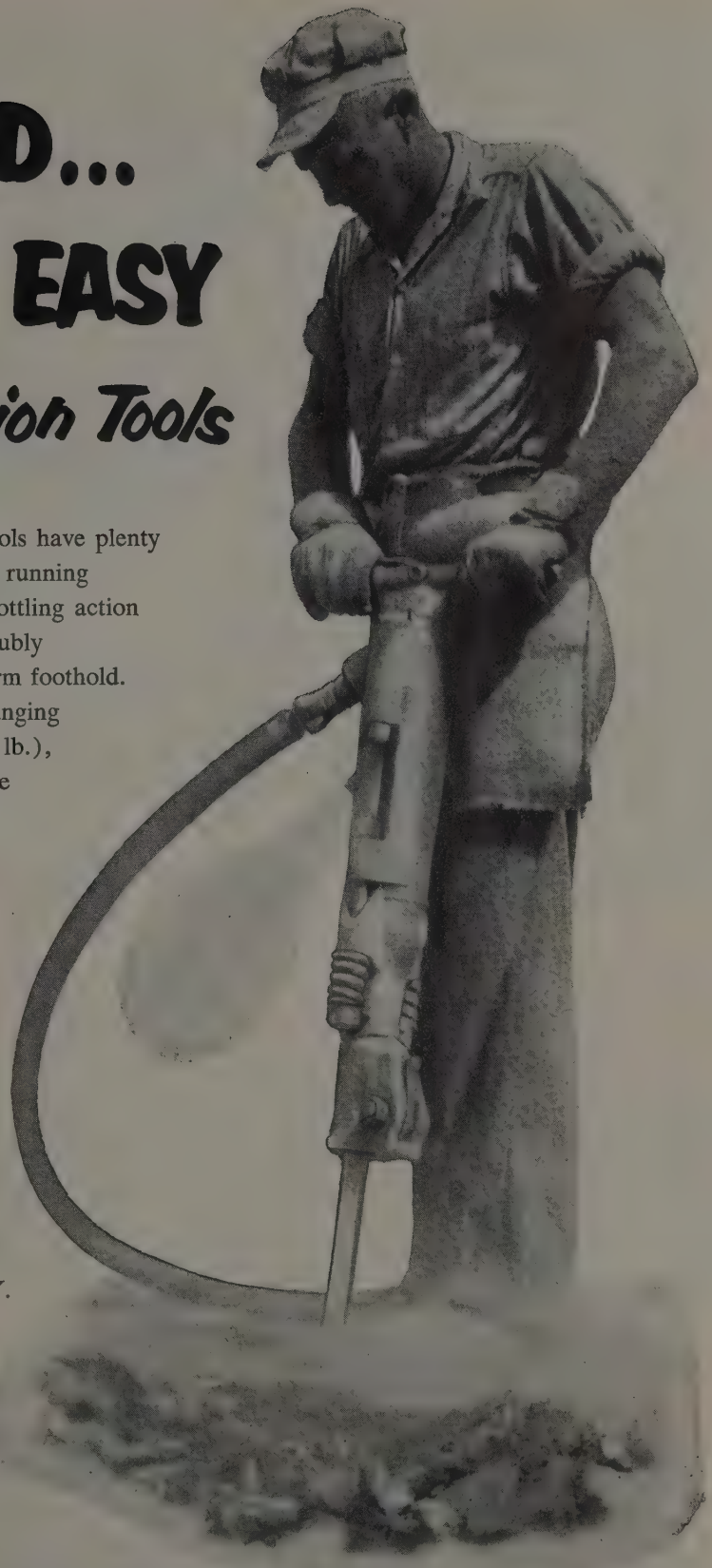
SOUTHERN CALIFORNIA SUBDIVISION—A 36-sq. mi. tract near Victorville has been bought by the Omart Investment Co. for $1,250,-000. The company plans to spend $8,000,000 on development plans. These include the setting aside of 1,000,000 ac. for industry, 8,000,000 ac. for agriculture, a residential section containing 5,000,000 homes, with construction to begin within 60 days, a resort section, and an artificial lake.

TRI-DAM PROJECT—Legislation now in Congress to authorize a loan and grant to California irrigation districts for construction of the Tri-Dam multiple-purpose project on the Stanislaus River (**Western Construction**—May 1954, p. 73) has been endorsed by Secretary of the Interior Douglas McKay. The loan and grant would not exceed $10,-375,000. Total cost of the proposed project of the Oakdale and South San Joaquin irrigation districts is $47,500,000.

RECENT MAJOR CONTRACT AWARDS and low bids in California include a low bid of $1,567,650 by **Guy F. Atkinson Co.** of South San Francisco for improvements to the Los Angeles River channel between 7th and 20th streets in Los Angeles. **Barrett & Co.** of San Francisco received a $1,500,000 award for construction of a 200-room, 6-story, student residence on the University of San Francisco campus. **Basich Bros. Construction Co., R. L. Basich**

HIT HARD... HANDLE EASY

CP Demolition Tools



Chicago Pneumatic demolition tools have plenty of extra power. Yet, their smooth running characteristics and responsive throttling action make them easy to handle and doubly safe where it's difficult to get a firm foothold. Available for every type of job ranging from the lightweight CP-111 (25 lb.), for lateral or overhead jobs, to the hard hitting CP-117 (80 lb.), for rugged, heavy-duty work.

"Hit hard and handle easy" also applies to all rock drills in the CP line – the fully cushioned, low maintenance Sinker Drills, Drifters and Stopers; and the light and heavy duty wagon drills – and for exploratory drilling don't overlook the CP line of diamond drills. For information write *Chicago Pneumatic Tool Co., 8 East 44th St., New York 17, N.Y.*

Chicago Pneumatic

PNEUMATIC TOOLS • AIR COMPRESSORS • ELECTRIC TOOLS • DIESEL ENGINES • ROCK DRILLS • HYDRAULIC TOOLS • VACUUM PUMPS • AVIATION ACCESSORIES

and N. L. Basich of South San Gabriel submitted a low bid of $934,211 for 6.9 mi. of grading and plant-mix surfacing and construction of one reinforced concrete bridge near Holtville, Imperial County. **Bufnel Corporation** of Hollydale received a $248,000 award for erection of a steel framework structure to house a generating unit of the San Fernando Valley steam plant. **Dan Caputo & Edward Keeble** of San Jose submitted a low bid of $630,000 for grading 0.7 mi. on Bayshore Freeway and construction of two reinforced concrete bridges between the 3rd Street overcrossing and the south city limits of San Francisco. **F. W. Case Corporation** of Newhall submitted a low bid of $484,160 for repairs to the San Mateo-Hayward bridge in South San Francisco Bay.

Clements Construction Co. & Clements & Co. of Hayward submitted a low bid of $320,609 for 2.9 mi. of grading and surfacing on US 97, Siskiyou County. **Eaton & Smith** of San Francisco submitted a low bid of $897,090 for construction of a 1,200-ft., structural steel, approach viaduct to the east end of the San Francisco-Oakland Bay Bridge. **Gallagher & Burk, Inc.** of Oakland submitted a low bid of $212,351 for 0.5 mi. of grading and plant-mix surfacing Rte. 75-B,H in Contra Costa County. **Granite Construction Co.** of Watsonville submitted a low bid for 4.9 mi. of surfacing on US 101 in Mendocino County. **George Herz & Co.** of San Bernardino submitted a low bid of $193,120 for 42.3 mi. of grading and bituminous treatment of shoulders between Barstow and Cranise Valley.

Peter Kiewit Sons' Co. of Arcadia submitted a low bid of $906,235 for grading and paving one mile of freeway, construction of three reinforced concrete bridges on Colorado Blvd. in Los Angeles and Pasadena. **Peter Kiewit Sons' Co.** of San Francisco submitted two low bids, one of $384,537 for 7.2 mi. grading and plant-mix surfacing near Canby, Modoc County, and one of $362,360 for 2.4 mi. of grading and road-mix surfacing in Siskiyou County. **W. F. Maxwell** and **Hermreck & Easter** of Los Angeles submitted a low bid of $577,653 for 3.4 miles of grading and plant-mix surfacing near Vista, San Diego County. **W. H. O'Hair Co.** of Colusa submitted a low bid of $129,475 for 2.8 mi. of grading and penetration treatment surfacing in Yuba County. **H. Earl Parker** of Marysville submitted a low bid of $316,000 for the final phase of reservoir clearing behind Folsom Dam. **George C. Rentz Construction Co., Inc.** of Gilroy submitted a low bid of $108,717 for construction of a concrete and timber bridge near Livermore.

Rice Brothers, Inc. of Marysville

Scraper work, such as building this farm-to-market road, puts much strain on rope . . . causes stresses that ordinary wire rope just can't take for long. TUFFY SCRAPER ROPE is specially pre-shaped to apply the *full strength of every strand* to the rope load!

Highway construction jobs often run into tough spots like this water-filled pot hole. Moving the heavy, gummy clay to fill it for a good road bed imposes a terrific strain on scraper rope. On jobs like this the flexibility and super strength of TUFFY SCRAPER ROPE really pays off.

The power of a crawler in front and back of a scraper is needed in some cases to hack out the dirt when preparing runways for jet planes. TUFFY SCRAPER ROPE plays a most important part. Its long life does away with expensive downtime caused by rope failure. The construction of TUFFY SCRAPER ROPE is so designed to give you long and economical service!

Tuffy Dozer Rope

Combined with proper cut-off procedure, TUFFY DOZER will greatly increase your service life . . . cuts downtime. Available in 150' lengths 1/2" and 9/16" diameter.

union Wire Rope corporation

2146 Manchester Ave. Kansas City 26, Mo.

Specialists in High Carbon Wire, Wire Rope and Braided Wire Fabric

submitted a low bid of $114,141 for 10.4 mi. of surfacing on US 40 alternate in Plumas County. **Scott, Stecker & Croft** of Saugus submitted a low bid of $262,314 for 8.2 mi. of grading and penetration treatment surfacing between Bridgeport and Nevada State Line. **A. Teichert & Son, Inc.** of Sacramento submitted a low bid of $3,088,946 for west embankment and outlet work on the Whittier Narrows flood control basin. **B. J. Ukropina, T. P. Polich, Steve Kral & John R. Ukropina** of San Gabriel submitted a low bid of $815,459, for 2.5 mi. for 4-lane divided highway in Sacramento.

COLORADO

MILE HIGH CENTER—Completion of construction on the 23-story Mile High Center in Denver (**Western Construction,** March 1954, p. 74) has been assured with the news that the Equitable Life Assurance Society has made a $10,500,000 loan on the job. George A. Fuller Co. is erecting the building as a joint venture with Webb & Knapp.

MULTI-PURPOSE RESERVOIR—The Corps of Engineers Board for Rivers and Harbors has approved a $17,000,000 multi-purpose reservoir on the Purgatoire River near Trinidad in place of an already authorized project for a stabilized enlargement of the river channel through the city. The federal government would pay all construction costs for the project, while Trinidad would have to pay back $8,730,000 over a 75-yr. period. Congress must authorize and appropriate money for the project, however, before construction can start.

DIAMOND DRILLING in the uranium fields of the Colorado plateau area will be carried on by Sprague & Henwood, Inc., according to the terms of two recent contracts awarded by the U.S. Geological Survey. Both contracts total 60,000 lin. ft. One covers an extension of exploratory drilling at La Sal Creek area No. 2 at Montrose County, Colo., and San Juan County, Utah. The other is for additional exploratory drilling on Gateway No. 2 (Beaver Mesa area) in Mesa County, Colo., and Grand County, Utah.

PLATORO DAM—Flood gates on the $4,000,000 Platoro Dam on the Conejos River will remain open this summer because Colorado owes Texas and New Mexico more than 150,000 acre-feet of water under the Rio Grande Compact and irrigation storage in Platoro must be held off until the debt is paid. Col. Lynn C. Barnes, Albuquerque district engi-

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neer for the Corps of Engineers, said that the Army would operate the dam gates this spring for flood control purposes only. When the flood season is passed, control will be relinquished to the Bureau of Reclamation. H. E. Robbins, regional director of the Bureau of Reclamation, said the Bureau would operate the project between floods but that the gates would be left wide open unless the Rio Grande Compact Commission gave him instructions to the contrary.

DENVER OFF-STREET PARKING—Bids have been asked for construction of an 8-story reinforced concrete, off-street parking structure in Denver, estimated to cost about $735,000, according to Thomas P. Campbell, manager of improvements and parks. The city had rejected previous bids on building two similar structures because they were too high.

RECENT MAJOR CONTRACT AWARDS and low bids in Colorado include a $773,861 award to **Colorado Constructors, Inc.** of Denver for construction of Twin Lakes Reservoir for the City of Boulder. **Gardner Construction Co.** of Glenwood Springs submitted a low bid of $925,313 for construction of a large fish hatchery building and related works at Rifle.

IDAHO

CLEARWATER PROJECTS — Construction of multiple-purpose projects at Bruces Eddy and Penny Cliffs on the Clearwater River began to look more hopeful with the news that five Pacific Northwest private utilities companies had incorporated into a $50,000,000 company, called Pacific Northwest Power Co., organized solely for the purpose of building the two big power dams. K. M. Robinson, president of Washington Water Power, was elected head of the new firm. The other companies interested are Montana Power Co., Pacific Power & Light, Portland General Electric, and Mountain States Power Co. Preliminary water diversion rights in the area were granted the combination according to Mark Kulp, state commissioner of reclamation.

Need for the projects (**Western Construction**,—March 1954, p. 76) was urged by the Corps of Engineers, Walla Walla District, which found the two sites were considered the most feasible storage areas in the Middle Snake area.

Bruces Eddy Dam will be an earthen-core, rock-fill dam 570 ft. high. Penny Cliffs Dam will be an earthen-core, rock-fill dam 590 ft. high. The only opposition to con-

struction of these projects so far has come from a group of sportsmen organized as members of the Idaho Wildlife Federation.

A third project, sponsored by the Bureau of Reclamation, would involve construction of a 560-ft.-high concrete gravity arch dam at Mountain Sheep on the main stem of the Snake River. It would create a reservoir 55 mi. upstream with a surface area of 14,700 ac., an annual usable storage capacity of 1,610,000 acre-feet, and a maximum storage capacity of 2,450,000 acre-feet.

PRESTRESSED CONCRETE—Monroe school, now being built in Boise, will be the second school building in the West using prestressed concrete construction, according to M. I. Leake, Boise architect. Use of prestressed concrete columns and beams will save about half the volume of concrete and three-quarters the weight of steel required for normal reinforced concrete, Leake said. Use of the precast walls on the job will reduce the cost of forming labor and material by 50%, he added. The job is being done by R. E. Rice Construction Co. under a $141,375 contract.

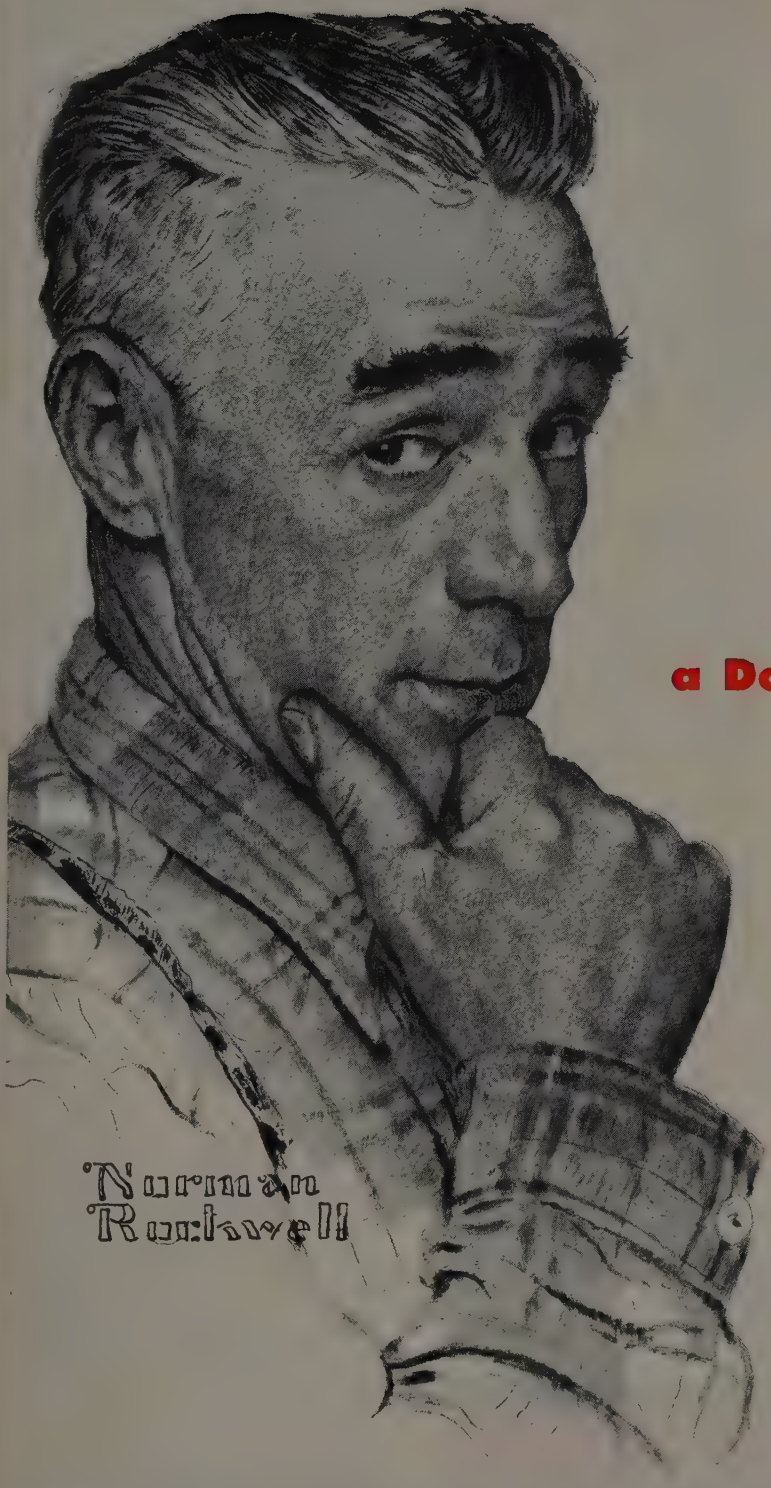
MACKAY DAM on the Big Lost River was scheduled to be raised 5 ft. in height and have its reservoir capacity increased to 44,000 acre-feet after a bond issue of $55,000 was approved by a two-thirds majority of voters who took part in a local irrigation district election.

BANK EROSION—Residents of the Boise Valley, who had complained of bank erosion on the Boise River, were warned by the Corps of Engineers, Walla Walla District, that only limited protection against flood damage will be provided by operation of the three reservoirs now complete or nearing completion. Even with supplementary protection by a continuous system of levees and revetments built by the Engineers at isolated locations along the river, floods like those which occurred during the early days of valley settlement would cause major damage. To provide complete protection against flood and erosion damage, a coordinated protective system, including both adequate reservoir control and adequate channel improvement and stabilization measures, must be provided.

The Corps' most recent survey of the capacity of the Boise River channel indicates that damage from overflow will not occur when discharges do not exceed 6,500 cu. ft. per sec. Overflow of certain low areas will begin as flows develop to greater than this amount and overflow will further increase with additional increases in channel flow. It was also pointed out that severe bank erosion problems of recent years, including their rate of increase, can be expected to continue as during the past few years.

RECENT MAJOR CONTRACT AWARDS and low bids in Idaho include a $326,545 award to **James Crick & Sons** of Spokane for 14.9 mi. of plant-mix surfacing on SH 13, Idaho County. **Hansen & Parr Construction Co.** of Spokane submitted a low bid of $173,558 for construction of a bridge and approaches over the South Fork Payette river at Banks. **Intermountain Company** of Boise submitted a low bid of $205,615 for earthwork, steel pipe lines, pumping plant remodeling, and a reservoir on the Dalton Gardens irrigation system. **Kiely Construction Co.** of Butte submitted two low bids, one of $156,620 for surfacing and stockpiling on US 93, Lemhi County, and one of $213,204 for surfacing of the Twin Buttes highway in Bonneville County. **Peter Kiewit Sons' Co.** and **LeBoeuf Dougherty** of Longview received a $1,135,332 award for construction of a 5,897-ft. concrete bridge and the south approach on 1.7 mi. of US 95 south of Sandpoint, Bonner County.

LeGrand-Johnson of Logan submitted a low bid of $115,182 for construction and surfacing of



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the Bannock highway in Bannock County. **Larry Mackey** of Kellogg received a $596,106 award for construction of the Pinehurst junior high school building and a 3-classroom addition to the Canyon elementary school. **Duffy Reed Construction Co.** of Twin Falls received a $199,700 award for 11.5 mi. of grading and road-mix surfacing of the Marsing-Walters Ferry road, Owyhee County. **Sather & Sons** of Yardley submitted a low bid of $647,100 by **Hagstrom Construction Co.** for construction of a steel frame hangar at Gore Field, Great Falls.

MONTANA

BUFFALO RAPIDS DAM—The Montana Power Co. has been given a 1-yr. preliminary permit for a proposed hydroelectric project at Buffalo Rapids on the Flathead River in Lake County by the Federal Power Commission. The project would include a concrete dam about 4 mi. downstream from one of the company's existing powerhouses near Polson, a reservoir, and an 80,000-hp. installed capacity power plant. The Buffalo Rapids site would be submerged by the proposed Paradise Project of the Corps of Engineers. However, the Paradise Project has neither been authorized nor recommended for authorization and was not included in the Bonneville Power Adminstration 1953 Advance Program. The Commission pointed out that the preliminary permit does not prohibit construction of the Paradise or any other project by the United States in the watershed involved.

FEDERAL AID FUNDS—Montana will have to come up with $2,714,800 more highway funds in order to match all the federal money which is available to the state under terms of the 1954 Highway Act, according to Scott P. Hart, state highway engineer. The new act would give the state an increase of $1,383,760 over the current act for the primary highway system, an increase of $950,170 for the secondary system, an increase of $88,375 for urban highways, and an increase of $1,909,900 in the interstate road system. The trouble is, Hart said, there is now a $5,900,000 accumulated amount of unmatched federal aid for which no matching funds are available.

LONGEST TRANSMISSION LINE—Construction of the longest transmission line belonging to the Montana Power Co., a 223-mi., 161,000-volt transmission cable between Anaconda and Billings, has begun, according to J. E. Corette, president and general manager. The R. N. Campsey Construction Co. of Denver and the C. F. Lytle Co. of Sioux

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City, Iowa, were awarded a joint contract to do the job. Completion date is October 8. Included in the construction plans is a 21,000-kv. substation at Clyde Park and additions to the Livingston substation, the Rimrock substation in Billings, and the Anaconda-Grace substation.

LIBBY DAM—Plans for construction of Libby Dam and reservoir on te Kootenai River (**Western Construction**—April 1954, p. 90, March 1954, p. 80) got into high gear as a result of a conference among Robert T. Stevens, Secretary of the Army, Douglas McKay, Secretary of the Interior, Major General Samuel D. Sturgis, Jr., Chief of Army Engineers, and Brigadier General E. C. Itschner, Assistant Chief of Engineers for Civil Works.

It was decided at the meeting to ask the State Department to resubmit the construction proposal to the International Joint Commission, which must approve the project since it crosses the International border between the United States and Canada. The original application was withdrawn April 8, 1953, when difficulties developed regarding location of roads, railroads, and other facilities. It was decided that another site, about 4 mi. upstream from the original location, would get around these difficulties.

The dam would be a concrete gravity structure 410 ft. high and about 2,700 ft. long at the crest. It would form a reservoir extending 53 mi. upstream to the border and 42 mi. further upstream into Canada and ranging in width from ½ to 1½ mi. It would cover 47,800 ac. and have a gross storage capacity of 5,985,000 acre-feet. The project, to cost about $263,000,000, would be capable of generating 800,000 kw. In addition to power generation and water storage, the project would almost entirely eliminate flood conditions along the Kootenai river upstream from Kootenai Lake in Canada.

RECENT MAJOR CONTRACT AWARDS and low bids in Montana: **McLaughlin, Inc.** of Great Falls submitted a low bid of $164,741 for construction of an aircraft apron, roads, and parking areas at Gore Field, Great Falls. **Nilson-Smith Construction Co.** of Great Falls received a $149,629 award for surfacing Montana and Lyndale Aves. in Helena.

NEVADA

HOYE CANYON DAM—The Walker River Irrigation District plans to build a $770,000 storage reservoir in Hoye Canyon on West Walker River and an equalizer canal from Wilson Canyon to the East

Walker River. Storage capacity of the reservoir would be 75,000 acre-feet. It would be paid for with a bond issue to be repaid in 35 yr. Engineering studies on the project indicate that there is enough water to justify construction of storage facilities for additional irrigation but year-round operation of power generation machinery is not justified.

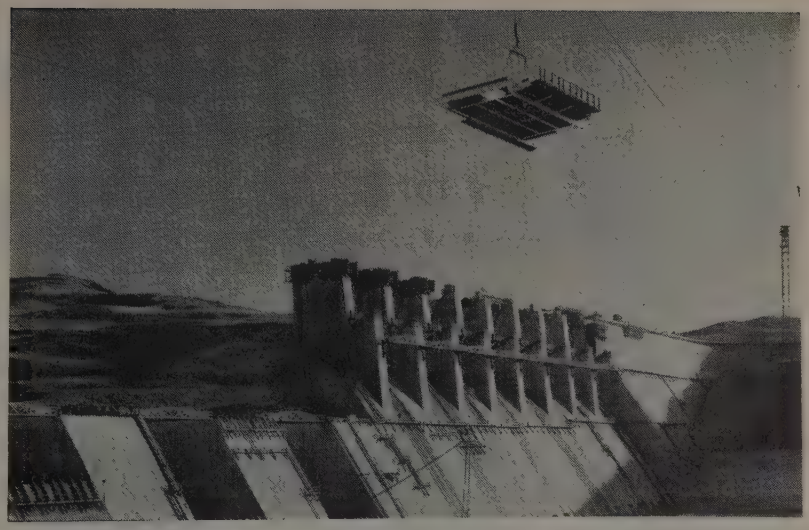
SUPER TRANS-SIERRA HIGHWAY—Military necessity for a super 4-lane, trans-Sierra highway to cost $40,000,000 was revealed in a secret engineering report sent by the Army to the Department of Defense. The report came from a survey of U.S. 40 by D. K. Chacey, engineering consultant to Brig. Gen. Paul F. Yount, Army Chief of Transportation. Chacey surveyed the area accompanied by Nevada and California state highway officials, engineers, and legislators. Current plans for the highway include a 58-ft. roadbed with four 12-ft. lanes, two in each direction, separated by a 10-ft. parking strip to aid in snow-clearing operations during storms.

AGREEMENT of property owners near Lake Tahoe to a Corps of Engineers plan to improve the Truckee River channel in the Reno-Sparks area and a $42,400,000 flood control and irrigation plan proposed by the Bureau of Reclamation has been withheld until they discover how much damage will result from the presence of continued high water in the lake. No such survey is definitely planned as yet, however. Principal features of the reclamation plans include construction of a 126,000 acre-foot reservoir at Stampede, a 20,000-kw. powerhouse at Calvada, both on the Truckee River, and a 115,000 acre-foot reservoir at Watasheamu and an 8,000-kw. power plant on the Carson River.

RECENT MAJOR CONTRACT AWARDS and low bids in Nevada include a low bid of $1,263,723 by **Isbell Construction Co., Inc.** of Reno for expansion work at the Reno Municipal Airport. **Young & Smith** of Grants Pass received a $91,295 award for 23.2 mi. of road-mix surfacing, Basalt to south of Mina, Mineral County.

NEW MEXICO

SAN MARCIAL LAKE—A $1,700,000 project, emergency channelization of Rio Grande water out of the lower end of San Marcial lake through salt cedar swamps near Albuquerque, was completed when finishing touches were put on the spillway out of the lake. List & Clark, a contracting firm from Kansas City, held a $750,000 contract for the work. An earlier contract for $950,000, held by McGinnis Bros. Corp. of Houston, was completed on March 19, 1953. The channel begins 14 mi. above the lake and runs 22 mi. below before it rejoins the Rio Grande floodway. The channel is supposed to reduce water loss in the area by at least 60,000 acre-feet a year. Work included construction of the channel and control fixtures, access roads, straightening the floodway, and cutting a pilot channel through the marsh.



PRE-ASSEMBLED SECTIONS FOR CHIEF JOSEPH DAM SPILLWAY

One of the first of 19 pre-assembled, 24-ton sections for the 922-ft.-long spillway bridge at Chief Joseph Dam on the Columbia River in Washington is swung into place. The sections, each a 49-ft.-long by 30-ft.-wide welded unit, were assembled by Bethlehem Pacific at the company's Seattle fabricating works.

ALAMEDA BRIDGE — Construction of a new Alameda bridge across the Rio Grande has moved up to first priority among Bernalillo County projects by agreement between state and county officials. Speed in construction was urged by the Corps of Engineers, which said that a $500,000 levee project northward from Alameda wil be delayed until a new bridge is built because the present bridge is too low.

POWER TRANSMISSION LINES in Mountainair and Willard would be replaced by about 28 mi. of higher voltage lines for more efficient operation, according to Hollis W. Harris, engineer for an electric cooperative in the central New Mexico Rural Electrification Administration.

AIR FORCE BASES in New Mexico are due to receive almost $20,000,000 worth of new construction if projects which have been tentatively approved by the House Armed Services Committee receive their full allocations. Walker Air Force Base at Roswell is due to receive $4,085,000, Kirtland Air Force Base at Albuquerque was alloted $5,170,000, and Holloman Air Force Base at Alamogordo was alloted $7,140,000. These allotments will be voted on as part of a complete military construction bill sometime in the future.

RECENT MAJOR CONTRACT AWARDS and low bids in New Mexico include a low bid of $608,389 by **Brown Contracting Co.** of Albuquerque for 9.2 mi. of grading and surfacing an alternate US 85, Albuquerque-Algodones road. **Wylie Brothers Contracting Co.** of Albuquerque submitted a low bid of $414,040 for 13.4 mi. of plant-mix surfacing on a 4-lane divided highway starting at Santa Fe and towards Albuquerque.

OREGON

COUGAR DAM—After months of discussion (**Western Construction**—April 1954, p. 94) an actual step toward the construction of Cougar Dam and reservoir in Lane County on the South Fork of the McKenzie River was taken when the City of Eugene applied for a 36-month preliminary permit from the Federal Power Commission. The City's Water & Electric Board, which filed the application, announced that construction would be sought under a "partnership" type of arrangement in accordance with the present Administration's policies, which encourage local participation in multiple purpose projects. Under this plan, the Corps of Engineers would

build, own, and operate the dam and reservoir while the City would design, construct, own and operate the plant and a re-regulating dam and powerhouse with 2,200-hp. capacity downstream from Cougar Dam.

WILLAMETTE RIVER-SALEM unit of the Portland-Salem Expressway has begun with clearing and grading operations under way along the entire 24-mi. section, which runs between the new $1,650,000 Willamette River Bridge at Wilsonville and North Salem. Bids for constructing the rock base will be opened in July and paving contracts are expected to be let in January 1955.

Project includes four twin overcrossing structures, a single overcrossing, 13 undercrossings separating the Expressway from local roads and railroad tracks, and a four-structure interchange at the North Salem junction with U.S. 99E. The 26 structures will cost about $1,478,000 and rock surfacing and paving are estimated at $3,300,000, making a total estimated project cost of $6,520,000. All structure contracts are expected to be awarded by midsummer. Design of the Expressway includes a width of 274 ft. on the normal right-of-way. The project will consist of a four-lane divided roadway, the pavement segments of each will be 24 ft. wide and have 10-ft. rock shoulders along the right hand side of the pavement. There will be a normal 30-ft. parkway strip between the roadway sections. All cross-traffic will go either over or under the Expressway. Access to the Expressway will be provided at the junction of State Route 217 near the Willamette River Bridge, at Woodburn, and at the junction with US 99E in North Salem.

Grading is being done under two contracts. R. A. Heintz Construction Co. of Portland has a $735,000 contract for the north half and Roy L. Houck & Son of Salem has the south half under a $1,007,000 contract.

State Highway representative on the project is J. D. Walker, division engineer. Structural design is under the supervision of G. S. Paxson, bridge engineer and assistant state highway engineer. Completion is scheduled for October 1955.

RECENT MAJOR CONTRACT AWARDS and low bids in Oregon include a low bid of $158,130 by **J. C. Compton Co.** of McMinnville for surfacing the Blue Mountain Pass section of highway in Malheur County. **C. M. Corkum Co.** of Portland submitted a low bid of $633,880 for construction of Marcus Whitman elementary school in Portland. **Ross B. Hammond Co.** of Portland submitted a low bid of $1,075,488 for construction of a 670-bed, 5-story, freestanding addition to the existing Oregon state hospital at

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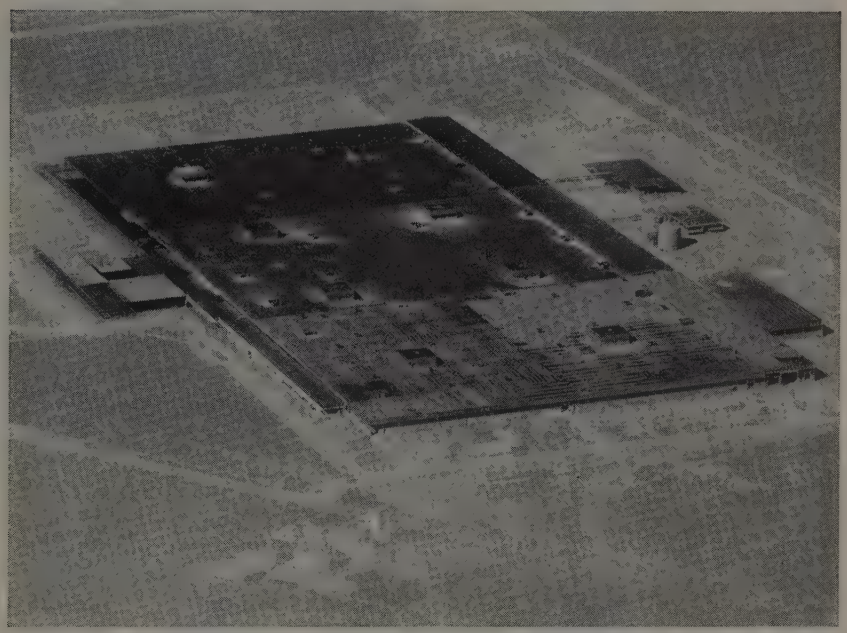

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Salem. **Lee Hoffman** of Beaverton submitted a low bid of $108,980 for replacement of the Calapooya River Overflow bridge in Linn County.

Vernie Jarl of Gresham submitted a low bid of $177,004 for grading a section of the Woodburn-Estacada highway, Clackamas County. **F. E. Lawrence** of Oregon City submitted a low bid of $126,306 for construction of 93.5 mi. of telephone line east of Oregon City. **Malarkey & Moore** of Portland received a $599,803 award for construction of a parochial school and convent at Richland.

UTAH

UTAH POWER & LIGHT CO. of Salt Lake City is in the midst of its biggest construction year in history. It plans to spend $25,250,000 for plant construction and expansion of facilities during 1954. The 66,000-kw. Carbon steam plant, now under construction at Castle Gate in eastern Utah's coal fields, will be ready for service late this year. Bechtel Corp. of San Francisco has the construction contract. A 100,000-kw. third addition to the Gadsby steam plant in Salt Lake City, which contains a reheat cycle for added efficiency, is scheduled to go on the line

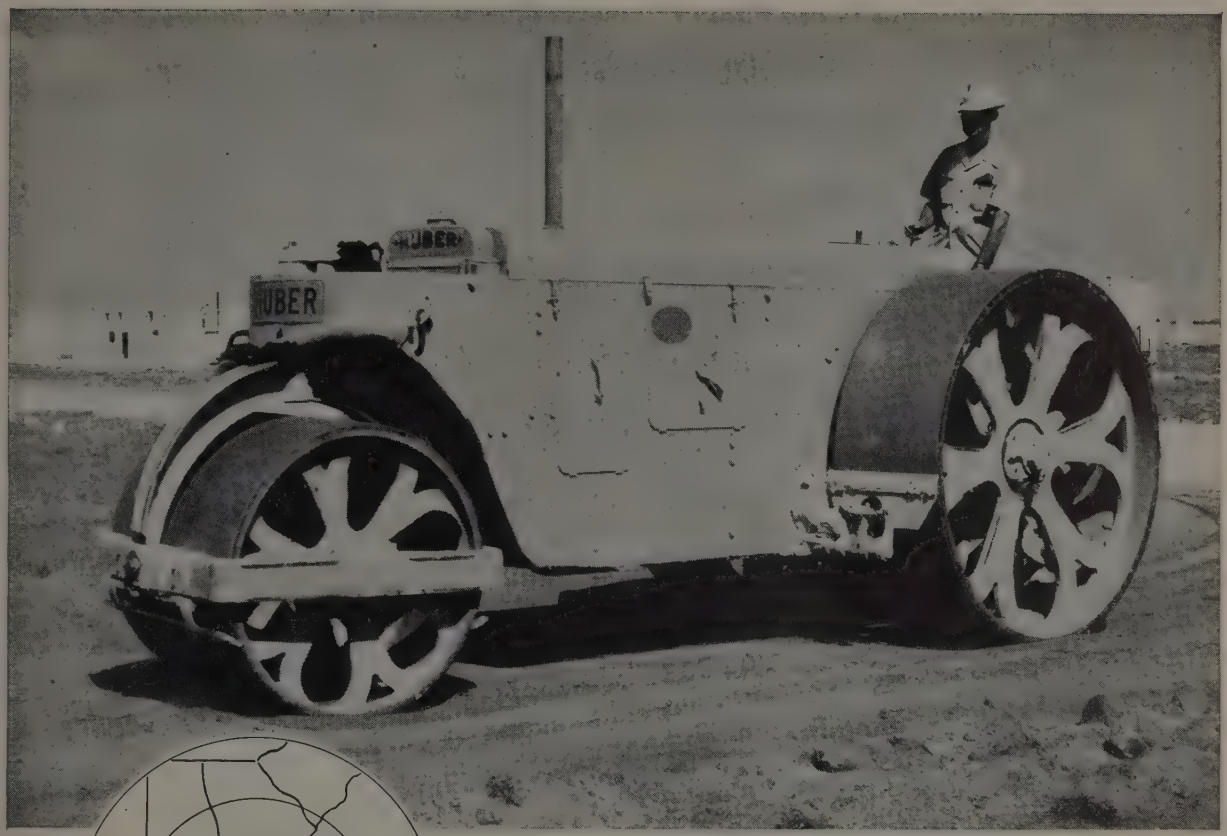
UTAH POWER & LIGHT CO.'s Carbon steam plant on its way up.

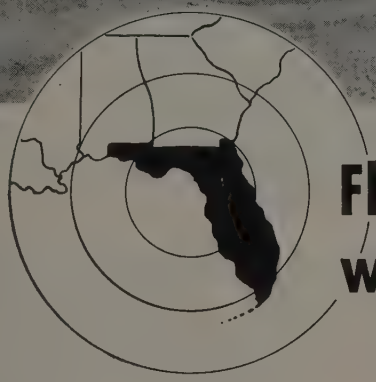
in mid-1955. This will bring the plant's total capacity to 241,000 kw. Bechtel is also building this plant.

More than $2,500,000 of the 1954 budget will be used to extend power line, substation, and service facilities. Planned transmission lines include completion of a 41-mi., $513,-000 link between the Hale steam plant near Provo and Mona substation. This will bring power to the south-central area of Utah. Other high voltage lines contemplated include those between Riverdale and Ogden, Riverdale and Clearfield, Lakepoint and Tooele, between Goshen substation near Idaho Falls and Rigby, and between the new Carbon plant and nearby Helper substation, which is undergoing a $240,000 reconstruction program.

Miscellaneous work contemplated includes a new penstock and surge tank at the Grace hydro plant on the Bear River in southeastern Idaho, and new street lighting systems budgeted for erection in six communities. New lights, already turned on in Layton, have adopted the innovation of lighting a divided freeway from the center islands. Important expansion of underground cable systems also are planned in the business districts of Ogden and Salt Lake City. Utah's subsidiary company, the Western Colorado Power Co., plans to build new high voltage lines between Ames and Telluride and between Koehler Lake and North Durango.

HIGHWAY SURFACE FAILURES—A road-mix surface between Monticello and the Colorado state line on U.S. 160, the original design of which was only for an 8,000-lb. wheel load due to very light traffic in the area, has revealed extensive failures. Uranium developments in the area during the last few years have increased trucking of maximum legal loads several times the previous count, resulting in failures





Florida Contractor Holds a winning Pair... TWO HUBERS

SECOND HUBER 10-TON ROLLER HELPS FIRM EXPAND

A Miami, Florida contractor who has built streets for many residential developments is the owner of two Huber rollers — a winning pair.

Five years ago the company bought its first Huber 10-ton three-wheel roller. The second one was added in 1951.

The procedure used on many projects is to sprinkle and roll an 8-inch course of lime rock to a smooth, hard surface which then is swept and sealed with asphalt at the rate of 3/10 gal. per square yard. This is covered with screenings or coarse sand.

This firm's experience with Hubers is typical, for Huber rollers make friends wherever they are used. Expert design and quality construction pay off in terms of fast, powerful and dependable service. Talk to your nearest Huber Distributor about dependable Huber road machinery. You, too, will like it.

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Helena, Billings, Montana
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to the road at a number of points.

Highway engineers discovered that gravel in the area was of poor quality, showing 15% to 20% passing the No. 200 mesh sieve, and was highly plastic. Therefore, it was decided to provide cement stabilization of the existing surface to a depth of 6 in. with 6% cement. Tests showed this would produce a surface with an average of about 2,000 psi. Very favorable bids were received on this project, showing a cost for the stabilization work of approximately 87c per sq. yd., despite the fact that the nearest railroad point is about 95 mi. from the project and that railroad point was more than 200 mi. from the nearest cement plant.

Treatment of adding additional gravel, which would require widening the frozen culverts, showed a considerable saving over the cost of adding sufficient base gravel to the surface to provide stable surface. A 3-in. plant-mix surface was provided in the specifications to be placed over the cement-stabilized base.

Construction of the project, which covers 17.09 mi., was awarded to Thorn Construction Co., Inc. of Springville on a low bid of $536,576. The contract was awarded April 16, 1954.

RECENT MAJOR CONTRACT AWARDS and low bids in Utah include an award of $480,255 to **W. W. Clyde & Company** of Springville for 29.4 mi. of plant-mix surfacing in the Dixie National Forest providing a connection between US 91 and 89. **Gibbons & Reed Co.** of Salt Lake City submitted a low bid of $252,900 for 1.5 mi. of street improvement near Salt Lake City. **Reed Trucking & Const.** and **R. M. Jensen** of Salt Lake City submitted a low bid of $232,565 for 4.1 mi. of grading and road-mix surfacing on SR 10, Sevier County. **Strong Co.** of Springville submitted a low bid of $347,295 for 3.5 mi. of plant-mix surfacing on US 40 in Wasatch County.

WASHINGTON

BOX CANYON HASSLE—Cofferdam losses that forced revision in the construction schedule for Box Canyon Dam on the Pend Oreille River have resulted in termination of the contract between Pacific-General-Shea and Pend Oreille County Public Utility District No. 1. The break was affected on April 9, and the District has subsequently selected Morrison-Knudsen Co., Inc., to complete the work.

High water a year ago took out the contractor's powerhouse cofferdam and an auxiliary spillway cofferdam. Immediately resulting delays amounted to about 6 weeks of

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working time, and the situation was aggravated by the contractor's forced decision to suspend work in the forebay area due to the threat to the cofferdam there. A diversion schedule originally set for the 1953 and 1954 seasons had to be revised, with 1954 as the first year.

According to H. A. Sewell, engineer for the public utility district, several conferences were held to expedite the work, but on February 15 of this year Pacific-General-Shea filed with the District a study indicating that diversion of the river and construction of the river spillway could not be done between two high waters. On the basis of further studies, the contractor stated that 353 days would be needed for the complete operation, from beginning of cofferdam construction to completion of removal.

Considering this and other statements to constitute anticipatory breach of contract, the District invoked the termination provision of the contract. Pacific-General-Shea considers the action to have been recision; and arbitration or court action will ultimately have to decide the issue.

Offers to complete the work were received from Guy F. Atkinson Co., Morrison-Knudsen, and Albeni Constructors, all of whom agreed to do the spillway work between two high water periods. In a very difficult decision, reports Sewell, Morrison-Knudsen got the nod because of having equipment and personnel immediately available and having successfully completed two very difficult jobs in the same vicinity.

Coming on the job in the latter part of April, M-K immediately undertook reinforcement of existing cofferdams and other work necessary before 1954 high water. Actual diversion should be commenced after the flood, about July 5, and the contractor has filed a schedule calling for completion of the work in 270 days.

VICTORIA SHOPPING AREA—A $1,500,000 shopping center at Victoria is being planned by Buford Development Inc., a Seattle firm.

POWER RESOURCE SURVEY—Jack D. Stevens of Portland, Ore., ex-chief of Power Resources for the Bonneville Power Administration, has been selected by the Puget Sound Utilities Council to direct an engineering survey which will lead to a comprehensive, coordinated development of power resources for the Puget Sound-Cascade area. Gerrit Vander Ende, chairman of the Tacoma Utilities Board, said that Stevens will be expected to produce a report showing future power needs of the Council utilities, projects which have engineering and economic feasibility, and what steps need to be taken to meet power needs

relation to load growth and economic aspects of the region. The Council, which will use Stevens' report as the basis for selecting new projects to investigate and build, was organized by Paul J. Raver, superintendent of Seattle City Light, and includes Tacoma City Light, Puget Sound Power & Light Co., and Snohomish and Chelan public utility districts.

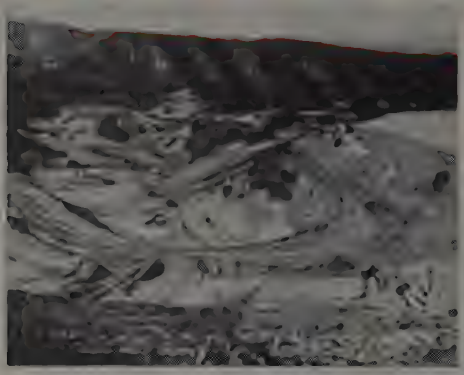
RECENT MAJOR CONTRACT AWARDS and low bids in Washington include an award of $109,146 to **American Pile Driving Co. Inc.** of Everett for grading, surfacing, and bridges on the Tolt to Duval highway, King County. **Bay Construction Co.** and **Don L. Cooney** of Seattle submitted a low bid of $947,292 for construction of 92 mi. of 345 kv. line for the Bonneville Power Administration in Klickitat and Umatilla Counties. **Donald M. Drake** and **George Fuller** of Portland received a $2,215,993 award for construction of a maintenance hangar at Larson AFB near Moses Lake.

Goodfellow Bros., Inc. of Wenatchee received a $344,289 award for 9.8 mi. of grading and surfacing SR 2 between Moses Coulee to Coulee City, Douglas County. **Peter Kiewit Sons' Co.** of Longview submitted a low bid of $130,733 for construction of a 210-ft. steel truss bridge on the Stillaguamish River highway, 15 mi. east of Robe. **E. Chuck Mardis** of Walla Walla submitted a low bid of $569,007 for construction of the 1-story, 50-bed Tri-State Memorial Hospital building at Clarkston. **McAtee & Heathe, Inc.** and **S & F Construction Company, Inc.**, of Spokane, received a $219,017 award for 10.4 mi. of grading and plant-mix surfacing on SH 3 in Spokane County.

C. L. Miller Construction Co. of Seattle submitted a low bid of $67,719 for construction of a 140-ft. reinforced concrete fishway on the Klickitat River near White Salmon. **Murphy Brothers** of Spokane submitted a low bid of $122,510 for construction of the East Side syndicate sub-trunk sewer in Spokane. **Northwest Construction Co.** of Seattle received a $118,951 award for 2.7 mi. of grading and surfacing on the Mercer Island Freeway. **John H. Sellen Construction Co.** of Seattle submitted a low bid of $155,902 for construction of a tilt-up structure 120 x 149 ft. in Seattle. **Lawrence Stacel** of Eatonville submitted a low bid of $200,000 for removing debris from the Alder reservoir on Nisqually river.

Stone & Thaut of Spokane submitted a low bid of $117,352 for 9.1 mi. of surfacing and stockpiling on SR 10 in Idaho and Lewis Counties. **J. P. Surace Construction Co.** of Seattle received a $258,598 award for 2.5 mi. of plant-mix surfacing from Rockport west, Skagit County.

Face-lifting



PANORAMIC VIEW of work at Glen Aire Estates.

REALLY FILLING THE BILL—TD-24 compacts fill for another Glen Aire house in accordance with new city specifications and latest engineering standards. In some spots, cuts up to 95 feet and fills up to 70 feet had to be made.

for a mountain

INTERNATIONAL TD-24s move half-a-million cubic yards of mountain in 3½ months

n three and a half months, four INTERNATIONAL TD-24s working on the development of Glen Aire Estates, a new 6 million dollar housing project in uburban Los Angeles, did a complete face-lifting ob on a mountain.

The five "Big Reds", owned by Contractor Harry Hicks of Sherman Oaks, Calif., started at he mountain top and worked down to the valley, learing trees, cutting roads and leveling sites vith a speed and ease that amazed everyone ex- ept Harry Hicks. He knows from experience hat the big "TD-24s" do the toughest jobs faster.

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VERAGES ONE A YEAR—Harry Hicks bought his first TD-24 in 1948. He had the first one in the Los Angeles rea, and now in 1953 he has a fleet of five. Five years— ve TD-24s . . . *"We know what they will do,"* says Harry. *"They consistently produce about 25 percent nore work than anything else."*

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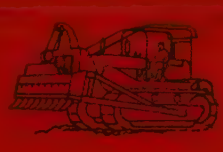


Howard S. Wright & Co. of Seattle submitted a low bid of $1,346,963 for construction of a 4-story addition and remodeling work for the Swedish hospital in Seattle.

WYOMING

MORAN RESORT CONSTRUCTION—Construction on the $6,000,000 resort area building program at Moran, now about 50% complete, is scheduled for completion October 1. Morrison-Knudsen Co., Inc. of Boise, Idaho, is doing the job.

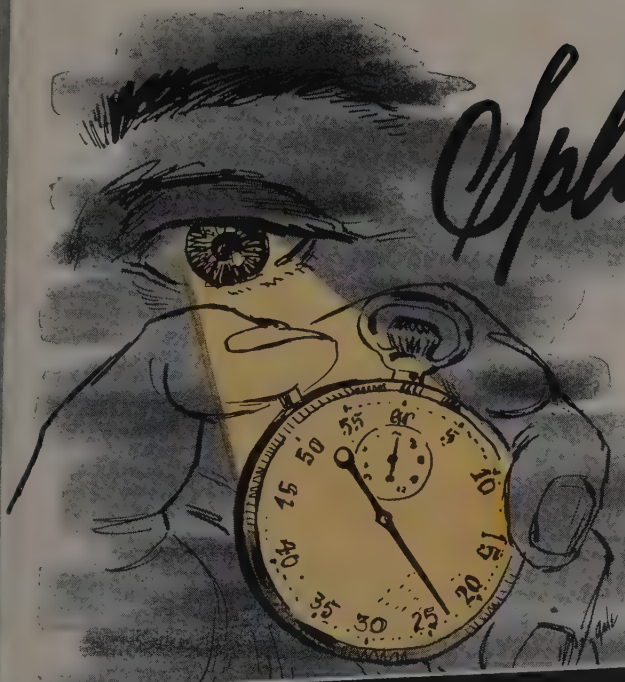
PALISADES DAM TRANSMISSION LINES—Construction has begun on 90 mi. of power transmission line from Palisades Dam to Jackson. The line, expected to be completed in September, will cost about $450,000. In addition, six substations, to cost $200,000, will be built along the line. Campsey and Lytle Construction Co. of Denver submitted the low bid on the job.

RECENT MAJOR CONTRACT AWARDS and low bids in Wyoming include a low bid of $628,950 by Ace Construction Co. of Omaha for construction of extensions to runways and taxiways at the Air National Guard Airport at Cheyenne.

ALASKA

RECENT MAJOR CONTRACT AWARDS and low bids in Alaska include a low bid of $396,990 by **Babler Bros. & Rogers** of Portland for 25 mi. of paving work in the Anchorage area. **Peter Kiewit Sons' Co.** of Seattle submitted a low bid of $503,240 for construction of a community center building and a service club at Big Delta (bid was 20% over government estimate). **Lytle & Green** and **S. Birch & Sons** of Seattle received a $1,042,060 award for construction of 22 ammo storage magazines, access roads, railroad spur, and fencing at Eielson AFB.

E. M. Peterson of Spenard submitted a low bid of $539,944 for construction of a 3-story dormitory at Elmendorf AFB. **Reed & Martin, Inc.** of Fairbanks received a $775,116 award for construction of 4,300 ft. of concrete utilidor, piping, and 17 manholes at Eielson AFB. **Valle-Sommers Construction Co.** of Seattle received a $400,000 award for improvements and alterations to the Seward installations of the Standard Oil Co.



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ALASKA Newsletter

By CLIFFORD S. CERNICK, Anchorage

JOB RUSH AGAIN — Despite warnings by employment officials, contractors, and unions, another "job rush to Alaska" has developed. Would-be construction workers are ariving in the territory in ever-increasing numbers. Large numbers of workers are heading north in the face of repeated warnings that the job picture here leaves much to be desired, and there are thousands of unemployed construction workers already in Alaska.

BY AIR, BY BOAT, BY LAND— Virtually every means of transportation is being utilized by Alaska-bound construction workers. Airlines, steamship companies, and territorial highway officials report a more pronounced influx of stateside job hopefuls. In the Anchorage area alone, new men are arriving at the rate of over 100 a week. More than 3,000 new construction workers have arrived in Alaska since January 1. The territorial employment service reports it has 25% more unemployed persons on its rolls at this time than it did last year.

CONTRACT PICTURE — Settlement of the carpenter-contractor wage dispute late in April was a bright spot in the Alaskan employment picture. Last year, precious working days in a rigidly-limited Alaskan construction season were wasted by contractual disputes. This year, however, an atmosphere of greater harmony exists. Under the terms of the agreement signed by the Associated General Contractors and members of Alaska carpenter locals, the carpenters will get a 12½-cent hourly pay increase in Westward Alaska and a 15-cent hourly pay increase in Southeast Alaska. The new contract also provides for free board and room in areas designated as "isolated zones." The 1953 scale provided an hourly wage of $3.56½ for journeymen.

STILL UNSETTLED—Failure of plumbers to reach an agreement with contractors can throw a monkey wrench into the otherwise smoothly-functioning work set-up here. Following the breakdown of negotiations between the union and plumbing contractors, about 300 men in that craft were thrown out of work in Anchorage alone. This has in turn seriously affected the employment of other crafts on construction jobs which have been forced to curtail or halt operations because of the unavailability of plumbers. Normally, plumbing work in the Anchorage area is stepped up after May 1. The plumbers are asking a scale of $4.50 per hr. and have rejected an offer which would have brought their hourly wages to $4.25.

SLOWDOWN CHARGED — An outgrowth of the plumbing wage dispute is the charge hurled at contractors recently to the effect that they were deliberately "slowing down" construction work to force the plumbers into a wage settlement. The charge was made by the Anchorage Building Trades Council. The council's statement accused contractors of deliberately bringing about "what amounts to a lockout against those crafts who have not as yet completed negotiations for 1954." The statement added: "By their action, the contractors are slowly but surely bringing the defense effort to a halt." R. E. McFarland, president of the trades council (composed of all crafts in the construction industry) said all unions in the council have affirmed their willingness to dispatch their members to any project "despite the fact that three of these unions have not as yet concluded agreements for 1954."

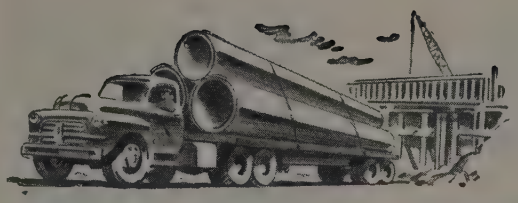
VIGOROUS REBUTTAL— Slowdown charges were sharply denied by Larry Moore, Alaska manager for the Associated General Contractors. Moore declared the charges were "without foundation" and pointed out that any slowdown was occasioned by the fact that some jobs had reached a stage where work had to be diminished because the job had progressed to the point where plumbing was needed in order to utilize other crafts. "Employers must conform to sound building practices," Moore said. "Major construction projects are directed by contractors who are better qualified than anyone else to determine the start and progression of the work."

BIDS TOO HIGH—A fairly rare instance in which the Corps of Engineers indicates it may reject all bids because they are too high has occurred in connection with bidding on the Whittier dock project. Government estimate for the project was $3,812,161. The lowest bid submitted was by the joint venturers Scheumann, Johnson, Manson-Osberg who quoted a $5,442,861 contract figure. A statement issued to the press by the Alaska District Corps of Engineers indicated the bids would be rejected because they were more than 15% above the estimate. The dock project was ordered by the military to replace facilities destroyed in a fire last year.

IN SHARP CONTRAST to such "over bidding" are the bids placed by contractors on other projects. Because of keener competition among contractors, a large number of the bids ranged from 5 to 20 per cent below the government estimates. An example is an Elmendorf sewer project which was estimated to cost from $886,000 to $1,000,000. Offers of the apparent low bidder ranged fom $719,242 to $807,226. Such spirited competition has resulted in chalking up large savings for Uncle Sam and, at the same time, forced contractors to be more careful, analytical, and shrewd in placing bids.

STOLEN BLUEPRINT MYSTERY—Officials of the Marwell Construction Co. and Fairbanks police are wondering what happened to a set of blueprints stolen out of a sub-contractor's pickup truck parked in downtown Fairbanks. The blueprints were for segments of work to be done on the Haines-Fairbanks pipeline job, and so far they have not been recovered.

CONSTRUCTION NEWS CAPSULES—The Defense Department has asked Congress to authorize $16,240,000 for projects in Alaska, including facilities at Ladd Air Force Base, Fort Richardson, Kodiak, Adak, Galena and Naknek . . . General Manager Frank E. Kalbaugh of the Alaska railroad estimates that $4,594,000 is needed for rehabilitation of a 62-mi. section of the Alaska Railroad, the territory's government-owned line . . . "A great future" for Alaska in development of industries and natural resources has been predicted by Alaska's Congressional delegate, E. L. (Bob) Bartlett . . . Col. Carl Y. Farrell took command of the Alaska District Engineer branch suceeding Col. Louis H. Foote on May 1. Col. Foote is being promoted to division engineer for the Corps' North Pacific Division with headquarters in Portland, Ore. . . . Fairbanks is seeking federal aid in a proposed slum clearance and re-development program for the city . . . Surplus is big business in Alaska. Last year, the Air Force turned over to federal agencies material and equipment totaling $8,146,000 in value . . . Charles Pugh, former manager of the Fairbanks office of the territorial employment service has been named as head of the Anchorage employment office, succeeding George Milligan, who has decided to live in the States . . . The 1954 longshoremen's wage contract gives them a 12½ cent hourly increase over last year, bringing longshore wages to $3.14.



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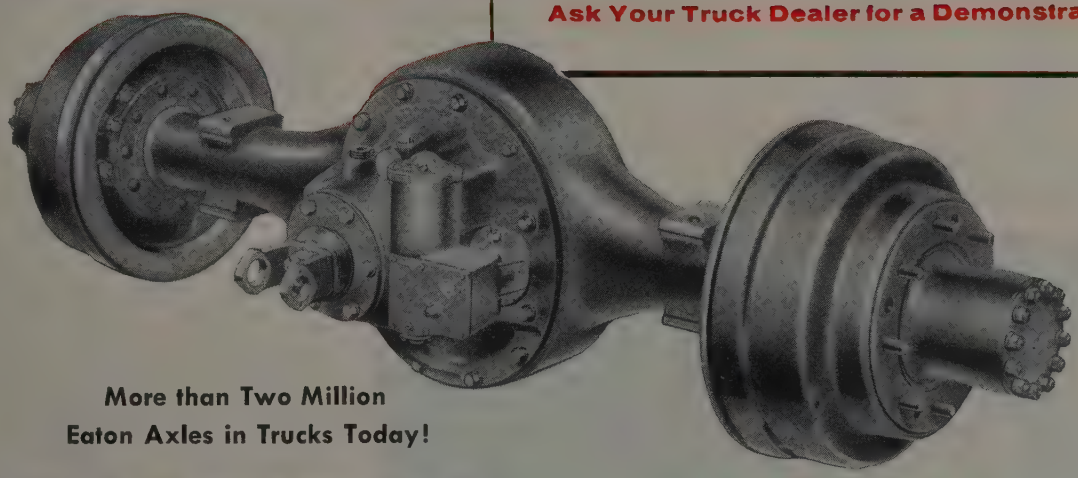

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ENGINEERS on the move

J. D. Jacobs (Don), until recently engineer and estimator in the San Francisco office of Walsh Construction Co., left last month for Cooma, New South Wales, Australia, where he will be chief engineer on the Snowy Mountains hydroelectric project (**Western Construction** — May 1954, p. 98). Work on the vast project is expected to last about seven years and Jacobs has gone over to get the initial phases under way. Contract is being executed by Kaiser, Walsh, Perini, Raymond, General, Bates-Rogers and Arthur A. Johnson.

* * *

Jack D. Stevens has been employed as consultant to the Puget Sound Utilities Council with offices in Seattle, Wash. In his new assignment he will analyze future power needs in the Puget Sound-Cascade area and make recommendations for fulfilling them. (See p. 124 this issue). Stevens' previous position was with the Bonneville Power Administration, where he was chief of power resources.

* * *

J. W. Taylor, Bureau of Reclamation engineer, under whose supervision the $12,000,000 North Unit irrigation project of the Deschutes area was completed, has moved from Bend, Ore. to Boise, Idaho, to join the USBR district office there. The project office at Bend has been closed, with the personnel being assigned to other posts. **Carlos C. Randolph,** project superintendent, is making his headquarters at Madras.

* * *

N. P. Bolic, county supervisor of roads and bridges in the Bingham area of Salt Lake County, Utah, recently resigned, following criticism of his office contained in a report by the county commission.

* * *

P. F. Stevens of Strong & Macdonald, Inc., was recently installed as president of Tacoma Chapter, Associated General Contractors. Other officers elected to serve with Stevens during 1954-55 are **James W. Purvis,** vice president, and **R. H. Hartman,** treasurer. **C. W. Todd** is secretary-manager of the chapter.

* * *

A. G. Hanson, county engineer of Wahkiakum County, Wash., having reached the age of 65, recently retired from county government service.

* * *

Monty M. Peeler, assistant manager of the power service department of the Salt River Power District, Phoenix, Ariz., was recently promoted to department manager, succeeding **Robert T. Harrell,** resigned. **Thomas F. Langham,** field accounting coordinator, was made assistant manager of this department.

* * *

C. M. Brown, Jr., executive manager of Intermountain Branch, Associated General Contractors, Salt Lake City, Utah, recently resigned the position, and **W. D. Eldredge** was named to succeed him.

* * *

David F. Brinegar, Phoenix, Ariz., formerly assistant secretary of the Arizona Interstate Stream Commission, and for 18 years in newspaper work in Arizona, has been appointed executive secretary of the Central Arizona Project Association. He succeeds the late **Howard J. Smith,** who died last February after a brief illness.

* * *

David S. Culver, former assistant construction engineer at the Hungry Horse Project in Montana, was recently presented with a Department of Interior citation for outstanding service. Announcement of the award was made by **E. L. Gochnauer,** Hungry Horse project superintendent. Culver left the USBR last October to accept a position as senior engineer with the Bechtel Corporation at Los Angeles.

* * *

Edward L. Stephens, project manager for the Bureau of Reclamation since 1945, and prominently identified with the development of the Klamath and Tulelake irrigation systems in Oregon since 1906, recently retired. He plans to move to California, making his home at Pacific Grove. **J. Pitts Elmore,** assistant to Stephens for the past year, is expected to succeed him.

* * *

Leon E. Sullivan, hydraulic engineer with the Bureau of Reclamation at Boulder City, Nev., for the second time in his career was presented with the Department of Interior's superior accomplishment award, according to announcement by **E. G. Nielsen,** Director of Region 3. **Vaud E. Larson,** head of the project development division, made the presentation. This second citation resulted from Sullivan's outstanding work in connection with the Bureau's report "Water Supply on the Lower Colorado River Basin."

* * *

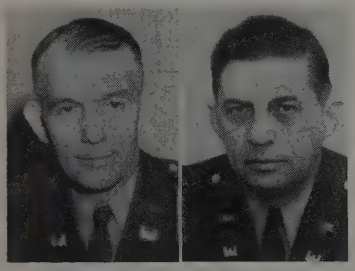
Reuben E. Cole, director of engineering and construction for the Atomic Energy Commission's operations at Santa Fe, New Mex., since 1949, has resigned in order to return to private construction business. Also recently announced by the Atomic Energy Commission is the resignation of **L. E. Johnston,** who has been manager of the Idaho oper-

TURNING OVER THE KEYS to a new barracks at the Oakland (California) Army Base to *Brig. Gen. Harry Van Wyk*, port commander, is *George Loorz*, president of Stolte, Inc., the contractor. Adding moral support to the transaction are *Lt. Col. A. L. Anderson*, (left) San Francisco District, and *Col. Lionel R. Ingram*, (right) South Pacific Division, both representing the Corps of Engineers.

ations office. Johnston resigned to accept a position with the Taconite Contracting Corp., Duluth, Minn.

* * *

Colonel Louis H. Foote, District Engineer, Alaska, as of last month, became North Pacific Division Engi-



Col. Foote *Col. Farrell*

neer, with headquarters at Portland, Ore., succeeding **Brig. Gen. Don G. Shingler,** who retired from active service. **Colonel Carl Y. Farrell** moved up to the position of Alaska District Engineer. He had been serving as Assistant District Engineer.

* * *

George E. Hyde, hydraulic engineer with the Corps of Engineers at Portland and Bonneville for almost 15 years, recently decided to leave Oregon to accept an engineering position in New York with the firm of Sanderson & Porter.

* * *

John MacDonald, for many years prominent in the Northwest trucking industry, was elected to the presidency of the Western Highway Institute at the eighth annual convention at Palm Springs, Calif.

* * *

Albert D. Heath, field office engineer for the Bureau of Reclamation during construction of Cachuma Dam in California, now fills a similar position for the Bureau on the irrigation distribution system at Delano, Calif.

* * *

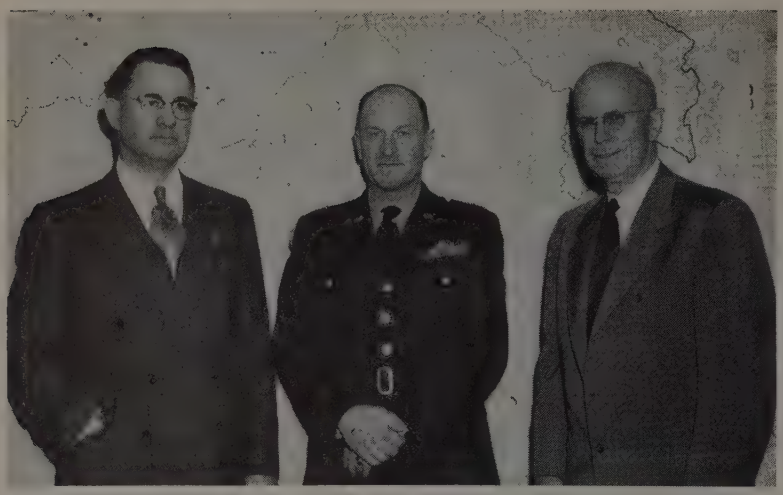
L. E. Wiscombe, with a background of 30 years' experience in engineering construction, with par-

L. E. Wiscombe
engineer-manager
Nephi City, Utah

ticular emphasis on the power and waterworks field, is engineer-manager of Nephi City, Utah. Employed by Nephi City Corporation, he is in charge of power plants, water works, sewage, and allied municipal works.

* * *

Richard E. Mittelstaedt retired May 1 as president of the California



PERSONNEL SWITCH—*Samuel G. Neff*, (left) former head of the construction branch, Walla Walla District, Corps of Engineers, has been named chief of the construction and operations division, North Pacific Division, in place of *Robert E. Hickson*, (right) who is retiring after 46 years and 4 months service with the Corps. *Brig. Gen. D. C. Shingler* (center), division engineer, announced the switch, shortly before his own retirement.

public utilities commission. He had been a member of the PUC since 1946, and his retirement was mandatory, since he had reached the statutory maximum age for public employment in California. Elected to succeed him is Peter E. Mitchell, who has been a member of the Commission since 1951.

* * *

Lloyd J. Hudlow, who has been assistant director of power for the Boulder Canyon Project, Ariz., has been appointed to succeed **L. R. Douglass** as head of the power project. Hudlow's new title will be project engineer.

* * *

Louis J. Frederikson, field representative for the Bureau of Public Roads, is presently located on the combined Zion-Bryce Canyon National Park approach road project and the Utah Forest Highway Project, a 29.4 mi. plant-mix bituminus surfacing stretch in Utah. Frederikson has served the Bureau on projects in southern Utah for many years. He reports to **F. W. Smith**, District Engineer, Ogden.

* * *

Fred E. Stolz is assistant to the area superintendent at the new regional office of Stolte, Inc. at Fresno, Calif. Besides being in charge of the office, he is engineering estimator for all Stolte work in the San Joaquin Valley area.

* * *

W. L. Karrer recently returned from Israel where, during 1953, he was irrigation advisor to that country. He is located at Kennewick, Wash., where he is again working as construction engineer on the $14.-000,000 irrigation project for the USBR.

* * *

J. D. Earl has been named regional administrative officer to head the newly organized administrative services division of the Bureau of Reclamation's Region 3 at Boulder City, Nev., according to Regional Director **E. G. Nielsen.** Earl has been assistant to the director since arriving in Boulder City in 1946. His new appointment is a promotion growing out of the recent reorganization of the USBR.

* * *

Norman Best has been appointed project chief at Wallace for the Idaho State Department of Highways, replacing **Joe Bernardy** who will be reassigned.

* * *

Reassignments among the engineers of Garrison District, Corps of Engineers, involve the following personnel: **Mike P. Mirkovich,** supervisory construction engineer (general) has been transferred to Detroit District as construction engineer. **George C. Kadlec** and **Carl B. Vogen** are transferred to the Missouri River Division as construction engineers, stationed at Oahe Dam, So. Dak. Also transferred to Oahe Dam is **Earl T. Garrett,** supervisory construction engineer (dams). **Jesse D. Thomas,** construction engineer (dams), is assigned to the New England Division, and **William G. Ryan,** supervisory construction inspector (general) to the Detroit District. Returning to Garrison District as resident engineer on powerhouse is **Olef Lein,** who has been in North Africa since May 1952 working on airfields.

* * *

D. L. Cheney, vice president of S. Birch & Sons, has been elected to his fourth consecutive term as president of Alaska Chapter, Associated General Contractors. **P. D. Koon** was chosen as vice president and **W. R. Johnson,** secretary-treasurer. **L. A. Moore** is manager of the chapter.

* * *

Walton W. Hofmann is the recently appointed chief engineer of construction for Bethlehem Pacific Coast Steel Corp., Steel Division. Hofmann comes to the West Coast from Johnstown, Pa., where he was assistant chief engineer of Bethlehem Steel Co.'s Johnstown steel plant. In his new position, he will make his headquarters at Bethlehem Pacific's San Francisco offices.

CALENDAR

Sept. 13-15—County Engineers and Officials, 2nd annual National Highway Conference, at Deshler-Hilton Hotel, at Columbus, Ohio.

Sept. 16-18—Western Association of State Highway Officials, 33rd annual conference, at Challenger Inn, Sun Valley, Idaho.

Oct. 14-16—Structural Engineers Association of California, annual convention at Hotel Del Coronado, San Diego.

Oct. 28-29—American Concrete Institute, regional meeting at Statler Hotel, Los Angeles.

DEATHS

Elmer F. Strickler, 68, for nearly 34 years a civil engineer employee of the Bureau of Public Roads, died of a heart attack at his home in Sacramento, Calif., April 6.

* * *

Walter A. Leech, 58, a structural engineer for Puget Sound Power & Light Co., died recently at Seattle, Wash.

* * *

Arthur D. Campbell, 66, for 36 years an engineer for the city of Los Angeles, died April 12 at his home in Santa Barbara where he resided since his retirement in 1948.

* * *

Melvin Stevens, 87, a long-time resident of Boise, Idaho, and a retired contractor, died recently of a heart ailment. At one time he was employed by the state of Idaho for 25 years as superintendent of construction, and later served as building inspector for the city of Boise.

* * *

Charles Stewart, 67, engineer in charge of the construction program at the Campbell Soup Co. and former engineer on construction of The Bee Building at Sacramento, Calif., died as a result of a heart attack April 20.

new!

ATLAS *Shotmaster* BLASTING MACHINE

The first condenser discharge type blasting machine utilizing a high voltage DC generator directly connected to charge the condensers.

Dependable blasting starts with a dependable blasting machine. And this new Atlas blasting machine is designed to give you every advantage in dependability and safety.

Hand actuated generator operation does away with battery replacements and gives consistent voltage in both hot and cold weather.

Built-in Volt Meter shows actual voltage while the condensers are being charged.

Adequate voltage assured. The condensers cannot discharge into the firing circuit below a predetermined voltage.

No danger of a residual charge in the condensers. With the condensers connected directly to the generator, any residual charge is dissipated quickly.

Simplified operation. The generator is hand operated. The firing trigger may be closed or open during the voltage build-up. Only when the voltmeter needle indicates optimum power can the firing circuit be activated.

Waterproof. The entire unit is sealed and the switch is waterproof. The new Atlas blasting machine is always ready to go . . . under all conditions.

Sturdy, welded steel case is compact and easy to handle. The whole machine weighs only 30 lbs.

Insulated-type terminals. Binding post screws are made of a non-conducting material. Terminals are well separated for maximum safety.

For complete information on this new blasting machine, get in touch with your Atlas representative. He will be glad to give you full details and arrange a demonstration if you wish.

ATLAS

ATLAS EXPLOSIVES

"Everything for Blasting"

ATLAS POWDER COMPANY,
WILMINGTON 99, DELAWARE

Offices in principal cities

SAN FRANCISCO PORTLAND
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SUPERVISING the jobs

George Gosich, general superintendent, heads the earthwork, clearing, drainage and paving of Dam Road in Contra Costa County, Calif. Assisting Gosich are **Don Harnish,** grade foreman, and **Louie Becerra,** pipe foreman. **Tommy Schweser** is acting as office manager. Contract covering this road job was recently awarded to Independent Construction Co., Oakland, Calif., at a cost of $347,102.

* * *

Howard Shelton, superintendent, **R. H. Shipley,** grade foreman, and **Glenn Lambson,** timekeeper, head up a $355,339 job recently awarded Lyle Price, contractor, for grading and draining 3¾ mi. of new alignment, Cordes Junction-Bridgeport Highway, about 78 mi. north of Phoenix, Ariz.

* * *

A. J. Drimel, superintendent, is handling a $315,000 highway job under the direction of **D. D. Skousen, Sr.** and **D. D. Skousen, Jr.,** whose firm recently won the award. Work consists of 4.7 mi. of grading and paving on U.S. 66, Albuquerque--Correo, New Mex. Head mechanic for D. D. Skousen & Son is **Kenneth Savage.**

* * *

Working under **George Boyer,** superintendent, and **Robert Faris,** project engineer and general foreman, on the Continental Can Co.'s tinning and lithographing plant, Pittsburg, Calif., are **J. C. Pierce,** carpenter foreman, and **Richard Kelly,** labor foreman. Subcontractors' superintendents are: **"Mac" McIntyre,** mechanical; **Verne Rutledge,** steel, and **Irwin Kief,** electrical.

* * *

Richard E. Hix is project manager for Grove Shepherd Wilson & Kruge, Inc., contractor on construction of eight 3-story dormitories and three mess-administration buildings at Ladd Field, Alaska, for the Corps of Engineers. **Frank Fleshman** is assistant to Hix. **Ray Young** and **Truman Fisher** are carpenter bosses. Other key jobs are held by **Don Clark,** project engineer, and **Victor Foss,** office manager. Work is expected to be complete in November 1955.

* * *

Maurice M. McCoy is supervising construction on the new brick structure for the State Department of Employment at San Bernardino, Calif. for Steed Brothers, contractor.

* * *

Frank Hafner, superintendent, with the assistance of **Fred Gibson,** is directing the work for Nielsen Construction Co., which is construting a shopping center in the Clairemont District of San Diego, Calif., a $300,000 project.

* * *

Woodrow Arrington, project manager, and **L. L. Monson,** general superintendent, head the construction force working for Arrington Construction Co. on a $2,000,000 contract for various buildings and utilities for ground testing facilities for aircraft propulsion reactor at Idaho Falls, Idaho. Other key men on the work are **Robert D. Taylor,** field engineer; **George Smith,** equipment foreman, and **Thomas N. Beall,** in charge of office and purchasing. Excavation for main structures is finished and the entire job is scheduled for completion in 12 months.

* * *

Lee Arnold is general superintendent for MacDonald, Young & Nelson, Inc., which, on a low bid of $4,194,461, was awarded the contract for ramp construction revision of distribution structure on the Oakland approach to the San Francisco-Oakland Bay Bridge. **Al Crowl** is working as field engineer on the same job. **Ray Boyd** is office manager.

* * *

George V. McKeever is general superintendent and **Rolph Jensen** is job superintendent for Barrett Construction Co., which recently was awarded a $1,500,000 contract for construction of a student residence on the University of San Francisco campus in San Francsco.

* * *

Paul Groomes is superintending the construction of the El Pueblo Elementary School for Nomellini Construction Co. which was awarded the contract at a cost of $372,000. **Steve Kosach** is superintending the heating subcontract, and **"Slim" Brady,** the electrical.

Paul Groomes

* * *

Grant Brown, superintendent; **R. B. Kurtz,** general foreman; **Joe Maucebo,** master mechanic; **Joe Gipps,** labor foreman, and **"Cy" Robie,** office manager, are key men on the grading and surfacing contract for 3.7 mi. of U.S. 99 between Project City and Mountain Gate, Calif. This is a $686,678 contract recently won by Fredrickson & Watson Construction Co.

* * *

Fred G. Peterson is project manager for Winston Bros. Co. on construction of San Antonio Dam in Southern California. Others among the supervisory personnel are: **W. R. Sell,** project engineer; **Ted C. Little, Ralph Latham** and

George Boyer *Robert Faris* *Verne Rutledge* *Richard Kelly* *J. C. Pierce*

When DW21s and the New York Thruway meet, **the dirt begins to FLY!**

Here's the record of these DW21s:

Soil—Sandy loam, clay and gravel
Haul—2300 feet
Trips per hour—9-10 trips
Load per hour per machine—180-200 yards
Hours used daily—8-10 hours
Loading time—1 minute
Spreading time—20 seconds (on the run)

THE New York Thruway, being built *for* speed, is being built *with* speed. The above record of fast-stepping, rugged Cat* DW21s explains why. Coupled with earth-eating No. 21 Scrapers and push-loaded by brawny Caterpillar D8 Tractors, the DW21s are making the dirt fly for Petrillo, Healy & Gammino, Providence, R. I.

L. DeLiro, grade foreman, sums up their impressive performance:

"Not only do these DW21s move the dirt fast, but they are easy to handle for our operators. The big tires float over rocks and ordinary haul roads with ease."

These machines were designed for big loads, high speeds and easy handling. Because tractor and engine are built to match by *one* manufacturer, you get a balance between weight and horsepower that no other two-wheel earthmover can offer. Every bit of the 225 HP at the flywheel can be put to work efficiently.

And the entire rig is matched to the operator. The DW21 has positive hydraulic follow-up steering system, making it as easy to steer as an automobile. Its 5-speed constant-mesh transmission saves time and energy for operators. They shift on the move without fumbling for the proper gear.

Now you can see the high-speed DW21 at work on your job. Just call your Caterpillar Dealer and name the date. He'll be happy to demonstrate.

Caterpillar Tractor Co., San Leandro, Cal.; Peoria, Ill., U.S.A.

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Archie Turnbull, excavation superintendents; **Ben L. Richards,** concrete superintendent, and **Roy Shriner,** master mechanic. **W. B. Rohan** is purchasing agent and office manager.

* * *

J. B. (Joe) Engle, superintendent for Dalke-Macco, is in charge of a $700,000 contract at Bakersfield, Calif., where the city has an eight-building project at Emerson Junior High School. **O. C. Conkey** is job engineer; **Pat Bradshaw** is general foreman, and **Rich Amoroso** is in charge of the office work.

* * *

Paul Stroope is directing the construction of an office building for San Diego Gas & Electric Co. in El Cajon, Calif. Nielsen Construction Co. is doing the $225,000 job. **John France** is foreman. **J. Kerr** represents S.D.G.&E. on the project.

* * *

Ed Shetsted is superintendent for F. E. Young Construction Co., which is constructing the $800,000 Escondido Union High School, Escondido, Calif. He is being assisted by Foremen **R. Gangwisch, W. A. Shetsted** and **H. R. Shetsted,** as well as **Nick Esparza,** labor foreman.

* * *

Chris Buestad is working for M & K Corporation and Fredrickson & Watson as superintendent of a $1,500,000 contract being executed by this joint venture for the State of California which has a building program under way at Sacramento. Among other key personnel are **Al Carlson,** carpenter foreman; **J. D. (Whitey) White,** concrete foreman; and **Jack Davis,** office manager. **H. Clay** is supervising for Soulé Steel Co., and **Ray Bonine** for Crebbe Electric. **G. D. Glenn** and **Gus Roth** are construction engineers representing the state.

* * *

Les A. Johnson is supervising a pier construction job at Tacoma, Wash., for Hart Construction Co., which recently secured the award from the Navy at $79,500. **J. H. Blair** is office manager. Work is at Pier 3, U. S. Naval Station.

* * *

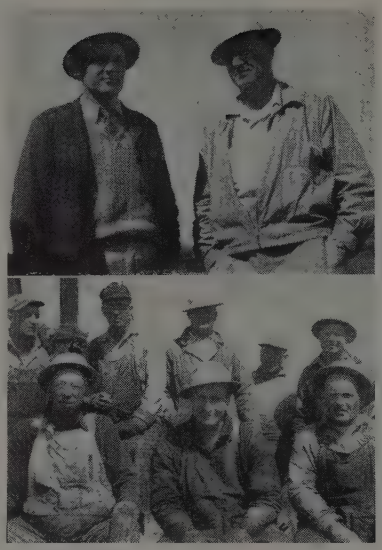
Bob Austin is in charge of concrete and road work being done by Cascade-Austin Co. at Umatilla, Ore., for the county. **William W. Simms** is acting as chief inspector for Tudor Engineering Co.

* * *

O. H. Rogers, assisted by **Harold M. Chute,** is superintending a tank erection job at Spokane, Wash., for Chicago Bridge & Iron Co., which is doing the work for Carter Oil Co.

* * *

Fred M. Kaiser, project manager, and **Axel O. Nordstrom,** general superintendent, head the crew of George A. Fuller Co., working on the Oceanarium at Palos Verdes, Calif., a $3,000,000 project being built for Marine Land of the Pa-



IN CHARGE of driving piles for Raymond Concrete Pile Co. on Antioch (Calif.) Bridge are (top) *Harry Luthin* (left) and *Carl Hartzell.* In pile crew (bottom) are (front from left) *Jim Tomlinson, Jeff Davis,* and *Tony Freitas,* foreman. In back row (from left) are *Frank Holt, S. O. Drennan, Al Martin, J. Mountney,* and *Joe Belue. "Carty" Freese,* another foreman, is not shown.

cific. Others among the key personnel are **Frank Friesen,** carpenter foreman, and **Elmer Leggett,** labor foreman. In the office, **C. S. Pherigo** is in charge; **R. L. (Bob) Carris** is accountant, and **R. B. Hancock** is timekeeper. In the employ of subcontractors on the job are **Connie Greeson,** steel foreman; and **L. D. VanOver,** grading superintendent.

* * *

Ottas Warren is supervising the construction of a nine-building city school project at Bakersfield for King Construction Co., who got this contract at a cost of about $600,000. **Charles Mullings** is carpenter foreman.

* * *

C. R. Tumblin of Tumblin Company is directing a $1,161,000 job for his firm consisting of a reinforced concrete stadium at the city college in Bakersfield, Calif. Carpenter foreman is **Joe Galvin.** Job is expected to run til the middle of March, 1955.

* * *

Max Eiden, project manager, and **Melvin Williams,** superintendent, are heading a $205,615 contract of Intermountain Company in Idaho. Job is for earthwork, steel pipe lines, pumping plant remodeling and a 140,000-gal. reservoir on the Dalton Gardens irrigation system.

* * *

W. W. Jones is project manager on a contract recently awarded to the chemical plants division of Blaw-Knox Co. for engineering and design of modifications to the chemical processing plant at the Atomic Energy Commission's National Reactor Testing Station, Idaho. The chemical processing plant is used in the reclamation of unburned uranium from used reactor fuel elements.

* * *

Arley Robinson is superintending the construction of a $1,500,000 four-story addition to the Bon Marche department store being erected by Bennett-Campbell, Inc., at Seattle, Wash.. Other key men on this contract are: **John Ferguson** and **George Hamner,** assistant superintendents; **Ted Bode,** foreman; **Dick Nefzger,** labor foreman; **B. G. Lampe,** engineer; **Bill Knapp,** clerk, and **A. W. Hall,** construction supervisor.

* * *

F. H. Brown, job superintendent, and **A. (Tony) Bruno,** job foreman, are supervising a highway job under the direction of **W. B. McMakin,** vice president and manager, and **G. V. Atkinson,** vice president of L. C. Smith Co., contractor who recently secured the contract at a cost of $504,481. Work consists of grading and surfacing 4 mi. of Sign Route 1, reinforced concrete bridge, San Mateo County, Calif.

* * *

T. E. Moore, project manager, has the assistance of **Jim Harris,** super-

intendent, and **"Woody" Nabors,** grading foreman, on a 5½-mi. grading and paving job on the Tucson-Florence highway, Ariz. Pioneer Constructors got this contract on a $287,000 bid, and have the following equipment on the job: 1 1½-cu. yd. Bucyrus dragline and 1 ¾-cu. yd. Bucyrus shovel; 2 No. 12 Cat bladers; 4 pneumatic rollers; 2 I-H tractors and 1 Pioneer crusher. Grading is finished and select material work is just about completed.

* * *

A. Hartwig is superintending the construction of a distribution building and supply center for Western Electric Co. and Pacific Telephone & Telegraph Co., in San Leandro, Calif. **Clarence Lindner** is field engineer, and **D. E. Peugh** and **S. E. Franc** are office engineers. This large contract, $4,500,000, is being carried out by Swinerton & Walberg.

* * *

"Eddie" Givens, superintendent, with the assistance of **George Parker,** is supervising a $240,000 contract of I. Givens Construction Co., covering 4.8 mi. of south entrance road to Grand Canyon National Park, Coconino County, Ariz. **A. T. (Sleepy) Aybal** is powder foreman and quarry superintendent.

* * *

Herb Studer, superintendent, **Floyd Ohlsen,** project engineer, and **L. C. Holloway,** office manager, comprise the top personnel on a paving job at Ladd AFB, Alaska. Peter Kiewit Sons' Co. is doing the work at a cost of $3,319,241.

* * *

Charles Luttrell, superintendent along with **Joe Donham,** grade foreman, and **G. L. Gibson,** bridge superintendent, is supervising a 6.5-mi. grading and paving job on U. S. 85, Springer-Colmor, New Mex. for Jack Adams, contractor who received the award on a $559,573 bid.

* * *

Tom Reilly is general superintendent for Goodfellow Bros., Inc., contractor who recently won the $445,545 contract for grading and surfacing 3.2 mi. of U.S. 10 from Pine Creek to Smelterville, Idaho. Reilly is being assisted by **Ed Cunningham,** project foreman, and **Lloyd Gadeberg,** chief mechanic.

* * *

Sidney McMullan is superintending the construction of a 10-story structural steel, brick-face building for the First Bank Building Corp. and First National Bank of Arizona, at Phoenix. **Ben F. Morey** is assistant superintendent on this $2,740,000 structure, contract for which is being executed by James Stewart Co.

* * *

Blaine P. Clyde, construction superintendent, assisted by **Ruel Jensen,** is directing the work of grading and paving 29.4 mi. on the Zion-Bryce Canyon National Park ap-

proach road and the Cedar-Long Valley forest highway in Utah for W. W. Clyde & Co., contractor on the $480,000 job.

* * *

Deward Stringham, grade foreman; **H. L. Norman,** structure foreman; **P. N. Ihrig,** master mechanic, and **William Engle,** crusher foreman, are top men working for Young & Smith Construction Co. on a $642,336 job consisting of 7.9 mi. of grading, Emory-Castle Rock, Utah.

* * *

James W. Kirwan is superintending a contract which recently went to J. N. Conley at a cost of $959,139 for widening to 4 lanes, grading and paving a 7.1-mi. stretch of U.S. 99 between Salmon Creek and Ridgefield Junction, Wash. **Ernest A. Ruoff** is office engineer. **Wayne W. Weien** is assisting on the job as foreman.

* * *

Larry Arpin, superintendent; **E. R. Hoffman,** engineer; **Gordon Elmore,** general foreman; and **Joe Valente,** master mechanic, are top men working for Vega Engineering & Grading Co. which is doing earthwork, clearing and structures for rehabilitation of drains, Unit BW-1, Middle Rio Grande Project, New Mex., a $187,801 contract.

* * *

Fred A. Singleton, is superintendent on Northwestern Engineering Co.'s $404,525 contract covering 8½ mi of stabilization and asphalt surfacing in Montezuma County, Colo. Job is expected to be finished in September, 1954.

* * *

Robert Ohran, San Jose, Calif., a bricklayer apprentice, recently won the annual nationwide apprentice brickmason competition sponsored by the Bricklayers, Masons & Plasterers International Union, in cooperation with the Structural Clay Products Institute. In addition to a first prize of $500, he was awarded a week's vacation at Coronado, Calif. **James Jameson,** Los Angeles, placed second and won $300. Third prize of $200 went to a Texan, **Billy Joe Hudson** of Dallas.

* * *

Robert Risk is project superintendent on Eaton & Smith's $897,090 contract for construction of 1,200 ft. of connections to the west end of San Francisco-Oakland Bay Bridge, Calif. **Frank Zimmerman** is superintendent on miscellaneous work, and **Paul Hantzsche** holds the master mechanic spot.

* * *

Harold Stanley is supervising a $150,000 job for F. L. Flynn & Co., which recently was awarded a contract for 385½-ft. steel and concrete overpass, N.P.R.R. tracks, Three Forks-Townsend road in Montana. Work will probably be finished the middle of November.

In addition to the job personnel previously mentioned in the April issue of the magazine as working on the $3,000,000 plant of the Grayson Controls Division being erected by Lindgren & Swinerton, Inc., at Long Beach, Calif., the following men also hold key spots: **Forrest E. Orr,** general carpenter superintendent and **Tony R. Perrotto,** general labor foreman. Working at the site for Quinton Engineering and Architects as field engineers are **Samuel Postil** and **John Shepherd.**

* * *

Kenneth Wright is general superintendent for G. E. Schilling, contractor on the $445,000 sewage disposal plant being constructed for the city of Sparks, Nev.

* * *

Andrew Cathey is superintendent for Eaton & Smith on a $193,442 contract for 3.1 mi. of grading and untreated rock surfacing on St. Hwy. 29-D, Tehama County, Calif. He is being assisted by **Jim Lewis,** labor foreman, and **Don Marin,** mechanic.

* * *

O. J. Brown is superintending a $472,920 contract recently awarded to J. A. Troxell covering access, tramway, tunnel and intake structures on the hydroelectric generating plant at Annette Island, Alaska. **L. A. Pederson** is outside foreman on the same job, **A. L. Osborn** is tunnel foreman, and **Cliff Peterson** is tunnel shift-boss.

* * *

Tom Benson and his assistant **Harry Gammelgard** are superintending a $1,670,000 high school

Tom Benson

project going up in Antioch, Calif., contract for which is held by Pacific Company. Other key men on the job are **Howard Veira** and **A. E. Chandler** on the carpenter end, and **George W. Reed** in charge of masonry.

SAFETY

Job accidents take their toll

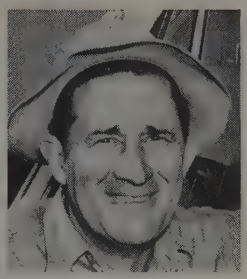
THESE were the accidents that resulted in death or serious injury on the West's construction jobs during the last reported month.

Kenneth Van Fleet, 44, was crushed to death April 16 when a road grader he was operating went out of control and plunged from an embankment near Ukiah, Calif.

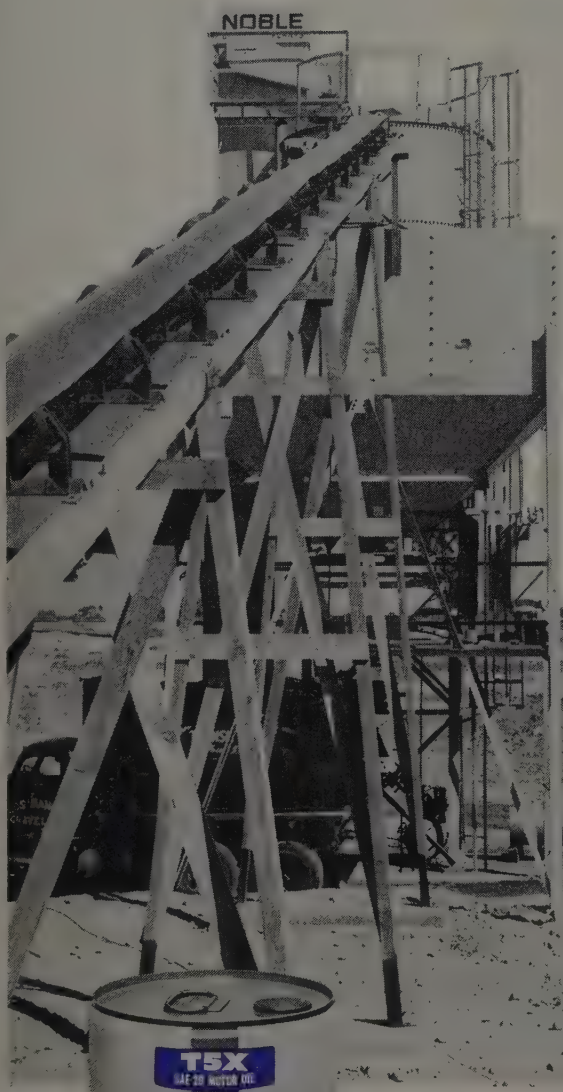
ACCIDENTAL DEATHS and serious injuries on the West's construction jobs are reported each month in the interest of safety-on-the-job.

H. R. McDonald, 21, a construction worker of Buhl, Idaho, was killed at Fallon, Nev., when he was crushed beneath an overturned dump truck. Injured in the same accident were **M. E. Frederick,** 39, and **Roland Herrier,** 56. The men were employed by Silver State Construction Co. on a road project on U.S. Highway 95.

"We believe T5X is the greatest contributing factor toward long motor life."



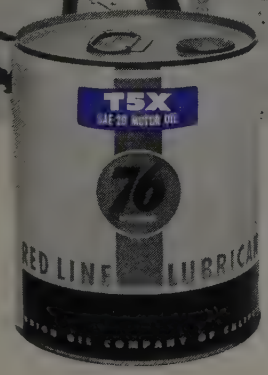
Frank Buffuna, Jr.
Los Banos Gravel Co.
Los Banos, California



"Union Oil products have lubricated our equipment since 1941 when our firm was founded. Today we're using T5X in everything... our mixers, dump trucks, loaders, shovel, dozer, a couple of pickups and several automobiles.

"Our seven Ford trucks average 200 miles daily with maximum loads under rugged, dusty conditions. We usually overhaul at 90,000 miles, but on occasion our engines have piled up as much as 120,000 miles without showing more than .004" cylinder wear. Considering our type of operation, this is truly remarkable. And although we change filters frequently and service our cleaners weekly, we believe T5X is the greatest contributing factor toward long motor life."

T5X is *finest by far* for your equipment, too! Call your Union Oil representative for the purple oil that cuts maintenance and replacement costs by giving greater engine protection under every operating condition.



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TRICKS of the TRADES

WANTED: A *good* way to finish concrete deck slabs

By P. C. LEONARD
Resident Engineer
Washington Department of Highways

ONE PROBLEM of highway construction has become increasingly difficult with the years. And that is securing a good riding surface on concrete structures. The width of these structures has increased until it is well nigh impossible to work out a method for finishing the deck slabs without everyone winding up wading around in wet concrete. This condition brings nothing but chaos and a very rough riding deck.

Excess stresses

Unnecessary roughness when encountered by 30 tons of truck and trailer traveling at high speed creates stresses in a structure far in excess of those it is designed for. Then too, the motorist who foots the bills is usually quite narrow minded about rough decks. This problem, like the weather, has been widely discussed with no one doing anything about it. This article is our feeble attempt to arouse some interest in a solution.

The first road grader was a timber held in a diagonal position and dragged back and forth along the road. As long as the roads were mud at about the consistency of today's wet concrete, this timber did a perfect job of leveling and smoothing! Of course, when surfacing was introduced the timber no longer sufficed. It had to have more weight and cutting edge.

Among modern tools adapted from the old-time drag is the diagonal float, as used by the Johnson float finisher for concrete pavements. A concrete pavement that has been floated back and forth by means of a diagonal float will have a riding surface far superior to pavement finished by hand or other method. The Johnson machine is excellent for work where you have a fixed width and lots of length to work on. The longer the diagonal float used, the longer the imperfections it will correct. But at the same time, the longer the float, the greater distance through which it must be dragged to make its corrections in the surface.

Compromise needed

This unlimited distance is something that just doesn't ordinarily happen on a bridge deck. Neither, in today's structures, is there a fixed width. So, there must be a compromise to fit conditions. But it is no compromise to build finishing bridges. If these are made long enough to reach from curb to curb, they are too difficult to move back and forth and too high off the concrete to work from effectually. The best solution to this finishing problem—where width of section is variable—is a new type of finishing machine. A machine capable of taking a lumpy, swaybacked slab [See box.—Ed.] and reshaping it to a perfect riding surface. A machine capable of supporting itself on fresh concrete and automatically cutting off the high places and filling in the low places.

Now, don't go away! There are several types of finishing machines already on the market. They are much too cumbersome, and they are not readily adaptable to roadways of varying widths. We are quite familiar with them, and we are tempted to believe we have something better!

This figment of our imagination is quite small and light. Varying widths of roadway are of no consequence because it levels on the same principle as a road grader. However, instead of blading gravel back and forth, this machine works up a mortar and blades it back and forth until a smooth riding surface is achieved.

Mechanical monstrosity

When we first conceived this revolutionary mechanical monstrosity, our first impulse was to rush right out and get a patent. The next reaction was to view anyone with suspicion that took a polite interest in our idea. No doubt about it—they were trying to steal it from us! However, there soon came a saner moment when we realized that we really had all the work we could do building highways during the week and sanding, painting, and sailing a boat on week-ends. What can we lose by giving an idea away!

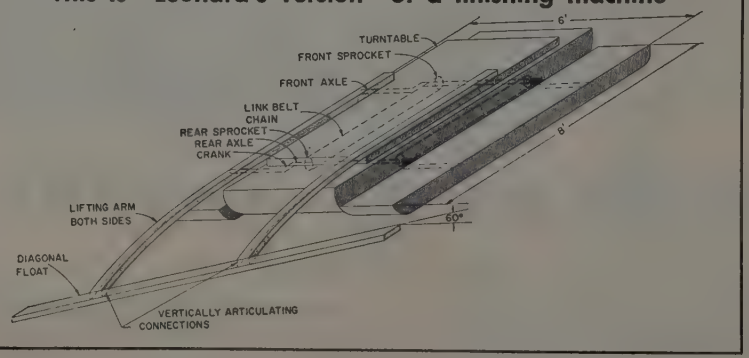
The accompanying sketch shows that the basic idea is a tractor with a walking motion similar to a big Bucyrus Monighan. This walking tamping motion not only furnishes motive power for the following float or blade, but it tends to push the rock down and to work a mortar to the surface. And this mortar is readily distributed back and forth across the slab by means of the float.

Burlap finishing piece

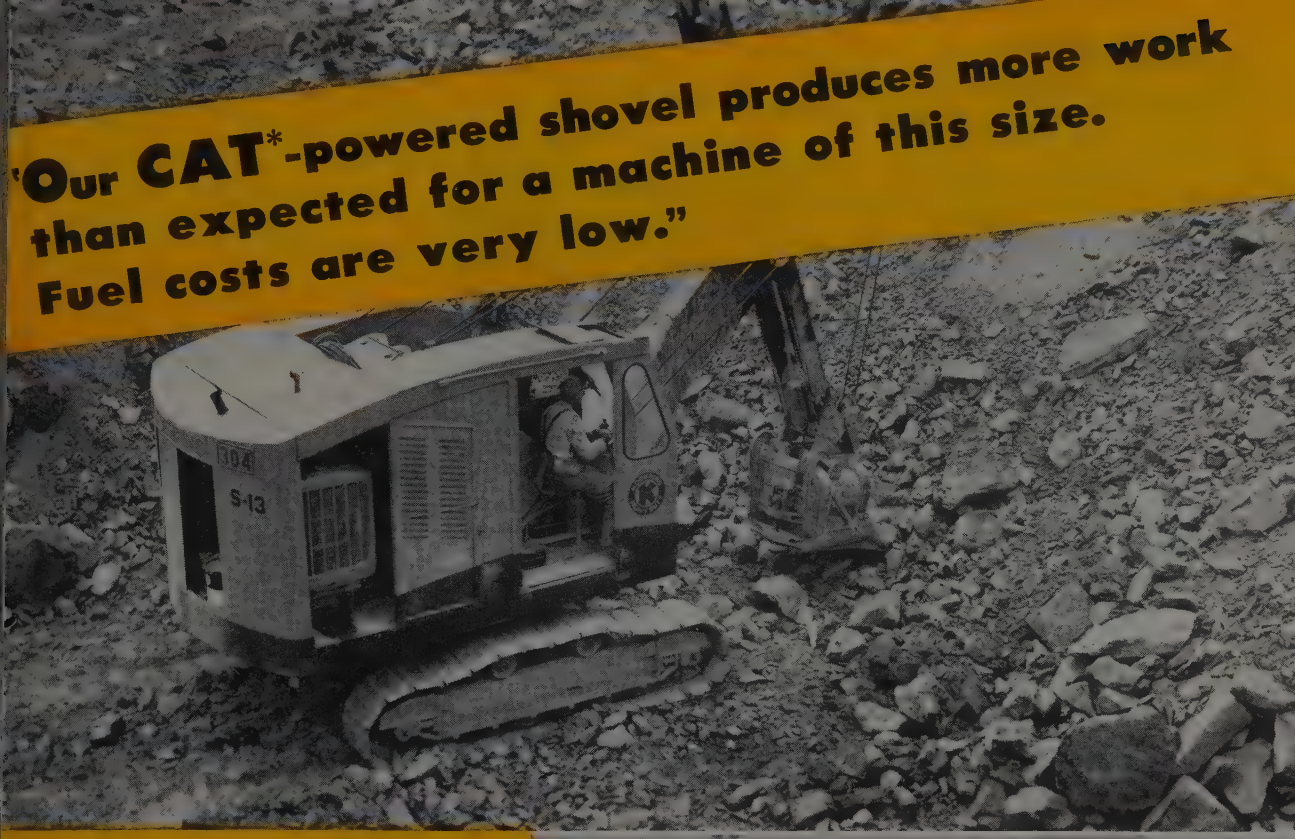
The float is attached to the tractor by two arms. The joint between the float and the arms is vertically articulated so that vertical tractor motion is not transmitted to the float. Behind the float should be a piece of burlap (not shown) to eliminate any small diagonal lines in the surface induced by forward motion of the tractor.

The machine is manually operated and power-driven, with drive chain passing around sprockets on the driveshafts fore and aft. A crank radius of about 2 in. seems sufficient to walk the machine along. The float

This is "Leonard's version" of a finishing machine



"Our CAT*-powered shovel produces more work than expected for a machine of this size. Fuel costs are very low."



Left to right:
Superintendent C. R. Webb and President Duffy E. Reed,
Duffy Reed Constr. Co., Twin Falls, Idaho.

THIS Koehring ¾-yard shovel, powered by a Cat D318 Engine, is excavating pit run gravel for use on relocation of U.S. 93, fifty miles south of Twin Falls. Working under dusty conditions at a 5100-foot altitude, this unit averages 1700 cubic yards production per eight-hour day.

Another Caterpillar Diesel, a 15-year-old D17000, powers a crusher that puts out 1200 tons of ¾-inch minus a day. You've seen the comment on the D318. Here's one on the D17000. "This engine has operated more than 40,000 hours with a minimum of ordinary repair costs. When flood waters and river silt filled it, it was rebuilt—and it's still going strong."

Besides these engines, Duffy Reed Constr. Co. relies on a fleet of other Caterpillar units for profitable production. The line-up: six D8 Tractors, a D6 Tractor, three No. 12 Motor Graders and another D318 Engine.

Standardizing like this on rugged yellow equipment pays off many ways. For example, many parts are interchangeable—you don't have to carry a large inventory. Operators and mechanics become familiar with one make. Result: operators get more work out of the rigs. Mechanics spend less time on maintenance. What's more, all units use low-cost No. 2 furnace oil without fouling—a big saving. And there's also considerable saving in prompt, one-stop service on the job from one dealer—your Caterpillar Dealer.

Ask him to *show* you why standardizing on Caterpillar means bigger production, fewer headaches and greater profit for you. It won't take long—he has the *facts!*

Caterpillar Tractor Co., San Leandro, Cal.; Peoria, Ill., U. S. A.

CATERPILLAR*

*Both Cat and Caterpillar are registered trademarks—®

A WORD TO THE WISE— STANDARDIZE!

Who is P. C. Leonard?

PETE LEONARD has been pushing structural work for the Washington Department of Highways for several years. Judging from his writings, he "pushes" with a needle-like wit as much as with anything else. Currently he is a resident engineer assigned to District I (Seattle), where he has been in on the building of many major concrete structures—Lake Washington bridge, Alaskan Way viaduct, and Battery Street subway. The accompanying discussion of methods and machinery for finishing concrete deck slabs on highway structures was prompted by many years of first-hand observation of how a bridge is built. Here's the way Leonard puts it:

P. C. Leonard

Start at bottom

"Let us start at the bottom and see what takes place as a reinforced concrete bridge is constructed. We very carefully construct an adequate footing at each end of a span, upon which we erect columns which are also adequate. With the addition of the crossbeam here, we are up to the bottom of the deck at each end of our bridge with support that is substantial. It cannot deflect, or settle, or change in any way when the deck load is applied.

"As a rule we drive several bents of falsework piles, upon which we place conventional caps. Then we probably go on up with posts, which we cap again. Then come the stringers, which reach from cap to cap and form the foundation for our girders and crossbeams. Between girders we come up with smaller posts and caps which support the deck slab between girders. We then pour the girders and crossbeams, giving our falsework about 50% of the total load it is to carry.

"So far, so good. Following the deck reinforcing come the screeds, which are the guides for striking off the concrete to what we calculate ourselves into thinking is the desired grade!

"What do we mean by calculating ourselves into a line of thought? Here's how it works! First, the designer calculates the grade for his structure, which is the perfect riding surface we seek. To this he adds something for camber, which is okay (a sway-backed bridge would be a horror to behold).

"Next, the bridge department sends a memo to the boys in the field to allow a certain amount for 'anticipated deflection.' Next the instrument man adds 1/16 in. for take-up between pile and cap, and another 1/16 in. for between post and cap, and so on until he gets up to the deck. This totals up to 3/4 in. or more. This figure is carefully added to the screed grades everywhere, except over the bents at each end of the span!

Blood-shot eyes

"Then the resident engineer comes along with his blood-shot eyes and know-it-all attitude and insists on adding a little bit more to the middle of each falsework span to allow for what he thinks will be additional deflection. (At first we thought this last bit was the result of years of experience, but later we realized that he does this just to throw his weight around.) A good way to counteract this last move is to hurt the resident's feelings on the morning of the day you are to set screeds. He will then sit in the office all day and pout!

"This will give you a free hand to apply all of the above-mentioned values and come up with a grade line comparable to the outboard profile of a pretzel. The irony of the thing is that the deck, with utter disregard for all this elaborate arithmetic, usually assumes a shape all its own. The only part of the slab that arrives at the right elevation is the road angles at each end, which are directly over the bents. These cannot settle! And now it is up to the finishers to beat the thing back into shape, with no place to stand, and with such long-handled tools that their efforts are almost ineffectual."

assembly is full revolving. At the end of a pass along a slab, it would be necessary to raise the float arms, swing 180 deg., and set the float down again. These motions could be accomplished by means of a lever, ratchet and turntable.

Dimensions are only approximate. They should be computed so that the whole rig amounts to a load of about 25 lb. per sq. ft. This would permit working the thing on 4-in. slump concrete. As an example, we have a tractor width of 6 ft. The float should project at least 6 in. beyond the tractor to wipe up any irregularities left by the machine itself. The float, lying at a 60-deg. angle, would be 14 ft. long, which would do a very excellent job indeed.

A machine of this type would not depend on ribbons or screeds for guidance. Therefore, it would not be limited to a specific width. Variable roadway widths would be duck soup, since it would float a 7-ft. strip in one pass, with overlap adjusted to take care of any total dimension. The machine would work admirably on traffic interchanges, city streets, and all paving jobs too small or varied in width to be adaptable to the Johnson machine.

The diagonal float is something that has been thoroughly tried out. It is the best known method for obtaining a smooth riding surface on concrete. The only thing revolutionary about this idea is the means of pulling it by walking action. Well, there you are, boys! How about some of you equipment designers kicking this idea around a bit?

Dry chemical recommended to avoid oil deposit fires

CUTTING OILY steel plates can be hazardous because flames from the cutting torch often heat the oil deposits to the ignition temperature quickly, causing fires.

One way to avoid such fires, say engineers of the Ansul Chemical Co., producer of dry chemical fire equipment, is to spread a thin layer of dry chemical over the area to be cut. By doing this, the flames are extinguished before they can get started and production remains uninterrupted.

loads, adds to life of shovels, cranes, and draglines

Cummins Torque Converter Packages give smooth steady power over the entire digging or working cycle. Even where digging is the toughest and power requirements fluctuate widely, the Cummins Torque Converter maintains power without lugging, stalling or overspeeding. Crane work, too, can be speeded because loads can be handled more smoothly and accurately.

The output of the Cummins Torque Converter Package is measured by an output shaft governor which determines the exact amount of power required each instant and automatically matches engine speed to load requirements. This increases work capacity, adds to equipment life, saves fuel and engine wear.

Cummins Diesels, ranging from 60 to 600 h.p., equipped with one of many types of torque converters, can match any job you have. Available as replacement units or in many makes of new equipment.

C208

CUMMINS **Cummins** Engine Company, Inc.
Columbus, Indiana

Rugged diesel power (60-600 h.p.)

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Authorized Sales & Service: MISSOULA—Taber's Truck Stop.

PORTLAND: Cummins Diesel Sales of Oregon, Inc.
Branches: EUGENE; BAKER; COQUILLE; GRANTS PASS; PENDLETON.

SAN FRANCISCO: Watson & Meehan
Branches: FRESNO; REDDING.
Authorized Sales & Service: STOCKTON—Stockton Fuel Pump & Injector Service; SACRAMENTO—Frank J. Coyle; EUREKA—Fred E. Barnett; RENO—Nevada Transit Company.

LOS ANGELES: Cummins Service & Sales (4-9-54)
Branch: BAKERSFIELD. *Authorized Sales & Service:* BISHOP—Inyo Diesel Service; INDIO—Crow Motor Company; BLYTHE—Leo's Diesel Service; COLTON—Smith's Diesel Sales; EL CENTRO—Rhyne's Automotive Service; SAN LUIS OBISPO—San Luis Truck Service; SAN DIEGO—F. R. Laux Diesel Service; SANTA MARIA—Hanson Equipment Co.; BAKER—Newton Automotive Service.

PHOENIX: Cummins & Moran
Authorized Sales & Service: YUMA—Cooper Tractor Service; LAS VEGAS—Stirling Diesel Service.

DENVER: Cummins Diesel Sales of Colorado, Inc.
Branch: CASPER. *Authorized Sales & Service:* DURANGO — La Plata Repair Shop; CORTEZ—Cortez Diesel Sales; SCOTTSBLUFF—Western Motor Truck Company.

Controlled tests demonstrate new joint-sealing process

A SIMPLER and more effective way of securing tightly sealed, flexible joints in large-diameter concrete pipe lines under moderate head pressures, was demonstrated at the Graystone Concrete Products Co. plant in Seattle in a series of carefully controlled operating tests observed by officials of the City Engineering Department.

Featured in the tests were two sections of 84-in. pipe of specially engineered tongue and groove design, in combination with a newly developed, full compression Tylox Rubber Gasket, manufactured by Hamilton Kent Manufacturing Co.

The tests were designed to stimulate actual field conditions in determining the approximate maximum operating pressures under which an effective seal could be maintained, with the test section joint placed in various straight and canted positions. The test was conducted with a maximum 34-ft. water head which exerted a pressure in excess of 75,000 lb. on the end plugs.

"The successful results of this test amply demonstrated the fact that tightly-sealed, flexible joints can now be secured in large-diameter pipelines as readily as in smaller pipe," R. E. Kramer, Graystone pipe department sales manager, said.

The new pipe and gasket combination was developed over a two-year period as a cooperative project by Graystone and Hamilton Kent engineers. The gaskets are already in extensive use in the Northwest on concrete pipe lines from 8- to 42-in. diameters, Kramer explained.

Compound protects threads against welding heat

A HIGH TEMPERATURE thread compound that protects against the welding action of threaded connections subjected to prolonged exposure to extreme heat has been developed by Crane Packing Co. Known as "Thred-Gard," it is said to eliminate seizing and galling at high operating temperatures.

The compound is non-hardening and acts as a lubricant to allow easy disassembly of threaded connections, even after lengthy service under the severe conditions. Not only is dismantling time greatly reduced, but damage to stud, bolt, pipe joint and plug threads is prevented thus permitting their re-use.

By reducing wrench torque, the compound allows fittings to be drawn up to a greater degree of tightness without undue stress or strain. It acts as a protective coating to keep threaded surfaces smooth and insure pressure-tight, metal to metal contact.

TOOLS of the TRADES

Use the coupon on page 153 for free information on any of these items

1

CAT MAINTENANCE GUIDE—A 24-page, four-color, cartoon-style booklet (Form No. D411) on the maintenance of earth moving equipment has been published by **Caterpillar Tractor Co.** It describes a visit to a typical earthmoving contractor in which service specialists tell how to care for bulldozers, cable and hydraulic controls, pipe layers, rippers, scrapers, shovels, and wagons. Fine points of adjustment and lubrication are explained in more than 90 drawings. This easy-to-understand booklet is highly recommended, for beginning maintenance men especially.

2

A CATALYTIC MUFFLER that reduces noxious and irritating components of 4-cycle diesel engine exhausts has been developed by **Oxy-Catalyst, Inc.** Called the Dieseler, it attaches directly to the engine exhaust manifold and burns the carbon monoxide and hydrocarbon fumes in exhaust gases by catalytic action. This process eliminates much of the heavy smoke and strong odor emitted by diesel engines, and should permit more widespread use of 4-cycle diesel equipment underground or in closed plant areas.

3

A NEW LINE of carbide-tipped, hammer-core bits bearing core slots and having extension shanks for any depth hole has been announced by **Tilden Tool Manufacturing Co.** Speed of drilling is furnished by multiple carbides set in the perimeter of the hammer body. This results in rapid penetration of extremely hard materials, double hammer capacity, and lower cost per hole.

4

A SIMPLE METHOD for reducing losses due to wear and tear on friction surfaces of many types of machines is claimed for Cop-Sil-Loy, a compound which combines an alloy of copper, silver, and lead. It does not melt under temperatures up to 1,250 deg. F and sustains friction up to 900 deg. F. It conducts heat as fast as copper, lubricates as well as lead, but does not deteriorate like these metals. This compound increases the friction surfaces of the braking portion of a machine 50% by filling in the pits and pores in the drum and lining surfaces. Extended tests have indicated that losses due to failure of present friction materials can now be reduced by 90%. Manufactured by **Cop-Sil-Loy, Inc.**

5

A WALER SUPPORT that fits over any 2 x 4 upright stud has been announced by **Conver Steel & Wire Corp.** as a form accessory. It serves as a shell for horizontal walers and prevents downward thrusts on tie rods that pass through wall forms. These supports may be placed as near or as far apart as wall thickness and other conditions dictate. Another advantage is that they will support the weight of workmen who stand on the walers without permitting any distortion or injury to wedges, spreaders, or tie rods.

6

HELPFUL HINTS on the use and care of hydraulic pulling tools may be found in a new **Owatonna Tool Co.** folder. It is a composite of articles which have appeared in magazines. Fully illustrated, it is actually a thumbnail manual on hydraulic pulling. Recommended reading for every maintenance shop.

7

JT50 CONCRETE GRINDER—**Stow Manufacturing Co.** is making a new concrete grinder which has a ½-in. flexible shaft 8 to 12 ft. long to connect the motor to the anglehead. It is powered by a ¾-hp. motor at 3,400 rpm. Either wet or dry angleheads may be used. The wet angleheads have an attachment for water tubes so that water in iniected through the center of the spindle and comes out in the middle of the grinding wheel. Since wet grinding requires lower speeds, angleheads are available in ratios of 5:1, 8:1. 10:1, and 18:1. Other attachments are available. Ask for Bulletin 526.

8

PORTABLE METAL BAND SAW—A completely portable, electric, metal-cutting band saw, Model 524 Porta-Band Saw, has been introduced by **Porter Cable Machine Co.** Weighing only 16 lb., it is said to be the only metal-cutting saw ever made that is fast and light enough to be used free-hand in any position. Dimensions are 7½ in high, 7½ in. wide and 19½ in. long. Band speed is 240 surface ft. per min. under load.

9

HARD-SURFACING MANUAL—**Victor Equipment Co.** has published a 45-page, loose-leaf manual containing information on how to rebuild parts and prolong service life with hard-surfacing. It contains information as to type of alloy to use, preparation, and welding and finishing procedures in 126 illustrations and text.

NEW LITERATURE

Free copies of any of the items in this section may be obtained by using coupon on page 153.

10

"Nine Profitable Minutes for Contractors"

A 16-page, color, illustrated booklet entitled "Nine Profitable Minutes for Contractors" has been published by **Hyster Co.** as a key to how contractors can increase productivity of new or used tractors by adding the right attachment. It contains many time and cost-saving ideas taken from actual experience. On-the-scene action photos show tractors and attachments working in different construction operations. Ask for Form No. 1305 when sending for this booklet, which contains many ideas on what to do in unusual situations.

11

"Flex-Plane Finishing Machines"

This is the title of a 16-page booklet published by **The Flexible Road Joint Machine Co.** (Bulletin P-111) which describes the company's line of portable finishing machines for highway, airport, municipal, and special concrete slab finishing. It contains specifications, photographs, and descriptions of various types of the machines in action on the job, close-up pictures of various attachments, drawings and a special photograph pointing out the special advantages of this particular machine.

12

Ready-mix concrete service

The White Motor Co. has published a 6-page, color folder entitled "Facts that Will Increase Operating Efficiency and Transportation of Ready-Mix Concrete." The folder contains photographs and drawings of White six-wheelers and sets forth the advantages claimed by the mnufacturer of this product.

13

Bethlehem's Mayari R

"Mayari R—Bethlehem's High-Strength Corrosion-Resisting Steel" is the title of a 6-page illustrated booklet published by **Bethlehem Pacific Coast Steel Corp.** The booklet describes this low-alloy steel in a variety of situations. It contains many tables and charts showing properties in comparison with other steels and wrought iron. Other charts show its resistance to corrosion in comparison with other steels, its workability, and various cold-formed shapes. Recommended applications, illustrated by photographs, show this steel in action on construction projects.

14

'Calcium Chloride in Concrete'

A 40-page manual entitled "Calcium Chloride in Concrete" has been published by **Calcium Chloride Institute.** It is a ready reference to quantitative data and includes about 20 charts and 40 illustrations referring to the various aspects of calcium chloride as used in modern concrete construction. The four separate parts of the manual include data on initial and final set, early strength, ultimate strength, integral curing, workability in density, resistance to surface wear, cold-weather protection, air-entrained concrete, and high early strength cement. Ask for Manual M-1 when sending for this.

15

"Armco Liner Plate"

A new 24-page manual entitled "Armco Liner Plate" has been published by **Armco Drainage & Metal Products, Inc.** It contains data on joint tests, compression tests, strength and weight properties, gages, plate arrangement, and other useful information including photographs of many typical applications. A complete data section contains recommendations on what type of material to use in different situations as well as specification charts and tables. Many of the photographs illustrate various recommended uses.

16

Continuous mix bituminous plant

An 8-page folder in color has been published by **Pioneer Engineering Works, Inc.,** to describe its new medium-size Model 81 continuous mix bituminous plant. The catalog, called Bulletin No. 653, unfolds into a 6-page cutaway view of one of these plants with each vital part explained by a lead-in number or letter. Other photographs show close-ups of various parts.

17

Welded steel pipe

An 18-page booklet on the manufacture of welded steel pipe has been written by Richard Aubrey, a metallurgical engineer with **Kaiser Steel Corp.** It consists of descriptions of three methods of making the pipe. They are continuous furnace weld process, electric resistance weld process, and submerged arc welded pipe. Booklet contains a number of photographs illustrating the processes in the mills and several macrographs illustrating the processes in the mills and several macrographs illustrating the various types of welds described at a magnification of 100 times.

18

Onan technical bulletin

D. W. Onan & Sons, Inc. has issued a technical bulletin about the installation of emergency stand-by electrical generating plants with automatic line transfer controls intended for the man who knows very little about the subject. This 16-page booklet contains simple formulae to determine the amperage of a given plant, supplemental tables for the same purpose, drawings of various plants with each important part indicated by words, simple wiring diagrams, and lots of explanation as to how, where, and why to use these stand-by plants.

19

Cleveland Model 190 backfiller

A 6-page folder on the Model 190 backfiller has been published by **The Cleveland Trencher Co.** It unfolds into a 3-page picture of this machine with each vital part clearly defined. Ask for Bulletin No. S-118.

20

Heating pipelines

An 8-page, color bulletin on heating pipelines has been published by **General Electric Co.** It contains photographs and drawings showing

pipelines being heated with electric heaters, directions on how to install heaters, and formulae and charts showing how to calculate heating requirements.

21

Road joint devices

Information covering a full range of road joint devices for concrete highways and air strips has been gathered together and published in a comprehensive bulletin by **Richmond Screw Anchor Co., Inc.** It describes such devices as light-weight dowel baskets, heavy type dowel supports and spacers, and the new short dowel, one-man type of load transfer assembly which is available with stainless steel dowels for special application.

22

Paving breakers and air tools

Two new bulletins describing the latest models of paving breakers and air tools for construction and plant maintenance work have been published by **Gardner-Denver Co.** Bulletin PB1 gives the features and specifications of heavy-duty, medium-weight and lightweight paving breakers. It also describes the sheeting driver, pin driver, spike driver attachments, and other tools for use with these paving breakers. Bulletin ST-100 describes and gives the specifications for clay spaders, trench diggers, and single pad and triplex backfill tampers. Ref. No. 820.

23

Asphalts, paving and liquid

A 32-page booklet of specifications, tables, and uses of paving and liquid asphalts has been published by **The Asphalt Institute.** It is loaded with tables of specifications of different types of asphalts, recommended use, loading temperatures, and average weights and volumes of asphaltic materials.

24

High-strength bolts

An 8-page, color booklet describing structural steel bolting with high-strength bolts has been published by the **U.S. Steel Supply Division, United States Steel Corp.** It contains specification tables, a discussion on why high-strength structural bolting makes better joints, bolts versus rivets, how bolted structural joints are designed and fabricated, advantages of high-strength bolting, diagrams showing the bolts in operation, and tables of mechanical requirements, tension, and torque values.

25

Lorain Moto-Cranes

A two-color, 20-page descriptive catalog featuring Lorain Moto-Cranes and self-propelled cranes of the 524 series has been published by **The Thew Shovel Co.** It contains many photographs of these cranes in action on construction projects and close-up views of the various vital parts of the machinery and accessories.

26

Cutting costs

Cutting the costs of handling construction materials is the theme of a 4-page color brochure published by **The Prime-Mover Co.** Illustrated with action photographs, it describes how Prime Mover power wheelbarrows are used to haul construction materials on a number of projects. A specification sheet includes schematic diagrams of the barrow with each vital part explained.

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NEW EQUIPMENT

More information on any of the items in this section may be obtained by using coupon on page 153.

27

Portable dust collectors designed "on-the-square"

A newly-engineered line of portable dust collector units, designed to provide peak efficiency in dust collection for all sizes of asphalt plants, has been announced by **Madsen Iron Works, Inc.** Three models are avail-

able. Model 160 is designed for use with 1,000-lb. plants and the Madsen 2,000-lb. special asphalt plant. Model 280, a two-cyclone unit, is designed for use with 2,000 and 3,000-lb. asphalt plants. Model 380, a three-cyclone unit, is designed for 4,000-lb. plants.

Each unit is mounted on a base frame wide enough to receive a standard trailer axle, vacuum or air brakes, and pneumatic-tired wheels. Model 280 and 380 front ends are goosenecked for transport by truck tractor or dolly with drawbar.

An outstanding feature of these units is the "on-the-square" design, whereby about 90% of the surface of the unit, including the cyclone, air ducts, and piping, can be replaced with flat steel plate when repairs and maintenance work are necessary. The square cyclones are lower in overall height than conventional cylindrical-type units; therefore, they may be repaired and painted readily. The 8-ft. cyclone units are spaced 12 in. apart to provide easy access to the adjacent sides for maintenance work. The duct work is arranged in parallel so that each cyclone receives a proportionate share of the air volume load.

An additional wet scrubber unit, called the Madsen Tripple Wet Tube Dust Washer, may be added for the purpose of dust abatement and air washing of asphalt plant dryer exhaust to meet air pollution requirements.

28

Versatile hydraulic unit accommodates 11 separate attachments

A new hydraulically-operated unit, known as the Davis Pit-Bull, has been announced by **Mid-Western Industries, Inc.** The unit, which fits all Ford or Ferguson tractors, has 11 attachments available.

The attachments include a ⅝-cu. yd. bucket, a backhoe that digs 10½ ft., a trencher with a digging depth of 5 ft., and an 8-ft. rotary broom with a 60-in. operating arc for sweeping at angles, a 72-in. dozer blade, a swinging crane, a 45-in. roller with a rating of 100 psi., a rotary mower which pivots 180 deg. for side mowing, a 2,500-lb. capacity liftfork, a 350-lb. hammer, and a 5-ft. auger. An operator's cab is available as an accessory. This unit has four speeds in each direction.

The machine was designed as a special answer to the high-inventory equipment problem in the construction field. A supply of quick couplers on hydraulic hose connections aids a quick changeover from one attachment to another. Literature available.

29

Rear-dump trailer-tractor team hauls 33 cu. yd. of material

A new rear-dump trailer, the PR21, has been announced by **Athey Products Corp.** It will team up with the Caterpillar DW21 tractor in a combination that can haul 33 cu. yd. of any material at speeds ranging from 2.16 to 20 mph. Features of the new trailer include an open-mouthed body that makes an easy target for overhead loading devices, low overall loading height tapering from 9 ft. 5 in. at the front to 6 ft. ½ in. at the rear, and a body made of ⅝-in. high-strength steel.

The trailer has an all-welded, frameless design. Its tread is 123 in., which provides additional stability for

high-speed hauling. Drawbar and draft connection are welded, one-piece construction. Two 3-stage, hydraulic hoists lift the body to a 60-deg. angle to spill the load. Power is provided by a 55-gpm. hydraulic unit mounted on the rear of the tractor. Lip of the trailer's body extends well to the rear of the tires to throw the load away from the wheels and over banks. The 19-ft. 11-in. wheelbase shortens to 13 ft. 4 in. in the dumping position. A cable prevents the body from tipping beyond safe limits and protects the hoists from damage. Body height at extreme dumping angle is 19 ft. 1 in.

The PR21 weighs 33,000 lb. and carries twice its weight in payload. The PR21-DW21 team, which weighs 57,250 lb., has proved useful in testing where narrow turning limits are encountered and where rock and other bulky material must be hauled.

30

Design improvements announced for Sierra Loader

Seven improvements on the Sierra Loader designed to boost output, increase belt life, and reduce maintenance costs have been announced by **C & D Manufacturing Co.** Included are a larger diameter (50 in.) disc plow carried on a redesigned, heavier plow beam; a new hypoid-type head pulley gear box to eliminate shock

load damage; heavier drive line construction, use of double-row sealed spherical roller tail pulley bearings; belt speed of 575 ft. per min.; and dirt-tight sealed bearings on the carrier rolls.

Optional equipment available is a side bar cutting attachment for blending stratified borrow pit material as it is loaded. The moldboard will cut 6 ft. while the disc takes its normal 2-ft. cut, giving a total cut of 8 ft. A single large crawler tractor will handle this unit.

31

Impact breaker uses triple-action reduction principle

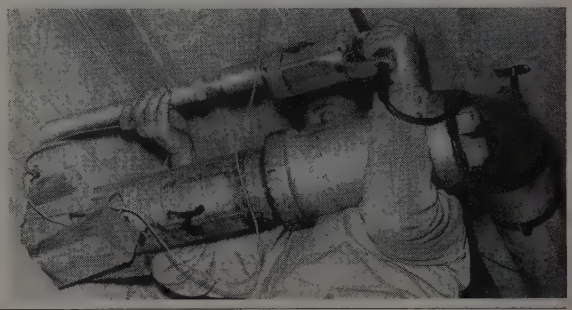
The Contractor & Construction Equipment Division of **Kennedy-Van Saun Manufacturing & Engineering Corp.** has introduced a new unit, called the Kennedy Cuber Senior, for impact breaking of stone and minerals. It is a dual rotor, up-running unit using multi-stage, triple-action reduction principle for both primary and secondary breaking of non-abrasive stone. It is designed for either stationary or portable use in open or closed circuit operation.

The unit will handle any quarry rock freely passing the 36 by 48-in. feed opening and, in many types of rock, can be operated in a closed circuit to produce 100% passing 1 in. Maximum capacities of the unit, known as Model 3648, in average limestone are up to 350 tons per hr. of minus 3 in., up to 275 tons of minus 2 in., and up to 150 tons of minus 1 in. Ask for Bulletin D-3648 for more information.

32

Portable electric hammers have tungsten carbide points

Lovequist Engineering Co. announces a new Demo line of portable electric rotating hammers and oscillating core drills. The tools, which operate at 2,500 rpm. and strike 10,000 blows per min., have bits with tungsten carbide points ranging in size from ¼ to ½ in., graduated in ⅛ sizes. This tool is reported to drill faster and make better holes, particularly in the angular and hard to get to places, than other tools of comparable size and capacity.



33

Backhoe designed for tractor use

Ottawa Steel Products, Inc. announces availability of a heavy-duty backhoe especially designed for use

with crawler tractors. It reaches about 15 ft, and will dig to depths of more than 5 ft. Shipping weight of the unit, with 18-in. bucket, is about 3,000 lb. Other bucket sizes are also available. Descriptive literature available on request.

34

Break-open stud setter

Powder Power Tool Corp. announces its new model Drive-it "410" which drives hardened steel pins in steel or concrete at the rate of 5 to 8 a minute with no prepara-

tion or drilling necessary. Safety features are that it cannot be fired away from work surface, nor at any dangerous angle, nor with one hand. Anti-recoil safety pads keep it close to work surface for protection of operator. It is completely portable without cords or hoses. A lighter unit, Model 320, may be used for smaller settings. Catalog sheets on both models are available.

35

Improved concrete-finishing machine

Model B-1 concrete floating-finishing machine has been announced by **Whiteman Manufacturing Co.** as an improved model. Ball thrust bearings have been added at the top and bottom of the handle, making trowel adjustment easier with the

machine in motion. Other new improvements include a safety switch on the handle which shuts the finisher off automatically when the operator releases the grip, a rubber collar to protect trowel adjustment arms from concrete, and snap-on float trowels. Powered by a 4-cycle gas engine.

36

Bottom dump spreader wagon

Pettibone Wood Manufacturing Co. has announced a bottom dump wagon which spreads transversely across the road to any desired depth or thickness of spread. Capacity of the wagon, which can be towed by an ordinary truck tractor having dual tandem drive, is 13 cu. yd. Advantage claimed for transverse spreading, as opposed to the ordinary longitudinal spreading, is the saving of at least one spreading operation and also more accurate control of material.

37

Field curing of concrete test cylinders

E. W. Zimmerman has developed the Acme Curing Can, which provides controlled humidity and temperature for field curing of concrete test cylinders. The bottom of the can has a flowed-in gasket to insure a complete seal when the top is in place. Most important part of the can is the specially-designed liner, which has a K factor of .4 in dry form. This liner permits an absorption of from 2 to 4 quarts of water with a 60% retention at 7 days. This can is sold in sets of 6 for $5.50 a set. Descriptive literature available on request.

38

New principle for crushing rock

The Latture Roto-Crusher, manufactured by **Waldrip Engineering Co.**, embodies a new principle for crushing rock. It features a pair of rotors, one concave and the other convex, each of which is corugated axially. The rotors move in opposite directions, timed so that the corrugations are in constant mesh. Thus rock is forced through the rotors at their peripheral speed, increasing the capacity of the crusher. Spacing between the rotors varies from ⅜ to 6 in. through use of a hydraulic system. Capacity of the crusher has been found to be 140 tons per hr. of ¾-in. minus material with an approximate reduction of 4:1.

39

Two safety devices

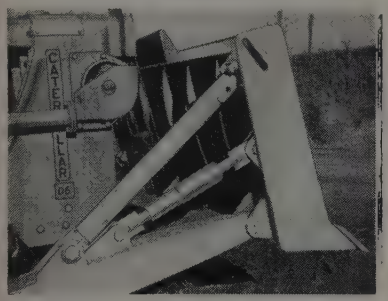
Safety Tower Ladder Co. has announced two new products especially engineered to safeguard high workers on towers and structures. One, the Tower Ladder Safety Device, is a lock which clamps directly onto a ladder or framework and is attached to a safety belt at the other end. Its locking and holding action is reported to be instantaneous. The other, the Safety Lifeline Lock, was designed to prevent injury should a workman fall or a scaffold fail. It is another safety

belt attachment which slips on to the lifeline rope and moves along the rope with the workman either up or down, as he slides it to the desired working position. Falling causes the device to lock instantly, automatically, and positively. It is supposed to be equally effective and positive in its locking action should a workman slip or a scaffold fail while the scaffold is being raised or lowered and the lock is being moved along the rope to a new working position.

40

Bulldozer stabilizer

A bulldozer stabilizer, designed to eliminate all looseness in adjustable type bulldozers, is being manufactured by **The Maquoketa Co.** It can be installed in the field in less than



2 hr. It is available for Caterpillar D-6 and D-7 dozers. With installation of the stabilizer, the dozer blade may be held rigid in a tilted or level position, whichever is desired.

41

2,000-lb. capacity asphalt plant

The Speed Batch, a new 2,000-lb. capacity, all-electric asphalt plant, has been introduced by **Universal Engineering Corp.**, a subsidiary of **Pettibone Mulliken Corp.** It has a capacity ranging from 25 to 40 tons

per hr. depending upon moisture content of feed material and type of mix. The basic plant weighs 32,500 lb. and is 38 ft. 8 in. long, 12 ft. 3 in. wide, and 9 ft. 7 in. high at the charging hopper measured from the bottom of the frame. Its charging hopper is 1-cu. yd. capacity. The dryer, pugmill, dust collector, and all power units and controls are combined on one frame. Also available as a portable unit.

45

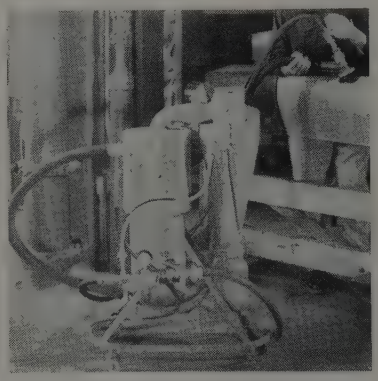
More powerful Cat D7

An increase of horsepower in the D7 track-type tractor has been announced by **Caterpillar Tractor Co.** Engine brake horsepower at sea level has been increased from 98 to 108 at 1,000 rpm., and tractor drawbar hosepower has increased from 81 to 90. The tractor will now develop a drawbar pull of 22,750 lb.

46

V-B Junior blast cleaner

Vacu-Blast Co., Inc., announces the V-B Junior, a new blast cleaner which offers dust-free cleaning for welding operations, spot cleaning,



and touch up work and other uses. The unit, which is light in weight and portable, uses all types of abrasives and operates from standard compressed air souces. Descriptive literature available.

47

Bethlehem mine roof bolts

Production of mine roof bolts has been started by **Bethlehem Pacific Coast Steel Corp.** at its Seattle plant. These bolts, which are slotted on one end and threaded on the other, have been recommended by the U. S. Bureau of Mines as a roof control measure in mines. In addition, the bolts are used extensively in railroad, vehicular, and water tunnel projects.

48

Tractor-mounted trencher

Earth Equipment Corp. has announced the 1954 model of its Everett trencher, a tractor-mounted, bracket-type trench digging machine for Ford and Ferguson tractors. Design improvements include a built-in rock guard, single-wheel design for faster penetration, V-belt power drive, and easily-accessible controls.

49

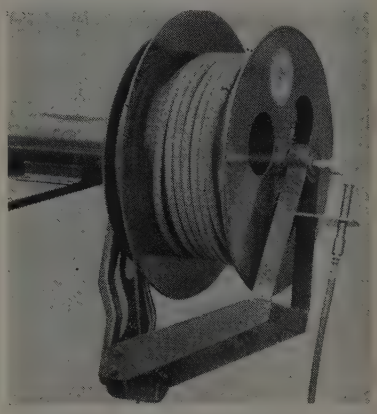
Lightweight safety cap

B. F. McDonald Co. has announced its new Safe-T-Cap which weights only 9 oz. Its crown is of radial ribbed construction which deflects falling objects rather than absorbs the force of the blow. A soft leather headband, fully suspended to help absorb shock and allow cooling air circulation, adjusts to any head size. Elimination of the normal full brim all around allows objects to be carried on a worker's shoulders without tipping or knocking off the cap. Recommended especially for foremen and other supervisory employees.

50

Combination hose reel-tagline

A new combination hose reel and tagline has been added by **McCaffrey-Ruddock Tagline Corp.** to its line of Rud-O-Matic Taglines. It was designed to steady the concrete bucket at any angle of the boom



while paying the air hose in and out. The air hose is never under stress, because the steel tagline absorbs the tension through a positive coil spring action at all times. The new tagline, which comes fully equipped with all necessary fittings and may be easily installed in 30 min., speeds crane operations, often permitting as much as 50% more loads per day's operation.

51

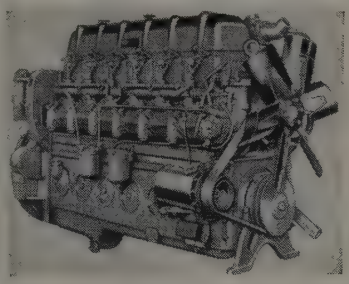
Model 3½D chain saw

Lombard has announced its new Model 3½D gasoline-powered chain saw which runs ful power and cuts at all angles. It has an automatic oiler and shut-off which gives protection against wear of chain and guide bar by constant oil lubrication while saw is in operation. It is equipped with a fast chain as standard equipment.

52

Improved diesel engine line

Harnischfeger Corp., R & H Diesel Engine Division, has announced production of an improved line of 2-cycle diesel engines featuring 36% greater power output. Compression ratio of all models is 16 to 1 and bore and stroke are 4.5 in. by 5.5 in. Horsepower ratings for



the new models at 1,800 rpm. range from 58 to 255. Displacement is 87 cu. in. per cylinder. The 6-cylinder model weighs 1,800 lb. for 7.06 lb. per hp., while the 4-cylinder model weighs 1,500 lb. with 8.33 lb. per hp. Other improvements include enlarged water passages and the addition of new channels, pistons now flat on top, special tips on injectors to provide soft spray pattern with a single hole, and a special alloy cast iron now used for the liners.

53

Cat roller track frames for 4D tractors

Roller track frames designed for oscillating D4 crawler tractors have been announced by **Caterpillar Tractor Co.** The new five-roller frames, which are 10 in. longer than the standard four-roller frames, are available as optional equipment. The new frames will require a 34-section track assembly in place of the standard 31-section track. The bigger units increase ground contact area, improve traction, and bridge the high spots on uneven ground for a smoother ride.

54

New pipeline regulators

A new 8900 series of regulators has been designed for use with gases supplied by pipeline systems using comparatively low pressures to supersede the present 8600 series by **Air Reduction Pacific Co.** These new oxygen cutting and welding regulators afford greater flow capacities, improved regulation, and lower static increment. They are of the inverse-type design and feature a seating arrangement which requires no nozzle. Catalog 806, which describes the company's complete line of gas regulators, and catalog ADC 705, which describes the 8900 series, are available.

UNIT PRICES

Selected abstracts for Western projects

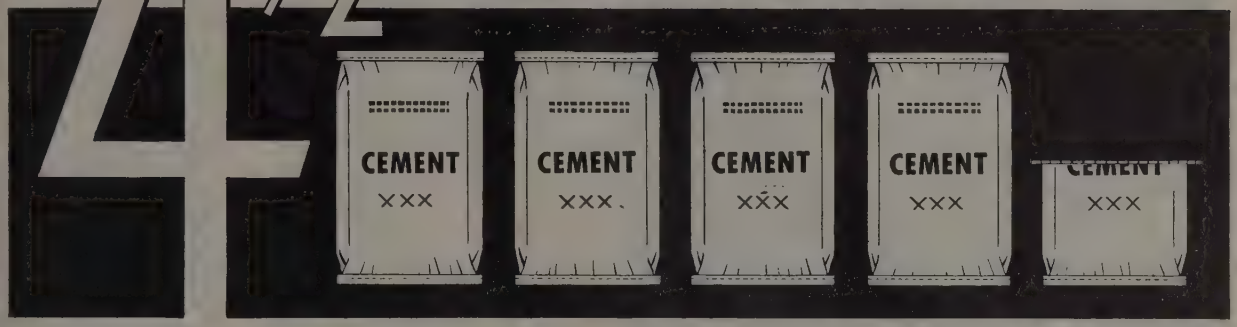
AVERAGE CONTRACT BID PRICES FOR 1953 OREGON HIGHWAY CONSTRUCTION

Here are prices for all components of Oregon highway work last year, based entirely on the figures of successful bidders. For the Oregon highway department the prices are useful as a guide in the preparation of estimates for 1954 work; for contractors it's a good checklist on what to expect from an average competitor. These figures used in conjunction with highway construction cost indices, described earlier in this issue, provide an up-to-date highway contract price guide for typical Western projects. The compilation was prepared by Chester E. Paulsen, Cost Analyst for the Oregon State Highway Department.

DESCRIPTION	NO. OF CONTRACTS	TOTAL QUANTITY	AVERAGE UNIT BID
EXCAVATION			
Struc. excavation, unclass.	84	103,466 cu. yd.	$ 2.74
Trench excavation, unclass.	31	11,680 cu. yd.	2.47
Common excavation	39	10,859,790 cu. yd.	0.266
Single class excavation	54	3,999,750 cu. yd.	0.458
Solid excavation	21	5,306,700 cu. yd.	0.845
Embankment in place	4	202,300 cu. yd.	0.60
Borrow excavation	18	1,683,190 cu. yd.	0.27
Cinder borrow	3	516,000 cu. yd.	0.317
Sand in blanket	1	2,500 cu. yd.	1.00
Short overhaul	57	68,467,000 yd. sta.	0.011
Long overhaul	56	2,080,250 cu.-yd. sta.	0.39
Truck haul	4	113,100 yd. mi.	0.16
Truck haul on borrow	7	173,900 yd. mi.	0.179
Truck haul on cinder borrow	2	2,290,000 yd. mi.	0.062
Hauling with trucks	3	548 hr.	5.82
Rounding cutbanks	35	448,600 lin. ft.	0.17
Finishing R/B & slopes	65	266.52 mi.	738.64
Roadbed widening and shaping	2	7.31 mi.	1,699.72
Grading and reshaping of existing shoulders	1	5.43 mi.	500.00
Grading with motor grader	14	1,515 hr.	11.12
Front end loader	3	244 hr.	7.87
Grading with tractor and dozer	2	75 hr.	12.00
Rock slope protection	2	17,900 sq. yd.	1.52
Rock slope and pier protection	1	110 cu. yd.	4.00
CONCRETE CULVERT PIPE			
6 in. culvert	2	250 lin. ft.	1.14
8 in. culvert	3	490 lin. ft.	1.66
12 in. culvert	42	13,780 lin. ft.	1.99
15 in. culvert	1	30 lin. ft.	3.00
18 in. culvert	46	50,399 lin. ft.	3.30
18 in. culvert, extra strength	4	1,620 lin. ft.	4.14
24 in. culvert	29	7,405 lin. ft.	4.67
24 in. culvert, extra strength	3	450 lin. ft.	5.00
30 in. culvert	10	1,974 lin. ft.	6.03
36 in. culvert	17	3,109 lin. ft.	8.82
36 in. culvert, extra strength	5	1,400 lin. ft.	9.67
48 in. culvert	3	616 lin. ft.	13.18
CONCRETE SEWER PIPE			
6 in. sewer	1	80 lin. ft.	1.25
8 in. sewer	20	19,202 lin. ft.	1.38
10 in. sewer	5	8,890 lin. ft.	2.19
12 in. sewer	22	25,530 lin. ft.	2.00
12 in. sewer, reinforced	1	34 lin. ft.	3.25
15 in. sewer	7	8,650 lin. ft.	2.61
18 in. sewer	9	11,380 lin. ft.	3.10
18 in. sewer, reinforced	1	100 lin. ft.	4.30
21 in. sewer	1	14 lin. ft.	4.09
24 in. sewer	1	1,150 lin. ft.	5.19
24 in. sewer, reinforced	1	800 lin. ft.	6.30
30 in. sewer reinforced	2	1,360 lin. ft.	6.73
60 in. sewer, reinforced	1	180 lin. ft.	22.50
CONCRETE SIPHON PIPE			
18 in. siphon	1	160 lin. ft.	6.00
24 in. siphon	1	40 lin. ft.	5.00
CORRUGATED DRAIN			
6 in. drain, perf. coated	10	30,870 lin. ft.	2.11
6 in. drain, coated	41	7,506 lin. ft.	2.35
8 in. drain, perf. coated	19	39,450 lin. ft.	2.43
8 in. drain, coated	6	3,930 lin. ft.	2.29
12 in. drain, perf. coated	5	2,114 lin. ft.	3.26
12 in. nested type	1	70 lin. ft.	3.00
CORRUGATED CULVERT			
12 in. culvert	17	3,184 lin. ft.	3.10
15 in. culvert	2	32 lin. ft.	4.00
18 in. culvert	28	20,890 lin. ft.	4.30
18 in. culvert, extra strength	5	1,314 lin. ft.	5.23
18 in. culvert, asbestos bonded	1	1,900 lin. ft.	5.00
24 in. culvert	16	4,018 lin. ft.	6.19
24 in. culvert, extra strength	8	3,900 lin. ft.	7.72
24 in. culvert, asbestos bonded	1	130 lin. ft.	7.00
30 in. culvert	3	734 lin. ft.	12.17
30 in. culvert, asbestos bonded	1	90 lin. ft.	9.00
30 in. culvert, extra strength, asbestos bonded	1	181 lin. ft.	12.00
36 in. culvert	8	1,640 lin. ft.	12.25
36 in. culvert, extra strength	2	242 lin. ft.	16.30
36 in. culvert, prot. invert	1	770 lin. ft.	19.00
36 in. culvert, asbestos bonded	1	200 lin. ft.	14.00
42 in. culvert	1	20 lin. ft.	16.00
42 in. culvert, extra strength	1	160 lin. ft.	15.00
42 in. culvert, prot. invert, asbestos bonded	1	80 lin. ft.	17.00
42 in. culvert, extra strength, asbestos bonded	1	150 lin. ft.	24.00
48 in. culvert	12	1,394 lin. ft.	18.19
48 in. culvert, extra strength	3	680 lin. ft.	21.10
54 in. culvert, prot. invert	2	420 lin. ft.	28.90
60 in. culvert	2	172 lin. ft.	33.16
60 in. culvert, extra strength	1	140 lin. ft.	37.00
60 in. culvert, prot. invert	3	356 lin. ft.	34.63
60 in. culvert, extra strength, asbestos bonded	1	230 lin. ft.	30.00
72 in. culvert	8	754 lin. ft.	37.05
72 in. culvert, prot. invert	1	200 lin. ft.	41.00
72 in. culvert, asbestos bonded, extra strength, prot. invert	1	200 lin. ft.	48.00
78 in. culvert	1	10 lin. ft.	35.00
78 in. culvert, prot. invert	1	60 lin. ft.	50.00
84 in. culvert	4	770 lin. ft.	47.22
CORRUGATED CULVERT, ARCH-TYPE			
18-11 in. arch-type culvert	1	120 lin. ft.	4.00
22-13 in. arch-type culvert	4	840 lin. ft.	4.94
29-18 in. arch type culvert	4	360 lin. ft.	7.21
36-22 in. arch-type culvert	3	226 lin. ft.	9.24
43-27 in. arch-type culvert	3	650 lin. ft.	12.45
58-36 in. arch-type culvert	3	670 lin. ft.	19.45
65-40 in. arch-type culvert	1	90 lin. ft.	25.00
72-44 in. arch type culvert	4	250 lin. ft.	30.40
CORRUGATED SECTIONAL PLATE			
72 in. sectional plate	4	905 lin. ft.	44.85
84 in. sectional plate	3	460 lin. ft.	45.26
90 in. sectional plate	2	330 lin. ft.	55.33
96 in. sectional plate	3	400 lin. ft.	56.46
104 in. sectional plate arch	1	80 lin. ft.	60.00
132 in. sectional plate	1	260 lin. ft.	90.00
152 in. sectional plate arch	1	120 lin. ft.	90.00
CORRUGATED SIPHON			
12 in. siphon	1	180 lin. ft.	7.70
18 in. siphon	6	1,790 lin. ft.	6.00
24 in. siphon	2	890 lin. ft.	7.98
30 in. siphon	1	180 lin. ft.	9.50
36 in. siphon	1	210 lin. ft.	12.00

Continued on page 164

4½ SACKS OF CEMENT!



Four and one-half sacks of cement are all that are required for concrete with a strength of 2500 psi (5 sacks for 3000 lb. concrete) when New BASALITE expanded shale aggregates are used.

Why use more? Low cement content not only means economy, but it also means better lightweight concrete—SHRINKAGE is MINIMIZED! These high strengths are obtained only with New BASALITE lightweight aggregate because of its rounded shape and sealed surface, which does not permit cement paste to penetrate the particle.

Good workability is an added feature of New BASALITE lightweight aggregate concrete. The harshness generally associated with most types of lightweight concrete is completely overcome by the rounded sealed particles of New BASALITE aggregate *regardless of slump specified.*

For the best in lightweight aggregates for lightweight structural concrete specify New BASALITE aggregate.*

* For design and construction in **Southern California,** specify and use **ROCKLITE Aggregate** from ROCKLITE PRODUCTS, Ventura, California.

ROUNDED EXPANDED SHALE AGGREGATE

Specify New BASALITE Throughout

BASALT ROCK COMPANY, INC.
Napa, California

LIGHTER • STRONGER • BETTER

UNIT PRICES ... CONTINUED

CORRUGATED HALF-ROUND

18 in. half-round	1	30 lin. ft.	3.50
18 in. half-round, asbestos bonded	1	430 lin. ft.	4.00
24 in. half-round	1	50 lin. ft.	4.15
24 in. half-round, asbestos bonded	1	70 lin. ft.	5.50
36 in. half-round	1	150 lin. ft.	9.00

CORRUGATED END SECTIONS

18 in. end sections, coated	4	311 ea.	30.93
18 in. asbestos bonded, special	1	12 ea.	100.00
24 in. end sections	1	14 ea.	46.00
Salvaging culvert pipe	29	12,750 lin. ft.	2.03
Salvaging & reinstalling sewer pipe	1	220 lin. ft.	3.00
Extra for installing under pavement	4	1,180 lin. ft.	3.11
Extra for installing under railroad	1	40 lin. ft.	12.00
Extra for installing connections	1	12 ea.	5.00
⅜-0 in. rock backfill in drains	25	10,560 cu. yd.	5.40

BITUMINOUS MACADAM & OIL MAT WEARING SURFACE

Furn. & place 120-150 asphalt	1	25 ton	60.00
Furn. & place 150-200 asphalt	58	12,741 ton	41.19
Furn. & place 200-300 asphalt	6	1,910 ton	46.91
Furn. & place MC-2 asphalt	9	772 ton	46.65
Furn. & place MC-3 asphalt	1	190 ton	48.50
Furn. & place RC-2 asphalt	1	50 ton	45.30
Furn. & place RS-1 emulsified asphalt	39	2,202 ton	45.45
Furn. & place emulsified asphalt	18	1,062 ton	44.61
Furn. & place aggregates	50	96,880 cu. yd.	3.90
Furn. & place aggregates (cinders)	3	9,800 cu. yd.	3.49
Haul & place aggregates	4	6,030 cu. yd.	2.15
Placing aggregates	4	65,880 cu. yd.	0.96
Hauling aggregates	4	240,000 yd. mi.	0.158
Furn. & place ¾-0 in. binder course	60	31,390 cu. yd.	3.28
¾-0 in. cinders in binder course	4	4,230 cu. yd.	3.12
Haul & place ¾-0 in. binder course	2	210 cu. yd.	4.23
1-0 in. cinders in binder course	1	1,800 cu. yd.	2.75
Reoiling preparation of base	4	185.53 mi.	58.89
Oiling preparation of base	2	18.95 mi.	143.53
Preparation of shoulders	2	24.62 mi.	100.00

ASPHALTIC CONCRETE PAVING

Class "B" in wearing surface	71	696,850 ton	5.92
Asphaltic concrete mixture (cinders)	5	106,940 ton	4.26
86-100 asphalt in mixture (cinders)	5	14,745 ton	32.38
Asphaltic Class "B" in patching	2	2,050 ton	5.76
Emulsified asphalt in seal coat	27	1,989 ton	40.05
Aggregate in seal coat	31	15,406 cu. yd.	3.97
Paving preparation of base	4	7.97 mile	285.57

MISCELLANEOUS STREET WORK

Class "A" concrete in box culverts	19	4,210 cu. yd.	53.30
Class "A" concrete in miscellaneous structures	22	161 cu. yd.	55.48
Class "A" concrete in monolithic sewer	1	470 cu. yd.	70.00
Metal reinforcement	21	696,700 lb.	0.118
¾x18 in. dowel pins	2	60 ea.	0.50
¾x8 in. dowel pins	1	180 ea.	0.35
Concrete sidewalks	9	2,371 sq. yd.	4.01
Concrete curbs	23	4,174 cu. yd.	43.88
Concrete curbs & gutters	2	63 cu. yd.	45.71
Asphaltic concrete dikes	1	1,500 lin. ft.	1.50
4 in. concrete surfacing	1	2,900 sq. yd.	3.60
Concrete driveways	1	20 sq. yd.	4.70
Concrete catch basins	32	478 ea.	76.67
Concrete catch basins special	4	10 ea.	99.50
Concrete end basin	9	184 cu. yd.	66.85
Concrete inlets	4	55 ea.	57.44
Concrete inlets special	1	1 ea.	100.00
Type "B" manholes	21	126 ea.	231.89
Type "A" manholes 5 to 10 ft.	1	18 ea.	220.00
Type "A" manholes 10 to 20 ft.	1	10 ea.	295.00
Drop & special manholes	1	10 ea.	565.00
Reconstruct manholes	2	7 ea.	125.00
Adjustment of manholes	11	49 ea.	52.35
Adjustment of catch inlet	1	1 ea.	50.00
Adjustment of catch basin	1	7 ea.	25.00
Adjustment of lamphole	1	2 ea.	15.00
Adjustment of valve boxes	1	20 ea.	10.00
Removal of walks	2	710 sq. yd.	0.82
Removal of walks & driveways	3	10,350 sq. yd.	0.40
Removal of catch basins	8	33 ea.	20.00
Removal of catch inlets	1	20 ea.	5.00
Removal of pavement	10	30,590 sq. yd.	0.43
Removal of curbs	10	14,000 lin. ft.	0.33
Removal of manholes	2	4 ea.	100.00
Removal of misc. structures	1	10 cu. yd.	20.00
Removal of monolithic sewer	1	740 lin. ft.	3.15
39 in. woven wire fence and one strand of barbed wire	1	250 rod	8.00
7 ft. chain link wire mesh fence	2	7,320 lin. ft.	2.60

PIT-RUN MATERIALS IN SUBBASE AND BASE

Pit-run 6-0 in. in base	1	23,300 cu. yd.	2.00
Selected R/B topping, haul extra	15	612,350 cu. yd.	0.49
Pit-run 3-0 in., haul incl.	5	33,290 cu. yd.	2.02
Pit-run gravel, haul incl.	15	268,360 cu. yd.	1.27
Cinders in base, haul incl.	3	59,900 cu. yd.	0.83
Quarry run rock, haul incl.	7	85,000 cu. yd.	1.07
Selected talus topping, haul extra	1	30,000 cu. yd.	0.45
Hauling talus topping	1	50,000 yd. mi.	0.12
Selected cinder topping, haul extra	2	138,000 cu. yd.	0.35

UNIT PRICES . . . CONTINUED

Haul cinder topping	2	390,000 yd. mi.	0.089
Hauling roadbed topping	15	1,733,100 yd. mi.	0.132

CRUSHED ROCK, GRAVEL OR CINDERS IN SURFACING

4½-0 in. base, haul incl.	1	130,000 cu. yd.	1.50
4-0 in. in base, haul incl.	1	14,000 cu. yd.	1.70
3-0 in. in base, haul incl.	13	411,940 cu. yd.	2.04
2½-0 in. in base, haul incl.	19	264,810 cu. yd.	2.23
2-0 in. in base, haul incl.	3	95,100 cu. yd.	1.75
2-0 in. in base, haul & place only	1	2,300 cu. yd.	1.00
1-0 in. in base, haul extra	1	5,000 cu. yd.	1.55
1-0 in. in base, haul incl.	3	17,770 cu. yd.	2.78
1½-0 in. in base, haul incl.	4	32,700 cu. yd.	2.40
1½-0 in. in base,cinders, haul incl.	2	27,600 cu yd.	1.93
1-0 in. in base, cinders, haul incl.	1	21,800 cu. yd.	1.80
¾-0 in. in base, shoulders and leveling course, haul incl.	88	530,270 cu. yd.	2.34
¾-0 in. cinders in base, shoulders & leveling course, haul incl.	2	28,700 cu. yd.	1.98
Crushed material in leveling, hauling & placing	12	33,868 cu. yd.	2.37
Hauling 1-0 in. surfacing	1	46,000 yd. mi.	0.15
Sprinkling	114	82,639 m/gal.	2.33
Furnish & place SS-1 in sprinkling	3	26,000 gal.	0.30

CRUSHED ROCK, GRAVEL OR CINDERS IN STOCKPILE

2-0 in. rock, haul extra	1	500 cu. yd.	3.00
1¼-0 in. rock, haul included	1	5,500 cu. yd.	2.63
1-0 in. rock, haul extra	1	2,000 cu. yd.	1.55
1-0 in. rock, haul included	1	500 cu. yd.	1.60
¾-½ in. rock, haul included	14	70,570 cu. yd.	3.18
¾-½ in. rock, haul extra	2	5,020 cu. yd.	2.97
¾-0 in. rock, haul included	2	6,500 cu. yd.	2.71
¾-0 in. rock, haul extra	1	500 cu. yd.	3.00
½-¼ in. rock, haul included	15	80,360 cu. yd.	3.17
½-¼ in. rock, haul extra	1	4,690 cu. yd.	2.10
½ in. #10 mesh rock, haul included	3	4,000 cu. yd.	3.07
¼ in. #10 mesh rock, haul included	13	35,310 cu. yd.	3.33
¼ in. #10 mesh rock, haul extra	2	3,800 cu. yd.	2.82
¼-0 in. rock, haul included	7	17,310 cu. yd.	2.83
¼-0 in. rock, haul extra	2	5,290 cu. yd.	2.63
1-0 in. cr. gravel, haul extra	1	500 cu. yd.	1.60
¾-½ in. cr. gravel, haul incl.	6	30,630 cu. yd.	2.91
¾-0 in. cr. gravel, haul extra	1	2,300 cu. yd.	2.50
½-¼ in. cr. gravel, haul incl.	6	35,700 cu. yd.	2.90
¼-0 in. cr. gravel, haul extra	2	3,900 cu. yd.	2.81
¼ in. #10 mesh cr. gravel, haul incl.	5	10,570 cu. yd.	3.03
¾-½ in. cinders, haul extra	2	8,150 cu. yd.	1.22
⅜ in. #10 mesh cinders, haul incl.	1	10,000 cu. yd.	1.39
¾-0 in. cinders, haul extra	1	2,000 cu. yd.	1.40
¾-½ in. cinders, haul incl.	1	1,480 cu. yd.	2.45
½-¼ in. cinders, haul incl.	1	1,480 cu. yd.	2.45
½-¼ in. cinders, haul extra	2	5,900 cu. yd.	1.29
¼ in. #10 mesh cinders, haul incl.	1	740 cu. yd.	2.45
¼ in. #10 mesh cinders, haul extra	2	4,950 cu. yd.	1.20
¼-0 in. cinders, haul extra	1	2,000 cu. yd.	1.50
Hauling crushed cinders, pile measure	2	53,500 yd. mi.	0.11
Hauling crushed rock, pile measure	2	82,000 yd. mi.	0.15

BRIDGES

Class "A" concrete	90	41,344 cu. yd.	59.90
Class "AA" concrete	2	1,040 cu. yd.	88.34
Structural excavation	81	29.079 cu. yd.	6.49
Struct. excav. below elevation shown	74	417 cu. yd.	25.44
Seal concrete	1	40 cu. yd.	40.00
Metal reinforcement	90	9,213,100 lb.	0.11
Structural carbon steel	8	839,600 lb.	0.24
Structural low alloy steel	6	1,094,000 lb.	0.23
Metal handrail	11	8,074 lin. ft.	10.27
Treated lumber	11	71.5 M-FBM	307.78
Untreated lumber	4	144 M-FBM	197.75
Trestle superstructure	3	1,961 lin. ft.	62.79
Furnish treated piling	25	53,920 lin. ft.	1.17
Furnish untreated piling	6	34,150 lin. ft.	0.59
Furnish steel piling	16	10,320 lin. ft.	5.27
Furnish end bent piling	1	2,070 lin. ft.	1.41
Drive piling	30	2,096 ea.	56.02
Drive steel piling	16	331 ea.	68.66
Concrete slope pavement	13	5,300 sq. yd.	4.96
Rock riprap	1	750 cu. yd.	2.50
Concrete handrail, precast	1	408 lin. ft.	18.50
Membrane waterproofing, without protective course	1	530 sq. yd.	3.00
Membrane waterproofing, with protective course	1	210 sq. yd.	4.50

TRAFFIC CONTROL

Concrete islands	3	670 cu. yd.	34.70
Concrete traffic divider	5	1,244 cu. yd.	34.87
½x7 in. boat spikes	4	6,680 ea.	0.18
Metal guard rail, concrete posts	16	61,700 lin. ft.	2.50
Metal guard rail, treated timber posts	2	12,000 lin. ft.	2.85
Corrugated metal sight posts	16	1,827 ea.	4.08
Concrete sight posts	2	124 ea.	13.94
Salvaging & reinstalling guard rail	2	2,980 lin. ft.	1.39
Asphaltic concrete traffic markers	17	44,520 lin. ft.	0.72
1 in. electrical conduit	1	30 lin. ft.	5.00
1¼ in. electrical conduit	7	5,210 lin. ft.	1.30

Continued on page 166

UNIT PRICES . . . CONTINUED

ROADSIDE IMPROVEMENT

Furnish & place topsoil	2	2,000 cu. yd.	1.81
Excavating & placing topsoil	10	85,400 cu. yd.	0.70
Truck haul on topsoil	3	70,300 yd. mi.	0.17
½ in. water pipe, galvanized	3	670 lin. ft.	0.55
¾ in. water pipe, galvanized	2	1,440 lin. ft.	0.60
1 in. water pipe galvanized	3	3,080 lin. ft.	0.95
1¼ in. water pipe, galvanized	2	740 lin. ft.	0.80
1½ in. water pipe, galvanized	2	560 lin. ft.	0.95
2 in. water pipe, galvanized	2	610 lin. ft.	1.09
2½ in. water pipe, galvanized	2	190 lin. ft.	1.61
½ in. water pipe, copper	1	130 lin. ft.	0.44
¾ in. water pipe, copper	1	510 lin. ft.	0.75
1 in. water pipe, copper	1	700 lin. ft.	0.93
1¼ in. water pipe, copper	1	240 lin. ft.	1.15
1½ in. water pipe, copper	1	330 lin. ft.	1.50
2 in. water pipe, copper	1	280 lin. ft.	2.25
1¼ in. water pipe, plastic	1	660 lin. ft.	1.55
1½ in. water pipe, plastic	1	1,360 lin. ft.	1.85
2 in. water pipe, plastic	1	570 lin. ft.	1.92
2½ in. water pipe, plastic	2	3,700 lin. ft.	2.00
½ in. drain valves	3	28 ea.	7.11
1 in. control valves	1	2 ea.	12.50
1¼ in. control valves	2	4 ea.	15.89
1½ in. control valves	3	8 ea.	17.27
2 in. control valves	3	12 ea.	22.70
2 in. gate valve	1	1 ea.	12.00
¾ in. quick-coupling hose valve	1	6 ea.	7.65
Shrubbery heads	2	39 ea.	2.18
Pop-up revolving sprinkler heads	1	14 ea.	14.00
Pop-up nonrevolving sprinkler heads	3	260 ea.	4.39
Furnishing & planting trees	2	125 ea.	5.48
Plant State-furnished vines	1	2,800 ea.	0.15
Plant State-furnished trees	1	14 ea.	5.00
Plant State furnished plants	1	144 ea.	0.75
Furnish & plant shrubs (misc.)	3	17,995 ea.	0.36
Furnish & plant covers	1	32,400 ea.	0.30
Preparing soil & seeding (lawn)	3	11.5 ac.	270.00
Grass seed, Highland Bent	3	295 lb.	1.00
Grass seed, Creeping Red Fescue	3	360 lb.	0.83
Grass seed, Annual Rye	1	150 lb.	0.10
Grass seed, Kentucky Blue Grass	1	25 lb.	1.50
Peat Moss	2	595 bale	3.78
Fertilizer, inorganic	4	184 cwt.	4.77
Sawdust mulch	3	205 units	9.57
Drill 6 in. well 25 ft. deep	2	2 ea.	74.37
Drill 8 in. well 25 ft. deep	1	1 ea.	83.00
Drill 6 in. well below 25 ft. level	2	150 lin. ft.	2.88
Drill 8 in. well below 25 ft. level	1	100 lin. ft.	3.30
Furnish & install sand point	1	1 ea.	20.00

DAM—Santa Felicia Dam, a rolled-earthfill structure on Piru Creek in Ventura County, California

California—Santa Felicia Dam—United Water Conservation District. A joint venture of D. & H. Construction Co., Macco Corp., and M. H. Hasler Construction Co. of Sacramento submitted a low bid of $3,534,826 on construction of a rolled-earthfill, 200-ft. high dam on Piru Creek in Ventura County before the United Water Conservation District at Santa Paula, Calif. Unit prices were as follows:

(1) D & H Construction Co., Macco Corp., and M. H. Hasler Construction Co.	$3,534,826
(2) Vinnell Company, Inc., & Vinnell Constructors	3,667,110
McCammon-Wunderlich Co.	3,739,968
Connolly-Pacific Co.—T. E. Connolly, Inc.	4,170,072
Guy F. Atkinson Co.	4,384,286
Morrison-Knudsen Co., Inc.	4,385,077
Grove, Shepherd, Wilson & Kruge of California, Inc.	4,486,952
Western Contracting Corp.	4,524,310
A. Teichert & Sons, Inc., and John C. Gist	4,544,886
Utah Construction Co.	4,992,770
Grafe-Callahan Construction Co.	5,799,503

		(1)	(2)
Lump sum,	diversion and care of stream during construction	$98,000.00	$275,000.00
200,000	cu. yd. stripping embankment foundation	0.32	0.20
350,000	cu. yd. earth excavation for spillway and road	0.60	0.20
250,000	cu. yd. rock excavation for spillway and road	0.60	0.80
20,000	cu. yd. earth excavation for outlet works	0.70	0.20
12,000	cu. yd. rock excavation for outlet works	0.70	0.80
500,000	cu. yd. earth excavation for cutoff	0.49	0.20
60,000	cu. yd. rock excavation for cutoff	1.35	1.00
500	cu. yd. slush grout	11.00	65.00
15,000	sq. yd. bituminous shale sealer	0.40	0.70
200	cu. yd. gunite	17.00	100.00
3,000	lin. ft. drilling pressure grout holes 0 to 40 feet	1.95	2.00
2,000	lin. ft. drilling pressure grout holes 40 feet to 80 feet	2.15	2.25
1,000	lin. ft. drilling pressure grout holes 80 feet to 120 feet	2.35	2.50
150	hr. washing and pressure testing grout holes	8.40	9.00
300	lin. ft. embedding grout pipe	5.60	3.50
1,000	bags pressure grouting, 0 to 1,000 bags	3.90	4.00
2,000	bags pressure grouting in excess of 1,000 bags	1.70	1.80
700	lin. ft. drilling holes for anchor bars and grouting bars in place	1.05	2.00

900,000	cu. yd. impervious core embankment	0.63	0.53
3,100,000	cu. yd. pervious shell embankment	0.37	0.41
50,000	cu. yd. riprap	2.30	3.50
40,000	cu. yd. gravel and cobble blankets	2.30	2.40
10,000	cu. yd. dumped backfill	0.75	1.00
7,000	sq. yd. crest, service yards and road surfacing	0.14	0.70
48	lin. ft. installing 18-in. diameter corrugated metal pipe for road drains	2.00	2.50
600	cu. yd. concrete backfill	12.60	15.00
3,000	cu. yd. concrete in outlet pipe conduit	30.50	28.50
200	cu. yd. concrete in the emergency shutoff valve house	40.00	47.00
700	cu. yd. concrete in the outlet pressure conduit	60.00	40.00
250	cu. yd. concrete in the intake tower	58.00	43.50
350	cu. yd. concrete in the outlet structure and open pipeway	58.00	50.00
3,500	cu. yd. concrete in the spillway walls	40.00	34.00
9,000	cu. yd. concrete in the spillway base slab and base slab keys	10.50	15.00
10,000	cu. yd. concrete in the spillway crest	11.25	15.00
1,000	cu. yd. dental concrete	15.70	62.50
100	cu. yd. miscellaneous concrete	56.00	88.00
2,600,000	lb. placing reinforcement steel	0.025	0.018
100,000	lb. cutting and bending miscellaneous reinforcement steel	0.035	0.012
4,000	lin. ft. subsurface drains for spillway	1.20	2.50
250	lin. ft. subsurface drains for open pipeway	2.00	4.00
1,200	lin. ft. surface gutters behind spillway walls	2.40	12.00
100	lin. ft. vertical drains behind spillway walls	6.80	5.00
30,000	lb. installation of emergency shutoff let pipe	0.10	0.12
20,000	lb. installation of outlet control valves	0.03	0.05
30,000	lb. installation of emergency shutoff valves	0.04	0.06
25,000	lb. installation of trashracks	0.06	0.08
6,000	lb. installation of embedded conduit anchor section	1.10	0.20
1,500	lb. installation of sluice gates and hoists	0.24	0.25
100	lb. installation of ladders	0.50	0.50
320	lin. ft. furnish and install chain-link fence for service yard	4.00	3.00
150	lin. ft. furnish and install chain-link fence for spillway	2.50	2.20
Lump sum,	installation of reservoir level gage piping	450.00	1,200.00
30,000	lb. installation of miscellaneous metalwork	0.45	0.18
Lump sum,	electrical installation	540.00	2,600.00
Lump sum,	storage building	3,000.00	6,700.00
600	cu. yd. concrete grout cap	12.50	30.00

First of four rectifier buildings for City Light, Seattle
C & R Builders, Seattle and Alaska, Gen. Con.

Symons Prefab Forms Re-Used on Building Jobs

Symons prefab plywood panels being used on the first of four rectifier buildings for City Light, Seattle.

Use Symons Prefab Forms on your next job. Send in your plans and get complete layout and cost sheet—No obligation. Our catalog F-9 will also be sent upon request. Symons Clamp & Mfg. Co., 4925 Diversey Avenue, Dept. E-4, Chicago 39, Illinois.

State of Washington—Homer Allen, Bellevue, Washington. Phone: Gibson 1220.

State of Oregon—Concrete Forms, 5475 N. Lagoon, Portland 18, Oregon. Phone: TW 8831.

News of DISTRIBUTORS

Chain Belt's new Western home

Chain Belt Co.'s new California plant at 7601 Telegraph Road, Los Angeles, was recently opened. The new building, built at a cost of over a half million dollars, and with an area of 41,000 sq. ft. on a 7-ac. site, houses a manufacturing plant, ware-

house and district sales office. S. Y. Warner, Jr. is manager in charge of the company's California operations. Kenworhy Thompson is factory manager. R. G. Kuhnmuench is district sales manager for Chain Belt's construction machinery products.

LeTourneau-Westinghouse appoints Nevada distributor

Pioneer Equipment Co. of Nevada, with headquarters in Reno, has been named Nevada and northeastern California distribtuor for LeTourneau-Westinghouse Co. products. The newly-appointed distributorship is headed by one of the veteran equipment men of the West, Wayne F. Watts, president. Watts directs Pioneer's sales operations. The parts department is headed by Mitchell T. Vuich, another construction equipment veteran, who is secretary-treasurer of Pioneer.

Bethlehem Pacific names chief engr.

Walton W. Hoffman was recently appointed chief engineer of construction for Bethlehem Pacific Coast Steel Corp., Steel Division. Hoffman comes to the West Coast from Johnston, Pa., where he was assistant chief engineer of the steel plant. He will make his headquarters at the company's offices in San Francisco.

Dravo opens West Coast office

A new West Coast office located at 681 Market St. in San Francisco was recently opened by Dravo Corporation. The office is under the management of William A. Walton who has been with Dravo since 1940. Frank S. Trumbower has joined Walton in San Francisco as territorial sales and service manager. In addition to the complete Dravo line, the office will represent Walker Process Equipment, Inc., which manufactures water, sewage and industrial waste treating systems.

J. T. Jenkins expanded headquarters

The main Los Angeles office of J. T. Jenkins Co., distributor of Kenworth trucks, is now operating

from new sales and service headquarters located at 2757 Leonis Blvd. This new truck distribution center occupies three acres of land and includes a modern new administration building for executive, sales and accounting staffs; a service building containing a large parts department and completely equipped truck service and repair shop. Jenkins has been Kenworth distributor in California, Nevada, Arizona, New Mexico and El Paso County, Texas, for 20 years.

Skookum sales

Two new salesmen, Howard C. Wilson and Richard W. Lyons, have joined the Skookum Company in Portland, according to announcement by Phil A. Hobbs, president. Before joining Skookum, Wilson sold heavy equipment in Washing-

Wilson *Lyons*

ton state. His new assignment covers nine Western states. Lyons has been in heavy hardware, mill and logging supply sales. He will cover Oregon and California. Skookum manufactures logging, mining and construction block, forgings and fairleaders.

Gar Wood appointments

Gar Wood Industries, Inc. announces several new appointments within its organization. M. A. Staben has been promoted to district manager for Tractor Equipment Sales in the West. He will be assisted by R. H. Worpell. Also in Gar Wood's Findlay Division, A. M. Guthrie has

been named assistant sales manager. He had been Findlay district manager for the West Coast since December, 1951. Also announced is the appointment of Albuquerque Truck Equipment Co., Albuquerque, New Mex. as a distribtuor for the products of the Wayne Division, including hoists and bodies, winches, cranes, etc.

Western Machinery Co. handles "Michigan" line

Western Machinery Co. of Phoenix has been appointed to sell and service in the state of Arizona the Michigan line of power shovels and tractor shovels, products of the Construction Machinery Division of Clark Equipment Co. John P. Keller is in charge of the Phoenix office and Robert B. George is sales manager. In Colorado, Western Machinery Co., Denver, was appointed distributor also for the Michigan line for the entire state of Colorado. Leigh M. Jones manages the Denver office. The two firms are affiliates of Western Machinery Co., San Francisco, one of the largest machinery distributors in the West.

Pacal Steel Service opens in Billings

A complete engineering department for structural steel, reinforcing steel and steel joists and a full supply of steel are features at Paper

Calmenson & Co.'s new Billings, Mont. headquarters. Pacal Steel Service includes over 15,000 steel items for builders, as well as earth cutting blades for all types of earth-moving equipment. John Merrill, manager of the Billings office, reports that the new set-up makes possible increased service to customers in the Mountain States.

New Worthington distributor

Jenkins & Albright Co., Reno, Nev., was recently appointed by Worthington Corporation to handle its construction equipment, including concrete mixers, road pavers, portable compressors and air tools. Territory covered will be the Nevada counties of Washoe, Storey, Lyon, Mineral, Esmeralda, Douglas and Ormsby, as well as Tonopah in Nye County. Jenkins & Albright also have the Reno agency for Mack trucks and P & H shovels.

Normont new Pioneer dealer in Montana

Pioneer Engineering Works, Inc. recently announced the appointment of a new dealer in Montana. Normount Equipment Co., Great Falls, will serve 15 northern and central counties of the state, and will carry the entire line of Pioneer Continuflo equipment. Complete sales and service to contractors and producers of all types of aggregates will be featured.

Shaw Sales named Harnischfeger rep

Shaw Sales & Service Co. of Los Angeles has been appointed distributor for Harnischfeger Corp. in the counties of Ventura, Kern, Inyo, San Bernardino, Riverside, Orange and Los Angeles, as well as Clark County, Nev. Shaw carries such well known lines as Allis-Chalmers, Blaw-Knox, American Hoist & Derrick Co., and many others.

Casey-Metcalf named Manitowoc distributor

J. D. Casey, president of Casey-Metcalf Machinery Co. of Los Angeles, announces the appointment of his company as distributor for Manotowoc Engineering Corp. for Southern California. In addition to this new line, Casey-Metcalf is distributor for such well known lines as Minneapolis-Moline, Seaman Motors, Reese Engineering, Baker-Lull, Huber Mfg. Co. and others.

Ed Daley appointed West Coast rep

Construction Machinery Co. recently appointed a new West Coast representative, Edward R. (Ed) Daley, who will make his headquarters in Burlingame, Calif. Daley will work with CMC distributors in seven Western states. He has a wealth of experience in the construction equipment field, including a period with Shaw Sales & Service Co. of Los Angeles and Edward R. Bacon Co. of San Francisco.

Edward R. Daley **West Coast representative for Construction Machinery Co.**

Aeroil announces exclusive distributor

Aeroil Products Co., Inc. announces the appointment of Brown-Bevis Industrial Equipment Co., Los Angeles as an exclusive stocking distributor for the Southern California area. Brown-Bevis has been a jobber of the company's products for a good many years, and as exclusive distributor will be in a position to give prompt and efficient service to all customers and prospects in the territory.

International Harvester promotes and transfers

Announcement is made by International Harvester Co. of several changes in its truck district management. J. W. Briggs, formerly branch manager, Salt Lake City, has been promoted to assistant manager of the Salt Lake district. W. L. Topf, formerly assistant district manager at Davenport, Iowa, has been transferred to Spokane, Wash., in the same capacity, and moving from Spokane to Davenport in the same capacity is M. S. Whittington.

Raymond Dobberfuhl appointed mgr.

Raymond H. Dobberfuhl has been appointed manager of the new R. & J. Dick Co., Inc. office and warehouse for the Southern California area. The new service center, at 5276 Atlantic Blvd., Maywood (Los Angeles) marks the third maintained by the Dick company on the West Coast, the other facilities being located at San Francisco and Seattle. The company manufactures power transmission and conveying equipment.

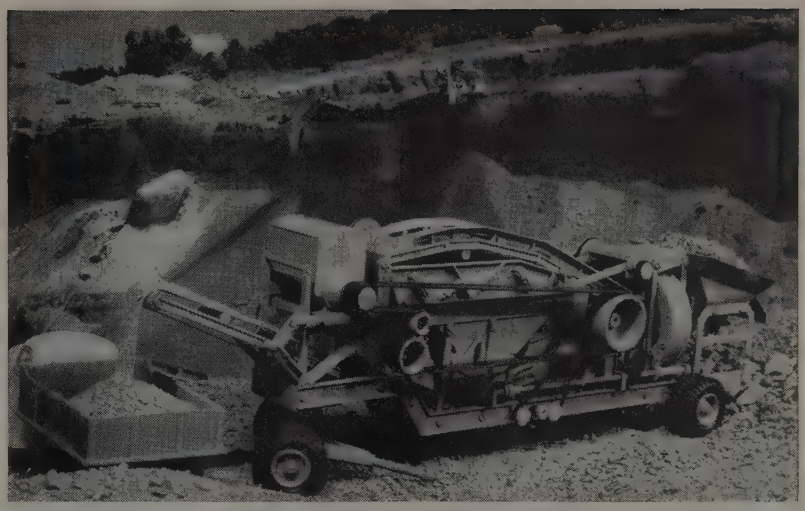
MANUFACTURERS

Clark Equipment Co. appoints field reps

Appointment of Chester J. Tucker as field service manager and William E. Woodley, Gale H. Stokes and Cecil L. Starner as field service representatives of Construction Machinery Division of Clark Equipment Co. was recently announced. Products of this division include power shovels, cranes and draglines formerly manufactured by Michigan Power Shovel Co., and a recently introduced line of tractor shovels. Woodley, Stokes and Starner all have spent a good many years with the Michigan company, and Tucker has been in charge of field service operations for the firm since 1930.

Morgenroth named to Fiberglas sales post

Dan E. Morgenroth, who has an extensive background of Fiberglas sales, engineering and product development, and industrial construction, has been appointed manager of general construction materials sales of Owens-Corning Fiberglas Corp. A graduate civil engineer, Morgenroth at one time served the company in the San Francisco branch offices. For several years he has been a consulting engineer for several building contractors.



JUST LIKE THE REAL THING is this scale model (½ in. to the foot) replica of a Cedarapids Pitmaster, shown against an actual quarry scene. It operates like a real crushing and screening plant, too. So if anyone is interested in crushing pea gravel, or maybe in training his kids to operate crushing plants, he should send to the Iowa Manufacturing Co. for more information.

Thor enters low price field

Thor Power Tool Co. has purchased the Speedway Manufacturing Co., thereby broadening its power tool manufacturing operations into the low price electric tool market. Speedway will continue with the same personnel at the Chicago plant, and under the same executive management, including William B.

Scace, president, and Jack R. DeBacher, vice president. It will operate as the Speedway Manufacturing Division of Thor Power Tool Co.

Barber-Greene names new president

W. B. Greene, president of Barber-Greene Co., material handling and road paving machinery manufacturer, recently announced his resignation as president, and the promotion of H. A. Barber to that

Barber *Greene*

office. Greene will continue his active participation in the company as chairman of the board of directors. Among other officers elected are S. E. Faircloth, vice president and production coordinator; E. H. Holt, vice president and director of sales, and R. C. Heacock, vice president and director of manufacturing and engineering.

Bohmer named asst. genl. mgr. of Le Roi-Transo

C. I. Bohmer has been named assistant to the general manager of the Le Roi-Transo truck mounted mixer division of the Le Roi Company. General manager of the division, Norman M. Sedgwick, announced that Bohmer will act as an advisor and field research and technical engineer. Bohmer comes to Le Roi from the Jaeger Machine Co., where he served as chief engineer.

Personnel changes at Atlas Powder Co.

Atlas Powder Co. has announced two personnel changes in the firm's explosives department. William T. Mahood has been appointed manager of the contractors section and George Gabuzda has been named manager of the development and standards section in the department's manufacturing division. Mahood, well-known in the national construction industry, joined Atlas as a sales representative in 1936. He was later promoted to sales manager and served in that capacity in the Seattle and San Francisco districts. Gabuzda joined Atlas in 1942 as a chemist. Recently he has been on special assignments in the manufacturing division. In addition to his duties as section manager, Gabuzda will be responsible for the development of new, and the improvement of old products.

Caterpillar elections

Louis B. Neumiller was elected chairman of the board of Caterpillar Tractor Co. at a recent board meeting in San Leandro, Calif., and Harmon S. Eberhard was elected to succeed him as president. The elec-

Neumiller *Eberhard*

tion of Neumiller as the new board chairman comes as a culmination of a lifelong experience with Caterpillar, dating back to 1915 when he joined the company as a clerk. Eberhard started his career with Caterpillar at the Stockton, Calif., plant in 1916. Progressing through various positions, he was named the company's chief engineer in 1933, and executive vice president in 1950.

L. A. Young buys Daybrook line of hydraulic machinery

N. D. Ely, president of L. A. Young Spring & Wire Corp. announces further diversification of

the firm's products through purchase of the assets of Daybrook Hydraulic Corp. Daybrook manufactures hydraulic products, including power tail gates, pumps, hydraulic hoists, farm hoists, and also steel dump bodies. Operations are being continued under the name of the Daybrook Hydraulic Division of L. A. Young Spring & Wire Corp.

Harold E. Smith dies

Harold E. Smith, 64, president of the T. L. Smith Co., Milwaukee, Wis., pioneer manufacturer of concrete mixers, died suddenly in Paris, France, April 20, while on a vacation trip. "H. E.", as he was known throughout the construction equipment industry, was the son of the late Thomas L. Smith, founder (in 1900) of the company, and inventor of the Smith tilting mixer and other construction equipment.

Harold E. Smith
president
T. L. Smith Co.
Died April 20

Johns-Manville expanded service

A new marketing section has been established in the Transite pipe department of Johns-Manville Corp. for improved service to its customers. Louis F. Frazza is appointed manager of direct sales operations of the new section, assisted by Otto A. Wirsig, staff manager; and Edward C. Koch, manager of dealer sales operations, assisted by James R. Allen, Jr., staff manager.

Atlas Powder scholarships

Atlas Powder Co., manufacturer of explosives, chemicals, activated carbons and industrial finishes, has set up eight $1,000 college scholarships, according to announcement by Ralph K. Gottshall, Atlas president. Awards will go to 1954-55 seniors, majoring in chemistry, physics or any branch of engineering, and will be given on the basis of scholastic records and the recommendations of the college staff.

Elegrader news

Drake-Williams-Mount Co. has disposed of all its interest in the Williams & Reisser Co. and all manufacturing rights to the Elegrader. The purchaser is Reisser Corp. of Blair, Neb. Vernon H. Reisser heads up this new corporation, and will be in a position to furnish the contracting trade with new complete Elegrader units for mounting on Adams motor graders, as well as spare parts for those machines that are in the field.

Water Seals, Inc. promotes Fucik

At a recent board meeting the directors of Water Seals, Inc., manufacturer of Labyrinth waterstops, elected Frank M. Fucik to the presidency of the company. E. W. Hillier continues as secretary-treasurer of the firm. Labyrinth waterstops are widely used throughout the construction industry to prevent seepage between successive pores of concrete.

Patnik receives Lincoln appointment

The Lincoln Electric Co. announces the appointment of Albert Patnik to the newly created position of dealer sales manager. Patnik joined the Lincoln sales staff in 1940, serving as a field engineer in the Los Angeles and Seattle districts. He was a regional dealer manager in the Northwest territory from 1947 to 1949, when he was made district manager in Seattle. He transferred to the home office in Cleveland in 1952. In his latest position he will have responsibility for the management of the Lincoln dealer organization, numbering some 1,000 dealers.

Space is sold as advertisers' inches. All advertisements in this section are ⅛ in. short of contracted space to allow for borders and composition.

CLASSIFIED

Rates are 8.50 a column inch. Copy should be sent in by the 20th of preceding month if proofs are required; by the 23rd if no proofs are required.

FOR SALE—Immediate Delivery

INGERSOLL-RAND QUARRYMASTER DRILL

Model QM-8. Serial 11242. Complete with 2—500 cfm. compressors, drill rods and finishing tools. Completely reconditioned and in A1 shape. Price f.o.b. Bridgeport, Washington $45,000.00

INGERSOLL-RAND PORTABLE COMPRESSOR

On rubber tires, 500 cfm. Serial 40 H 41078. Powered by Waukesha Diesel. Very good condition.
Price f.o.b. Bridgeport, Washington $6,500.00

Contact CHIEF JOSEPH DAM BUILDERS
Bridgeport, Washington Telephone 3501

FOR SALE
TUNNEL FORM HYDRO GATE

32-ft. STEEL TUNNEL FORM & TRAVELER consisting of three 8-ft. sections and two 4-ft. sections. Modified horseshoe shape 18-ft. 6-in. diameter. Can be readily converted to 270 degrees circular form. Used.
11-ft. 3-in. x 11-ft. 0-in. VERTICAL LIFT HYDRAULIC GATE 16,000 lb. sq. in. maximum unit stress 5,500 lbs. weight. Complete with 34-ft. 2-in. guide. Originally designed as trash gate on hydroelectric project. Unused.

PACIFIC POWER & LIGHT COMPANY
920 S. W. 6th Ave.
Portland 4, Ore.

FOR SALE

1201 Lima Crane combination shovel, Dragline and Clamshell, 3½cy Esco Bucket.
2 Euclid Mod 27FD End Dumps, 12cy cap 165 HP Cummins, late transmissions.
3 Euclid Mod 2FD End Dumps, 12 cy cap 165 HP Cummins, late transmissions.
1 500 CFM Chicago V type 100 HP Compressor.
1 450 CFM Chicago PB-8 100 HP Compressor.
1 500 CFM LeRoi Rex Portable Compressor.
4 Johnson Turbine Pumps 200 HP 14" OD.
2 Fairbank-Morse Propeller Pumps 20" OD.
1 D-4 Traxcavator.
1 Portable 3" Homelite Pump Mod 24.
2 Portable 2" Homelite Pump Mod 23.
4 Blaw Knox 4 cy Concrete Buckets. Ledger wood Type Cable Unit.

ALBENI CONSTRUCTORS
Newport, Washington
Phone 275 PO Box 764

FOR SALE

3—420 CFM Schramm Air Compressors
2—500 CFM Gardner-Denver Air Compressors
3—1600 CFM Fuller Rotary Air Compressors
4—Model 34E Rex Pavers
3—D13000 Caterpillar Power Units
Wagon drills, Jackhammers, Tampers and other air tools.
Catalog of used equipment furnished on request.

J. A. Terteling & Sons, Inc.
BOX 1428 BOISE, IDAHO

FOR SALE OR RENT

#250 Parsons Trenchliner used only 500 hours. New in late 1942. Digs 12½' deep, 30" to 64" wide. Weller Brothers, N. 633 Madelia. Spokane, Washington. KEstone—9341.

POSITION OPEN

ESTIMATOR—Well known international construction firm desires executive experienced in the preparation of competitive estimates for bidding dams, tunnels, airfields, roads, power plants and other heavy construction projects. Knowledge of quarry operations, rock tunneling, earth moving, mass concrete and heavy equipment operation essential. Foreign experience desirable. Extensive traveling will be required. Location—New York City. Outline experience in detail. Reply P.O. Box 6 B, Western Construction, 609 Mission St., San Francisco.

Experienced in supervisory capacity in paving, grading and handling equipment. Good pay. Maybe steady job. Well-known firm Southern California. Information confidential. Younger man preferred. Box 5A. Western Construction, 609 Mission St.. San Francisco. Calif.

Our Bulletin, "The Abacus Press," presents Hundreds of Surplus Items for Sale by The U.S. Government. Trucks, Jeeps, Heavy Equipment Bulldozers, Shovels, Graders, Tractors, Trailers, Tools, etc. Both by Bid & Auction. New & used. Latest edition $1.
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Box 213A, East Hartford 8, Conn.

Engineers—Foremen—Office Men
Learn latest methods to organize and run work. Prepare for the top jobs. Send post card for details.

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CONSTRUCTION CONSULTANTS
411 So. 5th Ave. Lake Worth, Florida

FOR SALE

200 H.P. G M C diesel stationary power unit. Like new. $1650.

Martin Motor
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Salt Lake City, Utah

FOR SALE

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NEAR BREWSTER, WASHINGTON

Carnegie Length	Shipped New — Used Only One Job MP-101 Pcs.	MP-102 Pcs.	Tees Pcs.
72-65 ft.	105	100	2
65-60 ft.	210	50	9
60-50 ft.	210	5	18
50-45 ft.	290	2	7
45-40 ft.	120	1	13

Also quantity 35 ft. and shorter—Quick Shipment Regardless of job, location. Write, Wire or Phone.

MISSISSIPPI VALLEY EQUIPMENT CO.
511 Locust St., St. Louis 1, Mo., CHestnut 4474

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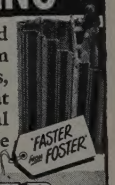

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PITTSBURGH 30 • NEW YORK 7 • CHICAGO 4
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LOW COST INSTALLATION AND OPERATION

CABLEWAYS

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ELECTRIC, STEAM OR DIESEL
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FOR SPEED ECONOMY EFFICIENCY FLOOD SAFETY LABOR REDUCTION

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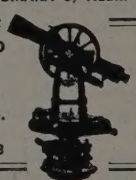
STOP that WATER

With FORMULA No. 640, a clear liquid which penetrates 1" plus in concrete, brick, stucco, plaster, etc. Seals out water, dirt Holds 20' head. Use outside and in. Preserves all absorbent materials. Sold 14 years. Quick, economical, sure. $3 in 55's. Free sample. See Sweet's.
HAYNES PRODUCTS CO., OMAHA 3, NEBR.

SOLD RENTED REPAIRED
Transits • Levels
Steel Tapes • Compasses



Portland Instrument Co.
334 S.W. 5th nr. Stark
PORTLAND 4, ORE., AT 3598

BRIDGES

Bailey bridges for rent.
Falsework trusses for rent.
Used steel truss bridges for sale.

BAILEY BRIDGE EQUIPMENT CO.
206 Bank of America Bldg., San Luis Obispo, Calif.

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BACKFILL, uncompacted

Funeral ends piledriving contract

MONTGOMERY STREET was jammed and the Raymond field office provided box seats for the contractor's people when San Franciscans held a funeral for Alfred, the West's biggest piledriver. Alfred thoughtfully saved enough steam to carry a black wreath (top) skyward on its Number 1 line during ceremonies.

April 19 was a dandy day for a funeral in San Francisco. At 10:35 a.m. "Alfred's" hammer beat its last—on the foundation contract for the new Equitable Building (**Western Construction**—February 1954 p. 59). And at noon a good portion of the city's financial district people gathered for a well-publicized wake. Alfred the Monster, which had pounded almost unceasingly for nearly four months, was dead!

Dignitaries included principals of the new building's owner, the architect, the general contractor, and the pile sub. "Raymond Concrete Pile Co.," intoned the master of ceremonies, "What an affliction!" And the company's representatives, Vice President O. C. Struthers and District Manager Russ Graff, drew a round of boo's from the crowd.

High point of the occasion was "consignment of the remains." A coffin had been prepared, and Alfred's noise was said to have been nailed inside! The coffin was put aboard an outward bound steamer, with orders for burial at sea somewhere west of Hawaii. The job had involved 415 steel piles (totaling 54,410 ft.) and something over 1,360,000 blows of the hammer. That's a lot of noise for one coffin!

The winnah!

Last summer we went to Alaska. We thought it high time that someone take on the chore of analyzing the many contradictions that had drifted down to the States. They had to do with a lot of things—even the weather, which is usually a pretty safe topic. And they came in official reports as well as in rumors.

We checked a lot of these contradictions at all levels of the construction industry in Alaska. The result was a special issue of **Western Construction** in October 1953, devoted entirely to construction in the territory.

That special issue has now been judged twice. First judgment came from you, the readers. Your response ran us completely out of spare magazine copies. And comments that were written in also boosted our feeling of accomplishment.

Now, just last month, the Western Society of Business Publications held its 6th annual Awards of Merit contest. And the Alaska issue of **Western Construction** walked off with two first-place prizes: outstanding special issue, and outstanding news reporting job. The news report was our feature entitled "Alaska: A special report on construction." It was prepared by the editor as a general analysis of events then current and significant to the construction industry in Alaska.

Engineering editors are a peculiar breed. We're engineers, but we're editors too. These awards are mighty flattering to "both of us!" They have come from authorities in both fields, engineering construction and business publishing. You can bet that we'll go on working toward more successes like this one.

P.S. Last year **Western Construction** took honorable mention in the grand prize classification. We've moved up a notch there, too: second prize in the 1954 contest.

. . . The Editors

Twenty-five years ago in *Western Construction*

"Senate Bill 712, which provides for state registration and licensing of contractors, was signed by Governor Young [California] on June 13. Assembly Bill 174 for state registration and licensing of civil engineers also has been signed."

* * *

"Contract has been awarded by the city of Seattle to **Rumsey & Jordan,** of Seattle, at $544,894, for construction of the power tunnel to connect Diablo Dam with the proposed power plant. Tunnel is to be 2,100 ft. long, 19½ ft. inside diameter, concrete lined. **W. D. Barkhuff** is city engineer."

* * *

"**Frank E. Bonner,** since 1922 district engineer, San Francisco, for the U. S. Forest Service, and representative of the Federal Power Commission, has been appointed secretary of the FPC."