



**WESTERN
CONSTRUCTION**

JULY 1950

NEXT MONTH
A New Name — A New Cover

Volume 25

JUNE 15 • 1950

Number 6

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JUN 26 1950

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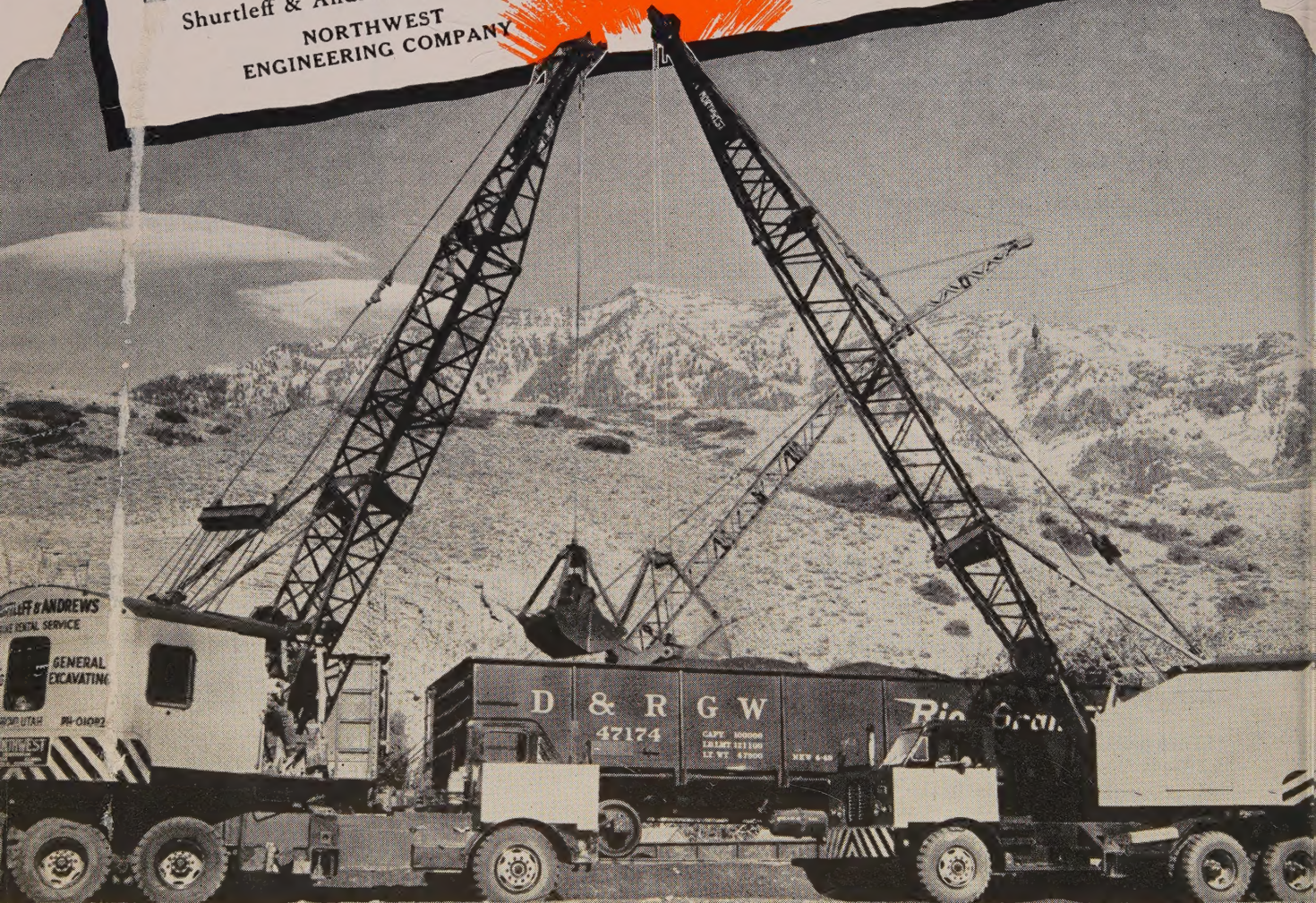
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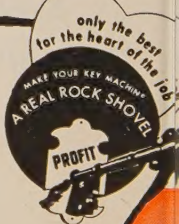
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WESTERN CONSTRUCTION NEWS

WITH WHICH IS CONSOLIDATED
WESTERN HIGHWAYS BUILDER

June 15, 1950

Vol. 25, No. 6

JAMES I. BALLARD Editorial Director
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Western Highways in Transition

WESTERN highway design and construction volume will go through a stimulating transition period during the next few years according to the outlook indicated by the articles in this annual issue.

Foremost development will relate to the problem of highway finance and the means of overcoming the growing deficiency in state highway programs resulting from the war years. Highway and public officials are agreed that the present program is losing the modernization battle—one step ahead and two back. Current revenues might be able to handle new construction and normal maintenance, if we were caught up on the deficiency. A supplemental program, added to that available from present funds, would take up this slack during the next few years. The regular program would then continue. Methods of financing this added program include the idea of toll roads, which seems to be the Eastern answer, but Senator Collier, chairman of the California interim committee on highways, advances valid reasons for proposing bond financing. Without trying to hide his appreciation of the disadvantages and pit-falls in bond financing for highways, the Senator makes a strong case for using this method, if it can be surrounded by adequate safeguards. Such programs, which are now being discussed in several Western states, would stimulate highway construction in this region.

Another significant development is indicated by the Washington Department of Highways making plans for the first urban freeway in that state. The traffic problems of Los Angeles have made that area the freeway-building example of the West, but the plan outlined for Vancouver on the main Seattle to Portland route indicates that this type of improvement program will become a more common solution to Western highway traffic problems.

Next, there is the problem of truck transportation, which is by no means regional, but has features that give it Western twists. Mountain grades and curved alignment, with resulting slow speeds for trucks, have turned engineers' attention to the possibility of adding another lane for commercial vehicles moving up-grade at less than 25 m.p.h. Also, tunnels which cut through ridges and save the lifting of foot-tons of freight, will receive increasing study both as to design and economics as commercial traffic increases in volume. Again, the physical dimensions and weights of trucks will be watched for their effect on existing highways. There are indications that size and weight have become standardized for the immediate future. Now attention turns to the other factor relating to the repetitions of legal loadings as truck traffic increases. It is relatively easy to load a truck to a legal weight, but it is quite different to be able to assure that a section of highway will carry this loading as the number of repetitions builds up. Results of such observations and studies, in turn, will be

closely related to maintenance. And maintenance will take on new significance as it is forced further toward the border-line of wholesale rebuilding. This could result in developing new equipment and methods to handle this expanding mileage of reconstruction.

In all, the next few years will not only witness an accelerating volume of highway construction in the West, but also create demand for the solution to new engineering problems and the development of new construction techniques.

Graduates: Specialty vs. Breadth

THIS MONTH engineering colleges of the West will graduate the annual crop of seniors to start their careers somewhere within the broad borders of the construction industry. They enter a field which is becoming more specialized each year. Probably they have channeled their professional education into one of the accepted divisions of the field through inclination, or through the hope that it will help in securing a job. Advance within any branch, whether it be design, field operations or a commercial position, will depend on the application of the graduate's specialized technical knowledge, combined with as much scientific and practical information as can be assimilated. In his zeal to become recognized as a specialist and secure stature in his chosen field, he is apt to take a dim approach toward other divisions of the profession and construction as an industry. Employers would be helpful if they encouraged the development of breadth as well as depth in the progress of the graduate. Only as the broad base of engineering interest and knowledge is maintained will the young engineer grow and be ready to accept greater responsibilities in later years as his horizon of activity widens. Specialization combined with breadth of interest in the work of others develops the well-rounded engineer who is ready for the immediate assignment and the ultimate responsibility.

Next Month . . .

WESTERN CONSTRUCTION NEWS

becomes

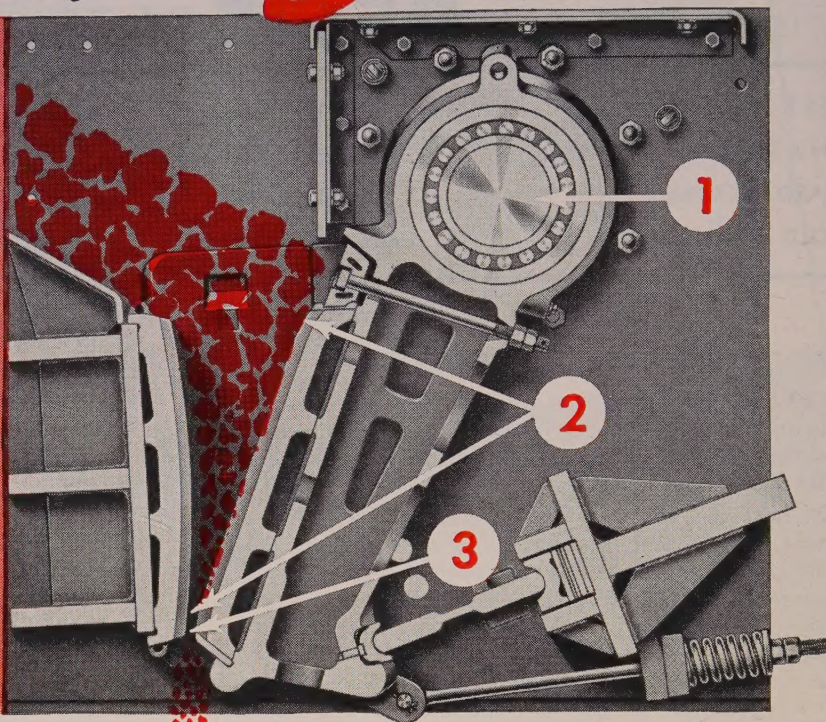
WESTERN

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with a new and modern front cover design

1 speed 2 long jaws 3 long stroke

**It Takes
ALL 3**



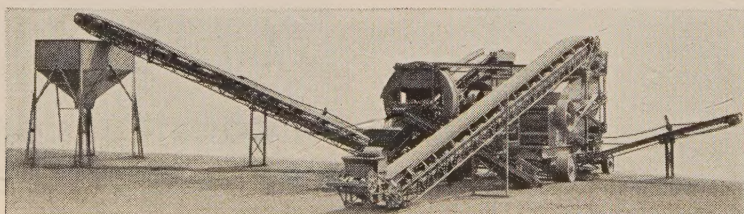
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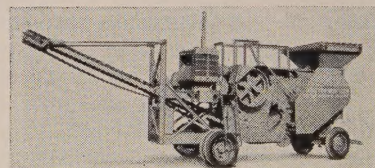
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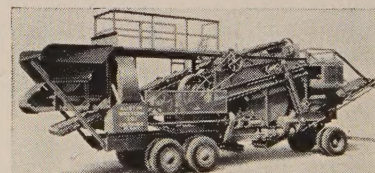
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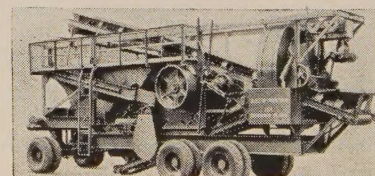
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MONTANA—WESTERN CONSTRUCTION EQUIPMENT CO.....Billings
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Washington Planning First Urban Freeway Construction

To handle a traffic volume increasing 10% per year, a freeway will be constructed through Vancouver to connect with the important Interstate Bridge across the Columbia River

THE WASHINGTON State Highway Department's experience with limited-access rural highways and urban freeways is limited both as to time and extent. However, it was realized before World War II that increased traffic volumes and advancement in all branches of automotive transportation required safer and more efficient highways. It was apparent that the economy of the state made it mandatory that the cost of highway transportation be reduced through systematic planning and designing of higher capacity highways. The logical place for the initiation of a program of highway improvement was Primary State Highway No. 1 at Vancouver, Wash., on U. S. Highway 99.

Local situation

The Interstate Bridge over the Columbia River connecting Vancouver, Wash., and Portland, Ore., is a toll-free bridge jointly owned and operated by the two highway departments. The Cascade Locks Bridge over the Bonneville Pool, 45 mi. upstream from the Interstate Bridge; the Longview Bridge, 45

mi. downstream; and the Hood River Bridge, 65 mi. upstream, are all toll bridges. These four bridges are the only highway crossings over the Columbia River between the Pacific Ocean and the Kennewick-Pasco Bridge, for a distance of 320 mi. by river.

The Interstate Bridge, because of its location on the principal north-south highway connecting all the large popu-

By
W. A. BUGGE
Director,
Department of
Highways,
State of
Washington



lation centers on the Pacific Coast and, to some extent, because it is a free bridge, serves 85% of all the motor vehicle travel between Oregon and

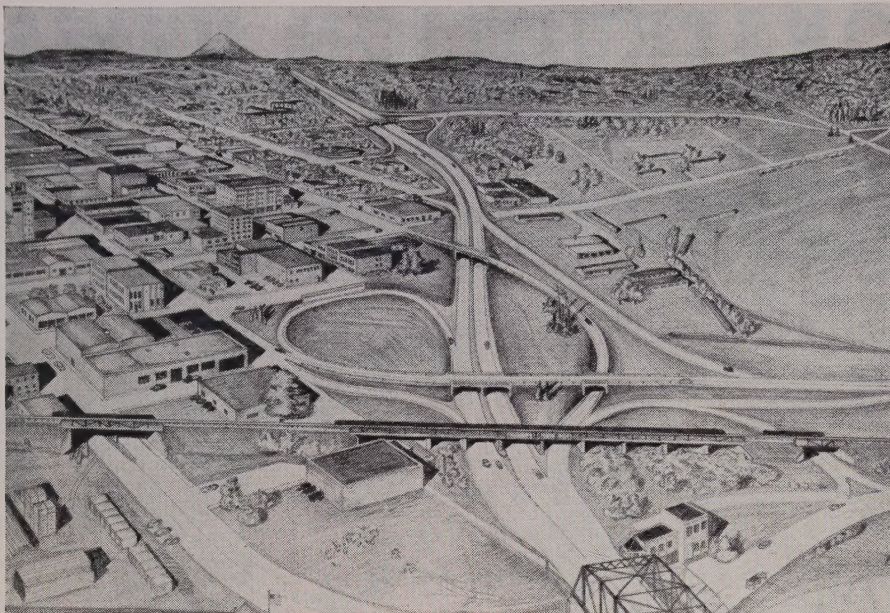
WHITE RIBBONS show route of 4-lane depressed freeway. Interstate Bridge at bottom; Vancouver business district, left.

Washington. About 50% of the traffic over the Interstate Bridge is inter-city travel between Portland and Vancouver. The bridge is 38 ft. wide between curbs, providing space for four traffic lanes about 9½ ft. wide. There is no median or separating strip between opposing traffic lanes on the bridge.

The Interstate Bridge was financed by a bond issue floated jointly by Clark County, Wash., and Multnomah County, Ore., and opened to traffic as a toll bridge on Feb. 14, 1917. It was designed for two lanes of vehicular traffic and two street railway tracks. In 1928, the states of Oregon and Washington purchased the bridge from the counties and abolished toll charges, making it the only toll-free crossing on the lower Columbia River.

Initial planning study

With the inauguration of the statewide planning survey in 1936 and 1937, data



PRINCIPAL traffic interchange on the freeway is in the downtown area of Vancouver at the north end of the Interstate Bridge. Ramp connection to business section is in left foreground.

were collected and studies made for a new route for Primary State Highway No. 1 (U. S. Route 99), beginning at the north end of the Interstate Bridge in the City of Vancouver. E. C. Simpson, at that time district engineer for the State Highway Department, initiated several reconnaissance surveys for an improved highway route north of Vancouver. It is believed that all possible routes through the city and northward have now been thoroughly investigated and analyzed. Further, the cities of Vancouver and Portland have completed several planning surveys which have included studies of traffic problems in Vancouver.

The Planning Division of the Washington State Highway Department, in cooperation with the Oregon Highway Commission, has also conducted origin and destination traffic surveys and made special studies for the planning and design of the proposed new highway facility northeasterly from the vicinity of the Interstate Bridge.

Problem recognized before the war

Early in 1940, before war industries contributed so largely to traffic congestion in all Pacific Coast cities, it was evident that traffic volumes had increased in Vancouver to the point that additional traffic routes were required to relieve congestion on the streets of the city and to expedite through traffic.

All responsible public and private agencies that have analyzed the Vancouver traffic problem have recommended a freeway connecting to the Interstate Bridge extending northeasterly through Vancouver following closely for about one mile inside the boundary of the Fort Vancouver Military Reservation.

Those who have offered solutions for the Vancouver traffic problem have generally adhered closely to the principles of design and construction proven practical by experience in other congested traffic areas. Nation-wide research and scientific analysis of the economics of

automotive transportation in congested urban areas have shown that a freeway arterial should: (1) be located near the outer margin of commercial or industrial areas, (2) provide traffic interchanges strategically located to provide convenient routes of travel for major traffic movements and (3) provide for free flowing through traffic, without conflict with local traffic or local business enterprise.

Route easy; right-of-way difficult

The selection of the general route of the freeway (see illustration) has not been a complex or difficult problem but the location and design of grade separation structures and traffic has provided some complications, due to existing traffic requirements, railroads, cemeteries and public parks.

The acquisition of right-of-way presented the most difficult problems in the location and design of the freeway and traffic interchanges. The principal traffic interchange (see illustration) is located at the north end of the bridge and is designed to provide free flow of traffic from the bridge directly to the freeway through the city. This interchange is also the junction point for Primary Highway No. 8, which is the principal arterial highway up the Columbia River Gorge to the eastern part of the state. The local and commercial traffic from Columbia, Washington and Main streets will merge with or cross the freeway through this interchange.

The interchange, as planned, will require the acquisition of the greater part of four blocks of business property in the lower end of the commercial zone.

Fortunately, the highway department has been able to secure nearly 1 mi. of right-of-way inside the westerly limits of the military reservation, permitting the construction of a depressed freeway and the maintenance of Western Reserve St. as a frontage road for local traffic. This plan leaves undisturbed about 20 blocks of residence and busi-

ness property along the westerly limits of the military reservation. The depressed freeway greatly reduces the cost of constructing the necessary grade separation structures and traffic interchanges. Inside the Military Reservation it will be necessary to remove a considerable section of the Bureau of Public Road shops and to move several military barracks buildings, some of which are of brick and masonry construction.

The freeway route bends westward and leaves the military reservation a short distance south of the military cemetery and traverses sixteen blocks of closely built up residence area before reaching the Leverich City Park. For a part of the distance, slope encroachment and right-of-way costs will be reduced by the construction of retaining walls. Landscaping of the freeway will harmonize with the terrain and the architecture of the buildings bordering the freeway.

The Spokane, Portland and Seattle Railroad crosses over the route of the proposed freeway about 250 ft. from the bridge end at an elevation that requires a depressed crossing under the railroad for the ramp connections for Columbia, Washington and Main Streets.

The City of Vancouver has acquired right-of-way for a street across the military reservation requiring a grade separation structure in the vicinity of 14th Street. A previous plan had placed this interchange at 10th Street.

The overcrossing at 22nd Street will carry traffic from Secondary State Highway No. 8-A and the St. Johns County road over the freeway. A more direct connection could be made to East 26th Street, which is the arterial access road to the down-river industrial area along the north bank of the Columbia River, if a cemetery were not an obstacle.

The triangular military cemetery in the northwest corner of the military reserve extends across the eastward prolongation of East 26th Street and is an obstacle that prevents the construction of a more desirable interchange at this strategic location. To avoid the cemetery, the freeway has been located along the west boundary of the cemetery and traverses about ½ mi. of residential area where right-of-way is costly.

Near the northern city limit the freeway crosses the westerly limits of Leverich City Park. Some readjustment of recreation facilities and park roads will be required to provide right-of-way for the freeway.

Traffic volume and distribution

The reported 1948 annual average daily traffic volume on the Interstate Bridge is 28,600 vehicles. During the past ten years traffic volume in the vicinity of the bridge has increased at an average rate of 10.7% per year, which indicates an average daily traffic of 32,750 for 1950. July is the peak month on the bridge, with Sunday traffic volume about 138% of the average daily traffic, or a peak volume for July Sundays of 45,200 vehicles.

The calculated practical capacity of

Continued on page 140

Heavy Construction in Previously Inaccessible Area for— Alaska's Big Turnagain Arm Project

To open Alaska's interior to vehicle travel, 71.6 mi. of highway is being constructed around Turnagain Arm, partly along the toe of steep mountain slopes—The highway link will complete connection between Seward and Anchorage

THE CITY of Seward, located on Resurrection Bay on the southeast coast of Kenai Peninsula, is the ocean terminal serving the portion of Alaska known as the rail belt since it is largely dependent upon the Alaska Railroad for access and supplies. While Seward is not located on the mainland, being on a peninsula 115 mi. south of Anchorage, the largest city in Alaska, it is important as being the only all-year ice-free port available for civilian use. The port of Whittier, used by the military, was connected by rail to the Alaska Railroad in 1942.

Seward has been connected with the interior by rail since the opening of the Alaska Railroad in 1918 but has been without a highway connection, since the Forest Highway beginning at Seward and extending north to Turnagain Arm through the Chugach National Forest terminated at Hope on the south shore of Turnagain Arm, 22 airline miles from Anchorage. With the growth of population in Alaska in recent years, and the increased significance of the military installations at Anchorage and Fairbanks, it has become desirable to connect the highway system of the Kenai Peninsula with the interior of Alaska roadway network which now extends only to Anchorage.

Location problems

The apparent solution was the extension of the existing Forest Highway across Turnagain Arm to Bird Point on the north shore, with a highway connection on into Anchorage. Such a proposition had been advocated by local interests in the City of Anchorage. This proposition appeared promising since Turnagain Arm is not a deep waterway such as are the estuaries or fjords of Southeastern Alaska, but is a shallow arm cutting the peninsula off from the mainland.

To determine the most economic and feasible crossing of Turnagain Arm, three locations were surveyed by the Bureau of Public Roads in the spring of 1945. There were:

1. Via Railroad, Mile 26 (McHugh Creek) and Gull Rock.
2. Via Bird Point Railroad, Mile 81, Sniper's Point and Sunrise (Existing Forest Highway).
3. Via Portage Railroad, Mile 67 and Quartz Creek.

The Gull Rock crossing was found to involve a bridge structure which would

be about 4 mi. in length and requiring long spans and deep piers, to be constructed in water 10 to 60 ft. deep at low tide, reaching a maximum depth of 95 ft. at high tide. This, coupled with the hazards of swift tidal currents, large heavy

ice flows and high winds, resulted in the conclusion that the site was not economically feasible.

The second crossing, between Bird Point, on the north side of the arm and Sniper's Point, on the south, was given careful study. This location had been considered, by all who had studied the problem of a bridge crossing Turnagain Arm, to be a feasible site for a bridge or causeway crossing. It affords the shortest distance across the arm (10,000 ft.) before reaching its eastern end. The survey of this site, however, disclosed that very swift tidal currents occur with each



PLANE taking off from new grade on the C. F. Lytle Co. and Green Construction Co. Turnagain Arm contract section. Due to isolation of the work, airplanes were used constantly for transportation of personnel and emergency supplies, such as critical repair parts.



ON THE MOUNTAINOUS portion of the Lytle-Green contract, it was found that 4-wheel drive or tracked vehicles were essential for transporting men and supplies.



GLACIER CREEK Bridge, above, was constructed near Girdwood, on the Turnagain Arm project. At left, welders splicing built-up steel rails for use on the bridge. Contractor was J. J. Badraun.

tide change and that the tide reaches a height of 38 ft. above mean low water. Flow readings indicated current velocities of from 4 to 12 mi. per hr. Flowing ice also had to be considered in determining a span arrangement and pier design. The main channel has a width of approximately 3,000 ft. and the balance of the crossing is a tidal flat over which the water rises to a height of 15 ft. Foundation borings made at this location were carried to a depth of 200 ft. below mean sea level without encountering solid rock or consolidated clays, encountering only sand and silt with occasional streaks of small gravel. With such foundation material, bridge pier foundations would have to be carried to great depths to insure the safety of the structure against scour. The estimated cost of the structure at this location was considered excessive for the benefits to be derived.

The third crossing location, Railroad, Mile 67 (3 mi. north of Portage) was on the north side of Turnagain Arm to a point about 1,000 ft. northwest of the mouth of Quartz Creek. The survey of this crossing indicated that here at the head of the arm the maximum tidal variation is only 13 ft. and it would be economically feasible to build a bridge and embankment crossing. Foundation borings were made at this location and again the deep sand was found.

It was, however, finally concluded to build the highway via Portage Junction Railroad, Mile 64, and around the head of the arm crossing Twentymile River, Portage River, Placer River and Quartz Creek with individual bridges. Foundation exploration borings were made by Lynch Brothers of Seattle, Wash.

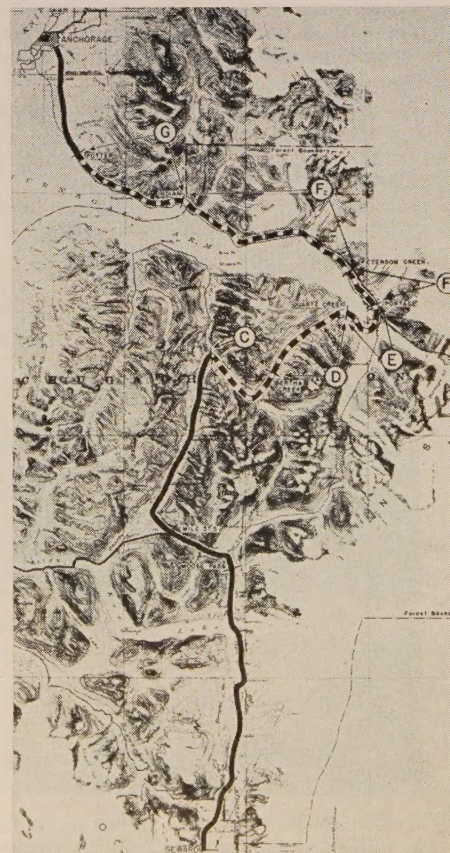
After it was decided to abandon the possibility of an arm crossing, it became necessary to select the best route around the head of the arm. Large snow slides were to be anticipated on the south shore of the arm between Hope and Portage, so a location was chosen which began at a point 10 mi. south of the arm and followed a favorable inland route through the mountains to a point near the head of Turnagain Arm, thence fol-

lowing the north shore to Anchorage. Seventy-three miles of new construction was required.

From the beginning of the project to Portage the route traversed mountain valleys involving heavy construction in a previously inaccessible area. From Portage to Potter, 12 mi. from Anchorage, a location was necessary which followed the north shore at the toe of steep mountainous slopes. The location problem through this area was made difficult by the existence of the railroad already constructed in the most favorable position and the long steep mountainous slopes which were known to be a source of frequent and dangerous snow slides.

The 12-mi. section, from Indian at the west forest boundary on the north shore of the arm to Potter, was the most expensive to construct as the railroad was generally benched in at the toe of

DASHED LINE shows location of present construction as it bends around Turnagain Arm. Anchorage is at top, Seward at bottom of route.



extremely steep rock slopes. The possible alternates of placing the road either above the railroad or lower and outside were considered but the final choice provided for a new roadbed to be constructed for the railway at a safe elevation above high water and below and outside of the existing roadbed, which was then adopted for the highway and made usable for that purpose by provision of the necessary roadbed widening.

The adopted standards for construction included a 22-ft. roadbed on the 19.2-mi. section lying through the mountains at the beginning of the project, with a maximum 24-deg. horizontal curve and maximum 7% grade. For the portion of the project adjacent to Turnagain Arm, a 24-ft. roadway width was adopted with maximum 12-deg. curves and 7% maximum grade. For the reconstructed grade between Indian and Potter a 6 deg. maximum curve was adopted. Bridge roadway widths 24 ft. wide were specified.

The project was constructed under a cooperative agreement by the Alaska Railroad and Alaska Road Commission of the Department of the Interior and the Bureau of Public Roads, formerly a constituent organization of the Federal Works Agency and now a bureau of the Department of Commerce. As finally adopted, the agreement provided that the Bureau of Public Roads would construct the portion of the project 47.7 mi. in length within the Chugach National Forest and the Alaska Railroad would construct the 11.9 mi. between Indian and Potter which comprised the joint highway-railroad section, with the remaining 12 mi. from Potter to Anchorage being constructed by the Alaska Road Commission by day labor.

The portion of the project being constructed by the Bureau of Public Roads is divided into four grading and bridge contracts and one contract for five bridges only covering the construction of five steel structures. The value of the contracts supervised by the Bureau of Public Roads totals about \$8,282,000 and with the work handled by the other organizations the total cost of the project is approximately \$14,500,000.

Three glacial streams are crossed at the head of Turnagain Arm. Glacial streams typically occupy very wide stream beds but are generally shallow, thus permitting adoption of treated timber pile trestle construction with concrete decks. The total length of trestles for the three main large streams and the minor overflow channels involves 3,920 ft. of timber trestles. Other bridges necessary in crossing 14 smaller streams require structural steel girder bridges with concrete decks totaling 2,375 ft. in length. A feature of the bridge construction design is the provision for precast stringers in place of treated timber stringers previously used for this type of construction. The substitution was made to permit wider use of local materials and was adopted at a time when structural timber was in very short supply.

The hazard of snow slides has been noted and the design has been made to



CRANE placing precast concrete stringers on one of the trestles at the east end of Turnagain Arm, this one constructed by Munter & Phillips, subcontractors to Lytle-Green.

locate the roadway, where possible, as far out from the toe of the slope as possible without seriously sacrificing alignment or shifting the roadway into deep water. Where the alignment follows the sidehill well above the railroad the roadway was designed through snow slide areas to provide for minimum cut or fill to offer as little obstruction to movement of the slides as possible.

The major items involved in the Bureau of Public Roads' contracts are listed as follows:

Excavation	1,340,000 cu. yd.
Borrow	1,500,000 cu. yd.
Borrow Haul.....(mi.)	1,210,000 cu. yd.
Concrete	7,530 cu. yd.
Structural Steel.....	1,882,000 lb.
Treated Timber Piling	28,700 lin. ft.
Culvert Pipe	27,400 lin. ft.

Seward being 1,585 mi. by water from Seattle, a major problem, from the contractors' viewpoint, was the cost and time required for shipment of equipment and supplies to the project. Operating plans required much more generous provision for repair facilities and stores of parts.

Other than the difficulty of access to the work, the most serious feature of construction which increased the difficulty of the contractors' operations was the necessity of stripping muskeg materials from some sections of roadway cuts and fills. In general muskeg con-

sists of organic peaty materials overlying either rock, gravel or clay formations. The muskeg was encountered at all elevations and was frequently found in cuts as well as fill sections. Material was stripped and wasted at selected sites, having regard for appearance and drainage.

Present contracts provide for grading and construction to a selected material type surface but future plans include crushed stone base course and bituminous surfacing on the entire length of the new work, with complete reconstruction and paving of the existing low standard road from Seward to Mile 58 being contemplated.

Construction was started in the fall of 1948 and is expected to be completed in the summer of 1951. B. M. French, District Engineer of the Seward District of Division 10 of the Bureau of Public Roads has supervised the portion of the project constructed by the Bureau of Public Roads.

Contractors on the work on the Bureau of Public Roads' section are: C. F. Lytle Co. and Green Construction Co. of Des Moines and Sioux City, Iowa; Max J. Kuney Co. of Spokane, Wash.; and J. J. Badraun of Seattle, Wash. On the Indian to Potter section supervised by the Alaska Railroad the contract is let to Morrison-Knudsen Co., Inc., Peter Kiewit Sons' Co., and S. Birch & Sons Construction Co.

The largest single improvement now under way is the paving program. In 1949, 145 mi. were paved with a light bituminous surface. Contracts have already been let using available funds for the paving of over 200 mi. more in 1950. By the end of the year it is hoped that paving will be completed on the Glenn Highway from Anchorage as far as Sheep Mountain; from Fairbanks as far as Big Delta; from Haines to the Canadian border, and other short pieces. By the end of the year much additional paving work will be under way. This will include completion of surfacing of the Glenn Highway and considerable paving on the Richardson Highway out of Valdez and between Copper Center and Big Timber Lodge.

In the climate of Alaska, roads must be given special attention at the time of the spring break-up and during periods of heavy rains. The new pavements will especially require great care at these times. Reduction of loads will be necessary and intelligent cooperation from the public is essential. Improper use can very easily destroy improvements performed at heavy expense.

Reconstruction work will include the Tok Cutoff which has been one of the worst through roads. By the end of 1950 conditions should be considerably improved on this key highway. After it has been reconstructed, it is planned to pave the Tok Cutoff in a similar manner to the other through roads.

New road construction will include completion of the Sterling Highway connecting Homer and Kenai with Seward. This highway, which was opened to traffic during the past winter over the frost, requires grading and surfacing with gravel before it will be suitable for summer travel from end to end.

Construction is rapidly progressing on the new road to connect Anchorage with Seward and the Kenai Peninsula (see above). Along Turnagain Arm the entire project is under contract and by the end of 1950 this road can be opened to limited traffic from end to end. This project is one of the most important in Alaska and is being handled as a co-operative undertaking of the Alaska Road Commission, the Bureau of Public Roads, and The Alaska Railroad. Final completion and formal opening of this highway, which will link the whole of the Kenai Peninsula to the outside world by road, is planned for 1951.

Construction will continue upon the new road extending northward from the Alaska Highway to Chicken, Jack Wade, and Eagle. It is anticipated that the road will be opened by mid-summer to Jack Wade, from which point a road now extends eastward to the Canadian boundary and on to Dawson, the capital of the Yukon Territory. This road will connect Dawson by road with the other parts of the Yukon Territory, the remainder of Canada, and the United States. In Alaska, new construction will continue from Jack Wade northward toward Eagle and it is hoped that a connection will be made to Eagle by the end of 1951. This will open extensive

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Large Maintenance and Construction Program Planned for Alaska in 1950

WORK of the Alaska Road Commission for 1950 will include a large program of road maintenance, reconstruction, and new construction in most of the inhabited regions of Alaska. Funds for carrying out the program are contained in the Department of the Interior Appropriation Act (not yet passed by Congress), together with Alaska Territorial road funds under a cooperative agreement, and funds contributed by

private interests for specific road purposes.

The program contemplates an increase of approximately 36% for maintenance over last year. Traffic has greatly increased and most of the roads must be kept open in winter as well as in summer. Year-around maintenance is planned for the Alaskan Highway, Glenn Highway, part of the Richardson Highway, and many local roads.



A SEVERE WINTER, coupled with a continuing increase in heavy truck traffic, caused excessive damage to Oregon highways. At left, a sleet slide last January cut off travel entirely on the Columbia River Highway 8 mi. east of Cascade Locks.

Oregon Will Recondition Inadequate Surfaces to Cut Maintenance Costs

HEAVY TRUCK traffic on Oregon's highways has increased three-fold during the past eight years. During the past winter, even more trucking was in evidence as a result of increased logging and lumber production. Coupled with two months of severe freezing weather, this has caused excessive damage to highways, particularly those with lighter surfaces. Prompt steps have been taken to repair this damage by existing maintenance forces and by awarding contracts for that part of the re-oiling in excess of the capacity of Oregon's five oiling crews.

The cost of highway maintenance has doubled during the past four years in Oregon. A plan is being developed to reduce the maintenance on those highways which require excessive repair by reconditioning them with additional base where needed and with asphaltic concrete surface of 3 to 5-in. thickness. A plan including such definite improve-

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ments on a number of highways is being considered by the Oregon State Highway Commission. Increased weight and increased number of heavy trucks, particularly those hauling logs and lumber, require this improvement of surface. Highways with adequate surface do not require excessive maintenance costs and do provide safer service and smoother riding.

Oregon's highway maintenance department is not increasing its number of employees this year. The total force including repair shops is 1800 men. The department has spent about \$1,000,000 for road equipment this year to replace old worn-out equipment. During the two previous years equipment valued at

about \$1,700,000 was purchased. This will reduce equipment repair costs and increase amount of work which can be done by a given crew. A number of good contractors in Oregon have oiling equipment. It appeared they would bid a favorable price and that quicker repairs on part of the damaged highways could be made by them than if the department purchased additional equipment and organized new crews to perform this excess program.

In 1949, Oregon's five oiling crews shot 4,050,000 gal. of oil on 796 mi. of highway during the oiling season and a similar output is expected this year. In addition, about 900,000 gal. of re-oiling will be contracted, covering about 180 mi. Some of these contracts have already been awarded and five were let during May. Two asphaltic concrete resurfacing jobs covering 15 mi. are now under way and an additional 165 mi. will probably be placed under contract later at a cost of about \$3,000,000. This is planned as a continuing program.

The resurfacing with asphaltic concrete is considered a capital outlay and not maintenance. For maintenance this year, Oregon's budget is no more than 1949 and efforts are being exerted to reduce maintenance costs. It is believed that a large program of reconditioning inadequate surfaces will be a forward step both in reducing maintenance costs and improving service to the traveling public. A surface which requires frequent and large amounts of patching is never very smooth or safe. Travelers coming to Oregon this summer will in most instances see little evidence of the past winter's damage because repairs are well under way and all holes and break-ups are patched as they occur.

California Decides Who Has Freeway Location Authority

FREEWAYS are constitutional, and California's Legislature has made a valid delegation of authority to the California Highway Commission to determine when and where they shall be constructed. This is the gist of a decision of the California Supreme Court, in the North Sacramento freeway case, upholding the power of the Commission to authorize relocation of highways. The decision was unanimous in upholding every contention of the State Department of Public Works in the litigation over the Sacramento-Roseville Freeway in Sacramento and Placer counties. The decision of the Supreme Court was handed down in the case of Holloway vs. Purcell in an opinion written by Justice Traynor and concurred in by all other justices of the court. A previous decision of the Superior Court of Sacramento County denying an injunction was affirmed.

The decision, it was pointed out by

Director of Public Works C. H. Purcell, completely validates such highway relocations as the Ridge Route between Bakersfield and Los Angeles, the Prunedale Cut-off north of Salinas, the recently completed Fairfield By-pass in Solano County, and the proposed relocation of the State highway as a freeway between Sacramento and Roseville, proposed relocation of the Redwood Highway northerly of Petaluma, and other similar improvements heretofore completed or presently proposed by the State.

The plaintiffs, motel owners and taxpayers, sought to enjoin the relocation of a portion of State Highway Route 3 (US 99E), between Sacramento and Roseville, on the ground that the California Highway Commission was without power to abandon any portion of Route 3 running past the places of business of plaintiffs since the highway had been constructed pursuant to provisions of State Highway Act of 1909, which Act provides for a system of State highways "permanent in character" which

are to be "permanently maintained and controlled by the State . . ."

The objecting property owners also contended that the constitutional provision, adopted in 1902, Article IV of Section 36, specifically authorizing the Legislature to establish a system of State highways, also precluded the State from authorizing the relocation of any highway once established under that constitutional provision and likewise precluded the State from building any "new and different type of State highway" than was commonly understood and generally in use when the constitutional provision was adopted. As freeways and limited access highways, with the access to abutting property and intersecting streets cut off, were not in use in 1902, it was contended that the Legislature could not now constitutionally authorize the Department of Public Works and the Commission to establish such highways.

In a clear cut decision, the court swept aside all of these contentions as

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WESTERN HIGHWAYS AND THE TRUCK PROBLEM

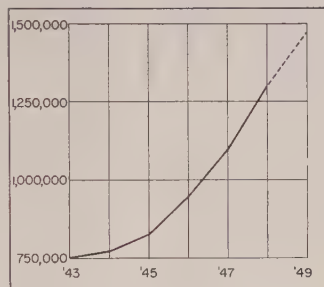
A Foreword . . .

TRUCK TRANSPORTATION is the greatest single force affecting the design and construction of the highways of the West. The steady increase in passenger vehicles resulting from spectacular population growth will result in more highway mileage, and more lanes, *but* it is the truck traffic which is producing engineering problems that will affect road design and construction, bridge building and surface maintenance. All elements of the construction industry have a vital interest in the commerce on the highways of the West.

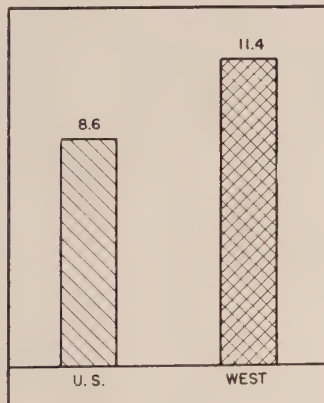
Trucks have helped build the West

The West has grown up with truck transportation. This region of the United States has developed its tremendous growth following the era of railroad net-work building and without benefit of inland waterways. It was natural that as soon as motor vehicles were developed for hauling loads they would be adopted into the economy of the West as a means of moving commerce. Further, this region built its basic economy on the production of bulk raw materials and agricultural products, which emphasized the flexibility of truck hauling to rail-loading centers and local markets. Later, as population stimulated the development of industry these processed raw materials began to move back to consumer markets by the means already well established and available. In all, growth of the West and trucking have been in step. The highway engineers and the construction industry in this region have been forced to assume responsibility for facilities to handle more commerce on public highways than in any other part of the United States.

The extent and character of this highway traffic and its growth can be demonstrated by a few simple relationships. For example, using the index of truck registration, the growth of commercial hauling has doubled since 1943 (number alone, not considering increase in size per truck). The West has almost 20% of the nation's trucks, with one per 13 people,

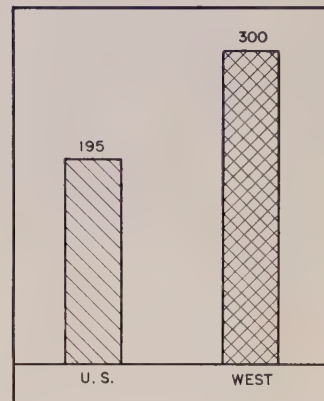


REGISTRATION of trucks in the West has sky-rocketed to double in six years.



LOADS on trucks are 32% heavier (tons) in this region than the U. S. average.

as compared to one per 20 people as the U. S. average. As to size, the average truck load in the West is about 11½ tons as compared to the national average of 8½ tons for interstate haulers. Also, these trucks are on the highways more for the average annual mileage per power unit is about 67,500 mi. in the West, and only 47,500 mi. for the nation. Just to add one further fact of regional significance, today about 50% of the freight moved in California travels the highway.



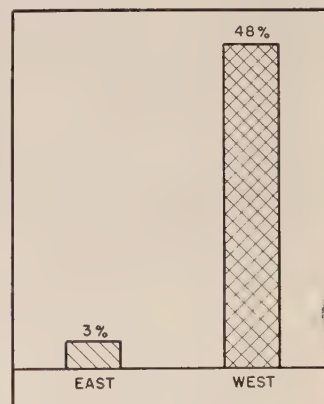
HAULS average 300 mi. for Western trucks, compared to 195 mi. for the U. S.

But trucks are providing highway problems

Those responsible for designing and building Western highways live with this pyramiding problem. Assuming the factor of gross weight and axle loads has reached relative stability, the effect of load-repetition on surface, base and foundation represents a problem of growing significance. Further, trucks must be provided with some means of getting into and through municipalities. City streets with sharp turns were not designed for highway hauling units and their unloading. In rural areas these heavier loads tend to use county roads more frequently, developing another set of problems. Mountain grades and curves, with trucks operating at slow speed and making passing difficult, present other problems that will influence location and highway economies.

These considerations emphasize the need for a far-reaching review of the entire problem. Not merely a review of axle-loads, lane width, bridge loading, grades and curves, but a back-to-fundamentals study of the problem is timely.

To help explore some of these problems with the presentation of basic data that is informative rather than controversial, a group of articles has been assembled to cover such phases as: (1) A broad discussion of highway utilization, (2) present position of the trucking industry, (3) axle-load studies made by the Bureau of Public Roads, (4) some known effects of overloading, (5) speeds on mountain grades, (6) two examples of private trucking roads and (7) financial adequacy.



AXLES of 5 or more per hauling unit carry 48% of Western highway freight compared to 3% in Eastern states.

Highlights of the Western Highway Transport Problem

Rapid regional expansion, increase in number and size of trucks, growing deficit in highway plant and mounting maintenance costs are major observations

IF MILLIONS of automobiles were suddenly equipped with flanged wheels and put on railroad tracks, the railroads would face something like the operating conditions which now prevail on Western highways. As freight trains labored up long grades, miles of automobiles would stack up behind them. Conversely, passenger and freight train schedules would become totally disrupted as large volumes of automobiles clogged the main lines. If, in attempting to revamp their systems to meet this new traffic requirement, the railroads were forced to undertake construction and maintenance at half the rate necessary to keep abreast of the demand, they would find themselves in the unenviable position now occupied by the men who are responsible for our highways, roads and streets.

Crude as this analogy may be, it at least suggests a situation which would command the attention of the public. But an equivalent situation occurring on our highways, as it is occurring, does not impress itself so vividly upon the public mind. The public appears to have little if any conception of the magnitude of our highway traffic problem or the costliness of moving traffic over our inadequate routes.

The governors of the eleven Western States have estimated the critical deficiencies of our highways, roads and streets at \$5,800,000,000. The national figure is \$41,000,000,000. These deficiencies represent an incalculable drain on our economy in the form of lost time, increased vehicle operating costs, greater wear and tear, and mounting burdens of highway maintenance, which are further contributing to the deterioration of the system. The deficiencies represent a threat to our national security—those on the 38,000-mi. national interstate highway system have been reported by the U. S. Bureau of Public Roads at \$11,000,000,000, and the Army regards this system as being the bare minimum which would be required in a present emergency. The deficient system is contributing to the enormous loss of 32,000 lives per year, 5,500 of them in the West.

Finally, perhaps the most disturbing part of the picture is that our construction program is continually falling further behind—the situation is getting steadily worse.

All this calls for sober thought by all citizens, and for concentration by all who are professionally interested in roads, on ways and means of bringing such public awareness into being.

In placing emphasis on the highway

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problem, we are dealing with the system which constitutes the roadbed—the main and feeder lines—of the trucking industry. The highway problem is influenced by, and in turn exercises its influence upon, the operation of trucks. An outline of the more striking features of our highway predicament may therefore provide some essential background to the succeeding articles on specific phases of the trucking question.

The highway problem strikes the West with particular force for several reasons. Although it is difficult, if not impossible, to develop a statistical case showing that the West puts more reliance on motor vehicles than does the rest of the nation—that is, relative to the other vital means of transportation—it is nevertheless true that the region has more vehicles per capita and more distance over which to operate them. There is about one registered motor vehicle for each 2.9 people in the West, compared with one for 3.6 throughout the United States. In addition to its own motor vehicles—more than 6,700,000—the West must accommodate a large influx of tourists, which in Washington, Oregon and California amounted to 1,640,000 passenger cars in 1949.

The Western problem is rendered continually more acute by the region's rapid expansion. While the national population increased by 12% from 1940 to 1948, the population of the 11 Western States increased by nearly 41%, and there is reason to suppose the trend will continue. The effect of such expansion is continually to widen the gap between highway needs and the available means of meeting them. Such expansion quickly outdates forecasts of requirements. As an illustration, the forecasts of gasoline consumption and of population used in California's "Collier" report of 1946, which were basic to the estimates of future highway needs, are already exceeded by 12% in each case.

With regard to trucks in particular, the West has special problems because its trucks are heavier and there are more of them. In 1948 the average loaded weight of combination vehicles in the West was 47,300 lb., while the national average was 39,500 lb. Registration of all type of trucks in the West in 1948 totalled almost 1,230,000, nearly 18% of the national total.

A few indications of trends on Western highways over the past few years emphasize the seriousness of our present situation. Since 1930, truck registration and the consumption of fuel by all highway vehicles in the West have both increased 2½ times. How these increases have outpaced our expenditures for road construction is indicated in Fig. 1. Causes for these large increases in truck registration, in addition to outright expansion of population and industry, may be found in the region's increased purchasing power (310% greater than in 1940) and in the shift of many industries to the use of trucks. Lumbering, to cite a large Western industry, which once went forward by logging railroad and lumber schooner, now operates principally with tractor and truck, utilizing 16,000 mi. of private lumber roads in addition to the public road system. Cement, petroleum, farm products, and canned goods are also shifting to the highways.

These changes in the volumes and densities of traffic on our highways have been accompanied by changes in the vehicles themselves—changes which have also added to the burden on the carrying system. The proportion of trucks among all registered vehicles in the West has increased—from 12.8% in 1930 to 17.8% in 1948. These 1,230,000 registered trucks represented nearly 18% of the national total. The trucks themselves have grown heavier. In California, for example, the average truck weighed 15,000 lb. in 1936; in 1949 it weighed 25,000 lb. From the standpoint of highway design this average figure is less important than the upper limits of weight, and in this connection it is noteworthy that much of the increase is due to the increasing percentage of combination units among all trucks, and in the average weights of combinations themselves—again using California figures, from an average gross loaded weight of 39,500 lb. in 1930 to 49,300 lb. in 1948.

The foregoing figures, while they do not constitute a complete massing of the data, may serve to outline the character of the ever-growing load which is being imposed upon our streets, roads and highways. How to take care of this load is the problem which confronts us all, and in considering the solution, we encounter corrective measures which are not only greater in magnitude but also different in quality from those we have thought of in the past.

There is a point beyond which the mere process of making roads wider and heavier no longer suffices; complex problems of geometric design assert themselves. Where a minimum road may cost \$1,000 to \$2,000 per mile, a first-class limited-access freeway may cost \$5,000,000 to \$10,000,000 per mile. This is not to say that the minimum type of road is no longer needed. To the contrary, we may suppose that our greatest mileage will be of the minimum type for many years to come. The figures merely illustrate that as we confront more and more traffic problems which can be adequately handled only by the provision of modern, heavy-volume facilities the

total costs become very large indeed, even though the costs per vehicle-mile may be less.

The nature of the problem is altered also by the above mentioned increasing use of trucks. The U. S. Bureau of Public Roads states that over rolling terrain the capacity of a two-lane highway carrying 20% commercial vehicles is only 63% of its capacity when all vehicles are passenger cars. Stated a little differently, a dual-tired commercial vehicle on an 0.1-mi., 3% grade uses road space equivalent to 5.8 passenger cars, and on a 1-mi., 6% grade such a truck is equivalent to 13.5 passenger cars. Although these figures may need to be revised as more of the higher-powered units are placed in service—units capable of maintaining speed on adverse grades—the figures serve to indicate that the proportions of different vehicle types in the traffic stream have an important bearing on the design of highway required to accommodate a given volume.

As we make our survey of how the West stands with reference to the rest of the nation, it is well to look closely at our road surfaces. There are 3,000,000 mi. of rural roads in the United States, and 18% of them are in the West. Throughout the nation 51% of these roads are surfaced, but in the West only 37%. Furthermore, 6.4% of the total national mileage is heavy-duty surfacing, whereas only 3.6% of our Western highways are so surfaced. Here is a shortcoming which is not always evident in general statements of deficiency.

As we survey trends, we should relate our cost figures to a fixed yardstick of dollar value. Such a correction for constant purchasing power was made in the data for Fig. 1. The number of dollars required for a given amount of highway work, as computed by the U. S. Bureau of Public Roads with the 1925-29 average at 100, dropped to a low of 61 in 1932, varied from 70 to 80 through the remainder of the '30's, and rose to a high of 158 in 1948. If, as many believe, something like \$150 will be required for some years to come in order to accomplish what formerly required only \$100, the chances of catching up are even more remote, for much of the revenue for highway construction comes from taxes of fixed amount—so many cents per gallon, for example. The effectiveness of the highway funds therefore decreases as the value of the dollar decreases.

Although we have been emphasizing deficiencies, the plus side of the ledger is not entirely blank. Certainly it shows no ready-made solution to our difficulties, but it does register some encouraging signs. Since the war, long-range planning studies have been undertaken in the principal Western states, and highway departments are endeavoring to keep current the estimates of need. In other words, more is known about the nature of the problem. California's Collier-Burns Highway Act of 1947 implemented that state's study of needs by providing for a sensible distribution of funds among echelons of government, streamlined administrative procedures, and set up guides for the effective use of the funds. Contributing to the sum

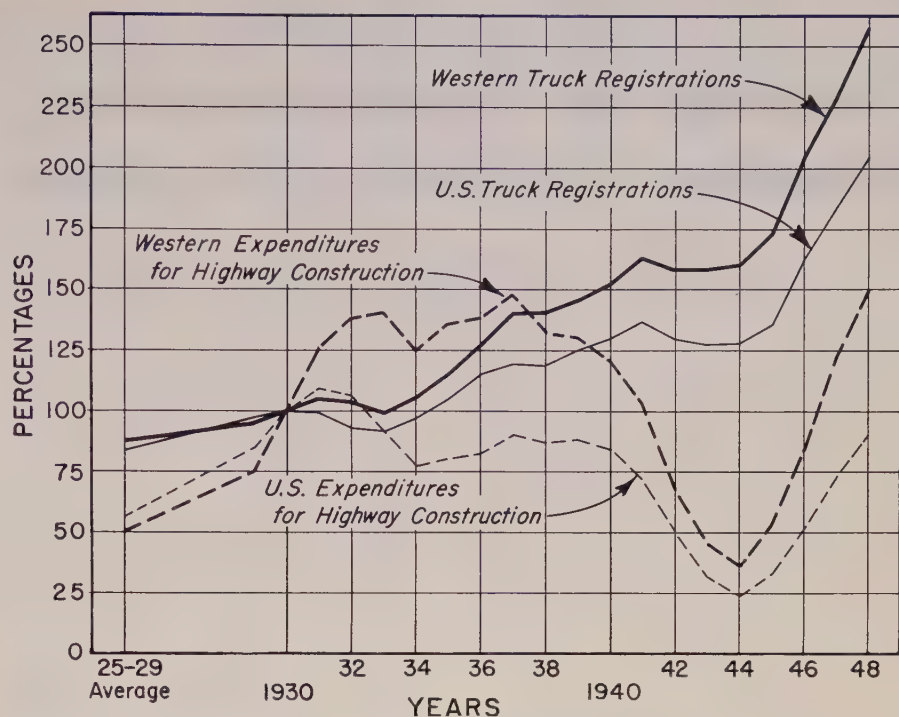


FIGURE I—Trends in Highway Construction Expenditures and Truck Registration in Per Cent of 1930 Figures, from Bureau of Public Roads Annual Reports.

total of information are studies undertaken by other agencies ranging from the Federal government down to municipalities, as well as new fact-finding groups.

In addition to being supplied with information, the highway field must be supplied with personnel. Steps to improve the supply of personnel have been taken by several universities throughout the country, and the training of well-qualified engineers for highway engineering is a primary responsibility of the new Institute of Transportation and Traffic Engineering at the University of California.

In between the pluses and minuses lie considerations which may be labeled as "not yet classified," and yet are of vital concern to truck operators and public officials alike. First of all there is the matter of truck size. Larger trucks are operated in the Western states because size and weight limitations are more liberal here than elsewhere in the nation. For example, truck full-trailer combinations of 60 ft. may be operated in all eleven of the Western states, whereas many Eastern states have a 45-ft. maximum. Also, the Western laws provide fairly consistent weight limitations

based on spacings of axles and groups of axles.

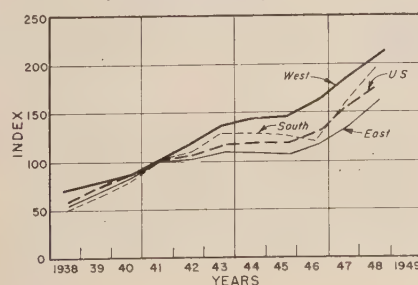
There are two major reasons for size and weight limitations. One is to prevent the use of vehicles which might be so large as to jeopardize highway safety. The other is to keep weights down to the point where the required pavements, subgrades and structures are not in excess of "reasonable costs." The question of "reasonable costs" leads in turn to the question of what share of highway costs the trucks should be required to bear. Various agencies are now attempting to bring to light some of the fundamental data which are prerequisite to finding answers to these questions.

But whatever the answers, and vital as they may be to the trucking industry, our present, known highway deficiencies will still be with us. We can safely say that trucks as well as all other motor vehicles, in fact our economy as a whole, will be fundamentally affected by our ability to provide adequate highway capacity.

One of the most encouraging aspects of the general highway situation is that there is developing a freer flow of information among all the men concerned with our streets, roads, and highways, a keener appreciation of what must be done, and a growing sense of cooperation. The final requirement is, of course, more money, and this money must come from those who use our Western highways. This money will be forthcoming only when the public understands the needs and is convinced that to pay for a better highway system will be a good investment. To all those connected with the highway field who realize the hidden extravagance of our deficient highways—to these men falls the responsibility of explaining the situation to the public. For if they can't make the explanation, and convincingly, who else can?

FIGURE II—For-Hire Intercity Trucking Has Tripled Since 1938.

Source, American Trucking Associations



Stating the Position of the Western Highway Truckers

Recommendations proposed for the eleven Western States include 13½-ft. height, a tire width of 102 in. and a maximum length of 65 ft.

THE UNPREDICTABLE

acceleration of motor transportation since 1940 is creating many complications in the problem of highway construction and design. As highways are planned and constructed for an average life of approximately 20 yr., the planning engineer today must look into a crystal ball in an effort to determine highway design policies which will meet present needs and also provide for vehicle requirements 20 yr. from now.

The question of vehicle sizes and weights has been an increasingly important factor in highway design since immediately after World War I. Size and weight limitations gradually have increased during this period, and of course it is not possible to reconstruct the entire highway system periodically to keep pace with these continuing changes. However, it is apparent that we are approaching an economic balance between vehicle sizes and weights and the required highway plant.

Western and Eastern differences

At the present time there are two distinct trends in motor vehicle sizes and weights which might be termed Eastern and Western. The Eastern trend is toward heavier axle loads and smaller vehicles. The Western trend is toward lighter axle loads and longer combinations. More powerful and better equipment is required in the Western region due to topography and climate. Vehicles must operate in temperatures varying from 50 deg. below zero to 120 deg. above, and from sea level to elevations of over 11,000 ft. This range in operating conditions requires more powerful engines, larger and more adequate brakes, and better gears and general equipment throughout the vehicle.

Recent studies by the Bureau of Public Roads show that the Pacific region has the greatest frequency of heavy gross loads and the lowest frequency of heavy axle loads. A typical Western unit made up of a 6-axle truck and full-trailer combination with a gross weight of 76,800 lb., and 8,000 lb. on the front axle, has an average of only 13,760 lb. on the remaining five axles. A typical Western unit made up of a truck-tractor semi-trailer combination has a gross weight of 72,000 lb., with 8,000 lb. on the front axle and an average on the remaining 4 axles of only 16,000 lb.

Because of the many differences in types of equipment and operating conditions, the size and weight problem probably can be most easily solved by attacking it on a regional basis. The

By **EDWIN L. MILLS**

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Western Highway Institute is making a comprehensive study of the problem in the 11 Western states in an effort to: (1) determine a policy which will conform to a long-range plan, (2) meet the highway and bridge design requirements for uniform adoption by all the states, and (3) meet the requirements for efficient motor transportation. This study includes an analysis of existing state laws, design requirements of highways and structures, and vehicle requirements for efficient operation.

The problem of size and weight

Two factors affecting efficient motor vehicle transportation are involved in any analysis of the size and weight problem. Size is of primary consideration for vehicles used to haul general freight and agricultural commodities. Technical developments and extensive use of lighter materials such as plastics, aluminum, etc., have reduced the weight per cubic

foot of many products, and thereby increase the volume of space required to haul a specific gross load. Cubic capacity therefore becomes an important factor in the efficient and economical transportation of general freight. Weight is the primary factor involved for vehicles used to haul specific commodities such as liquid products, bulk cement, etc.

Size restrictions are reasonably uniform in the 11 Western states, but sufficient differences exist to limit the size of vehicles in interstate operation to that of the lowest state. Six states now have a height limitation of 13½ ft. or over, four states have a limitation of 12½ ft. and one state has a limitation of 11 ft. but issues special permits for 12½ ft. on designated highways.

A height of 13½ ft. is required to provide sufficient cubic capacity for general freight vehicles. It also is especially desired by Western farmers for the transportation of commodities such as hay and cotton. The only highway design factor affected by vehicle height is vertical clearance. For safety and aesthetic reasons, through truss bridges have not generally been constructed in recent years with the result that underpasses and traffic interchanges are about the only structures involving limited vertical clearance. It is recognized that obsolete structures with limited vertical clearance still exist on our major highway system and that it will take some years to replace all of them. Western Highway Institute recommends that a height of 13½ ft. be adopted as a design policy and that the laws of the few Western states now having a limitation of less than 13½ ft. be revised as rapidly as replacement of structures with restricted clearances will permit.

A width of 96 in. is now legal in all of the Western states. However, two states provide for a width of 102 in. at the tires and another provides for 100 in. at tires. Additional axle width is required for wider brake drums and for the larger low pressure tires now in use. A width of 102 in. at the tires, with a body width of 96 in., will not affect the passing sight distance and will provide a safer and more stable vehicle. The Institute recommends that a body width of 96 in. and a tire width of 102 in. be adopted as an immediate policy in all Western states.

All of the Western states now have a legal length of 35 ft. or more for single vehicles. Studies now in progress show no indication of need for a length greater than 35 ft. for truck operations.

Lengths of semitrailer units

A semitrailer length of 40 ft. or more is now legal in nine of the Western states. In four of these states the length of semitrailers is limited only by the total length of the truck-tractor and semitrailer combination. The other two states, California and Oregon, still have a limitation of 35 ft. for semitrailers. The amount of offtracking on curves is the primary factor controlling the length of semitrailer combinations under that of other vehicle combinations.

Recent tests of the offtracking and turning characteristics of all vehicle

The Western Highway Institute recommends:

"A height of 13½ ft. be adopted as a design policy and that the laws of the few Western states now having a limitation of less than 13½ ft. be revised as rapidly as replacement of structures with restricted clearances will permit."

"... that a body width of 96 in. and a tire width of 102 in. be adopted as an immediate policy in all Western states."

"... the adoption of 40 ft. limitation for semitrailers in those states now having a limitation of 35 ft."

"... that the laws of the Western states now having a limitation of less than 65 ft. for combinations be revised to provide for a length of 65 ft."

"... that the 18,000-lb. limitation on single axles and the weight limitation for axle groups and overall axle spacings shown in Table 2 be adopted as a uniform policy in the Western states."

types and combinations show that the distance from the king pin to the rear axle of the semitrailer controls the amount of offtracking. The offtracking of a combination with a 40-ft. semitrailer is about the same as with a 35-ft. semitrailer on curves of 400-ft. radius or greater. A balanced design of 40-ft. semitrailers can be obtained that will give about the same offtracking as present 35-ft. semitrailers on the short radius curves. In view of the fact that highway design will not be affected materially by increased offtracking and that increased cubic capacity is required for economical vehicle operation, the Institute recommends the adoption of the 40 ft. limitation for semitrailers in those states now having a limitation of 35 ft.

A limitation of 65 ft. or more for combinations is now in effect in four of the Western states. Six states have a limitation of 60 ft., and one state has a limitation of 50 ft., with special permits issued for 60 ft. on designated highways. The tests of offtracking and turning characteristics show that truck and full trailer combinations and truck-tractor, semitrailer, and full trailer combinations (commonly known as doubles) produce less offtracking than other vehicle types. Studies on passing characteristics made by the Bureau of Public Roads indicate that an increase in the length of combinations from 60 to 65 ft. has an insignificant effect on the time required for passing. Combinations with a length of 65 ft. do not require a change in present highway design standards and will increase the cubic capacity required for economical transportation. The Western Highway Institute, therefore, recommends that the laws of the Western states now having a limitation of less than 65 ft. for combinations be revised to provide for a length of 65 ft.

The problem of weights

The problem of vehicle sizes is comparatively simple in relation to the complex problem of weights. There are wide differences of opinion on the subject of allowable weights as evidenced by the range of existing state laws throughout the United States. For example, existing limits on axle loads range from 18,000 lb. to 34,000 lb. However, the basic limitations of axle loads is the most uniform of all size and weight limitations in the Western states.

All eleven of the Western states have adopted the 18,000-lb. limitation for single axles and only two states are below the 32,000-lb. limitation on tandem axles. However, the limitation of loads on axle groups up to 18-ft. spacing and gross loads based on overall spacing between the first and last axle of the combination shows considerable variation.

Comprehensive studies are required to determine the effect of axle loads and gross loads on highways and highway structures. Limited studies of the effect of axle loads on highway pavements have recently been initiated and others are contemplated in the near future. Studies of the effect of loads on bridges and other structures also are under way and additional studies are in the planning stage. Several studies have been

Table 1. Size Limitations Under Existing State Laws

	Height (Feet)	Width (Inches)	Length in Feet		
			Single Vehicle	Semi-trailer	Combinations
Arizona	13½	96 (body) 102 (tires)	40	40	65
California	13½	96 (body) 100 (tires)	35	35	60
Colorado	12½	96 (body) 102 (tires)	35	(a)	60
Idaho	14	96	35	(a)	65 (b)
Montana	13½	96	35	(a)	60 (b)
Nevada	NR	NR	NR	NR	NR
New Mexico	12½	96	40	40	65
Oregon	11 (c)	96	35	35	50 (d)
Utah	14	96	45	45	60
Washington	12½	96	35	40 (e)	60 (b)
Wyoming	12½	96	40	(a)	60 (b)

a—Semi-trailer length controlled only by overall length of combination.

b—Combinations limited to two (2) vehicles.

c—Annual permits issued for 12½ ft. on designated highways.

d—Annual permits issued for 55 ft. for semi-trailers and 60 ft. for combinations on designated highways.

e—Permits issued for 45 ft. on designated highways.

NR—No regulation.

made of the effect of multiple axle loads on highway pavements. Results of these studies show that axle loads of a given weight do not increase the stress in pavements if the axles are spaced 40 in. or more apart.

Therefore, highway pavements are not subject to greater stress under multiple-axle loads properly spaced, than from single axles. Only in the design of structures is it necessary to consider the effect of multiple axle loads. It is indicated that the critical points in bridge loading occur at axle spacings less than 14 ft., and approximately at 24 ft. The critical points for balanced vehicle design are the axle group limitations between 14 and 18 ft., and the gross weight limitation on overall axle spacings between 24 and 40 ft.

In view of the fact that the critical points in bridge loadings do not coincide with the critical axle spacings for a balanced vehicle design, a variable scale of allowable weight for axle groups under 18 ft. and overall axle spacings over 18 ft. can be adopted. Until comprehensive studies can be completed and a long range weight policy can be factually determined, the Institute recommends that the 18,000-lb. limitation on single axles and the weight limitation for axle groups and overall axle spacings shown in Table 2 be adopted as a uniform policy in the Western states.

The vehicle sizes and weights recommended by the Western Highway Institute will provide uniform size and weight limitations based upon the existing standard of highways in the Western states. However, if highway funds are to be efficiently expended to provide an adequate and economical highway system, it is imperative that a long range policy on vehicle sizes and weights be established so that highways built today will be adequate throughout their normal life. Comprehensive studies are required to determine the capabilities of highways and highway structures and the economic balance between vehicle sizes and weights and the highway system required to provide efficient and economical transportation.

**Table 2.
Recommended Weights for
Axle Groups and Overall
Axle Spacing**

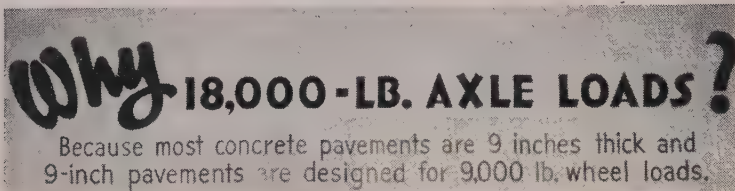
A. The total gross weight with load imposed on the highway by any group of two or more consecutive axles of a vehicle or of a combination of vehicles where the distance between the first and last axles of said two or more consecutive axles is 18 ft. or less, shall not exceed that given for the respective distance in the following table:

Distance in feet between first and last axles of group	Allowed load in pounds on group
4	32,000
6	32,200
8	33,600
10	35,000
12	36,400
14	43,200
16	44,800
18	46,400

B. The total gross weight with load imposed on the highway by any vehicle or combination of vehicles where the distance between the first and last axles is more than 18 ft. shall not exceed that given for the respective distances in the following table:

Distance in feet	Allowed load in pounds
18	46,400
20	48,000
22	49,600
24	51,200
26	56,100
28	57,800
30	59,500
32	61,200
34	62,900
36	64,600
38	66,300
40	68,000
42	68,000
44	68,000
46	68,000
48	70,400
50	72,000
52	73,600
54	75,200
56 or over	76,800

BPR Models Show Effect of Truck Loads on Highways



A FIRST requirement for design of a highway or bridge structure is a knowledge of the loads and forces that will be applied. Currently the dilemma among those who engineer the nation's highway plant concerns the formulation of a uniform set of facts that will satisfy this requirement.

What should be the limits for sizes and weights of vehicles that are allowed to use the existing public highway system? Should new roads be designed to carry heavier loads? If new roads are built of such greater strength, what assurance is there that future vehicle-operating practice will not demand still greater strength?

In 1946, the State highway department members of AASHO adopted by majority vote a policy of recommended limits as follows:

Height	12 ft., 6 in.
Width	96 in.
Length:	
Single truck	35 ft.
Single bus (2 axles)	35 ft.
Single bus (3 axles)	40 ft.
Truck-tractor with semi-trailer	50 ft.
Other combinations (not more than 2 units)	60 ft.
Axle load	18,000 lb.

Group axle load: A table of loads providing a maximum of 32,000 lb. on tandem axles spaced 4 to 7 ft. inclusive, and increasing from 32,000 lb. at 7 ft. to 73,280 lb. on axles with extreme spacing of 57 ft. in accordance with the equation:

$$W = 1025 (L + 24) - 3L^2, \text{ where:}$$

W = the gross load on any axle group, and

L = The distance in feet between the extreme axles of the group.

Views of BPR

The Bureau of Public Roads endorses the limits recommended by AASHO and states as its ultimate goal the providing of a nation-wide set of highway systems that are uniform throughout as to structural capacity. The Bureau believes this goal cannot be reached if there is continuous or intermittent increase in the axle and group axle loads permitted by States' laws, and it further believes that there is best likelihood of reaching this goal if the load provisions of the AASHO policy are adopted as legal limits in all States and enforced.

To support the AASHO policies on size and weight regulations, the Bureau has constructed models that present visually the basic principles determining the limits on single and group axle loads. The models were devised by H. S. Fairbanks, deputy commissioner, and C. F. Rogers, his special assistant, at the Washington, D. C., offices of the BPR. Currently, the models are being demonstrated before various groups in the West.

Pavement loading model

The first model is designed to show visually and graphically that axle loads determine the required road-surface strength. Essentially, the model is so constructed as to simulate the effect of loading on Portland cement concrete pavement.

The model (see Fig. 1) is constructed as follows. Lever arms spaced at uniform intervals project in front of the model. Weights suspended on the lever arms actuate plungers which in turn press on a simulated pavement made up of alternate layers of foam rubber pads and rubber diaphragms. As each plunger presses on the simulated pavement, it in turn causes a shutter to drop a distance corresponding to the relative effect of the weight placed on the load lever arm.

A light source is directed against the solid curtain made up of the system of

shutters. As the shutters drop under load the light is then permitted to pass through the resulting openings in the shutter curtain. Light passing through these openings is shown as a pattern on a chart. The chart has a system of horizontal ruled lines of equal spacing, each indicating a "unit" of deflection.

Thus, the spacing of the load levers simulates the spacing between the axles of a truck. Loads can be placed on the various levers to simulate different truck combination units. The resulting deflection on a "pavement" of uniform cross-section is seen visually on the chart in units. Comparative results of different types of "truck" loadings are obtained by comparing the total units of deflection.

Axle spacing tests

It is known from experience that the effect of two loads statically applied upon a road surface is not greater than the effect of either of the loads applied singly if the two loads are separated by not less than about 40 in. The first use of the pavement model is to illustrate this principle visually.

Simulated axle loads are placed on two of the arms that are widely separated. It is seen on the unit deflection chart that loads at widely separated points do not have additive effect on one another. Then the weights are placed on two lever arms closer together on the model. The deflections under each load remain the same as for the first loading, but there is some deflection at all points between the two loads. The loads are progressively moved closer together until the minimum spacing possible with the model is reached. With each successive move the deflection between the loads increases. At the minimum spacing the deflections under each load are greater than the deflections under single separated loads and the deflection between the loads is approximately equal to that directly beneath each load.

Thus, it is shown visually that when axles are spaced more closely than the critical length of about 4 ft., the effect of the loads is additive. That is, the deflection under and between each of the two loads is greater than the deflection under a single separated load. This establishes the necessity for spacing of tandem axles at a distance of not less than four feet.

By using proportional weights on the model, it is next demonstrated that the deflections produced by 32,000 lb. on tandem axles at 4-ft. spacing and by 18,000 lb. on a single axle are approximately equal.

Payload capacity

An effective visual comparison of predominant Eastern and Western truck-loading practices can be shown by the model. In the West, no state allows an axle load exceeding 18,000 lb., maximum gross weight averages about 70,000 lb., and length for all combination units is limited at about an average of 60 ft. In a number of Eastern States permissible axle loads are 20,000-22,400 lb. or greater, gross weights are in the range of 50,000-60,000 lb. with one at maximum of 88,000

FIGURE 1—Simulated Loads on a Simulated PCC Pavement.



lb., and lengths generally limited to 45-50 ft.

By proportionate spacing of loads on the model's lever arms, a 40-ft. Eastern-type truck-tractor semitrailer unit is compared to a 60-ft. Western-type truck-tractor semitrailer unit. The maximum deflections of the simulated pavement are shown to be much greater under the Eastern-type combination when the model is loaded as follows: The Eastern combination has a front axle of 8,000 lb. with single axle loads of 24,000 lb. at the rear of the tractor and on the semitrailer, gross weight 56,000 lb. and net payload of 38,000 lb. The Western combination has a front axle load of 8,000 lb. with tandem axle loads of 32,000 lb. on the tractor and semitrailer, gross weight of 72,000 lb. and net payload of about 42,000 lb. So, the Western-type combination carries a gross weight of 72,000 lb. and a net payload of 4,000 lb. greater than the Eastern-combination and carries it with less stress effect on the highway surfaces and structures.

Bridge loading model

The second visual model is used by the Bureau to demonstrate two bridge design principles: (1) Bridges are affected by the gross weight of a vehicle as well as by the load on each axle group, and (2) the effect of the gross weight is not that of a weight applied at a single point but rather that of a weight distributed over a significant length—the length of the overall wheel base—and applied to the bridge within that length at points separated by the distances between axles. It also helps to show that vehicles of widely different total weight may generate identical stresses in bridge members if the lengths and axle spacings of the vehicles differ appropriately in relation with their weights.

The model (see Fig. 2) consists of a miniature Pony truss bridge, corresponding to an actual bridge of 75-ft. length. The scale model is complete in every construction detail, from the gauged size of the truss members to the punched holes for the connecting bolts. It is fabricated of extruded aluminum, with a timber deck of miniature planks.

For the purposes of the loading tests, small truck units built to the same scale are provided, that can be loaded in a variety of ways. Pneumatic tires on the truck models complete the realism of the model.

To test the relative effects of differing distribution of the load on the truck models, SR-4 strain gauges are attached to the bridge members to be tested. One is on a transverse floor beam and the second is on a center section of the lower chord. The model is successively loaded with a number of types of trucks and combinations to demonstrate that the strains produced by the assumed H15 and H20 design vehicles and by trucks having axle spacings and loads in

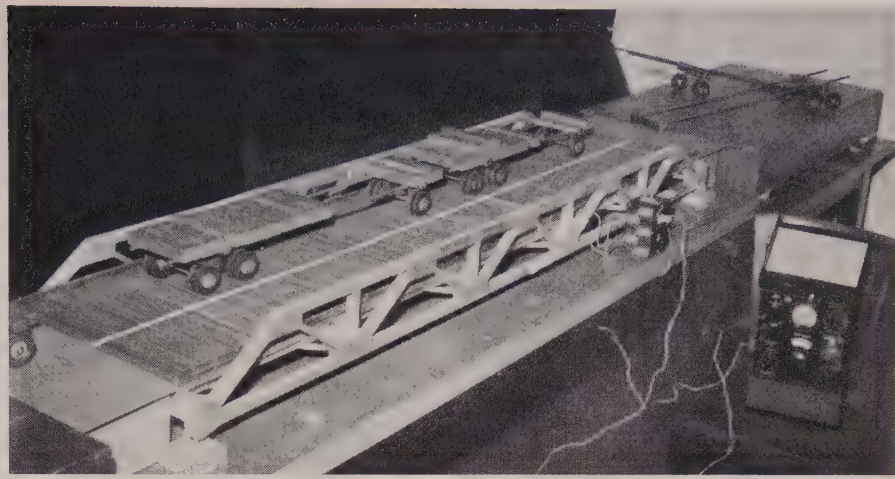


FIGURE 2—Miniature Truck Models on a Miniature Pony Truss Bridge.

accordance with the AASHO policy are approximately equal. (The H15 design vehicle has a gross weight of 15 tons on wheelbase length of 14 ft. and two axles loaded to 3 tons and 12 tons, respectively. It is the design loading that was used for the majority of bridges now in service on primary highways. The H20-S16 design vehicle is a 3-axle truck-tractor semitrailer, gross weight 72,000 lb., axles spaced at 14 ft., for an overall wheelbase of 28 ft., axle loads of 8,000, 32,000, and 32,000 lb., respectively. It is the design loading currently being used by many highway departments for primary highway structures.)

The simulated H15 truck is placed over the floor beam that is being tested, with the greatest weight positioned directly over the beam. About 90 units of strain are indicated.

Now, for comparison, a truck model loaded with a simulated 32,000-lb. load on a tandem rear axle is rolled into position over the floor beam which is being strain-tested. (This loading corresponded to the AASHO recommendation of 32,000 lb. on a tandem axle with axle spacing of 4 ft., giving a 16,000-lb. load per axle.) Now the strain gauge dial shows about 100 units of strain. Result of this first test indicates that a 32,000-lb. load on tandem axle spaced at 4 ft. does not cause an appreciably greater strain in bridge floors than the H15 (24,000-lb.) load applied through a single axle.

Using the same procedure, a lower chord of the model bridge's truss is tested for strain. First, an H15 truck (30,000 lb. on 14-ft. wheelbase) is positioned to give maximum strain in the bottom chord. The dial shows about 100 units of strain. Then a 3-axle truck (40,000 lb. on 16-ft. wheelbase, tandem axles at 4 ft. with 32,000 lb. and single axle with 8,000 lb.), meeting the AASHO Policy limits, is positioned over the chord. Now the dial shows a strain of about 120 units. Next a 3-axle tractor with 2-axle semitrailer (60,000 lb. on

wheelbase of 44 ft., tandem axles at 4 ft. with 25,500 lb. and single axle with 9,000 lb.), also meeting the AASHO limits, is positioned over the chord. For this loading the dial shows a strain of about 125 units. Comparisons of the strains produced by these loadings indicate that (1) only slightly more strain is produced by the 40,000-lb. and 60,000-lb. gross weights than is produced by the 30,000-lb. design vehicle; (2) distribution of load in accordance with AASHO Policy is the key to holding stresses from practical vehicles to near the stresses that would be produced by the assumed design vehicle.

Again, this test shows the realistic reasoning behind the AASHO Policy for group-axle load limitation. The general conclusion which may be drawn is that by proper distribution of the load on a greater number of axles properly spaced, gross weights greater than that assumed for design may be safely accommodated by our bridges.

The Bureau of Public Roads has recommended to Congress that bridges on the National System of Interstate Highways be designed for H20-S16 loading.

The bridge loading model shows effectively the increased stress which the H20-S16 design vehicle causes as compared to the H15 design vehicle. A simulated H20-S16 design vehicle is placed over the lower chord which is connected to the strain gauge. Total strain is about 200 units. This is more than double the strain produced by the H15 truck under the same conditions (see above).

For further comparison, the model is tested by a large combination that would be permitted on the Interstate system if it were designed for H20-S16 loading. This is a 3-axle truck with a 3-axle trailer. With a front axle of 8,000 lb., tandem axles of 36,000 lb. at 4 ft., and single axle of 18,000 lb., the gross weight is 98,000 lb. on wheelbase of 54 ft. When positioned over the chord which is being tested, a strain of about 210 units is noted. This is approximately the same strain as produced by the H20-S16 design truck. This demonstration shows also that a bridge of given design has no single fixed capacity but can accommodate varied vehicular gross weights according to the numbers and spacings of axles.

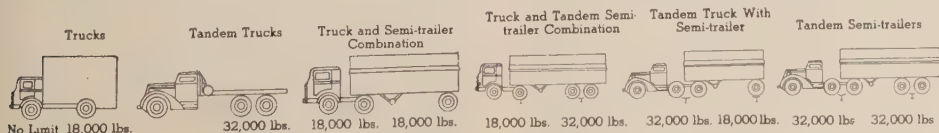


FIGURE 3—Recommended Axle-Load Limitations for Typical Truck Combinations.

Damage From Overloading Reported in BPR Studies

War emergency dictated permits for loads over legal limits on state highways with resulting damage

"WE ARE overloading our highways in their traffic volume capacity and in their structural capacity. There is more than ample proof. The overloading of safe capacity of numbers and by driver misuse is reflected in the accident record. The overloading of safe structural capacity is reflected in the skyrocketing maintenance and reconstruction costs." This significant statement was made recently by Thomas H. MacDonald, Commissioner, Bureau of Public Roads.

Between the years 1920 and 1940, much of the nation's highway system was built. During the first years of this program, the small number and small size of trucks, combined with the new pneumatic tires, kept any possible damage to a minimum. As a result, only a minimum of engineering interest was aroused in studying the problem of heavy loads and their effect.

During the latter part of this period, the parallel development of more trucks and heavier trucks focused attention on the resulting problem. Even when truck loads were held within legal limits, the number of repetitions began to increase and engineers were concerned with not only the total load, but the number of these loads carried by any highway during a period of time.

For example, in 1931, only 8 trucks out of every 1,000 had axle loads approach-

ing 18,000 lb., whereas in 1947, 76 trucks had axle loads of this amount or more (national figures). This represents 9 times the number of heavy load repetitions on any section of pavement. Even where overloads did not occur, engineers began the serious study of the effect of repetition as it relates to loads within legal limits.

About this time, the war emergency dictated the raising of legal load requirements under special permits for the handling of war material and equipment. State highway departments granted these permits in locations where they were essential, and where the highways were considered adequate for such emergency use. This provided an opportunity to study the effects of overloading, just at a time when truck loads and their effects had come under scrutiny.

Several of these studies were conducted by the Bureau of Public Roads and one particular one was made in a Western state. In this study, a section of Portland cement concrete pavement (18 by 60-ft. slabs, weakened plane and no steel) was compared to another similar section, both before and after an over-load permit was issued. The pavement slabs were examined closely, and about three months later the same two sections were again studied. In both cases, the pavements carried about a



RUTTING and shoving a bituminous surface may result from repeated heavy axle loads. In this case, a majority of loads traveled in the right-hand lane, and lack of distortion in the other lane was evidence of the cause of damage.

thousand passenger automobiles or more per day, with an additional traffic of between 500 and 600 legal weight trucks. During the 90-day period, one section carried 45 extra-legal loads per day on the average and the alternate section had only one such load per day. At the end of these three months an examination of the first section (45 extra-legal loads per day) showed that 79% of the slabs had new or extended cracks; whereas on the alternate section (one extra-legal load per day) only 7% of the slabs developed any increased cracking.

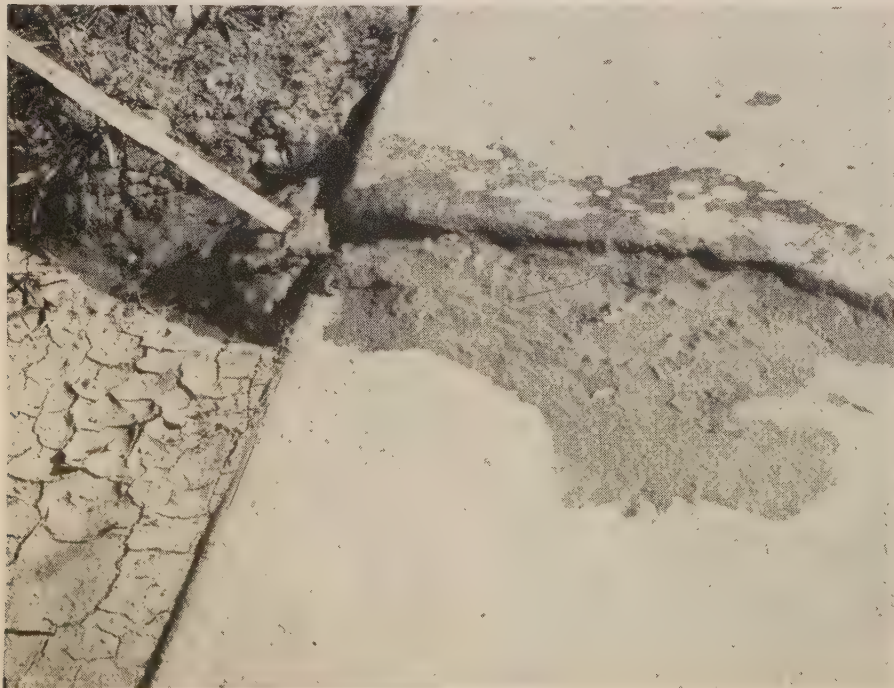
In a corresponding test in the same state, another two similar sections of pavement were studied, one with 42 extra-legal loads per day and the other with only one. After 50 days of this type of loads, the first section showed a 30% increase in observed cracking of slabs, whereas the alternate section showed no additional cracking, even though this section carried almost five times the number of passenger vehicles.

Similar observation on bituminous highways has demonstrated that repetition of extra-heavy loads tends to rut the surface and shove it out of shape. The effect of loads in this situation is demonstrated by the fact that the distortion of the surfacing is always in the lane carrying the loaded vehicles, and no comparable distortion is observed on the opposite lane.

Highway engineers are concerned with designing and building highways which will sustain legal traffic loads during their useful life. This does not permit any gradual increase in legal highway loads, because each increase would tend to make obsolete the sections of highway which had not been designed to these future and indefinite standards.

At the present time, highway maintenance cost for all state, county and municipal roads is approaching 75¢ for each \$1.00 expended for construction. This does not tell the entire story because much of the construction funds is spent for rebuilding highway mileage which has depreciated beyond recovery through ordinary maintenance.

PUMPING of mud under the corner of a slab represents the start of serious damage to a rigid pavement. Loss of support from pumping of mud results in a corner crack with the start of the process over again, aggravated by effect of the rough corner.



Extra Lane Proposed for Trucks on Heavy Grades

Arizona studies determine crawl-speeds for various sizes and loads to move traffic faster and safer

HOW FAST does a highway choke up when heavily loaded trucks travel up-grade? Is it possible to establish a standard minimum speed which passenger vehicles can maintain without spending great sums on added excavation and right-of-way? These questions have been the subject of a careful study carried out by the Division of Economics and Statistics, Arizona State Highway Department, under the direction of Wm. E. Willey, Engineer of Economics and Statistics. Conclusions are based on the uphill speeds of trucks on mountain grades, as determined by field research. The investigations show that extra uphill truck lanes or passing bays at critical points would provide an answer. Savings to the motorist would pay for construction involved, based on higher speed with more safety.

For some time the Arizona State Highway Department has been considering a minimum speed of 25 m.p.h. for all passenger cars on the open highway. The results of the truck-speed tests can be combined with this 25 m.p.h. minimum to locate the starting point for a possible third uphill truck lane. The question is: On a given grade, how long must the climb be before trucks fall below the 25-m.p.h. minimum and make necessary a third lane to allow traffic to continue without interference?

Locations for the observations and tests were selected on highways ranging from elevations of a few hundred feet up to 7,000, with traffic counts from 3,000 to 1,000 vehicles per 24 hr. The seven locations were on major routes and included grades from 2% to 6%. An eight-man field crew made the observations in a three-month period.

Three men traveled in the observation car, and marked time and speed as they checked the truck through the measured test run. Speed was measured with a calibrated speedometer. The observation crew noted when gears were shifted, the number of cars back of the truck that had no opportunity to pass, the number that took chances and did pass, the number of accidents that happened, and other incidents that would help in the office analysis. When the crawl speed of the truck had been reached, the truck was followed until the hill had been cleared. The survey car then returned to the weighing crew, where another truck was waiting to be escorted.

The operation was repeated until a typical sample run was obtained. Tests included trucks of different weight, power, and both diesel and gasoline engines. Test stations were run at night as well as day.

Speed observations were checked by the use of a calibrated electronic speed-meter. The average approach speed at the beginning of the grade was 47 m.p.h., and this figure was used as the common entrance speed for all charts at each station, and all graphs were adjusted to begin at this point.

The trucks were classified two different ways. They were grouped by respective weight/brake horsepower ratios, as occurring in the field; and in four groups of gross vehicle weight. A typical test run was made on U. S. 66 near Flagstaff, Ariz., at an elevation of 7,200 ft. The survey station was labeled 4-E, and had a hill 3,000 ft. long, including vertical curves, and about 1,600 of 6% grade with a long level approach. There was a 38-ft. roadway at nearly interstate standards, with P.C.C. surface 22 ft. wide and mixed bituminous shoulders. The traffic volume was 2,239 vehicles per day, of which 10.8% were of commercial type. The Arizona Highway 1949 adjusted sufficiency rating for this section of route (*Western Construction News*, March 1950, page 85) was 90 points, indicating a first class highway.

Weight classifications were:

Group A.....up to 199 lb. per brake hp.
Group B.....200 to 299 lb. per brake hp.
Group C.....300 to 399 lb. per brake hp.
Group D.....over 400 lb. per brake hp.

The brake horsepower was taken from the manufacturer's rating.

Truck Weight classifications were:

LightUp to 15,000 lb.
Medium15,000 to 30,000 lb.
Heavy30,000 to 50,000 lb.
Very Heavy.....50,000 lb. and over

Data were taken on nine trucks in Group A, with an average gross weight of 16,334 lb., and a ratio of 116 lb. per brake hp. of 116. These vehicles had an almost constant rate of deceleration except at the vertical curves. From a level approach at an entrance speed of 41 m.p.h. on the 6% grade, it required a distance of 1,500 ft. before the crawl speed of 16 m.p.h. was reached.

Better samples were obtained in the

same area when trucks were observed at another station. Trucks of all types required about 2,000 ft. to reach their crawl speed up an average 5.3% grade. Group A vehicles entered at 42 m.p.h. and crawled at 18 m.p.h. Group B vehicles entered at 47 m.p.h. and crawled at 14 m.p.h. Group C vehicles entered at 45 m.p.h. and crawled at 10 m.p.h. Group D entered at 41 m.p.h. and crawled at 7 m.p.h.

Data were computed in the form of profile speed charts, and studied for a general idea of how to proceed. About 9% of the trucks were eliminated if the speed varied more than 10 m.p.h. from the group average, for the following reasons: (1) extreme (20%) overloading compared to other similarly powered trucks, (2) trucks reported to be in poor condition by operator, and (3) trucks compelled to slow down by unforeseen cause such as cattle on the road, parked cars, slower vehicle ahead.

It was decided to plot individual speed charts for each of the 160 trucks observed during the study. These charts were for 3, 4, 5, and 6% grades, and for each of the four weight groups. The deceleration curve became steeper as the weight of the trucks became greater, and the resulting crawl speed became less and less. After all curves had been drawn they were studied for similar characteristics so that a composite performance curve could be assembled. The average speed patterns for heavily loaded vehicles are indicated on the accompanying table for grades ranging from 2% to 7%. Speeds of light trucks were not used in preparing the table.

This composite truck will lose 2 m.p.h. per 1,000 ft. of highway on a 2% grade. By projecting the approach speed to the overall average of 47 m.p.h., this same truck will travel 11,600 ft. before reaching a crawl speed of 23 m.p.h. For a 6% grade, the loss in speed is 23 m.p.h. for each 1,000 ft. of grade. It requires a distance of only 1,700 ft. to reach the average crawl speed of 7 m.p.h. For this example, the lowest crawl speed observed was 6 m.p.h.; the highest, 10 m.p.h.

Many engineers in charge of highway location and design believe that if a certain difference in uphill elevation is to be made, and if the per cent of grade is over 3%, then it is most economical to go immediately to a 6% grade, and cover the difference in elevation in the shortest possible distance. In considering results of this truck study, this concept can be amended to say that a 4% grade can probably be used, instead of the 3% grade previously stated.

W. C. Lefebvre is state highway engineer of Arizona.

DECELERATION OF LOADED TRUCKS AND GRADES, WITH DISTANCE REQUIRED TO SLOW TO 25 M.P.H. AND CRAWL SPEED

Grade	Speed loss per 1,000 ft.	Final sustained speed	Distance to slow to 25 m.p.h.
2%	2 m.p.h.	23 m.p.h. average	10,600 ft.
3%	5 m.p.h.	17.5 m.p.h. estimated	4,300 ft.
4%	9.5 m.p.h.	12 m.p.h. estimated	2,200 ft.
5%	15.5 m.p.h.	9 m.p.h. observed	1,400 ft.
6%	23.0 m.p.h.	7 m.p.h. observed	900 ft.
7% estimate	33.5 m.p.h.	6 m.p.h. estimated	700 ft.

Tunnels May Help Solve the Highway Transport Problem

An example would be the proposed tunnel at the southern end of the San Joaquin Valley

MORE HIGHWAY tunnels may provide the engineering answer to reducing the grades which trucks and other vehicles must climb in crossing mountain ridges of the Western States. The increase in truck transportation emphasizes the advantages of tunnel construction in solving problems of highway economics. Every foot taken off the crest of a ridge cuts out a 20-ft. length of 5% highway and saves 1 ft.-ton in lifting every ton of freight. Safe minimum vehicular speed and highway congestion on mountain grades provides a

further stimulus. Design, construction and ventilation of highway tunnels will become an increasing part of Western highway engineering during the coming years.

Among the several major proposals for such large scale projects is the plan for a tunnel through the Tehachapi Mountains connecting the southern end of the San Joaquin Valley with Los Angeles and the coastal region of southern California. At present, the route over these mountains (U. S. 99) carries a heavier load of trucking than any other

similar highway in the United States. The 4-lane highway is famous for heavy construction, including deep cuts and high fills.

The idea for a tunnel through this mountain barrier dates back to early railroad surveys in the 1850's. The railroad route was finally laid out over the Tehachapi range north from Mojave and the original highway followed the same general location. Later, highway traffic began to switch over to the present location, then unimproved, to eliminate mileage and secure a more direct passage over the mountains. This "Old Ridge Route" was gradually relocated and improved to its present, modern standards.

In 1946, Charles W. Jones of the Bridge Department, California Division of Highways, prepared a report which had been authorized by the Legislature. This report concluded that the tunnel was feasible as an engineering project, but that the benefits were not sufficient to justify the undertaking at the present time. The plan proposed a double-deck tunnel 25.3 mi. long from a point 6 mi. north of Costaic to a point west of Grapevine, carrying rail, truck and passenger car traffic.

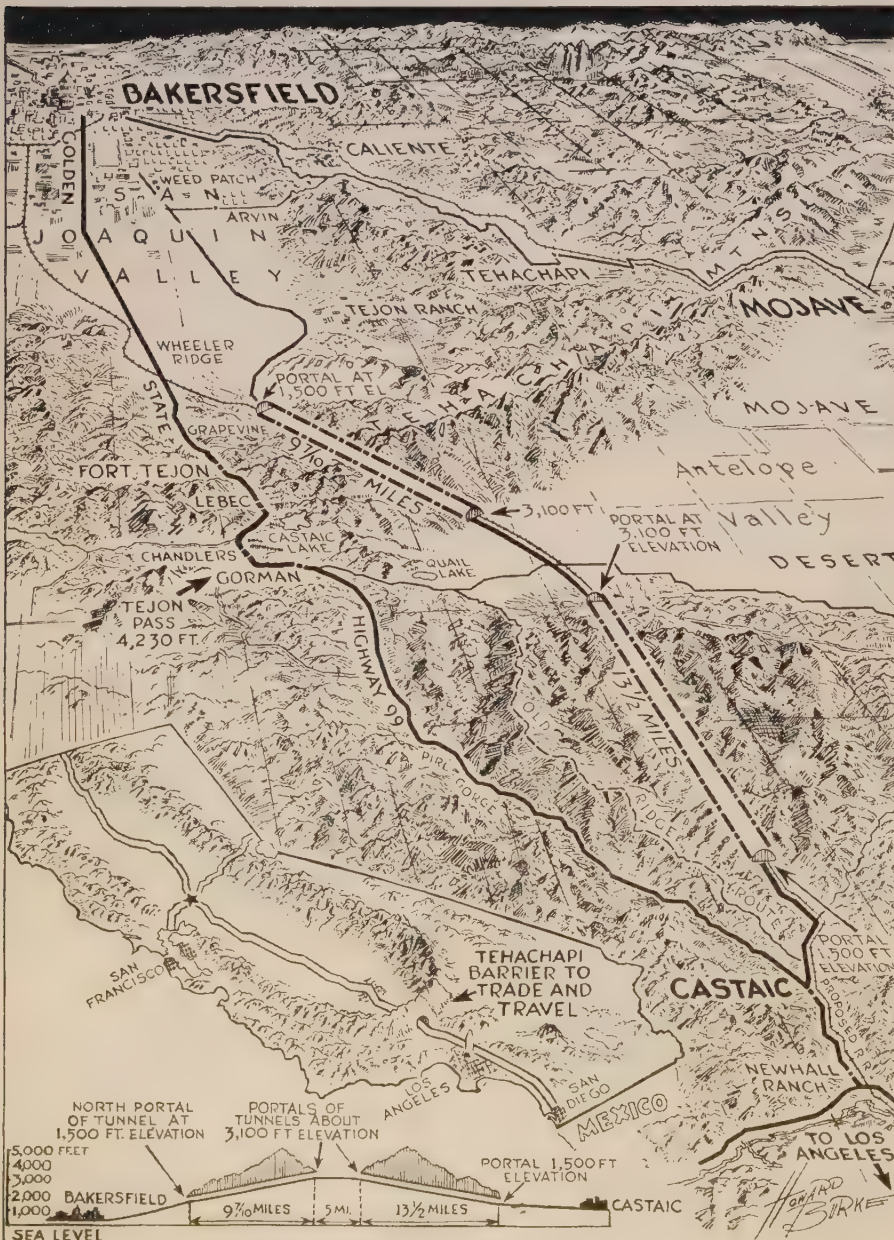
A modification of this plan was suggested by Cecil L. Dunn the following year, to provide two parallel tunnels, with vehicular traffic in one and rail traffic in the other. This plan was estimated to reduce the original cost estimate by almost half.

The latest modification of the project provides for two sections of tunnel. The southern end of the first 13.5-mi. section would start at el. 1500 and continue up a 2.24% grade to a portal at el. 3100 in the Antelope Valley. There would follow a 5-mi. open highway on a flat grade. The second section, which would be 9.7 mi. long, would descend on a 2.1% grade to a portal at el. 1500 ft. in the San Joaquin Valley. A highway about 33 mi. long would then complete this new highway route into Bakersfield. The general arrangement of this proposal and some of the details, including the location of the present route, are shown in the accompanying schematic drawing.

The proposal includes provisions for railroad traffic on the lower level of the tunnel. Railroad operation would be by electric locomotive operated from the sub-station located at the open section between the tunnels and near the Boulder Canyon transmission line. Although the grade of 2.24% is considered heavy for railroad traffic, it is accepted as permissible because of the straight alignment.

Cost estimates for this program have been placed at about \$50,000,000 for construction, with a further \$10,000,000 for contingencies. This estimate includes excavation for the tunnel at \$20 per cu. yd. (40 cu. yd. per ft. of tunnel), concrete lining and decking totaling 1,300,000 yd. at \$100, railroad facilities about \$7,000,000, and electrification of the railroad at about \$9,000,000.

It is proposed that the project be constructed by a special tunnel authority and financed with revenue bonds. The project is sponsored by the San Joaquin Valley Tunnel Assn.



Drawing courtesy Los Angeles Examiner.

Examples of Private Trucking Roads

I—Record of Log Hauling On Molalla Road in Oregon

Loads grossing 71 tons transported over 20-mi. road built with 12 in. of gravel and light bituminous surfacing which shows little failure after 7 years

SINCE 1943, a private forest truck road has been in operation a short distance southeast of Portland, Ore. This private forest road runs from the respective tree farms of the Weyerhaeuser Timber Co. and the Crown Zellerbach Corp. in the foothills of the Cascade Range across the Willamette Valley floor to several log dumps situated on the river. Length of this two-way private road is about 20 mi. In fact there are around 21½ mi. in the complete road system which is shared and owned equally by the two companies.

It is a matter of interest that this private forest road parallels a network of state and county roads. For a good portion of its length a branch line railroad of the Southern Pacific is alongside. A predecessor company to the Crown Zellerbach Corp., the Ostrander Railway Timber Co., operated over these public highways from 1939 up to the time the Molalla Forest Road was placed in operation.

The question naturally arises, why did these highway users decide on making a

LOADS going over the road are weighed on a 50-ton platform scale. Maximum axle load allowed on the road is about 15 tons.

By H. P. MILLER

Chief Logging Engineer
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BECAUSE truck transportation reaches its ultimate on the private logging highways of the West, a description of these "freight roads" provides a helpful addition to this group of articles. The 20-mi. Molalla Forest Road in the Willamette Valley has been in use for seven years and Mr. Miller presents interesting information on its purpose, design, surfacing, service and traffic. During 1949 the highway carried 13,060,000 ton-miles of logs, and peak traffic has exceeded 170 loads per day.—Editor.

large investment in a private road when so many public roads were available? The answer lies partly in the restrictions and regulations imposed by the state and county governmental agencies. In hauling forest products, logs are bulky and

weight is a big factor. Imposition of the prevailing weight limits seriously handicaps the log hauler who has a heavy product to handle. Unlike other commodities which can be packaged in convenient sized units or handled in liquid form such as petroleum products, economical log handling depends in great part on leaving the log in large size. Additional restrictions and regulations having to do with width, height, length of loads, when the hauler can or cannot haul, does not make the problem any easier.

Consideration was also given to the existing railroad and even to the construction of a new line. If all the logs had started from the same place and ended at the same log dump terminus on the river, there would have been considerable merit in the railroad idea. A railroad can be built as cheaply as a highway capable of log transportation, perhaps cheaper. However, the logs did not originate at the same source. They came from high up on mountain slopes scattered over many square miles. Differences in elevation of over 4,000 ft. had to be overcome. Such a type of country cannot be railroaded economically. If it had been possible to railroad, this region would have been developed 40 to 50 years ago. Log truck transportation alone has made it possible to economically harvest the timber crop in this area.

Consequently, if log trucks were to be used on the mountainous slopes, the logs might just as well remain on the trucks and be transported an additional 20 mi. to their destination at the river. To have rehandled the logs from log truck to railroad would have entailed a





AT THE RIVER, entire load of logs from each truck is lifted by a 60-ton electric crane and dropped into the river. The 75-ft. trackway spans both the road and river.

considerable expense in the installation and operation of a log transfer.

Construction of the private road, known as the Molalla Forest Road, was commenced in August, 1943. The road has its terminus at the log dumps of the companies located on the Willamette River several miles north of Canby, Oregon. It traverses some of the best agricultural lands in the Willamette Valley to a point about 7 mi. south and east of the town of Molalla. Feeder roads of the various users come into it on the last 4-mi. stretch. Some of the road follows an old railroad grade and in fact several railroad trestles have been utilized. The grade of the road is relatively level, being located on a broad valley floor. There is a very limited amount of 3% adverse grade and some 6% favorable. The maximum curve is 15 deg., or a curve having a radius of 383 ft. The alignment and grade permits speeds in accordance with laws and regulations governing state highways.

Location and structures

Throughout its length it is a two-way road except for one overpass and five bridges. The overpass is a structure 786 ft. in length with a number of log spans, the longest of which is 63 ft. It crosses over a main state highway (99-E), the double tracks of the Southern Pacific main line, and a branch line wye leg of the same railroad. It is built entirely of wood except for the concrete piers on the ends of the log spans. Including this overpass, there are three physical grade separations on the road. All are over well travelled state highways. In addition, there are 13 county and state highway crossings which have automatic signal lights. Speed limits at these crossings are limited to 20 m.p.h., and further regulated by the signal lights.

Structures on the road are 22 in number and range from the overpasses just described to log span bridges and cattle underpasses. There are three main river crossings with bridges ranging in length

from 228 to 653 ft. There are clear log spans up to 80 ft. in length. Self-imposed load limits by the operating companies have been set because of the bridge structures rather than because of the surface or amount of base rock on the road.

Logs are unloaded at the river either by sliding the load from the bunks over a brow log into the water, or by picking up the load with an electric crane (see illustration). The 60-ton crane hoist operates on 75 ft. of horizontal track. This track spans the roadway and the adjacent water in the river. There is a concrete pier at the road and a trestle pier in the river to support the crane beams. This installation is operated by the Crown Zellerbach Corp. The apron or brow log type of dump operated by the Weyerhaeuser Timber Co. is constructed of concrete and utilizes an electric winch to slide the loads off the bunks.

Width of the road as previously mentioned, is two-lane for most of the way. This corresponds to a travelled width of at least 22 ft., and preferably 24 ft. Use of 10-ft. loading bunks on the trucks and trailers make this width mandatory. All one-way portions such as the overpass or one-way bridges are provided with passing places selected for good visibility purposes.

Surfacing

Construction problems on grading or rocking at the time of building were not unusual. The overpass and the span bridges were perhaps the most difficult features. Drainage of the road subgrade was then, and remains now, the most difficult problem to solve. This is because of the very flat country the road traverses and the close proximity to a fair sized river subject to bank overflow during wet periods.

The surface on the road up to recently has had a light bituminous treatment. The original purpose of this bituminous surface was to furnish a dust palliative

during summer months. Construction records as to the amount of base rock ballast indicate around 12 in. of ungraded river gravel and rock. Test holes at frequent intervals have shown that the actual thickness at the present time is closer to 8 and 9 in. Due to base failures, a program is now under way to increase the thickness of the base ballast. Such additional thickness will be added to the present road on top of the present bituminous surface for the sections showing distress. A surprising amount of the road shows little failure despite the much heavier loading than that allowed on public highways.

Traffic and loads

Traffic using the road is mainly confined to the log trucks of the using companies and their contractors. There are a few users who pay a toll per ton mile for the use of the road, but the amount of tonnage they haul is relatively insignificant. Forest production is generally measured in board feet and the amounts hauled in 1948 and 1949 were approximately 122 million and 137 million board feet respectively. On a ton-mile basis, this would amount to 11,600,000 and 13,060,000 ton miles. This does not include the tare weights of the log trucks nor does it include the weights of maintenance and construction equipment, miscellaneous logging and construction supplies. Some of the tare weights of the log trucks exceed 20 tons.

Every load going over this road is weighed on a 50-ton platform scale. At the same time it is automatically checked for height clearance. This is necessary to clear the overhead traffic lights at the intersections with public roads. So far, the management has not finalized its policy as to maximum weights and loading for the road.

A tentative maximum of 30,000 lb., plus 10% tolerance for the axle equipped with dual tires is now being followed. With a 10,000-lb. load on the front axle, a gross load of around 71 tons would be permitted for a three-axle truck and tandem axle semi-trailer. This would allow a maximum net payload of around 51 tons. Converted to the unit of board feet measurement, this would be around 10,000 ft. board measure. The actual average load of course is less than this amount. Even at a 7,000 F.B.M. average, the load hauled over the private road is substantially greater than the 4,400 F.B.M. average hauled by the Ostrander Railway Timber Co. over state and county highways from 1939 to 1943.

Maintenance and operation

Maintenance work on the private road naturally varies with the season of the year and the volume of the traffic. In a single day more than 170 loads have gone over the road. In addition to the program for some increased base rock depth, there is a program of bettering the existing drainage and widening the shoulders as much as the limited right-of-way width will permit. During the clear weather periods, a certain amount of oil patching work is done.

In the operation of the Molalla Forest Road, the management maintains an ex-

tensive traffic safety program which includes a system of thirteen traffic lights at the public crossings of the road, posting along the road of proper warning and driving signs, and a full time traffic safety supervisor who patrols the road checking the traffic lights, road conditions and driving practices. The program also includes truck drivers' clinic meetings in which driving practices and policies are discussed. There is also published a booklet which covers the traffic regulations for the Molalla Forest Road. The traffic safety program is well respected by all drivers and during the year 1949 there were no lost time acci-

dents to any driver on the road and no intersectional accidents.

It is felt that the private road idea has justified itself in this particular case. Both the Weyerhaeuser Timber Co. and Crown Zellerbach Corp. operate or are constructing private forest roads of their own in other localities. For a tree farm operation which is organized on a sustained yield basis, hauling of forest products will take place as long as nature grows timber. Justification for a high standard private road with a yearly substantial traffic volume exists in fact, and private industry is willing to invest money in the idea.

ous crop. This particular area is noted for the rapidity of timber growth.

The plant at Ukiah and the timberland lie on opposite sides of the Coast Range. No existing highway or railroad facilities were available for bringing logs to the plant. The company elected to construct its own hauling road, which will be a private highway for the exclusive use of its trucks and other contract timber haulers. The public will not be permitted on the highway.

Design features

The main hauling road is about 35 mi. long and starts at an elevation of 105 ft. above sea level at the timber end, climbing to 2,355 ft. over the crest of the Coast Range and dropping to 615 ft. at the Ukiah plant. Over the ridge the road climbs 1,200 ft. in $4\frac{1}{2}$ mi. against the loads.

The highway was laid out for a 40-ft. width of roadway, with 30-ft. finished surface. Curvature on the road does not exceed a maximum of 30 deg. (200-ft. radius). Grades were held to a maximum of 6% for the loaded trucks going east, and a maximum of 8% for the empty trucks. Adverse grades steeper than 2% occupy about 12 mi. of the total length of highway.

Since the trucks will be hauling 40-ft. logs, the curves and their design represent an important engineering consideration. The 30-ft. width of surfacing is increased to 36 ft. on all curves. Original design called for a super-elevation on all curves equal to one-half the standard highway requirement for 35 mi. per hr. speed. Curves were laid out and constructed to this specification on the original program.

Further study of the hauling to be done on the road indicated that loaded trucks had difficulty in making right-hand turns on the 5% to 6% grades because the rise was accentuated as they came out of the "super." The loads tend

II—Latest Logging Road Built to Highway Standards

For gross loads exceeding 200,000 lb., the Masonite Corp. has constructed a 35-mi. route over the Coast Range to its new plant

FOR LOADS which would make a public-highway engineer shudder, the Masonite Corporation has built a 35-mi. road to transport logs from forest holdings near the coast of California to its new plant at Ukiah, Calif. This two-lane access road is considered one of the largest private-highway projects completed in recent years. Construction involved more than 5,000,000 cu. yd. of excavation and the finished gravel surface is 30 ft. wide. Over this road, with 6% maximum grades against the loads, the trucks will haul 40-ft. saw logs and Masonite logs in loads weighing up to 200,000 lb., and truck and load may gross nearly 250,000 lb. under ideal loading conditions.

Expanding its manufacturing facilities from the original plant in Mississippi, Masonite selected the redwood and fir forests of Mendocino County as the supply to serve a new plant located one mile north of Ukiah. This plant will serve the Western States with all types of Masonite products.

Purchase of more than 50,000 ac. of redwood forest area assures a perpetual source of raw material. Cutting will be in both redwood and fir timber, with modern forestry management directing logging operations to insure a continu-

FIRST LOAD of 40-ft. redwood logs over the road, showing the 12-ft. width of bunks. Loads climb 12,000 ft. in $4\frac{1}{2}$ mi.



to bind, with loss of traction. As a result, this feature of the curves has been eliminated and all curves on adverse grades will be flat, except for a slight elevation on the outside edge to assist the empty trucks making the down-hill turns.

Side-hill cuts were all established at the relatively steep slope of $\frac{1}{2}:1$. It was recognized, from the beginning, that some of the ground would not stand at this slope, but it was considered economical to let the material take its own slope and move out the slide material. This decision has proved sound because much of the side-hill cut has stood as excavated and the few slides have been cleared out without interfering with either construction progress or initial hauling. The alternative would have been to establish a flatter slope for all excavation and this is estimated to involve a much larger yardage of earth and rock to be handled.

The highway passes under a state highway at the Ukiah end and on a concrete-steel structure and one county road carried on a timber over-pass. No bridges are involved and small streams are handled by corrugated metal culverts up to 9-ft. maximum size. These large size units serve also to permit cattle to cross under the road.

The 30-ft. roadway has been surfaced with a 1-ft. depth of river gravel. During the present season, calcium chloride will be applied to this gravel surface for binding and dust control. Present plans call for allowing the highway to reach final settlement in the next two or three seasons and then an asphalt mat, probably of road-mixed type, will be applied to complete the highway.

Hauling on the road

At the present time, the Masonite plant has not been completed and hauling is on a small scale design for stockpiling. When the company starts its logging operations hauling will be done under separate contract, but the truck units will probably have the following characteristics:

They will be especially designed truck and semi-trailer units, powered with 300-hp. diesel engines. The bunks will be 12 ft. in width, with side stakes about 4 ft. high. This will represent a maxi-



SURFACING consists of a 12-in. depth of river gravel, dumped and spread in the 30-ft. width of roadway.

mum out-to-out width of about 13 ft. The height of the loads may reach 20 ft. above highway surface. On the return trips the bunks are swung 90 deg. to provide an 8-ft. width for the empty trucks.

Loads are estimated at an average of 15,000 bd. ft., which will represent about 150,000 lb. of load. Some especially heavy loads can result in a total weight approaching 250,000 lb. for truck and load. If this represented 200,000 lb. on the semi-trailer it would equal 50,000 lb. per axle (see accompanying photo). On the up-grades of 6%, these loaded trucks are expected to move at 10 mi. per hr.

For the down-grades, the trucks will be provided with Hydrotarders which will function somewhat like a fluid-drive mechanism in reverse. The down-hill energy of the load will drive these mechanisms, which are supplied with water from the regular cooling-system and the energy will be converted into heat, with the water passing through the truck radiator for cooling.

SIDE-HILL CUTS were made on $\frac{1}{2}:1$ to keep excavation at a minimum, allowing slide-areas to dictate where slopes should be increased. Excavation advanced in two directions and joined when the shovels on the pioneer cut met (right).

Construction of the highway project was carried out by the Utah Construction Co. An existing county road was used to provide access to the location near the summit and work was pushed in both directions. The contractor was responsible for the field engineering and laying out of the actual location. Another camp was established at the far end of the project and a total labor force of 250 to 300 men were employed during peak operations. Connection was maintained from Ukiah headquarters between the camps and major units of equipment by radio-phone.

During the first winter, the contractor carried out excavation work and fill, but was handicapped by the seasonal rainfall common to this area. Slides were rather frequent and work on the fills was difficult.

Incidentally, fills were deposited in horizontal layers averaging about 18 in. in thickness and were compacted entirely by the hauling equipment without resorting to the use of sheepfoot rollers.

During the following summer the contractor elected to push the job to completion, avoiding work during a second winter. As a result, equipment was expanded to include 8 shovels, 33 tractors, 75 trucks and 15 tractor-scraper units.

Following the end of the normal construction operations, Masonite has employed maintenance forces to take care of slides, clear ditches and carry out normal maintenance type of function. Further construction units are now engaged in pushing one-way roads in the actual timber areas from the main highway.

Organization

This fall the plant will begin operation and regular hauling will be started. The logs hauled to the Masonite plant, and supplemental contract hauling to local sawmills, may develop as many as 35 to 40 truckloads per day during peak summer months. E. T. F. Wohlenberg is general manager of the Ukiah plant. Sam Parnum is logging engineer in direct charge of the highway.

Operations of Utah Construction Co. were under the general direction of Frank S. Laird, project manager, and Newton Miller, engineer.



Bonds—A Solution to the Highway Finance Problem?

An issue of \$1,000,000,000 for a 10-year added program in California would overcome the war-caused deficit in the state's system

OVERSHADOWING all highway problems in the West is the urgent need for additional funds. Everywhere we find growing impatience with the progress of our highway program. There is a new and serious interest in toll road construction. Other means of credit financing are also attracting attention. The reason is that our highways are so crowded and in such bad condition that it seems impossible to bring them up to acceptable standards with current revenues.

Some progress is being made in our deplorable highway conditions, but we are going too slowly. We may even be losing ground. Our highway program needs speeding up. Revenues are too meager compared to needs for the modernization program we ought to have.

WE NEED A NEW HIGHWAY PROGRAM.

All of us are paying dearly for inefficient highways because of excessive vehicle operating costs and losses in time and accidents. This economic waste will add up to more than the cost of a good highway system before many years. And still we will not have the highway system we need.

ACTION IS NEEDED.

I am most familiar with the situation in California. This state has been actively studying the basic financial problems through the work of the Senate Interim Committee, and a brief review of these problems will provide a background for a solution I want to propose.

A suggested solution

In fact, I will state the solution first and then analyze the substantiating facts.

California ought to spend at least \$1,000,000,000 more for major highway construction during the 1950's than our present highway-user tax system will produce.

To review:

Less than 3 years ago the California Legislature passed bitterly-contested legislation to get money and improve road administration as the first step in a vastly expanded highway construction program. We raised user taxes on our motorists and truck and bus operators about 64%. Opponents of our 1947 program said that we were imposing unnecessary taxes; that we were promoting extravagance.

Yet, today, I sincerely believe that we need additional funds for highways.

By

SENATOR RANDOLPH COLLIER

Chairman, Committee on Transportation and Interim Committee on Highways, Streets and Bridges, California Senate

Actually, the 1947 highway act in its final form provided only a minimum program. But I believe some people thought we could sit by for 10 or 15 years without again worrying about highway financing. In retrospect, and in terms of post-war prices and other factors like increases in population, motor vehicle registrations and heavy vehicle traffic, the program was much too modest. It was little more than a beginning. However, it did provide for a redistribution of the tax burden among different classes of vehicles more equitably than ever before. We accomplished this, despite some necessary legislative compromises, by increasing the taxes on heavy trucks and buses more than other user taxes.

Furthermore, our 1947 legislation was extremely important to counties and cities. We had inquired into the facts and found that local governments needed more financial assistance to meet road and street problems. Therefore, a large part of the increased tax revenues was specifically earmarked for them. Besides we improved the formulas for distributing the money. Perhaps the final legislation may have gone too far in taking care of the counties, and perhaps the cities.

In any event, counties and cities fared handsomely in the 1947 legislation. To the extent that their road and street programs are now inadequate, I believe that they can and should augment their funds with locally-raised revenues. It is unfair to ask the highway-user to pay the costs of every road and street in the state. **It would be unreasonable to give any more support to counties and cities out of highway-user tax funds until the state highway system is completely modernized.**

Fortunately, our highway engineers and the construction industry have clearly demonstrated their ability to handle a greatly expanded highway program. The satisfactory bids now being received on highway projects are most encouraging. Moreover, the past three years have seen outstanding improvements in highway administration. Particularly is this true for counties where centralized administration under the direction of a competent road commis-

sioner is now required. And the adjustments in state administration which have taken place so speedily and effectively indicate that further acceleration of the highway program would be entirely feasible.

Let's look at the future

The State Legislature acts more or less like the Board of Directors of any corporation in dealing with highway affairs. The problems are many and varied, and require close and careful attention. For this reason, the Senate has set up an interim committee to study and report to the Legislature on progress under the 1947 highway act and the need for any changes in our highway laws. Our committee has found that several aspects of the highway situation need study.

I won't attempt to discuss all of these matters fully, but I should like to mention some to indicate the ramifications of the problem.

For example, we are seeking a more satisfactory method of taxing commercial vehicles because we find serious inequities in the present system. We insist that trucks and buses pay their full share, but we also insist that the taxes be fair. We'll never attain perfection but we might find something better than we've got.

On the other hand, we want to be sure that our size and weight limitations are kept and that violators are discovered and punished. Overloading of vehicles does untold damage to the highways. We simply can't afford to have our investment ruined by a few unscrupulous chiselers. Nor can we afford to be "pressured" into increasing permissible sizes and weights if we are going to preserve our highways.

Further, we find there is much room for improvement in county road administration. You may wonder why the State Legislature should be so concerned about this. The answer is simple. We impose the highway-user taxes that are returned to the counties and we owe a basic duty to the taxpayers to see that every dollar collected for highways is wisely spent.

Timing is important

In 1947 we were criticized for our alleged failure to give proper consideration to credit financing and toll roads. In my opinion, our critics had only a superficial view of the highway, road and street problems that existed at that time. Apparently they believed that construction of a few strategically-located highways was the immediate answer to California's problem. Instead, we needed a broad basic program for financing sustained and continued construction and maintenance of all types of highways, roads and streets in every section, county and city of the state. Moreover, one of our greatest needs was metropolitan freeways which quite obviously couldn't be financed by tolls.

To tie the basic pay-as-you-go program recommended in 1947 to a system of credit financing would have been a mistake. It would have confused the issues completely, and, in the political

atmosphere that prevailed then, might have defeated the entire program.

Today, the situation is different. We have in operation a reasonable pay-as-you-go program. The rate of progress is slow but steady. However, the basic adjustments that were necessary to undertake an expanded highway program have been made smoothly. This minimum program should continue substantially as originally planned.

Nevertheless, I think it is time to review the facts. Lack of money is preventing adequate progress. We need additional funds to develop the major traffic arteries of the state. We need a new financial plan; in my opinion, a **superimposed highway construction program.**

Means of financing

There are several ways to get the additional funds. I am not sure which would be the best (or which would be the most expedient, politically). However, before we make any final decision we should secure the finest available engineering, financial and economic advice.

At least these three methods should be studied:

1. *A general increase in user taxes and a continuation of our traditional "pay-as-you-go" system.*
2. *Borrowing against future income from present user taxes, supplemented perhaps by toll road construction where feasible.*
3. *Continuing our basic minimum program on a pay-as-you-go basis, but issuing bonds for a specific additional program to be paid for by specially imposed highway-user taxes hypothecated for debt service.*

Of course, the three are not mutually exclusive, and might be combined if that seemed wise. It seems to me that the third possibility has considerable merit, if the inherent dangers of bond financing can be adequately guarded against.

Let's consider this "superimposed" highway program for a moment. What are its advantages? Its defects? Its dangers? The possible safeguards?

Earlier benefits

There is nothing mysterious or profound about the state's use of credit. Its advantages are not different from those considered by an individual or a businessman when they seek a loan. **If we borrow we can enlarge our construction program with smaller tax increases than we would need if we tried to do the same thing by the "pay-as-you-go" method.** Moreover, we will not disturb the basic 1947 program. This program can continue after the bond program is completed.

Using our credit, of course, shifts a part of the cost of providing highways to future users. But why not, if the highways will continue to serve a useful purpose? **Should today's user bear the entire cost of building a facility that will last 40 or 50 years?**

The most significant argument for bond financing is that we secure the

benefits of modern highways much earlier than we otherwise might. This means that highway maintenance costs are cut. It also means that our motorists can enjoy much sooner advantages like reduced vehicle operating costs, and savings in time, and reductions in accidents.

Some objections to bonds

The usual objections to bond financing indicate its limitations and its dangers. Certainly the following are significant.

1. No matter how you sugar-coat it, a tax is still a tax; you can't service bonds without taxes; in fact, you need more taxes because you have to pay interest.
2. Provision of more funds, especially by the "painless" method of borrowing, might promote extravagance.
3. The wise use of credit requires expert, non-political management. In the political arena, basic principles of finance might be ignored. For example, we might build highways which would wear out or become obsolete long before the bonds were paid for.
4. The worst problem is that we can't predict, years in advance, exactly what kind of a highway system we'll need in the future. Highway problems are dynamic; they seem to be continuous.

That sketchy comparison of the pros and cons of bond financing shows how carefully the problem must be studied.

Ordinarily, I would take a dim view of using credit for highway improvements. As a general practice, our highway program should be so planned and scheduled that construction goes forward evenly year in and year out. With such a program we would not need to use our credit.

However, we fell so far behind during the depression and war years that it seems impossible now to catch up with any reasonable "pay-as-you-go" effort. **If we once eliminate our accumulated critical deficiencies, then we should be able to keep abreast of the situation by sound advance planning and programming under a "pay-as-you-go" system.**

Prudent public finance

There is no valid reason why our state government cannot use its credit prudently. Unfortunately, "pay-as-you-go" is a popular slogan in highway finance largely because of political blundering in the past. But there are situations where it is wiser to build highways and "go-as-you-pay." I believe we face this situation today.

Certainly under similar circumstances any business would borrow to make needed capital improvements. **Why can't we do the same for highways?** I think we can if we proceed cautiously. We can if we exercise sound business judgment and follow a well thought-out plan.

Some limitations are logical

Let me suggest some possible limitations that might do the trick.

First, I think we should definitely

limit use of the bond funds to construction on a designated system of major traffic arteries of extremely limited mileage.

Second, each project that is to be improved with bond funds should be approved in accordance with rigid, predetermined standards by a special board established for that purpose, after specific findings of fact regarding such matters as (1) the estimated life of the project; (2) estimated user-tax revenues which would be earned or generated by that facility during its useful life; (3) the estimated annual cost of the project, including maintenance, depreciation, and interest expenses.

Third, it might be well to require that a specified portion of the cost of each such project be paid out of current revenues. This might be likened to the investment of some equity capital and might reduce possible tendencies toward extravagance.

Of course, the life of the bonds should be strictly limited so that they will be retired long before it is likely that the facilities will wear out or become obsolete. In my opinion, bonds should be limited in life to not more than 25 or, at most 30 years.

If we are to use credit financing at all, the basic program should be proposed to the people as a constitutional amendment. Not only should the amendment authorize the bonds and the conditions under which they are to be issued, but it should spell out the purposes for which the money is to be spent, including designation of the eligible highway system and the project standards. The same amendment should provide for the additional user taxes necessary to service the debt.

Detailed study is required

Let me emphasize again that we have not worked out any details. What I have suggested is subject to great modification. A program of this magnitude needs careful study by experts. Therefore, I hope that the Legislature will investigate thoroughly this matter of credit financing. I would like to see the Legislature in 1951 direct an appropriate committee to go into all ramifications of the problem. This committee should consider hypothecation of revenues for major highways along the lines I have suggested, but it should also explore the feasibility of toll roads in certain locations. In addition, it might consider whether it is advisable to permit cities and counties to borrow against anticipated highway-user tax apportionments under certain conditions and for limited purposes.

I have a strong feeling that hard-headed analysis by engineers, businessmen and financiers will show that an investment of an additional billion dollars in California highways during the next decade will pay off. If we ought to get the funds by a bond issue, the Legislature should be prepared to submit a program to the voters in 1952.

In the meantime, we can proceed with our minimum program under the 1947 legislation. **But we should not delay too long. We need highways.**

THE LATEST EQUIPMENT AT WORK BUILDING WESTERN HIGHWAYS

**50 SHORT STORIES
TOLD WITH PICTURES**

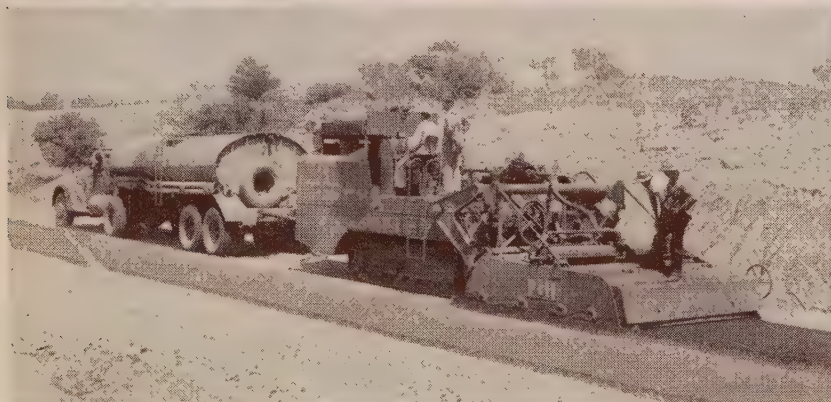




VOLCANIC CINDERS will form the base for 11 mi. of the main highway from the Grand Canyon to Williams, Ariz. Bowen & McLaughlin, Phoenix contracting firm, has set up this Cedar Rapids Master Tandem crushing plant to process the material. A total of 100,000 cu. yd. of the volcanic ash will be used for the roadway's base.



OIL MIX for patching streets in Helena, Mont., is mixed in an open yard and then loaded into dump trucks for delivery. This view at the yard shows an Athey Force-Feed Loader picking up the mix. The loader has filled more than a hundred 4-cu. yd. trucks for one day's patching.



TO STABILIZE sandy native soil for construction of 11 mi. of U. S. 283, Ellis County, Okla., an MC-3 asphalt is mixed with the soil. Contractor W. E. Steelman of Oklahoma City is using a P&H Single Pass Stabilizer to process the material at a rate of 500 lin. ft. per hour of the 8-in., 24-ft. roadway.

CUTTING OUT a new road in Boulder Canyon near Boulder, Colo., Platt-Rogers, Inc., of Pueblo uses Bucyrus-Erie's new 2-cu. yd. power shovel, the 51-B.

TO DRIVE PILING on the Santa Ana Freeway project in Los Angeles, Pacific Crane & Rigging Co. uses a mobile Lorain Moto-Crane equipped with 50-ft. leads and drop hammer.

BACKFILLING over a pipeline on a project near Coalville, Utah, where thick scrub growth occurs on steep slopes, Enoch Smith & Sons Co., Salt Lake City, uses a Galion 116 Motor Grader.

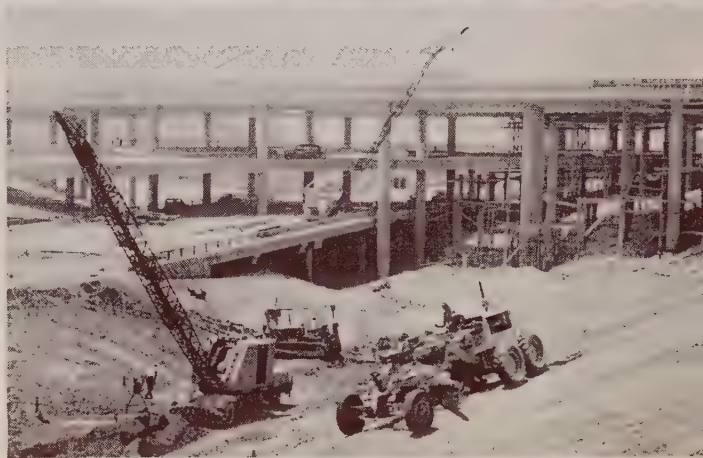




ON U.S. 40 IN COLORADO, main Salt Lake City-Denver route, the perennial problem is to keep heavy winter snows from blocking the roadway. In this view near Berthoud Pass, an Adams 610 Motor Grader equipped with a B-70 Rotary Snow Plow throws a cascade of snow to one side to widen the cleared roadway. Elevation of the highway at this point is about 11,000 ft. The equipment is owned by the Colorado State Highway Department.



THE WORLD'S FIRST four-level grade separation is now completed at the intersection of the Hollywood and Arroyo-Seco Parkways in the heart of Los Angeles. View is of construction late in 1949 when final work was in progress. James I. Barnes Construction Co., Santa Monica, did the job under a \$2,300,000 contract.



TAKING A TURN, a Caterpillar D-8 and LeTourneau Carryall combination dumps its load after taking another big chunk off the 90,000 cu. yd. of excavation required for construction of U. S. 95 near Fernley, Nev. Silver State Construction Co. of Fallon, Nev., has a \$261,800 contract for the project.



100,000 CU. YD. of solid blue limestone rock excavation was required for construction of U. S. 2 near Kalispell, Mont. S. Birch & Sons, contractor of Great Falls, used two 500-cu. ft. per min. Chicago Pneumatic compressors to supply air for wagon drilling operations. Note sheer rock wall at right.



IN THE SHADOW of Utah's Wasatch Mountains, 137,000 cu. yd. of completed excavation has prepared Salt Lake County's Wasatch Boulevard for base and surfacing. Working in the mud after melting snows, a Caterpillar D-8 tractor and LeTourneau Carryall combination gets ready to pick up another load. Contractor is Anderson Construction Co., Price, Utah.





LOADING ROCK from a road cut near Salem, Ore., Carl M. Halvorson of Portland uses a Lima Type 604 shovel equipped with a 23-ft. boom, 18-ft. dipper handle and a $1\frac{1}{2}$ -cu. yd. Amaco dipper.

A FLEET of F-8 Ford trucks equipped with tandem rear axles hauls payloads of 36,000 lb. through mountainous country for construction of the highway between Pueblo and Canon City, Colo. The fleet is operated by Graham Trucking Co., Pueblo.

COMPACTING grade for the new City Creek road in the San Bernardino Mountains near Running Springs, Calif., Frederickson & Kasler, Sacramento, uses a new Hyster Grid Roller pulled by a Caterpillar D-8 tractor.



IN COLORADO, where high-grade aggregates are available in abundance, bituminous road-mix surfaces provide good wearing qualities at relatively low cost for mountain routes. In this view of road-mixing operations, a tank supply truck is stationed ahead of the pressure-mixing distributor. An Adams 512 Motor Grader follows the distributor to blade the windrowed aggregate into uniform thickness on the road surface. The equipment is owned by the Colorado State Highway Department.

DUMPING AGGREGATE into the bins of the dry batch plant owned by United Ready Mixed Concrete Co. at South Gate, Calif., is the company's new White Super Power Truck, which has a tandem drive tractor and weight-truck features which increase the payload. The truck travels 250 mi. per day delivering gravel to the plant for eventual use on the Imperial Highway job.

SCARIFYING a city street in San Francisco is an Austin-Western Master "99" Power Grader owned by Charles L. Harney, San Francisco contractor. The unit is equipped with dozer and grading blades along with the scarifier.

DUMPCRETES, a Scoopmobile and central mixing methods teamed up to speed construction of a highway overpass in Monterey County, Calif. Central Supply Co., Salinas, Calif., supplied the ready mix concrete; Dan Caputo was contractor.

ON RIP-RAP work in South Dakota, a Minneapolis-Moline RTI Industrial Wheeler equipped with a Lull 4A Shovel loader loads material into a conveyor bin while an International dump truck stands by to be loaded.





TO SUPPLY aggregate for paving a 4-lane freeway through the Santa Ana Canyon in Southern California, Peter Kiewit Sons' Co. set up this Cedar Rapids Master Tandem plant. Note bulldozer feeding plant from above. Material at the plant location consists of alluvial deposits providing the entire range of aggregate sizes.



ON THE 35-MI. private logging highway built by Masonite Corp. in the redwood region of California, about 5,250,000 cu. yd. of excavation was required to provide the 30-ft. roadway. Following the pioneer cut, the Utah Construction Co. used this Bucyrus-Erie shovel with boom and dipper-stick designed for coal-stripping service to overcast material across the full width of the road in one cast. This highway, which will handle loads grossing up to 250,000 lb., is described on page 79 of this issue.



AN OILSPREADER unit gets a refill by gravity flow from a transport truck. Both units, on Model SU Four Wheel Drive trucks, are owned by the California Division of Highways.



UNSEASONAL SNOW delayed the W. W. Clyde & Co. \$400,000 contract for plantmix surfacing on U. S. 40 near Salt Lake City. Below, snow on the frame doesn't help much as a mechanic welds a new sheave block on the frame of a Le-Tourneau Carryall.



FOR DRIVING PILES on bridge approaches, crews in Kearney County, Kansas, use a Caterpillar D-4 tractor, a Hyster tractor donkey, a DLA-4 special crane, and Trackson Traxcavator combination.



ON THE HOG-BACK section of the North Umpqua highway in Washington, Slate Construction Co. of Albany, Ore., is breaking up plenty of rock, in this view with Sullivan wagon drills powered by a Gardner-Denver compressor.





A 70-TON truss bridge was fabricated in the shop and then hauled to the construction site by the road department of Churchill County, Nev. Riding on two 3-axle dollies, the assembly was towed by a Quick-Way Model E dragline.



LARGE QUARRY ROCK is reduced to road ballast size by a Lippman Portable Primary Crushing Plant on a Washington highway job. Crusher on this unit is an 18 x 36 Grizzly King. Capacity is 100 tons per hour on hard rock with a 3-in. discharge opening.



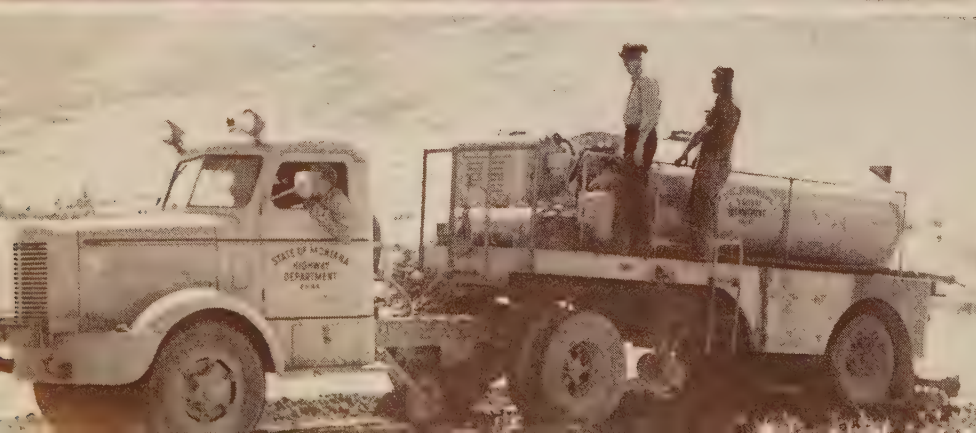
FOUR HOT OIL road patchers for 6-man crews have been put into service by Los Angeles County. Flat bed bodies are mounted on Mack Model LFSW 6-wheel chassis. A 385-gal. oil storage tank, set immediately behind the cab, is equipped with coils to heat the oil by utilizing exhaust gases. Special boxes carry all tools.



JUST put into operation by Clark County, Nevada, this new Tel Smith 7A Dual Crushing, Screening and Loading Plant, with about 25% to be crushed, is turning out from 60 to 80 cu. yd. per hour when making minus $\frac{3}{4}$ -in. material and from 70 to 90 cu. yd. per hour when making minus $\frac{1}{2}$ -in. material.



SOIL CEMENT stabilization is now extensively used in California. View is of a recent job at Riverside, with J. A. Payton as contractor. Two Wood Model 54 Roadmixers were used to prepare the roadway with a 5-in. thickness. An average of 300 tons was mixed per hour, and soil cement for 2.6 mi. of the 26-ft. roadway was mixed in 30 hours.



ROAD OILING trailer owned by the Montana State Highway Department is used for black topping operations. The unit is towed by a Model HR Four Wheel Drive truck.

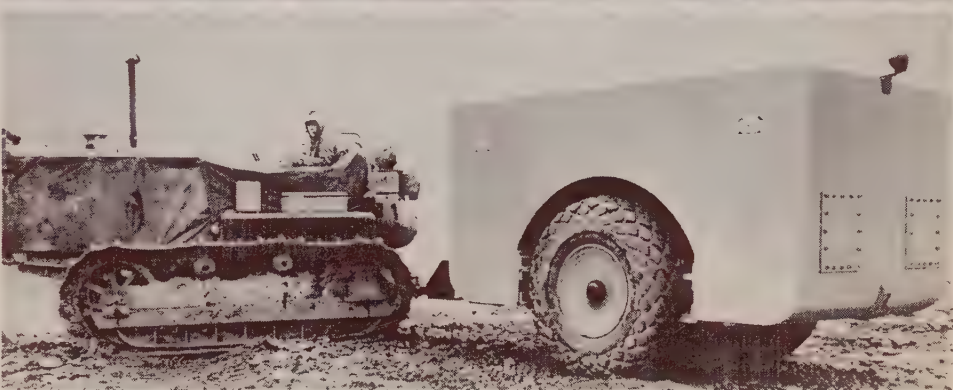
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SOFT CLAY hampered operations of Grant Construction Co. on a highway job near Copeland, Idaho. In this view, an M-R-S 125 rubber-tired tractor pulls a Le-Tourneau FP Scraper. On a 2,100-ft. round trip, the unit averaged eleven trips per hour.



→
NEAR MOAB, UTAH, Whiting and Raymond of Springville, Utah, is using a Pioneer 46-VE Diesel Electric Crushing Plant on the Kane Springs project. The unit is producing about 120 tons per hour.



→
THE PORTLAND DISTRICT, Corps of Engineers, is using this compactor for general work. It is the Roll-O-Pactor, manufactured by Wm. Bros Boiler & Mfg. Co. Four big tires are mounted on two axles for easy turning. The 450-cu. ft. body, when filled with gravel, weighs from 20,000 to 80,000 lb.



→
THE ASPHALT plant of Tracy Rock & Gravel Co. at Tracy, Calif. In front of the Barber-Greene plant, a Koehring 304 dragline loads hot patch material into one of the firm's fleet of dump trucks.



AT AN ELEVATION of 13,500 ft., equipment owned by the City of Colorado Springs picks up gravel for use on a highway up Pikes Peak. A Quick-Way Model E truck shovel loads International trucks, while a TD-18 International tractor strips cover material.



HIGHWAY MAINTENANCE in the West can sometimes be as lonesome as riding herd. Two men of the maintenance crews of the Nevada Department of Highways are shown painting shoulder markers. To prevent wet paint from running, the crew makes three passes, from black top to white body to black bottom.



LOADING WET SNOW from the city streets at Kellogg, Ida., a Caterpillar D-4 tractor equipped with a Trackson Traxcavator is owned by the city. Snow was 4 ft. deep on the city streets after a storm last winter.





SET UP in one of New Mexico's rocky canyons is this Universal TwinDual Master portable crushing plant owned by the New Mexico State Highway Department. The plant features three full stages of reduction with two crushers: jaw crusher in the first stage, and the TwinDual Roll Crusher in the second and third stages.

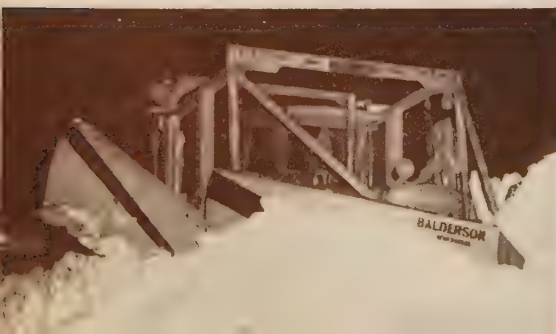


CLEANING UP steel reinforcing and concrete around the base of a counterfoot wall formerly used as a footing is a Hyster tractor-mounted Hystaway Back Hoe. The footing was removed to make way for the new Broadway Bridge approach in Portland, Ore. C. J. Montag & Sons, contractor.



WORK on the Fairbanks International Airport in Alaska. A Wooldridge Terra Cobra skirts the water's edge to level glacial till. Ten of the Terra-Cobras are being used by Morrison-Knudsen Co., Inc., for land leveling and gravel stockpiling on the project. Tractor in background is equipped with a Wooldridge Model WE-2 power control unit and BHD-19 bulldozer.

SNOW REMOVAL in Kootenai County, Idaho. The county uses this Caterpillar D-6 tractor equipped with Balderson V snow plow wings to clear heavy snows from 88 mi. of county roads.



NEAR MT. SHASTA on construction of the new Everett Memorial Highway, a Northwest shovel loads a Caterpillar W10 wagon. Contractor on the job is Harms Bros. of Sacramento, Calif.



CLEARING an earth slide on the Sunset Highway near Portland, Ore., is a Duo-Way Scoop, Mixer-mobility Co. The Scoop makes good use of its dozing blade as well.





Natural Rock for Base Within Right-of-Way Aids— **Heavy Grading Job on Utah Highway**

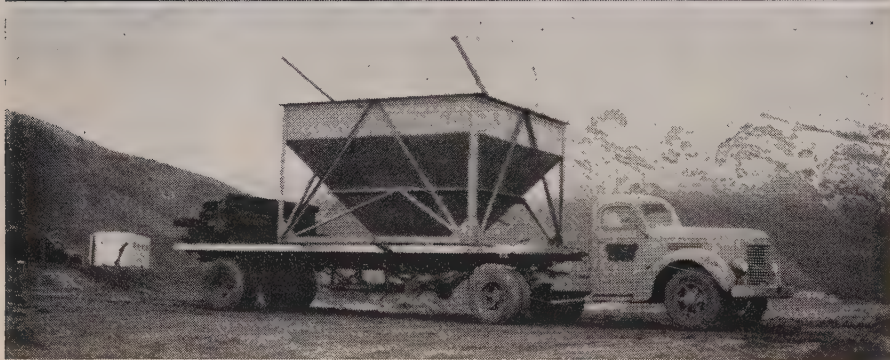
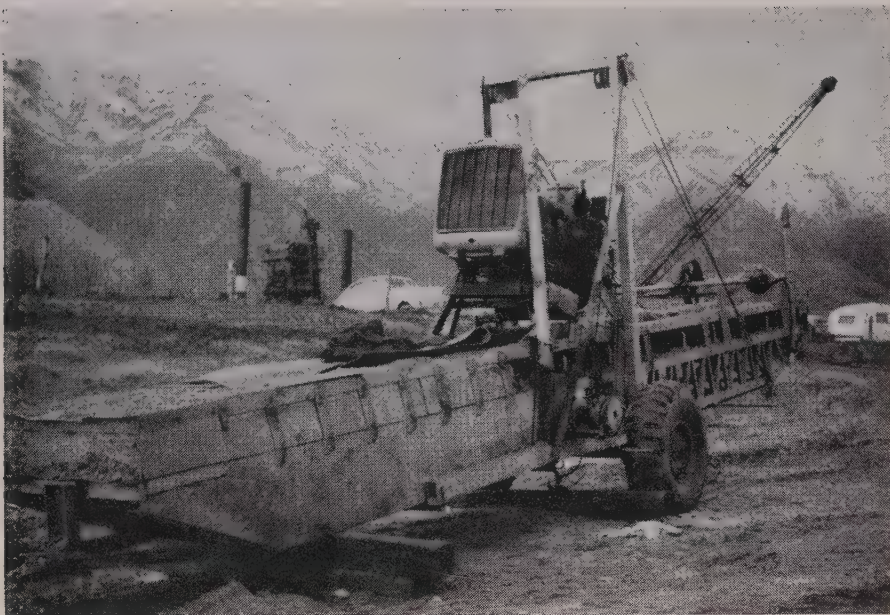
RARELY does a contractor have all the good rock he needs within the right-of-way limits of a highway job. In order to take advantage of an ideal layer of rock at the site, the L. T. Johnson Construction Co., Ogden, Utah, has set up its rock plants directly on the line of the highway during the grading. The 6.6-mi. contract, covering a new route from Ogden, south toward Weber Canyon and Salt Lake City, was awarded Nov. 11, 1949, by the Utah State Road Commission for \$480,191.

The highway is in the foothills of the rugged Wasatch Range, along the shores of prehistoric Bonneville Lake that evaporated into the famed Great Salt Lake. Higher by several hundred feet than the city of Ogden, the land is covered with a 1 to 2-ft. overburden of sand and clay. Beneath the sand lies a valuable 8 to 10-ft. gravel cap. This gravel cap is being excavated to the limit of the state right-of-way and processed for base course, crushed gravel surfacing, aggregate for plant-mix bituminous course, and cover coat material. Present evidence indicates that sufficient material is available for the project. Having rock and road coincide in this manner saves the contractor much prospecting for economical gravel pits from private property owners.

The natural rock simulates river-run gravel, with sizes prevalent up to 6-in. diam. Where the gravel cap is loose, the



GRADING operations on the Ogden highway, right. Combination of seven sheepfoot rollers tamps fill. Rock in foreground is rejected material over 2-in. diameter which is used for deep fills. Grading at the toe of a 2:1 slope, top of page.



"IF IT'S GOT TO MOVE, put wheels on it" is the motto on the Ogden highway job. At top, a homemade conveyor loader, fabricated by the contractor, is 40 ft. long and has a 30-in. conveyor belt. The 12 by 12-ft. portable hopper, bottom, was also made by the contractor.

portable rock plant is fed by one bulldozer and belt loader. Where the going is somewhat harder, the plant is fed by a Link-Belt Speeder LS-80 crane, rigged with an oversize 1-cu. yd. dragline bucket. The dragline, in turn, is fed by a D-8.

When the gravel cap has been worked down to grade, the plant is moved ahead on line. The maximum distance between plant setups is 300 ft., and the average is about 250 ft. Distance is determined solely by the speed of the D-8 and its ability to keep the plant full. The plant rejects 5-in. rock, which is hauled ahead and placed at the base of heavy fills.

Base gravel is 2-in. minus material. This is supplied simply by loading a hopper and 2-in. screen with the conveyor. Oversize material is again hauled to the fill areas. Both the hopper and conveyor belt were made in the contractor's shops, according to his design. The conveyor loader is 40 ft. long and uses a 30-in. belt. It is powered by a Caterpillar 318 Diesel as used in the No. 12 motor grader.

Common excavation on the job, 815,000 cu. yd., is ahead of schedule, yet tough enough to be interesting. At one extreme point on the job, dirt from a cut 160 ft. above grade was hauled to a fill 150 ft. below grade. The haul road had a slope of 20% to 25% to connect this gap of over 300 ft. Crawler-type tractors

were used entirely until a haul of about 15% was established, at which time the rubber-tired rigs were added.

Pioneering on the job involved no heavy clearing, yet took much time since the bulldozers had to work on slopes that approached 1:1 in places. This could be done only because the firm sand and clay would support the equipment, and even then the catskinners had to inch his tracks in each direction when beginning a cut.

Loading is usually fast where the grades are steep. However, it is hard on the equipment, and cutting edges of the scraper bowls show wear that would be expected from loading beach sand. Beneath the gravel cap, the cuts are in finely stratified sand and clay. The rich, purple clay, broken up by the sand, is

CARL FONNESBECK, left, and W. E. MICKELSON are the two superintendents on the job for the contractor, L. T. Johnson Construction Co. of Ogden.



Equipment on Ogden Highway Job

- One Caterpillar DW-10 tractor-scraper.
- Three Le Tourneau Super C Tournapulls.
- Two model W, two FP and one J Carryalls pulled by D-8's.
- Eleven Caterpillar D-8 and one D-7 tractor.
- One International TD-18 tractor.
- Two Caterpillar No. 12 motor graders.
- Seventeen 48-in. Southwest Welding and Le Tourneau sheepfoot drums (seven each on the D-7 and TD-18).
- Cedar Rapids Junior Tandem gravel plant and shaker screen, 22 x 36-in. jaws.
- Fourteen Ford dumptrucks, F7 and F8.
- Three Internationals, 6 cu. yd.
- One Sterling and one International lowboy trailers.
- One Link-Belt Speeder 80 one-cu. yd. dragline.
- One Barber-Greene asphalt batch plant.

strongly abrasive on the equipment. Grading is proceeding at a rate of 6,000 cu. yd. per two-shift day, unhampered except by minor problems.

At the south end of the project, the new roadway crosses an alluvial fan. In this section of about 15,000 cu. yd., boulders of from 1-cu. ft. to 6-cu. yd. sizes comprised 75% of the excavation. No explosives were used. The rubber-tired rigs were used for the removal.

Late spring snows, extending into the month of May, haven't appreciably slowed the job or caused trouble beyond the discomfort of the crews. In fact, the snows in one respect have been beneficial. Several times the equipment was temporarily shut down due to a fine white dust, locally named blowsand, which became so thick that the equipment operators had difficulty in breathing and seeing the grade. In a damp condition resulting from the late snows, this material has not been as troublesome as it could have been in normal weather. For comfort, canvas covers to guide the engine heat to the operators have been left in place until warm weather is a certainty.

Excavation is being run on two shifts. The complete servicing of equipment is being done by a special crew on the graveyard shift, midnight to 6:00 a. m.

Generally, moisture has been no problem. The contractor moved the crews out on the job during the first part of February, getting an earlier than usual start. Few jobs at elevation 5,000 ft. are begun before this. An early start also meant that no moisture had to be added to the fills for a considerable period of time. Getting the water trucks in and out during the early phases of the work could have hampered operations.

An added point of good luck for the contractor is that the home office is

Continued on page 104



Reno Contractor Building a Major Highway Almost on Office Doorstep

A CONTRACT that comes only once for each license is held by Isbell Construction Co., Reno, Nevada. The firm is building a section of highway that passes directly in front of the Isbell main offices.

The job is divided into two sections, which were bid separately. The Isbell firm was awarded the contract for both sections—one extending north from a point near the Isbell offices, and the other extending south, to make up a total of about 5 mi. on the Reno-Carson City highway. Curiously enough, Isbell had stiff competition on the bidding for the southern section of the job, even though it was in the shadow of the Isbell offices. Isbell's low bid was \$312,569; second low bid by Dodge Construction Co., was \$313,525; third low bid was \$316,623.

Work on the highway consists of grading, providing rock base, and plantmix surfacing to provide a 4-lane divided highway. Fast traffic and excess ground water are the contractor's biggest problems so far. As often happens,

there is too much of each, in the wrong places.

Usual practice for a Western contractor doing a plantmix surfacing job is to set up a portable plant at the site, since it usually is a long distance to the

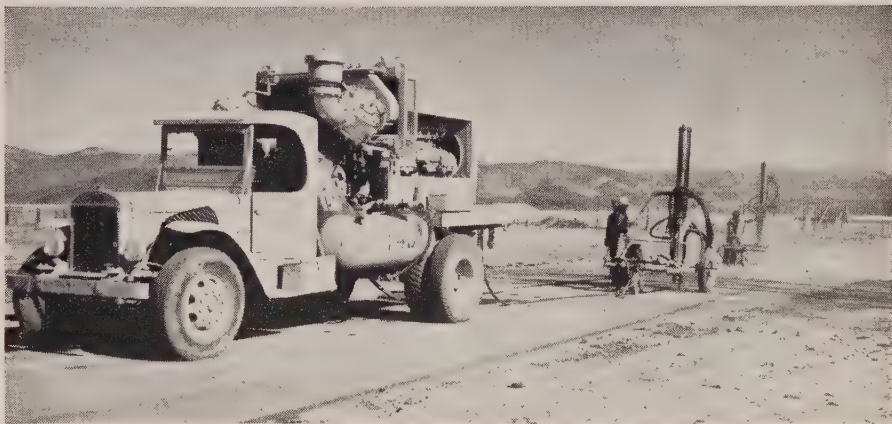
nearest permanent plant. In this case, however, the contractor has a comparatively short haul to his main plant, a Madsen No. 102. The plant, largest in the Reno area, is located on a 160-ac. site.

Another job not so near

With the closest job on its doorstep, the Isbell firm has another job at quite a long distance from home. This is a contract with Kennecott Copper for stripping a copper mine at Santa Rita, New Mexico. Whereas shanks' mare is enough to get supervisory personnel to the job mentioned above, the firm maintains one Navion and two twin-engine Beechcrafts for visiting the New Mexico project.

On the Reno project, Henry Isbell is project manager, W. J. Isbell is general superintendent. Frank Zielinski is job superintendent, and Don Duke is office engineer. Dale Rose is resident engineer for the Nevada State Department of Highways.

FOR AIR POWER, the contractor rigged a 450-cu. ft. per min. Ingersoll-Rand compressor on the bed of a Mack truck. Jackhammers in background are Cleveland D-14's mounted on wagons.



Canyon Highway Straightened by Relocating Both River and Road



RELOCATION of Route 95 in western Idaho is also necessitating relocation of a portion of the Little Salmon River. Old route for the highway, near the Idaho town of Riggins, followed the river's bends through the canyon. The new route, about 0.9 mi. long, straightens the curves in both the river and road.

Straightening the curves involves some 30,000 cu. yd. of excavation, and 10,000 cu. yd. of rock fill. Material shown being moved with the dragline must be handled three times. First handling is by the pioneering bulldozer. Second action is from the dragline, which stockpiles rock. When the new channel is nearly completed, a small cofferdam (see view) will be broken and the river will flow around the dragline and bulldozer. The dozer will then fill in outside the bend while the dragline trims new slopes. Fill along the highway will be lined with a 5-ft. thick blanket of stone riprap.

Vernon Brothers Co., Boise, holds a \$53,000 contract for the job. John Thompson is the firm's superintendent. Charles E. Aldrich is on the job as resident engineer for the Idaho Bureau of Highways.

Improving Colorado's Loveland Pass Route on Continental Divide Crest

LOVELAND PASS is situated at the crest of the Continental Divide on State Highway No. 91, U. S. Route 6—the dividing line between Clear Creek and Summit Counties in Colorado. The highway, reaching an elevation of 11,992 ft., is one of the major links between Denver and Grand Junction. Presently the road accommodates approximately 600 vehicles per day. Truck transport accounts for a considerable portion of the traffic volume during winter months.

Initial development of the route was started in the 1880's to provide passage for stage coaches, freighters and ore wagons. The original road was abandoned in 1906. The route again came into use about 1920 as an automobile road. From 1920 until 1937, considerable money was spent to improve the original road by widening it and reducing curvature by knocking off rock points. Because of its spottiness, this work was not a type which lent itself to contract operation. The improvements were piecemeal and had as their objective the reduction of many hazards that occur on primitive roads in high altitudes and which are constructed on precipitous side hills.

In 1937 and 1938, under the \$25,000,-000 State Anticipation Warrant program, 20½ mi. of additional improvements were undertaken. Approximately \$670,000 was expended on the road during this period. This work involved additional widening and gravel surfacing of the entire 20½ mi., as well as additional minor improvements in alignment. In 1939 and 1940, all of the approaches to the foot of the Pass were oil surfaced, leaving 8 mi. on the west side and 4 mi. on the east side of the Pass with only a gravel surface. During all of the development period, traffic was increasing and, as usually happens with an increase in traffic, the demand was for more and faster improvements. As normally happens, the interested parties were formed into "pressure groups" and a steady drum-fire of publicity started. Each group had its own proposal for improving the Pass.

Tunnel under summit?

One of the most widely backed proposals at the time was the construction of a tunnel underneath the summit, approximately 1 mi. in length. This would eliminate some of the potentially bad slide areas and remove the discomfort and dangers which are always in attendance in driving on highways at high altitudes during time of heavy snow fall and high winds.

It was decided then to undertake preliminary work on a tunnel operation. Because of the excessive cost, which occurs when construction of large size highway tunnels are attempted without complete information for prospective contractors, the Highway Department decided that the geology of the proposed tunnel could be best determined by the

After abandoning the much talked-about plan for a 1-mi. tunnel, Colorado has placed under contract improvements on 8 mi. of this major highway link between the eastern and western slopes

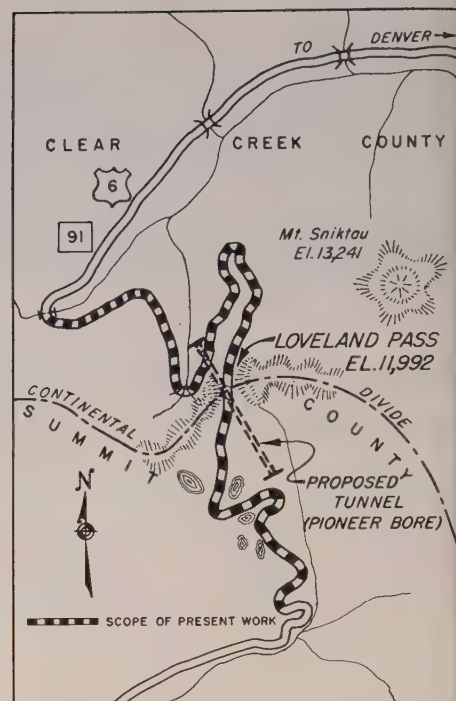
driving of a pilot tunnel with a 7 x 7-ft. heading. The bore of such a pilot tunnel would be sufficiently small to eliminate the construction problems attendant in building a two-lane highway tunnel, and it could probably be accomplished at a minimum cost. It was reasoned that the cost involved in the construction of the pioneer bore would probably be returned many times in the savings which would result when a large bore tunnel was undertaken. The construction of the pilot bore was then undertaken in 1941 by the E. H. Honnen Construction Co., and was completed in 1943 at a total cost of approximately \$281,000.

By the time this task had been performed, the geology of the proposed tunnel was firmly established. During the war period, wind measurements were taken; drainage coming into the tunnel calibrated; and all of the other problems attendant on the completion of a two-way tunnel were studied. Subsequent to the war, \$1,000,000 was appropriated in the 1946 Colorado Highway Department Budget to start construction of a tunnel which was to be approximately 5,400 ft. long and to have a 32-ft. width at the spring line.

No acceptable bid for tunnel

The crest of the tunnel was to be semi-circular in shape and a 14-ft. vertical clearance was provided at the curb lines. The first phase of the work contemplated was the construction of 2,000 ft. of the ultimate 5,400 ft., and the project was advertised for bids in 1947. In

VIEW of construction at 11,000 ft. elev. Extra equipment was required for high elevation.



spite of the many estimates of the construction cost made by various people, the widespread interest in the project by the contracting industry and the fact that everyone insisted that such a tunnel could be driven at a price which the state could afford, only one bid was submitted. Because of a long-standing highway department policy, the bid was not opened as it was not subject to competition. The bidder did indicate that he believed the approximate cost of the completed 2-way tunnel would be about \$10,000,000.

Detailed estimates, prepared by the engineering staff of the Colorado Highway Department for the project, including the approaches, lighting, ventilation and required lining, showed a cost of about \$7,200,000. Because of the lack of competition in bidding and the apparent high cost, the tunnel project was abandoned. The original \$1,000,000 budget allotment was predicated on approximately 50% state funds and 50% federal aid. The 50% of state funds (\$500,000) was then assigned to improve the road over the top of the pass, and the federal funds assigned to other needed improvements. It is of interest that a one-way tunnel had been given consideration and had been rejected by the Bureau of Public Roads as not suitable for the proposed site.

Current improvements

The total length of the project which is presently under way is 8 mi.—4 mi. on the west side at the foot of the Pass had previously been awarded. The 4 mi. at the foot of the Pass is under contract to the Brown Construction Co., Colorado Springs. The 8 mi. at the summit, 4 mi. of which is on each side, is under contract to Colorado Constructors, Denver.

All projects have a minimum width of 30 ft., shoulder to shoulder and provide for a 22-ft. paved surface. Sharper curves

Continued on page 104

Construction Design Chart

CXX...Reinforced Brick Masonry Beams

THE ULTIMATE strength of brick masonry depends upon the quality of the materials and the workmanship entering into the construction. The answer to the question relative to the allowable working stresses to be used in the design of reinforced brick-masonry elements may be a little confusing if a comparison is made between existing literature on the subject and various building codes. The 1946 edition of the Uniform Building Code¹ specifies the allowable working stresses in the masonry to be a function of the ultimate compressive strength as determined by physical tests on masonry prisms of specified size. Brick Engineering,² and also the Seattle Building Code, 1946 edition, quote allowable stresses as given in earlier editions of the Uniform

By
JAMES R. GRIFFITH
Dean of Engineering
University of Portland
Portland, Ore.



Building Code, where test prisms are not available. It is believed that these values represent conservative practice and should be used unless actual test prisms show justification of higher amounts.

In the November 1946 issue, a chart was

published for the design of reinforced brick-masonry beams with balanced tensile reinforcing utilizing the values $f_b = 400$ p.s.i., $f_s = 16,000$ p.s.i., and $n = 25$. These are conservative values for cement-lime-sand mortar. This original chart will also be found on page 192 of the booklet Construction Design Charts.³

The accompanying chart is identical to the former one except that the values $f_b = 500$ p.s.i., $f_s = 20,000$ p.s.i., and $n = 20$, have been utilized. This value of $f_b = 500$ and $n = 20$, is for cement-sand grout, a material which workmen very much dislike using due to its faster rate of setting. While I question its economical value, in contrast to cement-lime-sand mortar, I thought best to include such a chart for those who might desire to use such materials. I have likewise increased the allowable value of f_s to that permitted by the various codes although I personally prefer to hold steel stress to a lower value from the standpoint of elongation.

A solution line has been drawn on the accompanying chart for the assumed values of $b = 13$ in., and $d = 20$ in., as used on the first chart, for comparative reasons. The following values will be noted on the chart:

$$A_s = 1.09 \text{ sq. in.}$$

$$M = 32 \text{ ft. kips}$$

$$\text{Dead-load of } (b d) = 210 + \text{lb. per lin. ft.}$$

The following constants were obtained from the table on page 366 of Brick Engineering² for the assumed allowable stresses:

$$p = 0.0042$$

$$K = 74.07$$

We then have, for the assumed beam size

$$A_s = p b d = 0.0042 \times 13 \times 20 = 1.092 \text{ sq. in.}$$

$$M = K b d^2 = 74.07 \times 13 \times 20^2 = 385,164 \text{ in. lb.} \\ = 32.097 \text{ ft. kips.}$$

The dead-load of $(b d)$, assuming brick masonry to weigh 120 lb. per cu. ft., would be

$$\text{Dead-load} = \frac{b \times d}{144} \times 120 \\ = \frac{13 \times 20}{144} \times 120 = 217 \text{ lb. per ft.}$$

On the previously published chart, wherein lower stresses were used, the following values were obtained:

$$A_s = 1.24 \text{ sq. in.}$$

$$M = 29.1 \text{ ft. kips.}$$

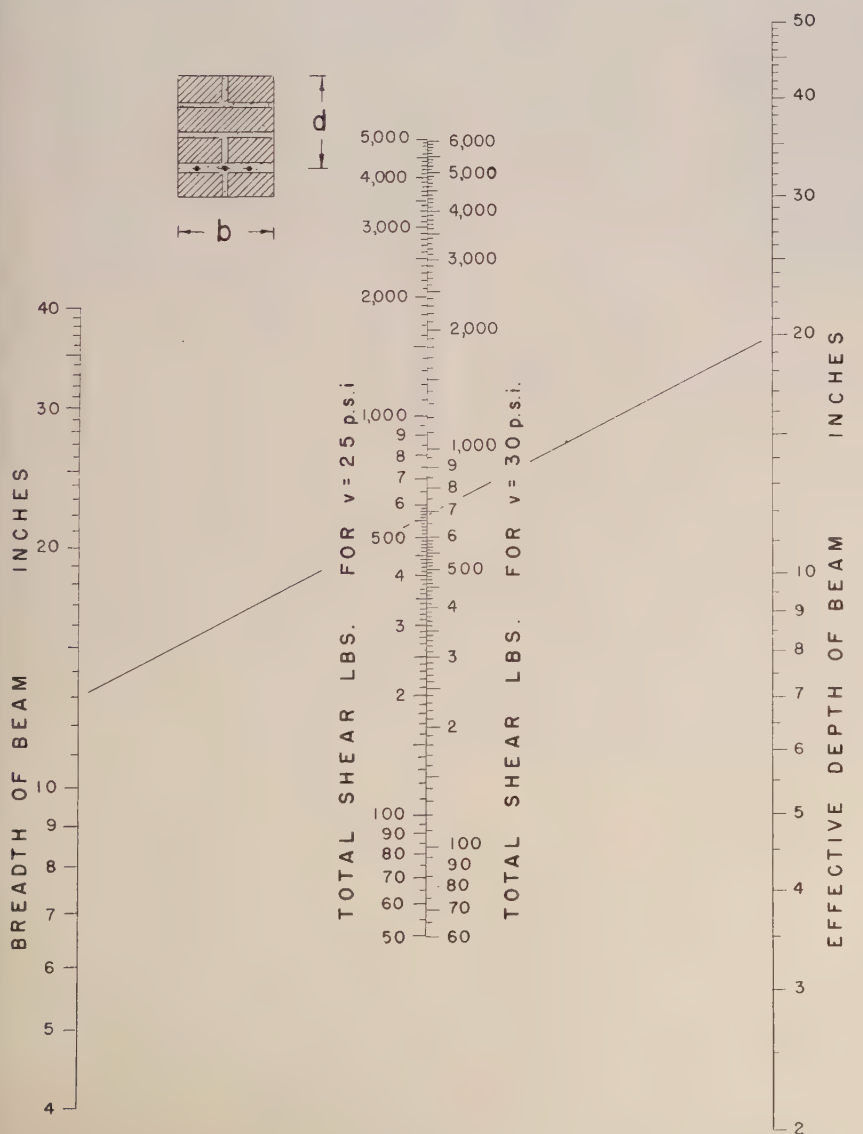
¹Pacific Coast Building Officials Conference.
²Structural Clay Products Institute, Washington, D. C.

³Western Construction News.

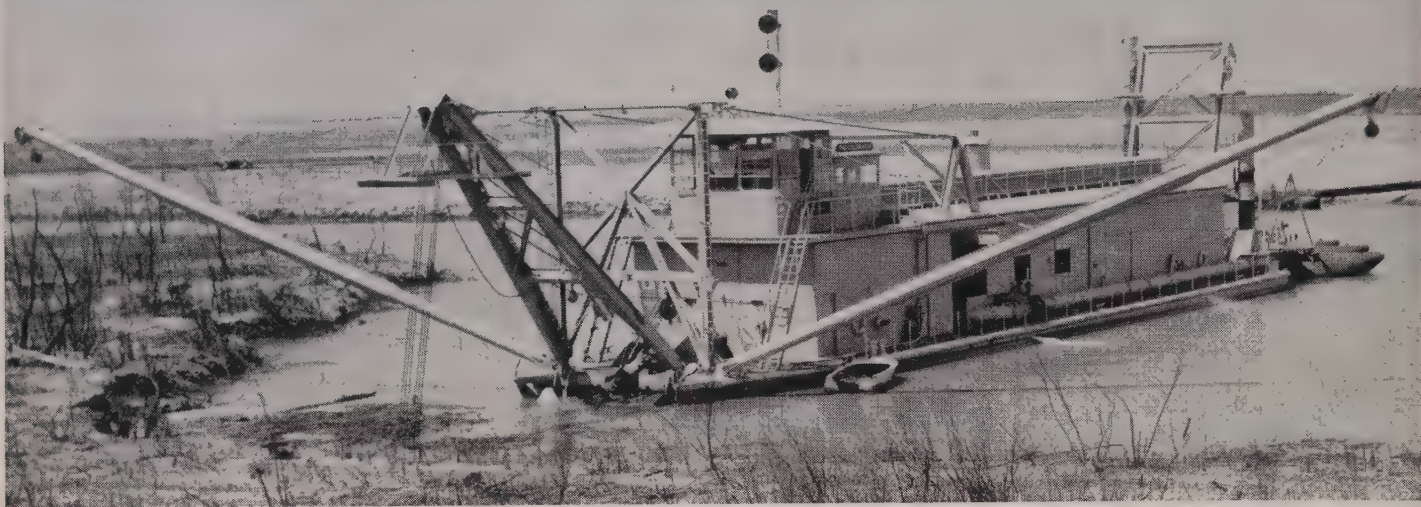
CALIFORNIA'S 58 counties and 305 cities spent \$120,512,030 for streets and roads during the fiscal year ending June 30, 1949, according to a report made last month by the California State Controller. This was an increase of \$23,568,513 over the preceding year. More than 50% of the total expenditures were made by five counties—Los Angeles, San Francisco, Alameda, San Diego and Fresno.

REINFORCED BRICK-MASONRY BEAMS

WITHOUT WEB REINFORCEMENT



J. R. GRIFFITH



Last November, the dredge was moving upstream excavating channel near Needles, Calif.

Raising the Colorado River Dredge

THE BUREAU of Reclamation dredge "The Colorado" is again securely moored at the River Control wharf at Needles, Calif., and rehabilitation work is nearing completion.

The dredge sank in the Colorado River about 3 mi. below Needles during the night of Nov. 4, 1949. At the time of sinking it was working upstream in the river excavating a channel approximately 150 ft. wide and 19 ft. deep and depositing the excavated sand and silt in a levee along the eastern bank of the cut. The dredge had been operating on a 24-hr. basis, five days a week and, on Friday night, Nov. 4, was anchored and closed down for the week-end. Saturday morning a maintenance crew, arriving to perform some minor adjustments during the closed-down period, found the dredge sunk in the 19-ft. channel, with just the engine room roof and pilot house extending above water.

Initial refloating attempt

Taking advantage of the special construction of the dredge, a vigorous effort was under way within 24 hr. to pull the dredge away from the main current of the river into shallow water, where a low cofferdam for final raising could be constructed at nominal expense. The dredge hull is built of bolted sections to permit disassembly for transportation to the different sites of work along the Colorado River. It consists of three rows of pontoons, of which the two outer rows are made up of entirely enclosed pontoons. In the center row two pontoons are open and contain the operating machinery, while the bow and the stern pontoons in the center row are also closed units similar to those of the side rows.

The initial attempt at refloating was in effect a race between the rapidly accumulating sand around the hull and the expeditious effort to close various



By

C. P. VETTER

Chief, Office of River
Control, Bureau of
Reclamation
Boulder City, Nev.

openings in the outer rows of pontoons so that compressed air could be introduced and the water in the pontoons displaced. The resultant buoyancy would not be sufficient to raise the dredge, but it would lighten it sufficiently so that a 100-ton pull from shore would have been able to move the machine into shallow water.

Although divers and equipment were assembled in record time, the Colorado River won the race. The current which, on the morning after the sinking, was relatively quiet, shifted suddenly and the entire hull was buried in sand within four days. By the end of the first week it became apparent that refloating would be a major undertaking and would require some considerable time.

Advertising for bids

In line with the general principle which has been adhered to for years by the Bureau of Reclamation to execute work wherever practicable by contract, several prominent contracting organizations were invited to send representatives to a meeting in Needles to inspect conditions at the location of the dredge and to ascertain the extent of facilities and equipment which could be placed at the disposal of a contractor for refloating operations. At the subsequent meetings with these representatives, the clauses of the proposed specifications

were discussed in detail to be sure that the contract would contain no provisions which would make the work unnecessarily difficult and thus increase the bids to be submitted. Specifications for refloating the dredge were issued on Nov. 26, and on Dec. 7, 1949, bids were opened. Only two bids were received, in the amounts of \$238,700 and \$247,960.

Since the Bureau of Reclamation has had little previous experience in salvage work, the firm of Pillsbury and Martignoni of San Francisco was contacted. W. L. Martignoni of that firm was appointed consultant to the Bureau for the purpose of assisting in the preparation of an engineers' estimate to be submitted and opened at the time the construction bids were opened and read. The engineers' estimate, based on a plan devised by Mr. Martignoni, was \$95,000. A similar estimate for a plan using a complete cofferdam, consisting of two rows of steel sheet piles, was \$118,000. In view of the very large difference between the engineers' estimate of \$95,000 and the low bid, the Bureau of Reclamation had no choice but to reject the bids and proceed on the basis of force account operation. To assist the Office of River Control in the execution of the work, W. L. Martignoni and W. M. Cathey, both of the firm of Pillsbury and Martignoni, were retained as consultants. The work on the second attempt at refloating began on Dec. 14 and on Feb. 18, 1950, the dredge was again afloat.

Plan for refloating

The plan prepared by Mr. Martignoni started with a continuation of the work of making the outside pontoons water tight. This work had been started at the initial refloating attempt. Simultaneously, timber bulkheads were erected around the two engine room pits, extending from the deck to about 1 ft. above water surface. To refloat the



...but, while anchored overnight on Nov. 4, it sank with just the pilot house above water.

dredge, these two interior compartments were to be unwatered simultaneously with the introduction of air into the outside pontoons.

Although only a little over a month had elapsed since the dredge sank, not only had the 19-ft. channel around the dredge been refilled so that the water depth around the dredge was only 3 to 4 ft., but the entire interior of the dredge had been filled with river deposits. To illustrate the extent of this silting, a later examination of the hull after it had been refloated showed that a lubricating oil tank which had only one 1½-in. diameter opening was almost completely filled with sand.

Before the bulkheads could be placed, the major portion of the sand had to be removed from the interior of the dredge. This was accomplished by means of sand pumps. The bulkheads were erected, thoroughly braced from side to side. Bracing was also inserted in the hull so as to prevent the collapse of sides and bottom of the pontoons because of the increased water pressure exerted in the course of unwatering. Simultaneously all outboard elements, such as the ladder and the frame supporting it, the anchor booms and the spuds, were removed. All this work was performed by divers under the immediate direction of Fred Divine of Portland, Ore.

Moving sand bar threatens

During the week of Feb. 13 the sand was removed from around the hull and as much as possible of the sand inside the engine room was removed, timed for a schedule calling for refloating sometime during the week of Feb. 20. During the last two or three weeks of these preparations for the refloating, the current had shifted away from the dredge and operating conditions, particularly for divers working outboard, were much improved. Toward the end of the week of Feb. 13, however, the current suddenly shifted back and a sand bar approached the dredge rapidly, threatening to again engulf it in sand. For that reason the final preparations were expe-

ditioned, and the pumping of the compartments and the introduction of air into the pontoons were started on the morning of Feb. 18.

Hoisting to break suction

To assist in the raising of the dredge and particularly in breaking the suction between the bottom of the dredge and the sand, two pile clusters had been driven in front of the bow. On each was mounted a heavy duty salvage hoist, which was able to exert a lift of some 75 to 80 tons on the bow of the dredge. After the suction under the dredge had been broken and the dredge was freed at the bow, the stern rose rapidly until the aft deck was about 6 in. above water. Thereafter the bow rose slowly but it became necessary to exert a considerable pull by means of the salvage hoists before the deck at the bow of the dredge also came above water.

As soon as the deck was clear of the water surface, manhole covers were removed and sand pumps placed in operation to move the large quantities of sand that had accumulated within the individual pontoons. By 11:00 p. m. on Feb. 18 the deck was almost 1 ft. above water and the dredge declared to be safe.

During the following days the sand removal from the interior of the dredge and the closed pontoons continued until a freeboard of about 20 in. had been secured. It is of interest to note that, in order to raise the dredge weighing approximately 500 tons, in excess of 800 tons buoyancy and mechanical lifting power was required.

Towing to Needles

The timber bulkheads were not immediately removed because there still remained the towing of the dredge a distance of 3 mi. from the place where it sank to the Needles yard. Along this distance there was one long stretch of swift water and two extensive sand bars, where the water depth was only 2 to 2½ ft., while the draft of the dredge was more than 5 ft. It was believed desirable to retain the bulkheads around the open

engine pits until this hazardous trip had been accomplished.

The travel through the swift water was accomplished with little difficulty, by the help of a gasoline-operated warping hoist of 80 tons capacity, mounted on a barge in front of the dredge and operating on an anchor or deadman placed on shore. The crossing of the bars was accomplished by operating two sand pumps mounted on the bow of the dredge and by stirring the bottom material by means of two heavy Navy-type propulsion units, one mounted immediately in front of the dredge and the other on the stern of the dredge itself.

In the morning of Feb. 25 the difficulties had been overcome and the dredge was moored at the wharf at Needles. The total cost to the Government was \$80,000. The transportation of the dredge to the wharf, which was not included in the contract originally proposed, cost an additional sum of \$4,000.

Rehabilitation of the dredge

Work of rehabilitation virtually commenced the moment the deck of the dredge came above water. All sand was washed out from the interior of the dredge, the last sand grains being removed by means of rags. All equipment was removed and a minute inspection made of the entire hull to determine whether it had been subjected to undue stresses and strains prior to or in the course of the refloating operations. It was found that the entire hull was sound, the absence of bows and warps being remarkable in view of the bolt assembly of the welded hull.

Advertisements were issued for the rehabilitation of the two main Diesel engines and of all the electrical equipment, with the result that the manufacturer of the engines, the Enterprise Engine and Foundry Co., was low bidder on the rehabilitation of that equipment, while the rehabilitation of the electrical equipment is being shared by firms in Los Angeles, San Francisco, and Portland, with Ets-Hokin and Galvan of Los Angeles taking the major share. The re-



AFT END of the dredge during raising operations, with timber cofferdam around 300-kw. generator pit. Bulkheads around the two engine rooms were placed 1 ft. above water.

habilitation of the dredge is estimated to cost \$75,000.

Cause of the sinking

To determine the cause or causes of the sinking and to recommend such remedial measures as might be indicated to prevent a recurrence, E. A. Moritz, Regional Director of Region 3 of the Bureau of Reclamation, of which the Office of River Control is part, appointed an Advisory Board of three experts: Jean Allen, one of the country's leading dredge designers; W. C. Beatty, mechanical engineer, previously of the Bureau of Reclamation; and L. R. Douglass, Assistant Regional Director, Region 3, Bureau of Reclamation, who has had some forty years of experience in construction work, both in and out of the Government service.

After intensive investigation of the circumstances leading up to the sinking of the dredge, a minute inspection of all parts of the dredge after it was refloated, and questioning of every member of the crew, the Board concluded that the cause of the sinking was the simultaneous occurrence or existence of three or more circumstances.

The Board found that there was some apparent error in the trim calculations prepared by the manufacturer in that the dredge was much lower at the bow than had been anticipated according to the computations. Although this low bow might have been an advantage so

far as dredge efficiency is concerned, it had the result of bringing very close to the water surface the eductor openings from the pontoons of the bow of the dredge through which bilge water was removed by means of high pressure water. The eductor openings were closed by means of automatic check valves, but the type used in the pontoons near the bow of the dredge, including the one in the center forward position, was a vertical type. This type valve, because of its construction, was susceptible to getting stuck, as a result of fine silt finding its way into the valve's operating parts.

While normally the eductor openings were just above water surface, on the night when the dredge sank (anchored bow upstream), a sudden shift of the current tended to pile up the water in front of the dredge sufficiently to permit water to enter the eductor openings. In addition, the water surface rose about 1½ in. during the night, while the dredge may have been unable to follow because of tight anchor lines.

The check valve of the center front pontoon was found stuck open and, as soon as water began to enter the pontoon a siphon would form, resulting in rapid filling of the pontoon. As soon as the water flowed over the deck, it began to fill the two outside bow pontoons through relatively large openings in the deck used in mounting the 7-drum hoist, located in the forward end of the dredge. This produced an additional dip of the

bow, permitting the water to enter the forward engine compartment and resulting in rapid foundering of the dredge.

Improvements being made

To attempt to prevent so far as practicable a recurrence of the sinking of the dredge, many improvements and alterations are being carried out.

One of the main handicaps in raising the dredge and a factor contributing to the sinking were the many penetrations of decks and walls of the otherwise closed pontoons. These penetrations permitted the passage of water into the pontoons and then from pontoon to pontoon. These penetrations were necessary because of the location within the pontoons of high pressure water piping, wire rope lines for the hoisting of the spuds, and the electrical cables. All water piping is being removed from the outer rows of pontoons. All electrical cables and wire rope for hoisting the spuds are being placed overhead.

Bilge water from the pontoons will be removed by means of pneumatic sump pumps discharging through openings located 24 in. above deck. All machinery, such as the 7-drum hoist, is being bolted to beams welded to the deck of the pontoons, thus eliminating the necessity for anchor bolts penetrating the deck. Each engine room compartment is being surrounded with a 19-in. height of coaming to prevent water from entering the open cockpits until the deck is well below water surface.

In making its investigation of the integrity of the hull and its recommendations for the improvements, the Board was assisted by the long experience in marine service and salvage operations of W. L. Martignoni.

The dredging in the Colorado River is carried out by the Office of River Control, of which C. P. Vetter is chief, with headquarters at Boulder City, Nev. The Office of River Control is a part of Region 3 of the Bureau of Reclamation. E. A. Moritz is Regional Director. Regional Directors are directly responsible to Commissioner Michael W. Straus, with headquarters in Washington, D. C. The Chief Engineer of the Bureau of Reclamation, L. N. McClellan, with headquarters in Denver, Colo., prepared the specifications for the dredge and has advised on its construction and operation.

Design and construction of the dredge was described in *Western Construction News*, April 15, 1949, page 81.

Sacramento River Power Job

THE COUNTY of Butte, Calif., has applied to the Federal Power Commission for a preliminary permit for investigation of the proposed development of a water-power project on the Sacramento River in Shasta and Tehama Counties.

The proposed development, designated the Iron Canyon Project, would include a dam, a powerhouse with an installed capacity of 54,000 kw., and a reservoir which would store 503,000 ac. ft. of water per year. The application says that the proposed use or market for the power is "public use and sale of surplus."

NEWS OF WESTERN CONSTRUCTION

JUNE 15, 1950



"Twin Cat" at Work Clearing Hungry Horse Reservoir Area

THE "TWIN CAT," two conventional Caterpillar D8 tractors joined in a consolidated power unit, is currently getting its first tough operating tests at Hungry Horse Dam in Montana. This biggest bulldozing tractor of them all is being used by J. H. Trisdale, Inc., of Redding, Calif., holder of a \$2,484,360 contract for clearing 7,800 ac. of land in the Hungry Horse reservoir area.

Developed by the Peterson Tractor & Equipment Co. of San Leandro, Calif., (*Western Construction News*, February 1950, page 94) the "Twin Cat" is formed by removal of the inside tracks from two D8 tractors and the introduction of steel beams to join the two tractors into a single rigid operating unit. Other modifications are made so that controls for the combined unit can be handled by one operator.

At the present time, two "Twin Cats" are in existence; one at Peterson's shop, which was the original test model, and the one now being used by Trisdale at Hungry Horse. To construct the Hungry Horse unit, conversion parts and blueprints were shipped to the local Caterpillar distributor at Kalispell, Mont., the Westmont Tractor & Equipment Co. Two new D8 tractors were

combined in the Westmont shop. A special blade 21 ft., 8 in. wide was manufactured by Trisdale at his Project City, Calif., shops, and shipped to Hungry Horse for attachment to the unit.

This special blade is one of the reasons the "Twin Cat" is setting spectacular clearing records on the timbered slopes of the reservoir area. The giant blade is equipped with rooter teeth along the full width, but is supported by standard push beams and corner braces. The extra-long blade is proving to be very efficient in knocking down and pushing trees.

As Buster Peterson, partner in Peterson Tractor & Equipment, stated after his return from a trip to Hungry Horse where he saw the "Twin Cat" go into operation, "The front rack actually hits the trees and brings timber down and stacks it in one operation. It is particularly fast since the operator doesn't have to hit every tree dead center to knock it down. The unit goes 200 to 300 ft. into a heavy growth of young timber before

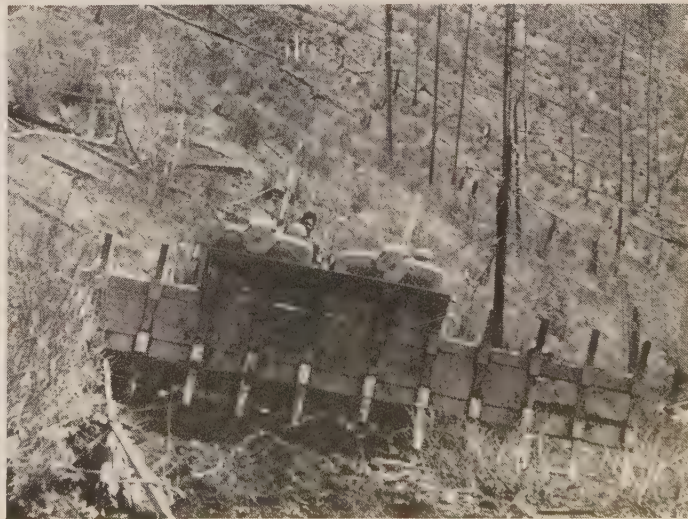
THE BIG combined power unit has been equipped with a special blade, 21 ft. 8 in. wide, that has rooter teeth along the full width. The blade is proving its efficiency at knocking down and pushing trees.

enough is stacked in front of the blade to stop it."

All necessary controls on the "Twin Cat" were designed at the shops of Peterson Tractor & Equipment. The operator sits on a seat that has been raised 6 in. for visibility. He sits about midway between the two power units and has a clear view between them to the ground beneath the blade. Most steering is done smoothly with the throttles, which are in the middle and are controlled by the operator's left hand. Track brakes are individual, as are the track clutches, and are operated in the usual manner. Gear shift levers and reverse gear levers are individual. Main engine clutches are connected, and are operated with a hand lever and foot pedal connected in parallel. Only one control unit is used for the blade, this being on the right side. To counteract the weight of the control unit, a 1,600-lb. casting (part of the conversion unit) is secured to the left drawbar. The combined unit has the conventional five forward and three reverse speeds.

The "Twin Cat" has been rated at 270 hp. at the yoke of the twin drawbars (a single D8 is rated at 144 belt hp. and 130 drawbar hp.). It takes about 100 man hours to combine two tractors into the single "bigger tractor."

So far, the "Twin Cat" has been used on thick stands of fairly new growth. Thinner stands of older growth are being cleared by using two tractors which drag 8-ft. diameter, 4½-ton steel balls



down the hillsides, the balls connected by chain. (*Western Construction News*, April 1950, page 75.) Production by this method is about 20 ac. per hour.

Operation methods of Wixson, Crowe & J. H. Trisdale on clearing a previous 22,500 ac. of the Hungry Horse reservoir site were described in *Western Construction News* for November 1949 on page 68.

Start Second Reactor At Idaho Atomic Plant

GROUND is being leveled preliminary to the start of construction of the Atomic Energy Commission's second reactor at the reactor testing station near Twin Buttes. The Fluor Corporation, Ltd., Los Angeles, has set up a field office at the testing station's central facilities area, and has erected a construction shack at the site of the materials testing reactor. Frank G. Crawford is project manager for the firm, working out of the Los Angeles office. The firm has a force of 29 men on the site, headed by Paul E. Jerde, general superintendent. Rasmus Rasmussen is job superintendent.

Meanwhile, first steel has gone up on the experimental breeder reactor. Structural steel is being provided by the Judson-Pacific Murphy Corp., Emeryville, Calif., and is being erected by the Paramount Steel Corp., Long Beach, Calif. Foundation concrete work being done by the Bechtel Corp., San Francisco, is about 85% complete.

At the central facilities area, Morrison-Knudsen Co., Inc., of Boise, Idaho, has completed construction of a tunnel

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through which stockpiled sand and gravel will be moved by conveyor belt to bins of the concrete mixing plant. The company has erected conveyors and assembled a washing, screening and crush-

ing plant. Production of concrete aggregate to be stockpiled in a storage area near the mixing plant started May 8. James Warner is in charge of the aggregate production plant.

Sedimentation of Lake Mead Follows Original Estimates

THE SEDIMENTATION study of Lake Mead behind Hoover Dam, now completed, shows that original engineering estimates on the life of the reservoir were very nearly correct or even on the conservative side. Storage capacity of the reservoir in 1936, when Hoover Dam was completed, was about 32,500,000 ac. ft., and it was expected to have a life of about 230 years. Rate of sedimentation, as determined by a survey made jointly by the Bureau of Reclamation, the U. S. Geological Survey and the U. S. Navy, indicates that this expectation was well-founded. The report also points out that a continuing program of dam construction on the upper reaches of the Colorado River will increase the life of the reservoir by retaining silt above Hoover Dam.

Texas Hits Record Month for Farm-to-Market Road Awards

AN ALL-TIME mileage high in Farm-to-Market road construction in Texas was set May 16 and 17, when bids were taken on 535.5 mi. of new rural roads. This is the highest total of secondary or Farm-to-Market mileage ever contracted in one month by the Texas Highway Department. The previous record was 317 mi. set in May, 1948.

The bids totalled nearly \$5,000,000. The projects are financed principally from the funds provided by the last session of the Texas Legislature. The highway department started allocating the projects among the various counties of Texas soon after the action of the Legislature. Engineering work has been going on since that date and the department is now reaching its peak in actually placing the work under contract.

The work during the coming summer months on Farm-to-Market roads unquestionably will be the largest in Texas' history, but such a pace will not be continued after the special appropriated funds have been exhausted.

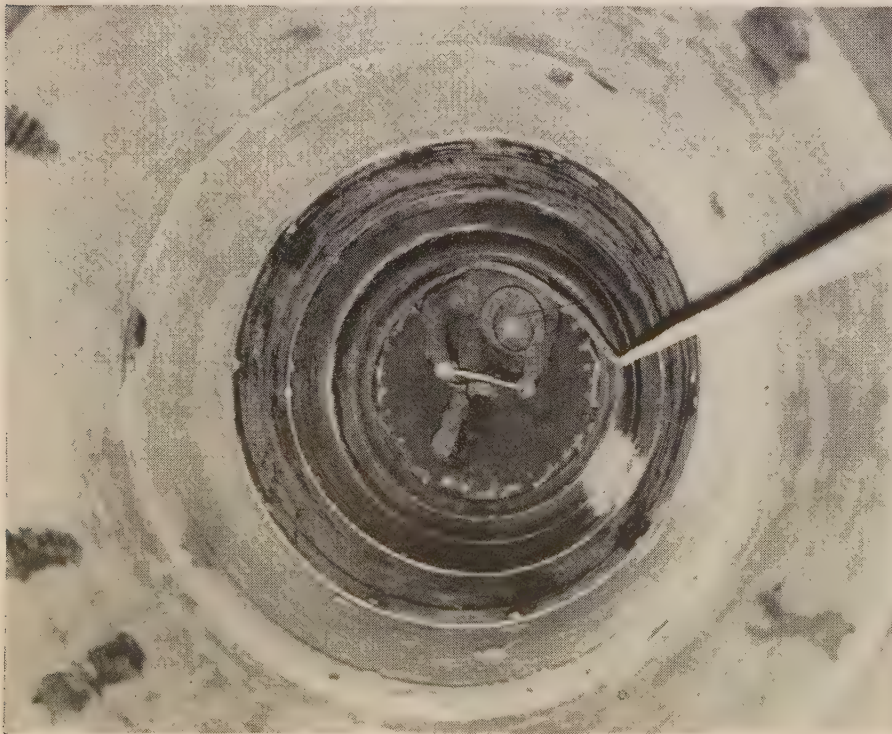
Alaska Railroad Plans for \$200,000,000 Construction

ABOUT \$200,000,000 in construction is planned for the government's Alaska Railroad this summer, according to J. P. Johnson, manager. Most of the work is planned for the "railbelt" area which extends from Seward to Fairbanks, and includes Anchorage. According to Johnson, the construction will fully prepare the Alaska Railroad to meet its responsibility of serving both military and civilian shippers with first class freight service. Because of progress on the \$75,000,000 railroad rehabilitation program in Alaska, reduction in freight rates was announced recently.

PAVING BREAKER DRIVES SHEETING AT ANGLE IN FOOTING SHAFT

OPERATING a No. 25 Thor paving breaker 28 ft. down in a 3½-ft. shaft, a worker drives steel sheeting at an angle to form the base of a bell-shaped footing. The shaft was later filled with concrete to form the footing for a 4-story building at Oakland, Calif. The foundation was constructed by Casey & Case Foundation Co. of Berkeley.

Thor Scoreboard Photo



4

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May Snow Surveys Produce Few Changes in Run-off Forecasts

MAY FORECASTS of 1950 water supplies for the Western States, announced by the Soil Conservation Service, disclose little over-all change from the April promises (*Western Construction News*, May 15, 1950, page 71). The Northwest still may expect ample, if not excessive, run-off, while Rocky Mountain and Intermountain States will also fare pretty well. The southwestern drought continues with no sign of abatement.

Sectional forecasts based on May snow surveys, are summarized in the following paragraphs:

Columbia Basin

The mountain snow cover is so much above normal that extremely high streamflows, some of near-record proportions, are likely as soon as the snow begins to melt. Below-normal temperatures during April, coupled with contra-seasonal increases to the already above-normal snow pack of April 1, have created a residual snow pack 23% greater than that of May 1, 1948, and varying from 31 to 127% above the normal on the separate drainages.

Should normal weather conditions prevail throughout the remainder of the snow-melt period, excessively high water seems certain in vulnerable areas. Each week that cool weather conditions continue over the southern part of the Basin, the less time there will be for this extremely large volume of water, now in the snow pack, to flow down the rivers.

On the Upper Columbia Basin, snow water-content increased during April to a point indicating a flood potential. The Kootenai and Flathead River measurements are highest in 14 years of record. It is anticipated that the April-July flow at Columbia Falls will be over 7,200,000 ac. ft., and that 9,200,000 ac. ft. will pass that point between April and the last of September. The 10-year averages for this station are 3,700,000 and 4,600,000 ac. ft., respectively, for the same periods. At Heron, Montana, near the Idaho state boundary, it is expected that the Lower Clarks Fork River will flow 14,200,000 ac. ft. between April and June and 17,600,000 ac. ft. between April and September.

The water-supply prospects for the portion of Columbia Basin in British Columbia have been increased somewhat by above-normal precipitation during April, and the seasonal forecasts of stream flow issued in April will probably be exceeded. The situation throughout the Province is very similar to that of 1948 at the same date, but the water content of the snow pack is considerably higher. However, these facts in themselves do not necessarily indicate a repetition of the 1948 general flood.

Rocky Mountain States

The general pattern of the irrigation water-supply outlook for Colorado, southern Wyoming and northern New

Mexico has not changed materially. Present forecasts for the areas where the run-off was expected to be above normal are improved, and where run-off was expected to be below normal, it now appears likely to be a little worse.

Estimates for the Green River in Wyoming are up about 15%; the North Platte, up about 5%; and for the South Platte, Arkansas and Colorado River tributaries in northern Colorado, no change. A 5% to 10% decline appears for the Rio Grande, and a 10% decline is in prospect for the San Juan and its tributaries. The greatest drop of about 15% is for the Dolores and San Miguel. The discharge of the Colorado River at Grand Canyon, previously estimated at 8,750,000 ac. ft., has been raised to 10,000,000 ac. ft.

Intermountain States

In general, there is little change in the water-supply prospects for Utah. Most of April precipitation was below normal, with high temperatures which caused a rapid rise in streamflow. Flow of streams in northern Utah approached record peaks. However, damage was not great, since cold weather cut streams back after two or three days of heavy flow. Precipitation during the last few days of April and first of May offset the low early-April precipitation, with the result that run-off conditions about the same as those previously forecast are still expected. Snow measurements on a few key courses indicate that damaging peak flows may still occur in northern Utah, but for southern Utah, the recent high precipitation may increase the water-supply prospects slightly, although below-normal stream flows are looked for.

April storms throughout northern Nevada guaranteed irrigation-season water supplies from the main snow-fed streams, but the southern Nevada drought continues. Prospects for summer run-off continue as forecast April 1, with above-normal run-off expected from the east slope of the Sierra and along Humboldt River. Cold weather during April maintained the mountain snow pack and will contribute to late run-off and late-season irrigation supplies.

Pacific Coast

Oregon's 1950 water-supply prospects remain good throughout the state although April precipitation was only 70% of normal. If normal snow-melt and precipitation conditions prevail, there should be no late-season deficiencies of water anywhere in the state. New run-off records will be established in the upper Deschutes watershed with extremely high stream flows to be expected on the White, Hood, Sandy, Clackamas, Santiam, McKenzie Rivers and the Middle Fork of the Willamette.

The over-all April-July stream-flow expectancy for California is slightly improved over the previous forecast of the

Continued on page 104

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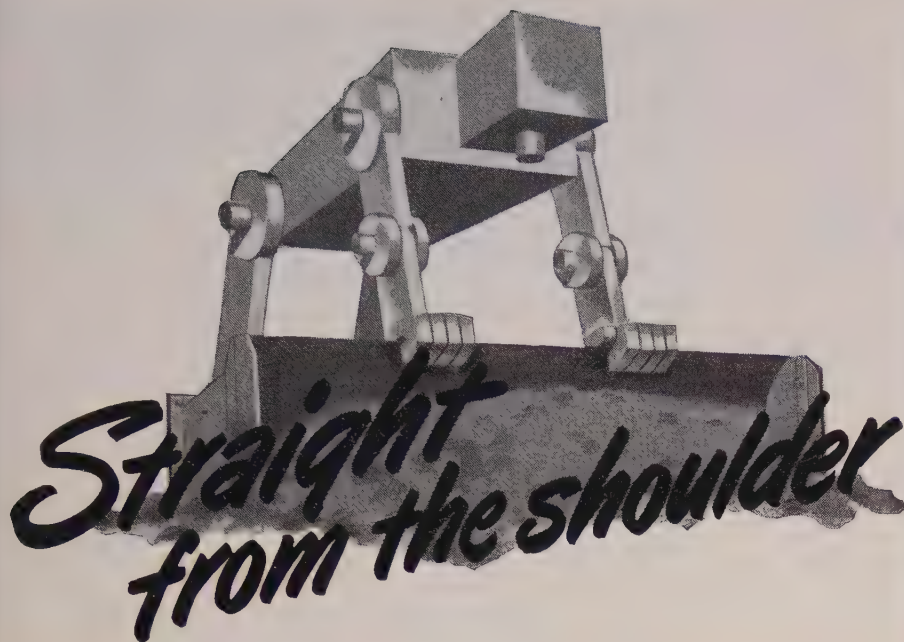
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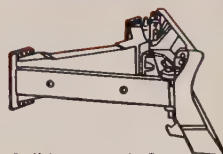
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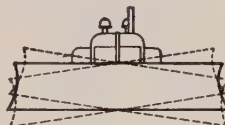


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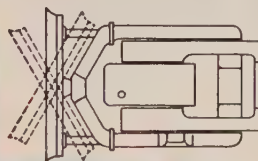
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Gate Equipment Company, Inc.
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Yukon Equipment, Inc.
Seattle, Washington

Fred M. Viles & Company, Inc.
Spokane, Washington

WYOMING

Studer Tractor & Equipment Co.
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Run-off Forecasts

Continued from page 102

California State Division of Water Resources. Scattered April rains over the snow-pack area averaged about normal, but were deficient in the Upper Sacramento and Lower San Joaquin Basins. The expectancy now is for 63% of normal flow for the Kern River Basin; 114% for the Mokelumne and American basins, and 81% on the watersheds above Shasta Dam. In summary, Sacramento River Basin will have about 95% of normal run-off, and supplies will meet irrigation needs; San Joaquin Basin will have 80% of normal run-off, with some local deficiencies. Reservoir storage is, or will be, satisfactory with the possible important exception of Millerton Lake.

Southwest

Drought conditions described above for southern Nevada and southern New Mexico are exceeded in Arizona, which is still in the grip of its long-continued water shortage.

No stream-flow forecasts were made for Arizona streams this year. The water-supply outlook for the state is worse than on April 1. Storage in the reservoirs of the Salt and Verde is at 27% of capacity; San Carlos, on the Gila, is at 3.5% of capacity. Precipitation has been below normal, as has run-off.

Loveland Pass

... Continued from page 94

will be widened to 36 ft. The sharpest curve on the new alignment, which occurs on a switch-back near the crest, will have a minimum radius of 125 ft.

Cuts and fills of 75 ft. on the side slopes are common throughout the new construction. In spite of the difficulty of construction, the contractors have maintained traffic through the project on an intermittent basis. When cuts are to be shot, traffic is stopped at the foot of the Pass on both sides and held there until the clean-up has progressed so that traffic may be safely routed through the construction.

This method of handling traffic is one that occasions considerable comment. In flat terrain it is usually possible to designate by-pass routes which are only nominally longer than the normal route. In the high mountain country such practice can hardly ever be used because any practical by-pass will often result in distances involving as much as 100 mi. of additional travel. For this reason, intermittent operation is resorted to as the only practical method of handling the necessary traffic.

All of the normal construction equipment used on such jobs is to be found in abundance on the present contracts. To those who work in the lower altitudes, it appears that there is an excess of equipment and that hauling equipment is under-loaded, the full capacity of shovels is not being utilized and that air compressors are not handling their full complement of rock drills. This seemingly inefficient operation is nothing new to those who are used to high altitude

construction. When it is remembered that power equipment loses capacity at the approximate rate of 3% per thousand feet of elevation, it can be easily deduced that equipment is working at only approximately 65% of its design capacity on Loveland Pass.

When the new improvement is finished, it will provide a highway over Loveland Pass which will compare favorably with any which now exist in similar areas.

Utah Highway

... Continued from page 92

within 9 mi. of the job. All heavy equipment could be hauled to the shops for major overhauls. The emphasis on mobility was noted throughout the job. Even the platform scales are equipped with wheels to facilitate moving. As one of the men stated, "The boss says if it's got to move, put wheels on it."

Underground water, not discovered before the start of construction, caused some difficulty on the north end (Washington Ave.) of the job, and required installation of 1,400 ft. of 8-in. perforated corrugated metal pipe five feet below subgrade. Another problem that required study was the presence of clay pockets. It was difficult to evaporate entrapped moisture in the pockets, and in some spots it was found to be more economical to excavate the clay and backfill with gravel, rather than lose time in attempting to evaporate clay-held water. When clay pockets were not excavated, it usually meant that an extra thickness of rock base was placed.

The new highway is a part of U. S. 89 and 305, and parallels the main Ogden-Salt Lake City route, between South Ogden and Uintah Junction. When finished, it will have four lanes of plant-mixed asphalt surface, totaling 44 ft. wide. That part of the job running through new subdivisions, south of the city the first 1½ mi., will be paved to a width of 74 ft., providing four 12-ft. lanes, and a 6-ft. dividing strip, not raised, and two 10-ft. shoulders, all paved with the standard 3-in. mat of 1-in. minus rock, plant mixed with 120-150 penetration asphalt. The shoulders will have a 2-in. layer of this material. The 346,500 gal. of asphalt and 31,200 tons of plant mixing for surfacing operations are subcontracted to the Reynolds Construction Co., Springville, Utah.

Woodruff L. Anderson is Assistant Chief Engineer of the Utah State Road Commission, and R. W. Griffin is construction engineer. J. G. Cox is Resident Engineer.

For the L. T. Johnson Construction Co., the job is supervised by Carl Fomesbeck and W. E. "Earl" Mickelson.

The contract is to be completed by October, 1950.

ARIZONA has adopted a budget of \$11,682,000 for new highway construction in 1950-51. In addition, there will be a carryover of about \$9,000,000 from last year's fiscal year budget, giving a total road program exceeding \$20,000,000.

Completion of Heart Butte Dam Helps Prevent Flood

THE MISSOURI River Basin reclamation project, which was authorized by the Flood Control Act of 1944, has returned its first flood control dividends by keeping the City of Mandan, North Dakota, high and dry when the Heart River went out of its banks with a record flow during April. Heart Butte Dam, 110 mi. upstream from Mandan, reduced the peak flow of the river at the dam 20,000 sec. ft. to 3,500 sec. ft. during the flood, which was caused by unseasonably warm weather. As it was, because of a heavy flow from two tributaries to the river below the dam, the peak flow at Mandan reached 27,000 sec. ft., or 5,300 sec. ft. more than the previous record flow of 1943. The contractors, C. F. Lytle Co. and Green Construction Co. of Des Moines, Iowa, turned the finished structure over to the Bureau of Reclamation in December of 1949, although their contract called for completion by November 22, 1950. The dam is an earth-fill structure, 174 ft. high and 1,850 ft. long. The reservoir has a storage capacity of 428,000 ac. ft.

Corps and Bureau Cooperate To Control Columbia's Flow

COORDINATION of flood control operations of Bureau of Reclamation reservoirs with Corps of Engineers' flood control units in the Pacific Northwest will reduce potential damage from the spring run-off of the Columbia River and its tributaries. Approximately 330,000 ac. ft. of vacant space exists in the reservoirs of the Yakima Federal Reclamation Project in eastern Washington, and there are 220,000 ac. ft. of vacant space in the American Falls Reservoir of the Minidoka Project in south central Idaho, which can be used to hold back flood waters contributing to the potentially heavy Columbia River run-off.

Under an agreement with the Corps of Engineers and the Bonneville Power Administration, the Bureau of Reclamation has already drawn down Franklin D. Roosevelt Lake, the reservoir behind Grand Coulee Dam, by 900,000 ac. ft. Under a supplemental agreement with the Corps and the BPA, the Bureau this week agreed to provide an additional 375,000 ac. ft. of space. The total Lake Roosevelt draw-down will cut a critical 1.4 ft. off the Columbia River spring flood at Vancouver, Wash., if the proper timing of filling the reservoir is obtained and estimated peak discharges occur.

DIRECTORS of the Orange County, Calif., Joint Outfall Sewer System have authorized construction of a \$2,500,000 sewer trunk line in western Orange County to relieve an overtaxed line. The project is apart from the \$8,000,000 of authorized bonds for a county-wide sanitation system, but eventually is expected to be incorporated in the overall plan.



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Alaska Highways

... Continued from page 65

mining areas to further development.

Construction commenced this spring on a new road to extend from Paxson's on the Richardson Highway to Cantwell on The Alaska Railroad and Mt. McKinley National Park. This badly needed road will be over 150 mi. long through the heart of an undeveloped area containing potentialities for mining, hunting, and fishing, and will provide access at Cantwell to the line of The Alaska Railroad which at present has no other highway connection for many hundred miles. At McKinley Park station this new road will connect with approximately 100 mi. of highway already

constructed through Mt. McKinley National Park to the foot of the greatest mountain in North America, and extending beyond it to the Kantishna mining district. Several years will be required to complete construction of this new road.

New local roads will be built where needed for connection of homesteaders with the main highway system and for the development of new industrial sites. An important program for this type of construction has been drawn up, but this will serve to take care of only the most urgent needs, even though the system is being extended year by year. Requests for farm and industrial roads are acted on as promptly as possible, with the advice of the Bureau of Land Management, the Department of Agricul-

ture, the Bureau of Mines, and the Geological Survey being considered in determining priorities.

A definite program for the elimination of the most hazardous, dangerous points along the main roads and highways is now being commenced, including replacement of weak and narrow bridges, elimination of blind turns, and improved highway marking. In some cases, work on inadequate bridges and other hazards will have to wait relocation of the road itself. This is so on portions of the Tok Cutoff where the bridges are the worst. Guard rails will be placed in a few of the most dangerous places; more are planned for the future.

Surveys of new roads will be completed this year from Fairbanks to Nenana and for extending the airport road from Metlakatla to the head of Annette Island, opposite Ketchikan. A new survey will be made of a road from Livenood to the vicinity of Eureka and Manley Hot Springs, looking toward the ultimate linking of this important mining, agricultural, and recreational district with the main highway system. Additional surveys will be made in the Copper River region to endeavor to find a practical and not unduly expensive route for connecting Cordova with the main highway system.

Surveys already completed include those of a road from Fairbanks to Chena Hot Springs, and Naknek Village to Naknek Airfield. These projects are awaiting appropriation of funds for construction. It is planned to make instrumental surveys of all new proposed road developments well in advance of construction so that estimates of funds for construction may be based upon a thorough knowledge of conditions and not upon mere guess work. When a survey is made, it is followed by a request for funds, if the project appears justified, but it should not be assumed that the making of the survey means that funds have already been received for the construction of that road. Every effort is made to obtain funds for needed road construction, but this depends upon the will of Congress. Definite progress is being made, but cases like the Naknek Road and the Fairbanks-Chena Hot Springs Road still require appropriation of funds, even though the surveys have been completed.

Reconstruction of the road from Nome to Council will be carried to completion during 1950. All of the other roads around Nome, and the Seward Peninsula Tram Road, will be maintained to suit the needs of traffic. New roads from Nome to Solomon and from Golovin to White Mountain have been surveyed, but funds for their construction, though requested, have not been included in this year's appropriation. Increased maintenance is planned for a road from Ruby to Long and Poorman and for the roads around Manley Hot Springs. The roads around Takotna, McGrath, Flat, Iditarod, Wiseman, and other places will be maintained in condition suitable to the needs of traffic. It is an objective of the Alaska Road Commission to gradually link these outlying

Continued on page 108



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Alaska Highways

... Continued from page 106

localities with the main road system where possible, but this is obviously a very long range objective in most cases, as extreme distances and lack of population may make it impracticable to do so.

In southeastern Alaska, the authority of the Alaska Road Commission is limited to those areas outside of the National Forests. The Haines Highway from Haines to the International Boundary of Canada is to be paved during the coming summer and is already under contract. Maintenance and gradual improvement of the other roads around Haines and Skagway, including

continuation of widening of the Skagway-Dyea Road, is contemplated. The survey on Annette Island will furnish data for preparation of a cost estimate and request for funds for the connection of Ketchikan with the Annette Island Airfield, by way of Metlakatla. Heavy rock work and other expensive construction conditions will probably limit this road to a low standard of construction, at least initially.

It is the objective of the Alaska Road Commission to connect all parts of Alaska with each other and with the adjacent regions of Canada. Studies are continuously being made and negotiations carried on to remove the obstacles that stand in the way of efficient low cost motor transportation. Probably no

region in the world, and certainly not in the United States, has more of these obstacles due to topography, climate, and international boundaries than has Alaska.

THE STRUCTURAL engineers of the State of Washington are now represented in an organization known as the Structural Engineers Association of Washington. Articles of incorporation for the organization have been accepted by the Washington Secretary of State. Elected officers of the association are: Homer Hadley, president; Cecil Arnold, vice president; Prof. A. L. Miller, special director, and Elmer Gunnette, secretary-treasurer.

PERSONALLY SPEAKING

Woodruff L. Anderson was appointed Chief Engineer for the Utah State Road Commission on May 9. He succeeds **Roy W. McLeese**, who resigned 7 months ago to become City Engineer of Salt Lake City. Anderson has been with the commission since 1923, becoming Chief Design Engineer and Assistant Chief Engineer, the post he held before the recent appointment.

The affiliation of **Maurice Nicholls** with the staff of Kaiser Engineers Division of Kaiser Industries, Inc., was announced recently. Nicholls holds degrees in both naval architecture and marine engineering from the University of Michigan, and will add those fields of services to the organization. In 1939, he became chief consulting engineer of all Kaiser shipbuilding projects. In 1942, he was in charge of the New York office, and served as liaison officer between the yards and the U. S. Maritime Commission. In 1947, he negotiated for the establishment of Kaiser-Frazer Export Corp. assembly plants in Europe and Africa.

Walla Walla District Engineer, **William Whipple, Jr.**, Corps of Engineers, has been ordered to the Industrial College of Armed Forces, Fort McNair, Washington, D. C., for a 10-month course in industrial mobilization.

R. H. Rae, general contractor, has been named president of the Edmonton, Alberta, Builders Exchange, succeeding **A. J. Maure**. **H. G. McDonald** is vice-president. The organization now has 88 members, of which 22 are general contractors.

Howard F. Clark, Colonel, Retired, Corps of Engineers, was recently appointed Manager of the Las Vegas Valley Water District, Nevada. During the war, he commanded a general construction regiment engaged in rebuilding war-damaged European cities and their utilities. Previous to his Las Vegas ap-

pointment, he was an engineer with Greeley and Hansen, Chicago consultants. Clark holds degrees in civil engineering from both Stanford University and M.I.T.

Roscoe D. Jones resigned recently as president of the East Bay Municipal Utility District, with headquarters in Oakland, Calif. Jones has been associated with the district for 25 years, serving as chairman of the organization committee in 1923. He was appointed to the board of directors in 1941, and was elected president in 1949. **Francis E. Boyd** succeeds Jones as president.

C. L. Eckel, Dean of the College of Engineering, University of Colorado, was recently elected President for 1950-51 of Chi Epsilon, national civil engineering honorary fraternity. The election took place at the biennial conclave of Chi Epsilon.

Paul G. Van Sickle, formerly with Morrison-Knudsen Co., Brazil, has returned to Denver, Colo., and located his own engineering firm at 442 Broadway in that city.

Olney John Hawkins, Chief of the Project Operations and Maintenance branch of the Portland District, Corps of Engineers for the past three years, and with the District for 20 years, has retired to accept a position as port engineer at Zonguldak, Turkey, for the Koppers Company, Inc., of Pittsburgh, Pa. Hawkins will be engaged in harbor development, jetty construction, and similar work. Contracts for about \$9,000,000 of the project have been awarded to a Dutch firm.

The appointment of **W. Darlington Denit** as Comptroller of the Bureau of Reclamation was announced May 1. Denit, an accountant and administrator with over 15 years government service, has been Assistant Comptroller in the Bureau. He succeeds **William F. Ku-**

bach, who is retiring after 40 years' service, 28 of which were with the Bureau.

S. A. Cunliffe, recently named as Provincial Government Engineer at Prince George, B. C., has returned to New Westminster, B. C., to take over the office of Divisional Engineer for the Lower Mainland and coastal area, from Silver Creek to Ocean Falls. He succeeds **O. P. Roberts**, who died suddenly at New Westminster early this year.

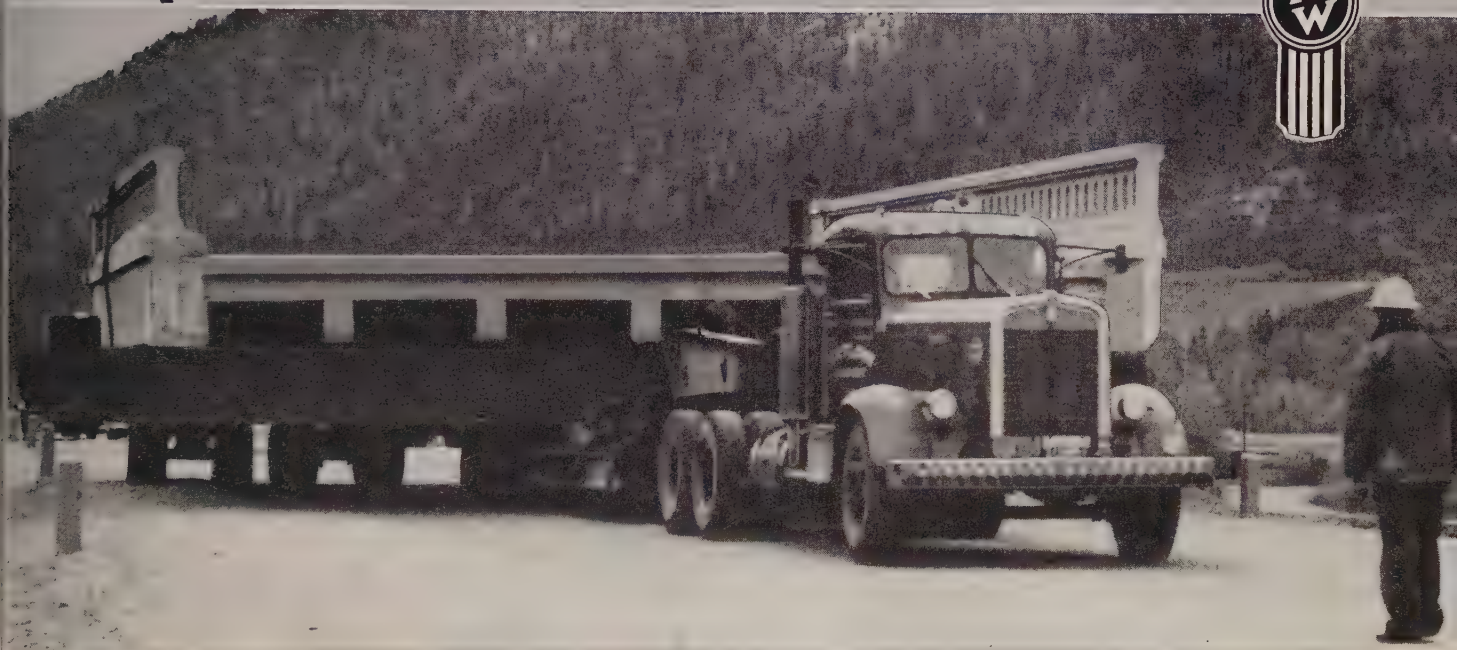
Effective Sept. 1, 1950, **Ray K. Linsley, Jr.**, Associate Professor of Hydraulic Engineering, will join the faculty of the Stanford University School of Engineering. Head of the hydrologic branch of the U. S. Weather Bureau for the past five years, Professor Linsley earlier had five years' experience on the Tennessee Valley Authority engineering staff and as hydraulic engineer in Connecticut. At 33, he is the author of "Applied Hydrology," leading treatise on the study of rainfall and runoff. He is a replacement for Professor **Leon B. "Pop" Reynolds**, who retires this year as Professor of Hydraulic Engineering after more than two decades of outstanding service to civil engineering students.

Promotion of **Goodrich W. Lineweaver** to Assistant Commissioner of the Bureau of Reclamation was announced April 28. Lineweaver has been Director of the Bureau's branch of Operations and Maintenance for the last five years. **E. D. Eaton**, who has been assistant director of Operation and Maintenance, was named acting director. The new Assistant Commissioner will have immediate supervision of program and finance operations of the Bureau of Reclamation, including appropriation presentations before the Bureau of the Budget and the Congress in addition to special assignments.

Pioneer Contracting Co., Inc., general contractors, has opened an office in

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Catlow Transport Company of Spokane recently moved a steel and concrete bridge from one highway location to another, using a Kenworth Model 524. The bridge was divided into three 117-ton sections and moved one and one-quarter miles on the 58 tires with which the truck and trailer were equipped. Harley Catlow, vice president says: "This same equipment is capable of handling 200 tons."



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Phoenix, Ariz., in the Luhrs Bldg. **A. G. Hall** is president and **G. N. Hall** is secretary-treasurer. The firm comes from Dyersburg and Memphis, Tenn., and specializes in levee building and road work, in addition to general construction.

Reorganization of officials of the B. C. Public Works Department has just been announced. **N. M. McCallum** has been appointed Chief Engineer, assuming the duties of **H. C. Anderson** who retired from government service last month. **J. Bowering**, UBC graduate, who has been serving as District Engineer at Yale, B. C., has been appointed Assistant Chief Engineer. **O. J. Wilkie**, Divisional Engineer at Williams Lake, is being promoted to Construction Engineer with headquarters in Victoria. He will have as his assistant **T. E. Webster**, who was in charge of location and construction of the Hart Highway.

Wellesley T. Richards is now engineer of maintenance of way and structures for the Western Pacific Railroad Co. at San Francisco with general supervision of the San Francisco to Salt Lake line and branches for the firm. He was formerly division engineer at Sacramento.

Paul F. Bronckhurst, formerly West Coast representative of various engineering and construction companies, has joined the staff of Kaiser Engineers at

Oakland, Calif. Bronckhurst has specialized in mechanical engineering and has held such positions as chief engineer and consulting mechanical engineer for some of the country's leading equipment manufacturers.

Alfred B. Lewellen, with the Bureau of Public Roads at Portland, retired March 30 after more than 30 years of service with the Bureau. He worked as engineer in charge of jobs on the Willamette and North Santiam highways in Oregon as these routes were first built through the Cascade range. He also worked on the Alaska highway during the last war. At the time of his retirement, he was office engineer in the BPR division office in Portland.

Carl Laux, recently of San Francisco, is now assistant to **W. C. Anderson**, city engineer of Las Vegas, Nevada.

Walter E. Riley and **Frank J. Foltz** of Phoenix, Ariz., announce the formation of a new consultant engineering firm in Phoenix. Riley was formerly on the engineering staff of the Pittsburgh-Des Moines Steel Co. During the war, he directed development of supersonic tunnels for the air force and sectional floating dry docks for the Navy. Foltz was in charge of the design and construction of the diesel power plant for the Salt River Valley Water Users' As-

sociation some years ago, and has worked with the Bureau of Public Roads and the Arizona State Highway Department. Offices of the firm will be in the Industrial Building, Phoenix.

Elmo R. Morgan, former Utah assistant state engineer, has been named administrator of the Atomic Energy Commission's new office of community management at Los Alamos, New Mexico.

Ben R. Chandler of Coos Bay, Ore., has been elected chairman of the Oregon State Highway Commission to succeed **T. H. Banfield**.

Enos Jones has been transferred from duties as street department engineer to the post of special projects engineer for the City of Reno, Nevada, according to City Manager **Emory Branch**.

Harry W. Bashore of Mitchell, Nebr., internationally-known water resources engineer who retired as Commissioner of Reclamation in 1946, has been awarded the Department of the Interior gold medal for distinguished service. **John C. Page**, wartime Commissioner of Reclamation, has also been given the same award.

Stanley E. Sporseen, civil engineer with the Portland District Corps of Engineers, has been loaned by the Depart-

The advertisement features a large, detailed illustration of a heavy-duty truck, possibly a bulldozer or a large transport vehicle, in the foreground. In the background, a large billboard is visible. The billboard has a white background with a black border. On the left side of the billboard, the text "where horsepower goes to work" is written in a bold, sans-serif font. To the right of this text is a circular logo containing a detailed illustration of a mechanical transmission component. Below the logo, the word "Fuller" is written in a stylized, cursive font, and below that, the word "TRANSMISSIONS" is written in a bold, sans-serif font. At the bottom of the billboard, a black banner contains the text "FULLER MANUFACTURING COMPANY (Transmission Division), KALAMAZOO 13F, MICHIGAN" in white, sans-serif capital letters. The entire scene is set against a backdrop of a landscape with trees and a sky.

ment of the Army to act as advisor to the Venezuelan Ministry of Public Works for one year.

Raymond R. Ribal, formerly drainage engineer for the City of Oakland, Calif., was appointed assistant city engineer on March 28.

Sidney Hogg has been appointed managing director of Western Bridge and Steel Fabricators, Ltd., at Vancouver, B. C. He previously held the position of chief engineer and general manager.

Harry C. Anderson, chief engineer and chairman of the Highway Board of British Columbia, has retired from that government's service to become general manager of the General Construction Co. and its subsidiaries, one of the leading contracting firms in British Columbia.

Allen Mattison, construction engineer with the Bureau of Reclamation at Fort Peck, Mont., now holds a similar position at Bismarck, N. Dak. He has charge of construction of transmission lines and substations.

Roy G. McGlone has been elevated to the position of technical advisor and engineering consultant in the Southwestern Division of the Corps of Engineers in Dallas, Texas, according to **Col. Louis W. Prentiss**, Division Engineer. **Donald H. McCoskey** has been transferred from Kansas City to succeed McGlone as chief of the engineering division at Dallas.

OBITUARIES...

Frank A. Stead of Berkeley, Calif., died suddenly from a heart attack on April 22. He had been engaged in the general contracting business in the East Bay for over 26 years.

John B. Macdonald, 66, civil engineer and president of the engineering firm of Macdonald & Macdonald, died in a Vancouver, B. C., hospital recently. He came to Vancouver in 1911 and was graduated from the University of Toronto.

Nicholas Cosco, 68, president of Nicholas Cosco and Sons Construction Co., Vancouver, B. C., died at his home in Vancouver recently. He came to Canada when 15 and West in 1906, when he started in the contracting business, specializing in sewer work.

John J. Sinclair, 67, retired civil engineer, died May 4 in Los Angeles.

John P. Oswald, 68, paving contractor, died April 30 in Los Angeles from a heart ailment. He entered the contracting business in 1908, and in 1912 formed

Oswald Bros. construction company with his brother.

George C. Thompson, 25, construction engineer for the Southern Pacific Railroad, died from drowning in the Willamette River near Lowell, Ore., on May 1. His body was discovered after a search of more than a week.

David R. Gronlund, 56, Los Angeles County Surveyor, died April 28 in Sawtelle Veterans Hospital. He had been in the West 45 years, and came from Batavia, Ill.

R. R. Robertson, 67, former deputy general manager of the Los Angeles Department of Water and Power, died

May 16. He directed work on construction of the two power lines from Hoover Dam and construction of the first unit of the Harbor steam plant. He retired in 1944 after working with the department for 32 years.

Thomas C. Menard, 65, county road superintendent, District No. 2, Maricopa County, Ariz., died May 15.

Richard Rothwell, 88, retired paving contractor of Los Angeles, died May 16.

Clifford P. Hook, 44, civil engineer of Phoenix, Ariz., died May 19. He served 15 years with the Soil Conservation Service and 9 years with the City of Phoenix engineering department.



51 TONS COMING IN FOR A SAFE LANDING...

When 102,000 pounds of airplane hit a runway at 110 m.p.h., even concrete groans. That's why the CAA recommends reinforcing with welded wire fabric.

With welded wire fabric, the CAA permits one inch less concrete and fewer contraction joints. This saving usually pays for the fabric and gives these additional advantages as a bonus:

- 1 Fewer shrinkage cracks during curing.
- 2 Cracks that do occur are kept small.
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- 4 Control of contraction and expansion stresses.

The highways leading to the field, and the culverts that carry off drainage, give longer, better service too, at lower cost when Clinton Welded Wire Fabric is used.

If Constellations don't use your field, remember that even 3,350 pounds of single engine impact at 55 miles an hour give your runway a beating.

Clinton Welded Wire Fabric exceeds American Standard specifications for every airport use... runways, taxiways, and aprons.

When you consider airport repair, expansion, or building, contact our nearest district office to learn how Clinton Welded Wire Fabric can give you more for your money.

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IN THE EAST: WICKWIRE SPENCER STEEL DIVISION, BUFFALO, NEW YORK
ON THE PACIFIC COAST: CALIFORNIA WIRE CLOTH CORPORATION, OAKLAND 4, CALIF.



SUPERVISING THE JOBS

Howard Payne is general superintendent and J. J. McCulloch is job superintendent for Brown & Root, Inc., on a \$4,322,000 contract for work on Granite Shoals Dam, Texas. Granite Shoals Dam will be a combination reinforced concrete, rolled earth, and rock filled section structure, 100 ft. high and 4,816

ft. long, under the direction of the Lower Colorado River Authority, an agency of the State of Texas. Estimated cost of the completed structure is around \$10,000,000.

L. P. Reed is project manager for the



KEY MEN on construction of 11.4 mi. of highway near Fernley, Nev., are l. to r.—Ed Leutinger, resident engineer for the State; F. G. Riley, job superintendent for Silver State Construction Co., and A. D. Drumm, Jr., owner of the Silver State firm.

NOW MORE THAN EVER **DAREX AEA** SAVES YOU MONEY

Here is good news to the many users of Darex AEA, **the world's leading air entraining agent for concrete.** The cost of Darex AEA now averages about 3¢ or less per cubic yard of concrete.

With the new lower prices announced January 1 and the improved efficiency of Darex AEA, you are assured that it "does a better job for less." Darex AEA contains no vinsol resin. It is not just another admixture, but is a chemical engineered air entraining agent, the product of years of research in cooperation with the cement industry. It is approved by all Government agencies and is in use throughout the world on every type of concrete construction, in ready mix, concrete block and pipe plants using every known type of aggregate.

Considerably less Darex AEA (from 1/2 to 1/3) is required than other admixtures. Safe to use, Darex AEA is compounded to develop maximum strength and give control of concrete mixes under varying conditions. Use it with economy and confidence and now, more than ever—"SPECIFY DAREX AEA—IT DOES A BETTER JOB FOR LESS!"

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PRESS-UR-METER for testing concrete.**



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Pacific Coast Aggregates, San Francisco; Blue Diamond Corporation, Los Angeles; Denver Fire Clay Co., Albuquerque and Salt Lake City; Baker-Thomas Lime & Cement Co., Phoenix; Ray Corson Machinery Co., Denver; Mason's Supply Co., Portland; Darco, Inc., Great Falls; Hawaii Builders Supply Co., Honolulu.

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Darex AEA Distributors for Dewey & Almy Chemical Co. in 11 Western States, Alaska and Hawaiian Islands.

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construction company bearing his name on the \$15,995,000 contract for Whitney Dam, a concrete and earthfill structure being built by the Galveston District, Corps of Engineers, about 35 mi. west of Waco, Texas. **Simon Piedmont** is superintendent. Work began March 30, 1948, and is expected to last through January, 1951. Whitney Dam will be 167 ft. high and 19,600 ft. long, with a flood control pool capacity of 1,630,500 ac. ft. Estimated cost will total about \$40,000,000 and work will continue through 1952.

Chet Allen is superintendent for Peter Kiewit Sons' Co. for the south section of the Denver Valley Highway, Denver, Colo. The \$348,000 contract is being built for Denver and the Colorado Highway Department. **Whitey Rea** is master mechanic.

Charles Deeds is superintendent for Healy-Tibbitts Construction Co., San Francisco, Calif., on the \$439,000 contract for installation of intercepting sewer at Oakland, Calif.

Wm. T. Spencer is superintendent on the 4.7-mi. state highway and steel bridge work in Del Norte County, Calif., north of Winton Corners. The \$393,374 contract is held by N. M. Ball Sons, Berkeley, Calif. **Tony Yung** is master mechanic.

Bert Butterfield is superintendent for the Ted Bares Construction Co., San Leandro, Calif., on the \$373,140 contract for sanitary sewer separation project at San Jose. **Andy Anderson** is job engineer and **Jim Spratt** is in charge of the field office.

Joe Hurtado is superintendent for the Nomellini Construction Co. of Stockton, Calif., on the \$1,495,682 contract for 13 one-story buildings of reinforced concrete for the California State Epileptic Hospital at Porterville.

R. K. Harris is project manager for Winston Bros. Co., Minneapolis, Minn., contractor on the \$2,000,000 relocation of the M-K-T Railroad track made necessary by Whitney Reservoir, about 35 mi. west of Waco, Texas. The job is between Whitney and Morgan, Texas.



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THE NEW P&H
955-A!

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FOR ME...TRA-LA!

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FAST STOPS
AND STARTS?
WITH
HYDRAULIC
CONTROL SHE'S
SMOOTHER
ALL AROUND

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ON A 2½ YARD
SHOVEL

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DREAM FOR BIGGER
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Yes, the new 955A is a standout. And almost a sellout, too! This 2½ yard shovel, a smaller version of the famous P&H Model 1055, can be shipped completely assembled. Lower digging costs in 2½ yd. capacity are important to you, so it's important that you check the P&H 955A right now. Get your copy of bulletin X-122 now!

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R. H. Hickman is project engineer, and H. S. Toggle is excavation superintendent. J. R. Neely is resident engineer for the Galveston District, Corps of Engineers. Work began Dec. 12, 1949, and is expected to continue to May, 1951.

Dick Haggerty is superintendent and H. S. Lord is project manager for Lord & Bishop, Sacramento, Calif., on the \$526,299 Walnut Grove Bridge across the Sacramento River at Walnut Grove, Calif. Harold Doty and John Matranga are the pile foremen.

Ross W. Phillips is superintendent on the 67-mi., \$369,587 contract for the Artois-Madison section of the Shasta-Tracy 230-kv. transmission line, Calif. Erickson, Phillips & Weisberg, Oak-

land, hold the contract which includes erection of 296 double-circuit steel towers and foundations.

John Tolvo is superintendent and George Brindle is engineer for the Colorado Constructors on the contract for grading new roadbed at Denver, Colo., for the Rock Island Railroad.

B. H. Pebley is project manager for the J. H. & N. M. Monaghan Construction Co. on the \$600,000 contract for new road alignment for the Colorado State Highway Department on route 81 between Wellington and 7 mi. south.

J. L. Connelly is project manager and Rolf Jensen is superintendent for Bar-



ON THE \$373,000 construction of highway near Alamogordo, N. Mex., Hoyle Lowdermilk, right, principal in the firm of Lowdermilk Bros., Denver, Colo., is acting project manager. With him is D. J. Coletti, timekeeper.

rett & Hilp, San Francisco, contractors on the \$1,197,000 eleven-story reinforced concrete apartment building being built for Ken Royce, Inc., in San Mateo, Calif.

O. H. Tucker is project manager for Morrison-Knudsen Co., Inc., on the \$2,595,000 contract for airport construction at the San Francisco International Airport, being built for the City of San Francisco. A. S. Hope is general superintendent and Gene Hargraves is office manager. Joe Miller is the paving superintendent and Tex Smith is pipe superintendent. The master mechanic is Lex Hobson.

Frank Zielinski is superintendent for the Isbell Construction Co., Reno, Nev., on the \$312,000 contract for widening the Reno-Carson highway. Foremen include R. H. Barrett, pipe; Otto Eggy, carpentry, Floyd Lambert, grade.

Al Pezzi is general superintendent for the Conyes Construction Corp., San Pablo, Calif., on the \$2,000,000 pipeline contract from an oil field at Worland, Wyo., to Baker, Mont. C. Kinkead and J. F. Allman are superintendents. H. F. King is in charge of the field office at Hardin, Mont.

Milt Hayes is superintendent and Les Carter is assistant superintendent for the Horner & Switzer Co. on 4.8 mi. of state highway work at Clear Creek Canyon, Colo., between Golden and Idaho Springs, a \$650,000 project. Hugh Patton is master mechanic and Howard Eastin is job engineer.

Howard Hill is superintendent for the L. J. Hesser Co. on the \$130,000 contract for grading and paving route 52 of the state highway from Wiggins, Colo., to 12 mi. south. Zeke Witt is master mechanic.

J. L. Smithson is supervising road construction on 13 mi. near El Morro, New Mexico, for contractor Hugh McMillan under a \$65,000 contract. The McMillan firm also has a number of other road construction contracts under way. Supervisory personnel are as follows: Ross Curless on street paving at Fabens,

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Full 180° swing, finger-tip operation, *low first cost*, minimum maintenance, and 15-30 yard hourly capacity adapts HOPTO to a wide variety of *profitable work*. And HOPTO needs no counter weights... NO swing clearance! Three types of buckets, 14" to 24" widths, are available for HOPTO:—enclosed, skeleton, and shovel bucket. Reversible teeth are of cast alloyed steel, heat treated for longer life.

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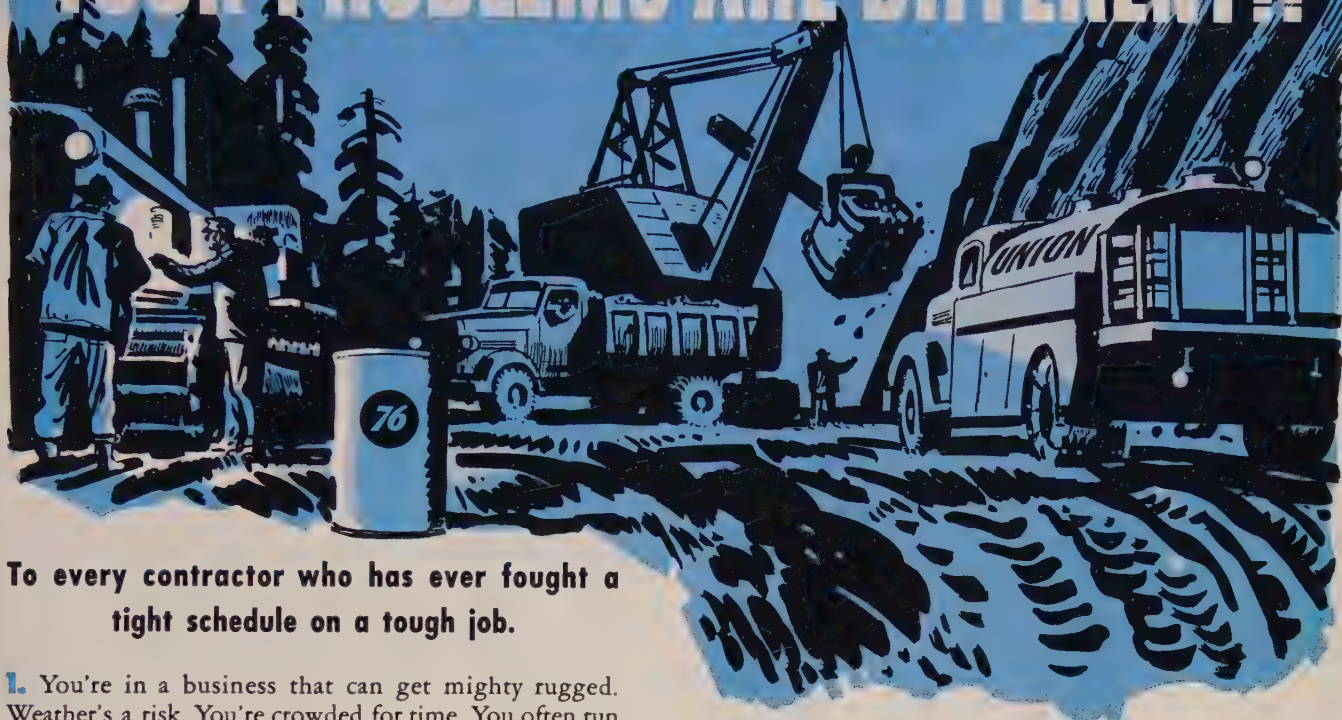
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1. You're in a business that can get mighty rugged. Weather's a risk. You're crowded for time. You often run into housing or supply problems. And you may require fuels and service at *any* hour—under the worst conditions.



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3. Yes, every man on the Union Oil team recognizes the special problems you're up against in the construction business. And you can bet your bottom dollar that obligations and commitments are completed *on time*.



4. This *dependability*, which characterizes the men of Union Oil, is one of the reasons why so many of the West's leading contractors *always* specify Union Oil products and service on their toughest jobs.

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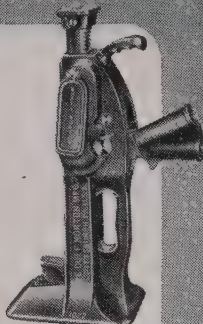
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Self Lowering
Screw Jack



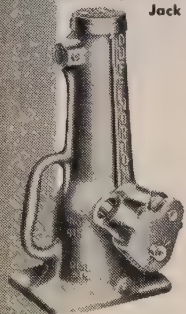
Low Height
Screw Jack



Ratchet Jack



Pole Pulling
Jack



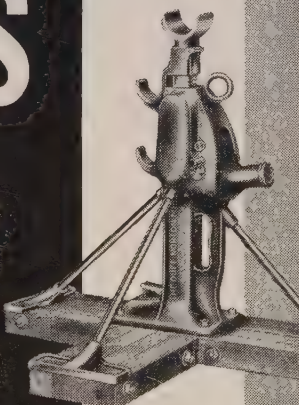
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Texas; paving under a \$40,000 private contract at El Paso, Texas, and on \$61,-667 resurfacing of U. S. Highway 62 near El Paso; **O. F. Giles** on the \$125,000 construction of curbs, gutters and pavement for the Beaumont subdivision development at El Paso; **J. P. Thomas** on the \$81,000 construction of streets in the City of El Paso under a private contract; **H. J. Logan** on the \$38,000 construction of roads in Jeff Davis County, Texas; **O. F. Giles** on the \$25,000 construction of roads for the Del Mesa addition to the City of El Paso; **A. Bruner** on the \$41,967 construction of roads in Loving County, Texas, the \$77,717 construction of roads in Crane County, Texas, and the \$99,397 construction of roads in Reeves County, Texas.

O. D. Cowart is acting as project manager and **Walter Gott** is superintendent for contractor **O. D. Cowart** on the \$220,991 construction of about 5 mi. of highway near Hanover, New Mexico. The job started in January and will be completed before the end of June.

Everett L. Christman is project superintendent for **Morrison-Knudsen Co.** on construction of a 10-mi. section of the Wellton-Mohawk Canal near Yuma, Ariz. **Jack Binder** is project engineer; **Bud Snowball** is excavation superintendent; **Gunnar Nygard** is structures superintendent; **Reuben "Andy" Anderson** is master mechanic, and **E. W. Weatherman** is office manager. Completion of the section is scheduled for April, 1951.

Jerry Dawson is superintendent and **Harold Richardson** is foreman for **Indenco Co.** of San Francisco on construction of a building for the Bank of America in Hayward, Calif.

Otto Worth is project manager and **Herman Smith** is superintendent for **A. Teichert & Son, Inc.**, Sacramento, Calif., on the \$450,000 contract for sewer and street work for the city of Tracy.

William N. Jones, on leave of absence from the position of administrative engineer for the Atomic Energy Commission, is supervising construction on three sewer jobs at Tucson, Ariz., for **Mark Cockrell Contracting Co., Inc.**, Phoenix. Assisting him are **Dan Mitosinku**, and **Homer E. Edwards** as paving foreman.

M. M. Pize Construction Co. of Tucson, Ariz., has **Edward G. McIntyre** as superintendent on construction of the Stadium Dormitory for the University of Arizona at Tucson. **Ted LaRue** is field superintendent. Carpenter foremen include **Ernest Smith**, **John Malt** and **Charles Slonaker**. **Alec Vogelsburg** is labor foreman. **Charles Allen** is office manager.

Howard Payne is general superintendent for **Brown & Root, Inc.**, on the

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BAY CITY

There is no secret about BAY CITY bigger performance. A check of specifications shows the many outstanding advantages that mean larger profit, lower maintenance and easier operation. Here are a few advantages so you can make your own comparison.

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A firm footing means added stability for greater output — faster operation.

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Alloy steel castings give strength and rigidity to maintain alignment of all machinery.

HELICAL GEARS

Quiet, smooth operation with added power on ALL drum gears and main transmission.

RIGHT: MODEL 65 HEAVY DUTY
1 1/4 YARD SHOVEL

BELOW: MODEL 45 HEAVY DUTY
3/4 YARD DRAGLINE

BALL BEARINGS

Anti-friction bearings throughout machinery, in drums and shafts—yes, even to boom point sheaves means reduced maintenance.

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The E-Z booster clutches utilize engine power to set main clutches and provide unexcelled ease of operation.

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Change front end attachments quickly and easily—tandem drums provide best cable lead for any work.

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Compare and you will know why this means reduced maintenance and low-cost operation.



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After making your own comparison you will buy BAY CITY for the biggest value in excavating and material handling equipment. A card or letter will bring you complete details. Let's get acquainted.

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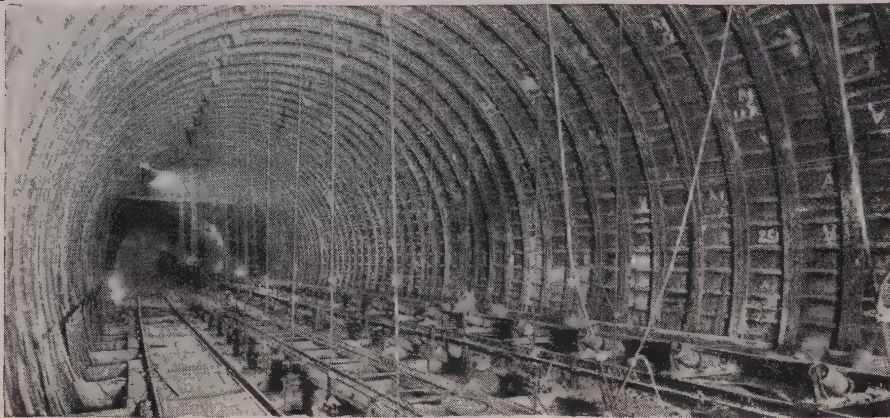


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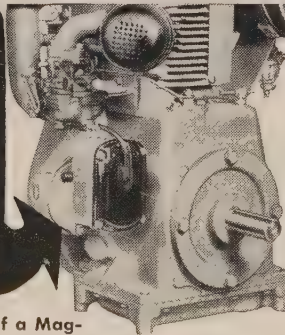
The fastest, most efficient, and least expensive method of driving large traffic tunnels is through the use of COMMERCIAL Steel Liner Segments. Witness their numerous applications on the largest tunnels in the country, both under ground and water. The most recent COMMERCIAL choice has been for tunnels on the Pennsylvania Turnpike . . . a wise choice, indeed, considering the time limit on almost all of these tunneling jobs. They do the large jobs more rapidly. Let us tell you more about COMMERCIAL LINERS . . . they're adaptable to any size tunnel. Write today.

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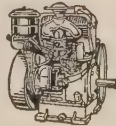
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Wisconsin engineers have found through long experience and experimentation that the best place to put the magneto, not only for convenient accessibility but for better ignition performance over an extended period of time is on the OUTSIDE . . . with an independent, direct drive from the engine to the Magneto. The Rotary Type high tension magnetos used by Wisconsin Air-Cooled Engines provide the greatest protection against ignition troubles because the Magneto itself is a complete, independent operating unit that doesn't rely on an unrelated part of the engine for its successful operation. It's tightly sealed against dust and moisture, of course, so it isn't affected by wet weather or snow and there is no chance of it getting "fouled up". And it's equipped with an Impulse Coupling that provides a quick, hot spark for easy starting in any weather, in any climate, a feature that can't be incorporated in flywheel-type magneto.

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H. E. SNIPES, right, is the general superintendent for E. V. Lane Co., Palo Alto, Calif., on construction of a sewage treatment plant for the City of Concord, Calif. R. E. Buttz is project manager for the firm.



\$2,844,759 contract for work on Marble Falls Dam, Texas. Fred Duke is job superintendent. Marble Falls Dam, 90 ft. high and 860 ft. long, is a concrete gravity type structure being built by the Lower Colorado River Authority, an agency of the State of Texas. Cost will be about \$7,000,000. C. F. Ende is resident engineer for the L. C. R. A.

Harold Ashton is the general superintendent for Ashton Building Co. of Tucson, a recently-organized firm. The firm has two projects under way. C. M. McClure is the job superintendent on construction of the \$117,000 St. Mary's bridge at Tucson. Marvin Skelly is the job superintendent on construction of the Tucson Vocational High School building, which will cost about \$1,400,000.

J. W. Henry is superintendent and D. E. Otis is assistant superintendent for Harms Bros. and N. M. Ball Sons on the million-dollar highway construction at Livermore, Calif., for the state highway department. L. W. De Vault is office manager and J. F. O'Brien is engineer.

H. A. Campbell is project manager and E. N. Murphy is superintendent for the Campbell Construction Co. on the \$260,000 Jr. High School building for Artesia, N. Mex.

Gene Huffman is superintendent for United Builders, holders of the \$1,000,000 contract to build a Junior High School building for the city of North Platte, Neb.

W. J. Mahaffy is project manager and Edward Helstrom is superintendent for the Cornhusker Tractor and Equipment Co. on a \$100,000 building contract in North Platte, Neb.

M. L. Boyd is general superintendent and R. B. Lasater is foreman on the 222 mi. of 26-in. gas pipe line under contract to R. H. Fulton & Co. by the No. Natural Gas Co. Work is near Perryton, Tex.

Clark Williams is superintendent on the 202-mi. stretch of 30-in. pipeline under contract to R. H. Fulton & Co. by the Transcontinental Gas Pipe Line



Co. The work is located on the Spartanburg, S. C., end of the Texas-East Coast line. **Dave Wagner** is in charge of the field office.

Vernon R. Bradley is superintendent and **Harry Wilson** is project engineer for the Guy F. Atkinson Co., holder of the \$946,620 contract by the Corps of Engineers for construction of a bridge across the Columbia River at Bridgeport, Wash. Carpenter foreman is **A. E. Whetstone**. **Ben Veenhvizen** is master mechanic. The bridge is part of the access to Chief Joseph Dam.

B. B. Armstrong is superintendent for Armstrong & Armstrong, contractors on the \$73,000 state highway contract at Rogers, New Mexico.

Lloyd D. Shilling is project manager and **Charles E. Roberts** is superintend-



CARL NEEDHAM is the general superintendent for American Pipe & Construction Co. at the firm's Pittsburg, Calif., plant, where pipe is being manufactured for the Hetch Hetchy Pipeline of the San Francisco Water District.

ent for Minnis & Shilling, contractors on the \$496,961 canal chute structure, Columbia Basin West Canal, being built for the U. S. B. R. in Washington. **Allen J. Sharp** is assistant superintendent.

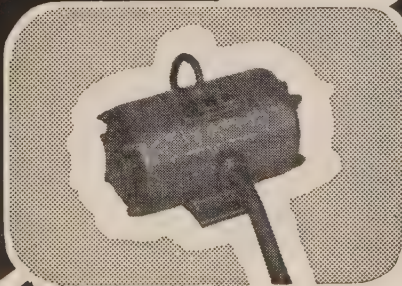
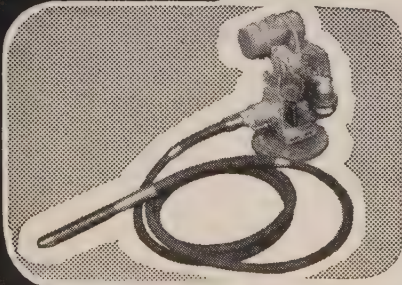
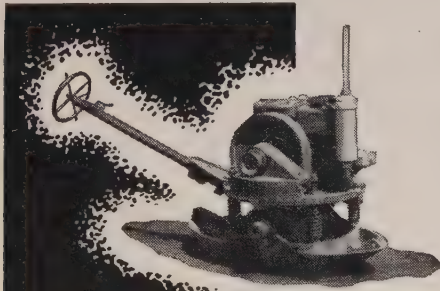
Jack Elliott is the general superintendent for Platt-Rogers, Inc., holders of a several thousand dollar contract for construction of a nine-hole golf course for the Broadmoor Hotel in Colorado Springs, Colo. The present work aug-

ments an 18-hole course already in operation by the swank hotel.

H. M. Thomas is superintendent for Allison & Haney, Albuquerque, on the \$561,509 storm sewer and paving contract by the City of Hobbs, N. Mex.

G. D. Young, Jr., is superintendent and **J. H. Ryan, Jr.**, is assistant superintendent for J. H. Ryan, contractor on the \$425,500 New Mexico State Highway Dept. contract for grade separation and bridge work at Manuelito, N. Mex., west of Gallup.

Mel Londgrin is superintendent for LaMarr Homes, Inc., Phoenix, and Republic Construction, Los Angeles, joint venturers on the \$7,200,000 Wherry Housing Project, WAFB, Roswell, New Mexico. The work includes 600 two, three, and four-bedroom houses, and 100 duplexes.



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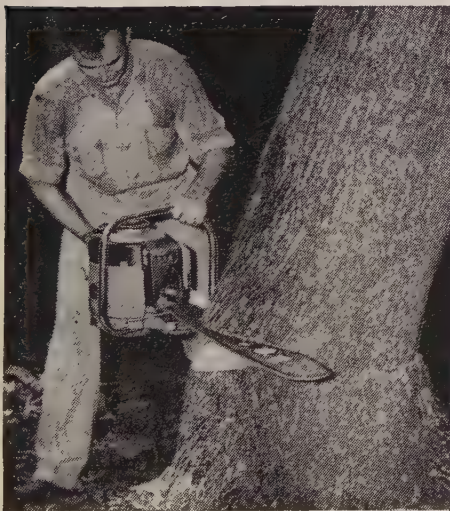
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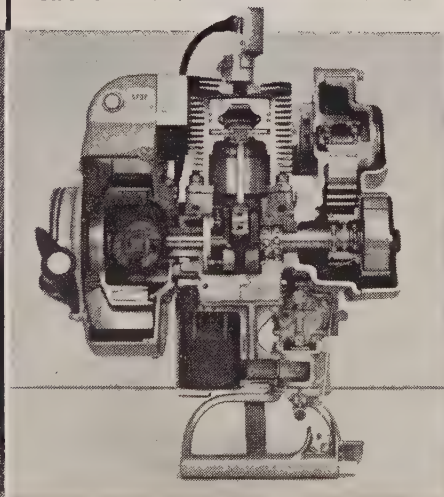
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HARTFORD 15, CONNECTICUT

California Delegates Freeway Authority

... Continued from page 66

being without merit.

In summary, the court held:

1. "There is ample statutory authority for the State Highway Commission to relocate any part of the State Highway system."

2. That the language in Section 8 of the State Highways Act of 1909 (the first State highway bond issue) to the effect that highways constructed or acquired under the Act shall be "permanent in character" and that they shall be "permanently maintained and controlled by the State of California" relates to the durability with which they were to be constructed and to the continuing obligation of the State (as distinguished from the counties) to maintain them as parts of the State highway system after they have been located and constructed; it does not mean that such highways may not be relocated and reconstructed if this becomes necessary "in the public interest."

3. That the court's interpretation of the 1909 Act is in accordance with "administrative, legislative, and judicial interpretation that it has always been given."

4. That the adoption of Article IV, Section 36, of the California Constitution, specifically authorizing the Legislature "to establish a system of State highways," in 1902, "in the horse and buggy days," does not mean that the State must forever construct horse and buggy highways nor does it preclude the Legislature from authorizing "the relocation of any highway . . . established under that system." Neither does it prohibit the construction of a "new and different type of State highway" such as a freeway or limited access highway.

5. "The construction of freeways or limited access highways is within the statutory authority of the State Highway Commission and the Department of Public Works."

6. "The construction of freeways and limited access highways is 'necessary or proper to construct and maintain' a modern State highway system" and does not necessarily constitute a taking of private property and rights of access without due process of law.

7. The Legislature may properly delegate to an administrative agency, such as the California Highway Commission and the Department of Public Works, "authority to construct and maintain or to abandon and relocate highways, to build freeways or limited access highways, and to do anything else necessary to the maintenance of a State highway system."

8. That existing State highway legislation constitutes a proper and valid "delegation of legislative power . . . to the Highway Commission . . . to determine when and where freeways will be constructed."

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equipment was needed for driving the piles on two different batters as well as vertical.

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Monotubes' many advantages help make savings on foundations for all types of structures. They're inherently strong. They come in lengths, gauges, tapers and diameters for varying soil conditions. There's minimum cut-off waste. They're easily extendible. Jobs started with Monotubes can be *completed* with them.

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Contracts . . .

Summary of Bids and Contracts For Major Projects in the West

Arizona

Daley Construction-Acme Materials Co., Inc., Phoenix, was awarded a contract at \$257,810 for the construction of underground water, sewer and electrical lines for the new Sky Harbor Terminal. The same company bid low at \$140,446 for 2.2 mi. of improvements, consisting of grading, draining and bituminous plantmix surfacing, on the Ashfork-Flagstaff Highway, near Williams.

Kolob Construction Company, Phoenix, bid low at \$151,998 for the grading, draining, laying aggregate base and surfacing of a new highway alignment, 5 mi. in length. The project is located about 38 mi. north of Phoenix on the Phoenix-Rock Springs Highway.

Larsen Contracting Co., Phoenix, submitted a low bid of \$305,283 for construction of 19.7 mi. of the Tucson-Ajo Highway, Pima County, to include grading, draining, applying bituminous surface treatment and bituminous road mix.

Rubenstein Construction Co., Phoenix, has started work on 500 housing units to cost an estimated \$5,000,000 at Williams Air Force Base. Contract was awarded by the Federal Housing Administration.

San Xavier Rock & Sand Co., Tucson, received a contract awarded for its bid of \$178,473 for installation of sanitary sewers and construction of pavement and curbs in the Vista Hermosa Improvement District, Pima County.

Vinnell Construction Co., Phoenix, was awarded a \$292,762 contract for a highway project to include: construction of reinforced concrete overpass and approaches, grading and draining of 1 mi., removal and disposal of existing concrete overpass and approaches.

Western Contracting Corp., Sioux City, Iowa, for its low bid of \$2,412,645, received the contract from the Bureau of Reclamation for construction of 29 mi. of the Wellton-Mohawk Canal Gila Project.

California

American Pipe & Construction Co., South Gate, was awarded the \$1,582,886 contract for building the first section of the conduit running from the coast portal of Tecolote Tunnel toward Santa Barbara (Cachuma Project), consisting of 9.6 mi. of construction of concrete pipe lines and structures. Award was made by the Bureau of Reclamation.

P. & J. Artukovich, Los Angeles, submitted low bids on 2 items on the Cachuma Project to the Bureau of Reclamation. The bid on Schedule 2 was \$1,489,359; on Item 61, \$1,020,000; these include construction of 10 mi. of steel pipe line and concrete structures on the Glen Anne Canyon.

Guy F. Atkinson, South San Francisco, was awarded a contract at \$1,392,744 for clearing, grading and surfacing, with plantmix surfacing on cement-treated base, 1.7 mi. in Santa Clara County near Los Gatos.

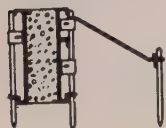
Ball, Simpson & Irving, Berkeley, received the award for its bid of \$284,877 for construction of 4.8 mi. of grading and drainage structures in California Forest Development Project, Sierra National Forest, Madera County.

Fredrickson Bros., Emeryville, bid low at \$310,483 for construction of 6.1 mi. of 4-lane divided highway between Auburn and Applegate in Placer County to be surfaced with plantmix surfacing on cement-treated base.

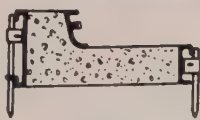
Fredrickson & Watson Construction Co., Oakland, last month was awarded one contract and was announced as low bidder of two others. The company was awarded a contract at \$217,948 for grading and surfacing 2.8 mi. of highway in Santa Clara County south of Gilroy. It submitted the low bid at \$249,634 for work on Shasta Dam and power plant, Redding, to include grading and paving roads and construction of curbs, gutters and sidewalk. The company was also low bidder at \$603,951 for construction of a new steel beam bridge, widening of four existing bridges and 9.8 mi. of highway construction, all in Shasta County between Anderson and Redding.



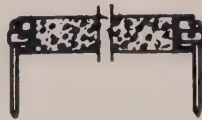
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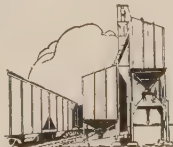


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3/4" Dia.	12000	19,720 lbs.	20,570 lbs.
1" Dia. 2 Strut	18000	27,580 lbs.	27,820 lbs.
1" Dia. 4 Strut	24000	37,930 lbs.	36,890 lbs.
1 1/4" Dia. 4 Strut	30000	55,270 lbs.	56,790 lbs.

*Assistant Professor of Civil Engineering

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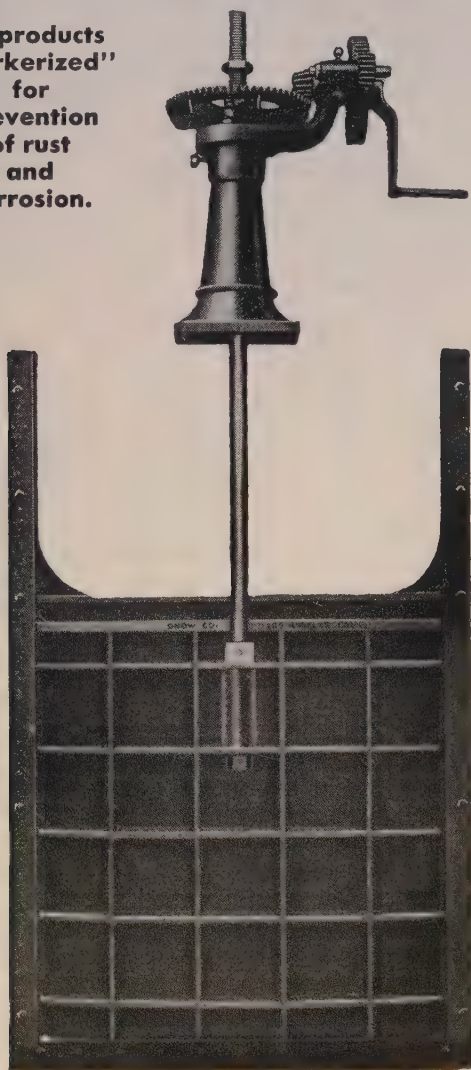
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Ben C. Gerwick, San Francisco, and George Pollock, Sacramento, as joint venturers, received a contract at \$737,153 for construction of sedimentation basins and appurtenances and installing of machinery and equipment near 34th and Wood Streets in Oakland.

Granite Construction Co., Watsonville, for its low bid of \$658,258, was awarded the contract for grading and surfacing about 3.1 mi. with plantmix surfacing on cement-treated base near Las Cruces, Santa Barbara County. The same company was low bidder at \$476,325 before the State Division of Highways for a project in San Benito County, north of San Benito River to include: Construction of a structural steel and reinforced concrete girder bridge, widening of an existing concrete bridge, raising the deck of an existing concrete slab bridge, and 2.3 mi. of grading and surfacing.

Griffith Company, Los Angeles, was awarded a contract for \$1,449,469 by the State Department of Public Works for work on the Hollywood Freeway between Western and Virgil Avenues, consisting of 1.7 mi. of grading and surfacing with Portland cement concrete pavement on cement-treated subgrade.

Charles L. Harney, San Francisco, has started work removing streetcar tracks on Sutter Street from Market to Fillmore Streets in San Francisco. Harney's low bid was \$158,584.

O. C. Jones & Sons, Berkeley, submitted the low bid of \$197,500 for widening a reinforced concrete bridge, construction of a reinforced concrete culvert, and .6 mi. of grading and paving.

Vido Kovacevich Co., South Gate, bid low at \$683,231 for the construction of 2 parallel concrete bridges and a railroad underpass, widening an existing bridge over Rio Hondo, and construction of 1.4 mi. of multiple-lane divided highway and outer highways, on Rosemead Blvd., Los Angeles County.

Robert E. McKee, Los Angeles, was low bidder before the Public Buildings Administration at \$3,907,700 for construction of a 6-story structural steel and reinforced concrete addition to the U. S. Marine Hospital, 15th Avenue near Lake Street, San Francisco.

Morrison-Knudsen Co., Los Angeles, received the contract for construction of an earthfill dam and concrete spillway in Santa Joaquin County, approximately 4 mi. east of Farmington. Its low bid was \$865,965.

Lars Oberg, Inglewood, bid low at \$295,465 for the construction of a reinforced concrete box girder bridge for an overcrossing on the Hollywood Freeway at Sunset Blvd., Los Angeles.

Ofeco Construction Co., Inc., Long Beach, was awarded an \$821,225 contract by the Chief of the Bureau of Yards and Docks for construction of an air blast facility at the U. S. Naval Air Missile Test Center, Point Mugu, Calif. The project consists of the construction of a 25,000-hp. power plant, including several buildings, test air piping, paved areas, water and electric distribution systems, and appurtenances.

H. Earl Parker, Inc., Marysville, was low bidder on two levee projects and one highway project last month. The company submitted the low bid at \$1,585,288 for the grading and surfacing of 1.7 mi. in Los Gatos. For construction of bank protection and levee setbacks near Knights Landing in Sutter and Colusa Counties, it bid \$684,536 before the Corps of Engineers. The company's bid of \$140,259 was low before the Corps of Engineers for levee construction near Isleton, along Georgiana Slough, Sacramento County.

Schroeder & Co., of Roscoe, received a contract for its low bid of \$179,871 for application of plantmix surfacing to 7.5 mi. of roadway in Los Angeles County, between Sunset and Ventura Blvds., on Sepulveda Blvd.

H. C. Smith Co., Los Angeles, was low bidder before the Corps of Engineers at \$509,527 for the construction of concrete outlet works and installation of gates at Isabella Dam, Isabella River, Kern County.

Duncanson-Harrelsen Co., Richmond, was low bidder before the Bureau of Reclamation at \$313,563 for the construction of foundations and erecting steel towers for the Shasta-Tracy Nos. 1 and 2 230-kv. transmission lines of the Central Valley Project between Rio Vista and Tracy.

Peter Sorenson, Redwood City, was awarded a \$1,433,045 contract by the Sequoia Union High School District for construction of a high school plant, consisting of 13 1-story concrete block and wood frame buildings in San Mateo County, between Atherton and Menlo Park.

A. Teichert & Son, Sacramento, received the contract award for its low bid of \$1,874,737 for 5.3 mi. of highway construction, to include the building of 2 new bridges, widening of two existing bridges, grading and plantmix surfacing, in Los Angeles County.

between Frenchman's Flat and Los Alamos Creek. The same firm was low bidder at \$628,370 for construction of the channel invert of the Sawtelle-Westwood system, near Venice Blvd. and McLaughlin Avenue, Los Angeles.

Colorado

Broderick & Gibbons Co., Pueblo, submitted the low bid at \$114,516 for 3.2 mi. of plantmix oil process surfacing on U. S. 85-87 at the north entrance to Pueblo Freeway, Pueblo.

Grafe-Callahan Construction Co. and **Rhoades-Shofner Construction Co.**, Los Angeles, were awarded a joint contract at approximately \$600,000 for construction of Tunnel No. 3 of the Grand Valley Project in western Colorado.

Peter Seerie, Inc., Denver, bid low at \$427,221 for construction of twin arch bridges with approaches and incidental sewer work, in Denver County, over the South Platte River.

Delmer A. Spafford, Farmington, Colo., received a \$300,000 contract for construction of a 27-mi. water supply line, Mesa Verde National Park, southwestern Colorado.

Idaho

Hoops Construction Co., Twin Falls, was awarded a contract for its bid of \$178,055 for construction of 6.5 mi. of highway on the Sawtooth Park Highway, south of Godwin in Twin Falls County. The work includes laying of the roadbed, building drainage structures, and surfacing.

Max J. Kuney, Spokane, was successful low bidder at \$438,024 for constructing the roadbed, drainage structures and surfacing of 8.5 mi. of U. S. 95 near Genesee in Latah County.

Charles A. Power, Spokane, has started construction on two additional lanes of highway, an underpass and an overhead, on Highway 10, between Coeur d'Alene and Huetter. The company's bid was \$267,677.

Duffy Reed, Twin Falls, was awarded a contract for \$522,428 for construction of 8.5 mi. of roadway and a 140-ft. bridge, in Valley County around Cascade Reservoir.

Stanley and Ehlen, Boise, received a \$278,244 contract for the surfacing of 14.9 mi. of highway in Latah County between Moscow and Potlatch Junction.

Utah Construction Company, Ogden, was awarded a contract at \$215,063 for construction of a central facilities warehouse and the Atomic Energy Commission's reactor testing station by the Idaho Operations Office.

Oliver Von Cannon and Walker & Bloomhagen, Sandpoint, Idaho, were joint low bidders at \$334,790 for clearing the right-of-way on the Lake Pend-Oreille section of the Spokane-Hot Springs 230-kv. transmission line. Award will be made by the Bonneville Power Administration.

Parsons & Fife, Brigham City, Utah, with a bid of \$293,629, received a contract for 10.6 mi. of construction of roadbed, drainage structures and bituminous surfacing on the Yellowstone Park Highway between Arimo and Downey in Bannock County.

Montana

Stanley H. Arkwright, Inc., was awarded a \$298,257 contract for grading, graveling, and bituminous surface treatment on 6.1 mi. of highway north of Roundup in Musselshell County.

Roy L. Bair & Co., Spokane, was awarded a contract at \$695,408 for clearing and grading 12.3 mi. on two sections of forest highway from St. Regis west to Henderson.

Kiely Construction Co., Butte, received the contract at \$290,726 for 6.8 mi. of grading, gravel surfacing, plantmix oiling and small drainage structures in Lake County, from St. Ignatius to Pablo.

Peter Kiewit Sons' Co., Sheridan, with a bid of \$238,509, was awarded the contract for 5 mi. of highway grading and surfacing in Big Horn County near Wyola.

McLaughlin, Inc., Great Falls, was awarded a \$269,389 contract for 5.8 mi. of highway grading, surfacing and draining in Rosebud County from Forsyth to Miles City.

O'Brien Construction Co., Great Falls, was awarded a contract at \$142,319 for grading, gravel surfacing, roadmix oiling and construction of small drainage structures on the Stryker-Rooseville highway in Lincoln County.

Lou Richardson, Miles City, was awarded a contract at \$199,857 for grading, gravel surfacing and bituminous surface treatment of 9.9 mi. of the Roundup-Forsyth highway in Rosebud County.

Painter & Douglas, Missoula, with a bid of \$166,356, was awarded a contract for improvement of 4 mi. of Columbia Falls-Glacier Park highway, south of Glacier National Park.

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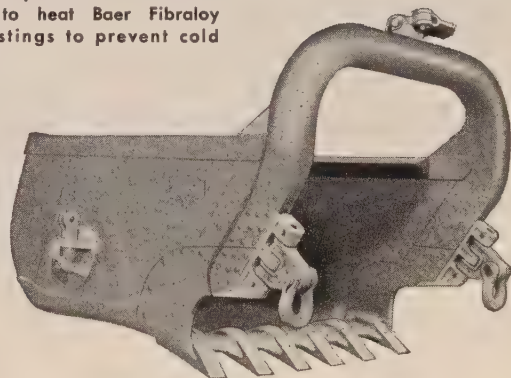
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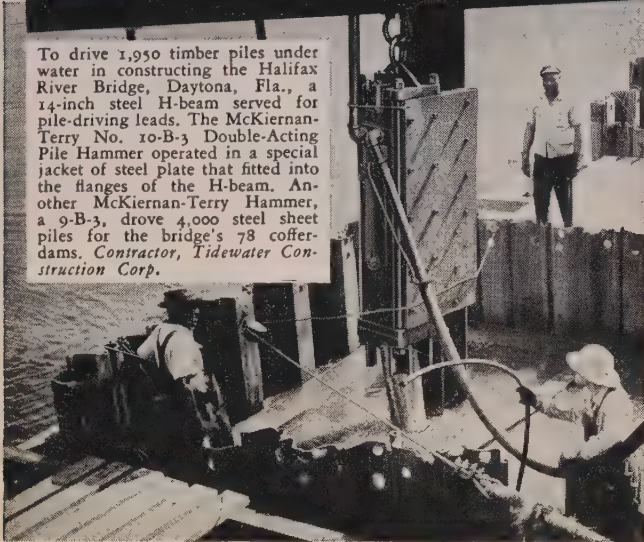
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To drive 1,950 timber piles under water in constructing the Halifax River Bridge, Daytona, Fla., a 14-inch steel H-beam served for pile-driving leads. The McKiernan-Terry No. 10-B-3 Double-Acting Pile Hammer operated in a special jacket of steel plate that fitted into the flanges of the H-beam. Another McKiernan-Terry Hammer, a 9-B-3, drove 4,000 steel sheet piles for the bridge's 78 cofferdams. Contractor, Tidewater Construction Corp.



Necessity mothered the invention of this novel pile-driving procedure, for here were conditions where conventional pile driver leads could not be used.

Past experience with McKiernan-Terry Hammers occasioned the selection of these hammers for the job.

Power, dependability and safety of operation, demonstrated for over fifty years on pile-driving projects of every description, all over the world, have made McKiernan-Terry Pile Hammers the No. 1 choice of leading contractors and engineers. They can always secure in the standard McKiernan-Terry line of ten double-acting hammers, five single-acting hammers and two double-acting pile extractors a hammer or extractor powered for any specific requirements.

FOR MORE INFORMATION

Write us, on your business letterhead, for late bulletins giving specifications and other data on McKiernan-Terry Hammers and Extractors.

McKIERNAN-TERRY FACILITIES

Coal and ore bridges, bulk material unloaders, bridge operating mechanisms, hoists and marine equipment are among the many other important products of McKiernan-Terry engineering and manufacturing skill, performing important service to industry, the railroads and our government.

MK-269 B

McKIERNAN-TERRY CORPORATION

Manufacturing Engineers 16 PARK ROW, NEW YORK 7, N.Y.

McKiernan-Terry
PILE HAMMERS AND EXTRACTORS

Nevada

Dodge Construction Co., Fallon, was awarded a \$303,109 contract for 16.1 mi. of reconstruction and roadmix asphaltic surface in Esmeralda Co., from Goldfield to Miller's Cutoff Rd.

E. T. Haas Co., Belmont, Calif., with a bid of \$218,268, was low before the 12th Naval District for construction of 10 mi. of pipeline at Hawthorne Naval Ammunition Depot, Mineral Co., Nev.

J & J Construction Co., Oklahoma City, with a bid of \$371,581, was low before the Bureau of Reclamation for stringing conductor and overhead ground wire 230-kv. transmission line on the Davis Dam Project, between Davis Dam and Coolidge.

Wells Cargo, Inc., Reno, Nev., was awarded a \$242,764 contract by the Department of Highways for 1.5 mi. curb and gutter, resurfacing and widening on South Main St., Las Vegas, Nev.

New Mexico

Brown Contracting Co., Albuquerque, was awarded a \$289,243 contract for construction of 9.1 mi. on route 96 in Sandoval County, N. M., between Regina and Cuba.

R. J. Daum Construction Co., Albuquerque, with a bid of \$429,065, was low before the Atomic Energy Commission at Los Alamos, N. M., for construction of a concrete block building and installation of a series of capillary air washers and filters.

Brown Contracting Co., Albuquerque, was awarded a \$121,079 contract for grading, reshaping, and surfacing 14.7 mi. of highway in Sandoval County, from Cuba to Laventana, N. M.

H. C. Jones, Albuquerque, with a bid of \$118,000, was low on construction of 6.8 mi. of access road to Jemez damsite, on the Middle Rio Grande Flood Control project.

Lowdermilk Bros., Espanola, N. M., with a bid of \$284,829, was low bidder on construction of 4 mi. of new highway on the east slope of Jemez Mountain, from Los Alamos Canyon to State Highway No. 4.

Robert E. McKee, Santa Fe, N. M., with a bid of \$2,261,060, was low before the Atomic Energy Commission for construction of a 3-story, 80-bed concrete hospital building at Los Alamos, N. M.

Wylie Bros., Albuquerque, was awarded a \$181,433 contract for 16.6 mi. of state highway grading and paving in Lea County, N. M., between Lovington and the Texas boundary.

Wylie Bros., Albuquerque, was awarded a \$210,634 contract for 18.8 mi. of grading, draining, and surfacing of state highway in Lea County, N. M., from Tatum to the Texas boundary.

L. C. Peddicord, Albuquerque, was low bidder at \$205,433 (lots 1 and 2) and \$144,038 (lots 1 and 2A) before the Atomic Energy Commission for installation of pavement and drainage structures for industrial area at Sandia Base, N. M. Lots 1 and 2 are concrete construction, and 2A is bituminous construction.

Henry Thygesen & Co., Albuquerque, was awarded a \$192,123 contract for 47.2 mi. of state highway surface reconditioning in McKinley and Valencia Counties, N. M., between Gallup and Albuquerque.

North Dakota

United Construction Co., Winona, Minn., with a bid of \$9,749,245, was low before the Corps of Engineers for construction of stilling basin and power house foundation, Garrison Dam, N. D.

Oregon

Guy F. Atkinson Co., Portland, was awarded a \$2,846,611 contract for logging, clearing, grubbing, roadway grading, detours, channel changes, and drainage structures in connection with Lookout Point Dam, on the Middle Fork of the Willamette River, Ore.

Intercity Sand & Gravel Co., Eugene, Ore., with a bid of \$151,212, was low bidder for 3 mi. grading and paving in Lakeview, Ore.

Utah Construction Co., San Francisco, was awarded a \$672,766 contract for construction of railroad track near Jasper, Lane County, Ore., adjacent to Lookout Point Reservoir.

South Dakota

Western Contracting Corp., Sioux City, Iowa, was low bidder at \$7,208,896 before the Corps of Engineers for clearing, grubbing, and excavation for Stage 3 of the Fort Randall Dam construction near Lake Andes.

Utah

Olson Construction Company, Salt Lake City, was low bidder at \$963,550 before the Bureau of Indian Affairs for construction

of two school buildings and three apartment buildings at Intermountain Indian School at Brigham City.

Whiting & Haymond, Springville, submitted the low bid of \$163,039 to the State Road Commission for 4 mi. of 2-in. roadmix bituminous surfaced road, Sevier County, west of Salina Canyon summit. The same company bid low at \$100,569 for construction of 5.5 mi. of 2-in. roadmix bituminous surfaced road in Utah County, from Alpine Junction to U. S. 91.

Washington

Guy F. Atkinson Co., Seattle, with a bid of \$731,151, was awarded a contract for construction of the Guide Meridian Bridge across the Nooksack River in Whatcom County.

J. P. Surace, Seattle, was awarded a \$157,537 contract for construction of approaches on the west side of the Agate Pass Bridge.

Bay Construction Co., Seattle, was awarded a contract at \$233,472 for construction of the 34-mi. Foster Creek-Columbia River section of the Foster Creek-Snohomish 230-kv. transmission line. Award was made by the Bonneville Power Administration.

Fred J. Early, Jr., Co., Inc., bid low at \$1,567,126 before the General Electric Company, which, with approval of the Atomic Energy Commission, will award the contract for constructing waste disposal facilities at the Hanford works.

Grays Harbor Construction Co., Aberdeen, with a bid of \$367,281, was low before the Corps of Engineers for the construction of the Westhaven breakwater.

Peter Kiewit Sons' Co., Omaha, submitted the low bid of \$2,176,813 to the Corps of Engineers for construction of the 1st phase of Chief Joseph Dam on the Columbia River, to include excavation for the north end of dam and construction of .4 mi. of cofferdam.

Joe Lundberg Construction Co., Seattle, submitted the low bid of \$220,279 to the Kirkland City Council for installation of a storm relief sewer, pumps, motors and work in the treatment plant of the Kirkland sewer plant.

H. B. Werner and F. W. Riddle, Eugene, Ore., were joint low bidders at \$436,238 for construction of 8 divisions of the 5-mi. Olympia intercepting sewer system.

Wyoming

England and Roth Construction Co., Rapid City, S. D., with a bid of \$370,966, was low bidder for grading, surfacing, and bridge work over the Little Powder River and on Gillette-Broadus Rd., Campbell County, Wyo.

J & J Construction Co., Oklahoma City, with a bid of \$587,440, was low before the Bureau of Reclamation for construction of 115-kv. transmission line on Missouri River Basin Project, between Alcova and Boysen.

Lichty Construction Co., and **Brasel & Whitehead**, Riverton, Wyo., were awarded a \$96,290 contract for construction of a buried asphaltic membrane lining near Riverton, Wyo.

Knisely-Moore Construction Co., Douglas, Wyo., with a bid of \$167,340, was low bidder on 6.7 mi. base course surfacing and roadmix treatment, including a stone chip seal coat on 28 mi. of road in Campbell County, between Gillette and Douglas.

Northwestern Engineering Co., Rapid City, S. D., was awarded a \$185,923 contract for 11.4 mi. base course surfacing and plant-mix work on the Midwest-Casper Rd., Natrona County, Wyo.

Taggart Construction Co., Cody, Wyo., was awarded a \$298,873 contract for 9.8 mi. grading, draining, roadmix surfacing, and bridge work on the Basin-Worland Rd., Washakie County, Wyo.

Alaska

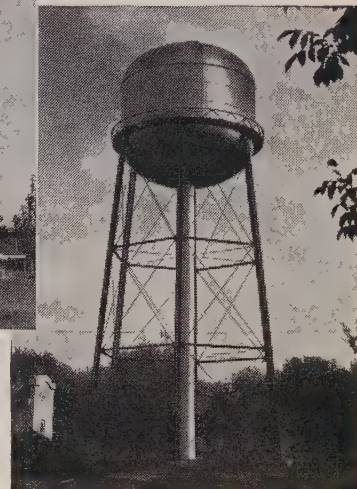
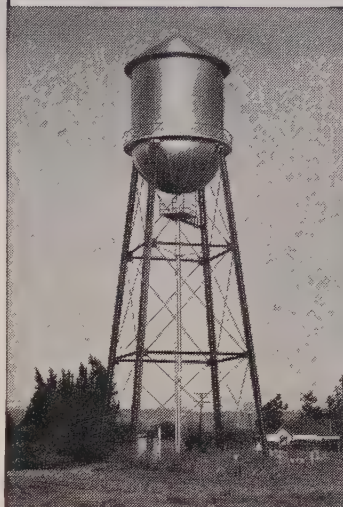
Morrison-Knudsen Co., Inc., Seattle, with a bid of \$942,560, was awarded a contract for construction of a 3-story, 62 by 121 ft. addition to St. Joseph's Hospital, to be of reinforced concrete, at Fairbanks. Owners of the hospital are the Sisters of Charity of Providence. In addition, Morrison-Knudsen was low bidder at \$2,238,000 for construction of the Galena military project at Galena, before the Alaska Corps of Engineers.

Munter Constuction Co., Seattle, with a bid of \$297,900, received a contract for construction of three bridges on the Glenn Highway, at Peters Creek, Matanuska River, and Tolsona Creek; and construction of the Gakona River Bridge on the Tok Highway, and the Shaw Creek Bridge on Richardson Highway.

Patti-McDonald Construction Co., St. Louis, was awarded a \$4,812,503 contract for construction of type A, government design, family housing units at Fort Richardson.

MODERN WATER STORAGE

for Every Municipal Demand!



ELEVATED STEEL

TANKS by

Pittsburgh • Des Moines

Pittsburgh-Des Moines Elevated Steel Tanks are built in types and sizes covering the entire range of municipal water storage requirements. When you consult with a P-DM engineer, you benefit by our half-century of experience in elevated steel tank construction for cities and towns throughout America. When your P-DM Tank is installed, you gain in better water service at lower cost—unfailing dependability—guaranteed satisfaction! Write!

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PLANTS AT SANTA CLARA, PITTSBURGH and DES MOINES

Sales Offices at:

SANTA CLARA, CAL. . . 627 Alviso Road	SEATTLE 928 Lane Street
PITTSBURGH . . . 3420 Neville Island	DES MOINES 921 Tuttle Street
NEW YORK . Room 919, 270 Broadway	DALLAS . . . 1225 Praetorian Building
CHICAGO . . . 1224 First National Bank Building	

NEWS *of* DISTRIBUTORS AND FACTORY BRANCHES

A reorganization of the management of the Industrial Equipment Division of *Lang Co.*, Salt Lake City, Utah, places RICHARD H. RAMPTON as new division manager in complete charge of all operations. With



RAMPTON

TAYLOR

Lang for four years, Rampton was formerly the assistant division manager. He replaces WALTER W. KERSHAW. J. VERNE TAYLOR becomes sales manager of the division. LAMAR W. MIDGLEY becomes assistant to the division manager.

★ ★ ★

VIRGIL G. GREENLEY has recently joined *Pioneer Rubber Mills* as the firm's San Francisco District Sales Manager. He will direct the sales of Pioneer mechanical rubber products in Northern California and Nevada.

★ ★ ★

The Osgood Co. and General Excavator Co. of Marion, Ohio, has installed a large stock depot at 450 Bayshore Blvd., San Francisco. This is also the location of the

firm's Northern California distributor—*Standard Machinery Co.* Eight states will be serviced from the depot. They are California, Oregon, Idaho, Washington, Arizona, Utah, Nevada and New Mexico. ORVILLE OSBORN will be service manager and PAUL ROBERTS will be parts manager. Both men have come directly from the firm's factory at Marion. FRANK L. JOHNSON is Western Division sales manager.

★ ★ ★

R. P. TYLER, vice president and general sales manager of *Macwhyte Co.*, Kenosha, Wis., was a recent visitor to the West. GEORGE WILDER, assistant to the president, accompanied him.

★ ★ ★

ALFORD R. SMITH, president of *Heil Equipment Co.*, San Francisco, announces his firm's appointment as distributor for the *Ven Corp.*, Los Angeles, manufacturer of the Ven Tailgate Loader. The loader is manufactured in sizes for ½, ¾ and 1-ton trucks.

★ ★ ★

DON SEE, who has been with *Peterson Tractor & Equipment Co.*, San Leandro, Calif., for the past 5 years, replaces BILL BEATTY to serve all of the firm's industrial accounts in San Mateo County, Calif.

★ ★ ★

DONALD K. JOHNSON, formerly with *Bucyrus-Erie Co.* at the firm's South Milwaukee headquarters office, is now located at Spokane, Wash. He will cover general construction work with Bucyrus-Erie distributors as follows: *Intermountain Equipment Co.* in the Spokane and Idaho areas, and *Westmont Tractor & Equipment Co.*

THE FIFTH EDITION of the "Compilation of Rental Rates for Construction Equipment" is now available from the Executive Office, Associated Equipment Distributors, 360 North Michigan Ave., at \$3.00 per copy. Monthly, weekly and daily rental rates on 266 major items of construction equipment are included in the compilation. Information on which the compilation is based was secured from equipment distributors throughout the United States and represents over-all averages of rental rates actually charged to them. Any contractor, distributor or manufacturer who has an interest in securing information about the rental of construction equipment generally available on the market will find the compilation of great value.

and *Great Northern Tool & Supply Co.* in Montana. His work will be associated with the Bucyrus-Erie branch office in Seattle.

★ ★ ★

R. C. HELLIWELL has been named by *Intermountain Equipment Co.*, Spokane, Wash., as the firm's regular representative covering the Chief Joseph project at Bridgeport, Wash. He has been with the firm for the past 1½ years on special sales assignments.

★ ★ ★

CLIFFORD E. BECKMAN has joined the sales organization of *Seitz Machinery Co.*, Billings, Mont., according to MELVIN SEITZ, president. He will work the northern Montana territory. Previously, he was associated with Flesch-Miller Co. of Indianapolis, Ind.

★ ★ ★

WILLIAM "PAT" PATTERSON has joined the sales staff of *Bay Cities Equipment Inc.*, Oakland, Calif., according to HOWARD STILLEY, sales manager. Patterson will cover the San Francisco and peninsula territory.

★ ★ ★

FLOYD ANDERSON, service engineer for the *J. D. Adams Manufacturing Co.*, has spent several weeks with the firm's distributors in the West.

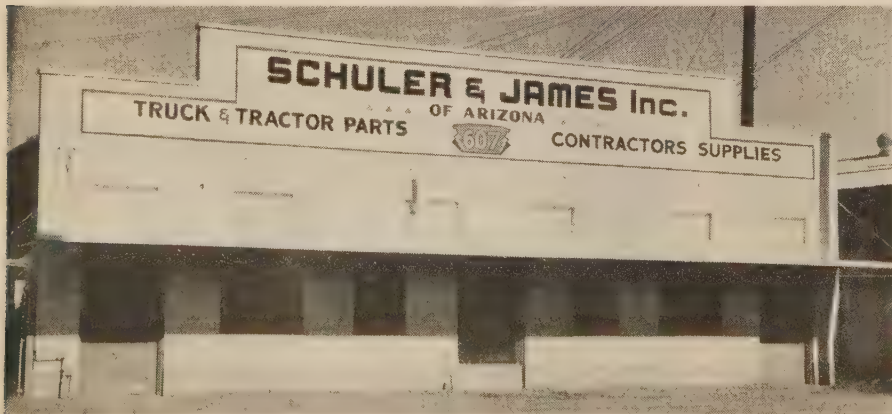
★ ★ ★

Appointment of *Westmont Tractor & Equipment Co.*, Missoula, Mont., as distributor for the all-hydraulic Hydrocrane has been announced by the manufacturer *Bucyrus-Erie Co.*, South Milwaukee, Wis. Westmont will sell and service the Hydrocrane in 12 counties along Montana's western border and in Glacier National Park. The firm has the Hydrocrane available in two sizes—the H-2, a ¼-cu. yd. or 2-ton machine, and the H-3, rated at ⅜-cu. yd. or 3-ton.

★ ★ ★

Appointment of FRANK S. FOSTER as assistant sales manager, Western Division of *Caterpillar Tractor Co.* has been announced by H. H. HOWARD, director of sales. Foster replaces TRUMAN E. SAGE who has joined *Northern Commercial Co.* in Seattle, Caterpillar distributor for Alaska. The new Western assistant sales manager

SCHULER & JAMES, INC., OF ARIZONA, has moved into modern new quarters at 607 North 19th Ave., Phoenix. The new building provides the firm with 7,500 sq. ft. of warehouse space plus offices and order department. Personnel at the new store include: John G. Baehr, president; Hugh A. Hall, vice president; Robert Rasmussen, manager; Ralph Hakala, secretary-treasurer, and Eugene Elgas, order department manager. Other Schuler & James offices in Los Angeles and San Francisco.

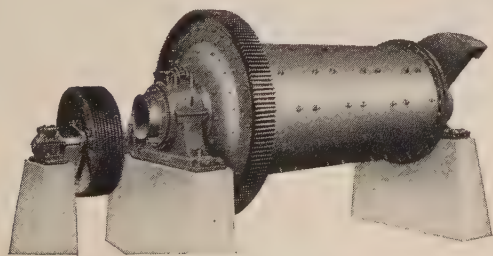


WHEN THE “Sands of Time” ARE RUNNING OUT

you'll be thankful for
the **DEPENDABILITY** of
TRAYLOR STONE CRUSHING MACHINERY

Failure to keep contract work moving on schedule can cost you thousands of dollars in wages and penalties. Concreting operations will never slow down for lack of approved aggregate . . . *and sand* . . . if Traylor Stone Crushing Machinery is on the job. For almost half a century, Traylor equipment has been the reliable standby of quarry operators all over the world. Its reputation for dependability has been built on the bed-rock of field performance. Traylor's complete line of stone crushing machinery . . . gyratory, jaw, reduction crushers, and rod mills . . . makes it possible to take advantage of Traylor economy and reliability through all stages of aggregate production from run-of-quarry rock to sand.

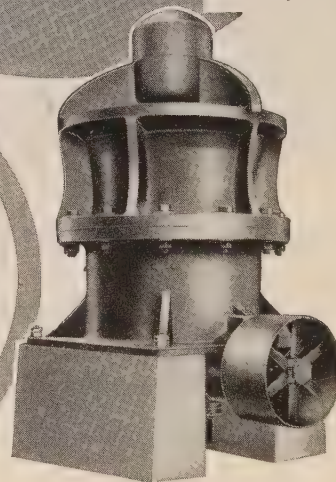
If you are considering the possibility of job-produced aggregate, it will pay you to discuss your requirements with a Traylor sales engineer. He can design an aggregate plant “Traylor-made” to fit your needs. No obligation . . . just drop us a line today.



TRAYLOR ROD MILLS
are built to meet
individual requirements.

ALL TRAYLOR CRUSHERS

are equipped with Traylor's famous curved crushing surfaces. This *exclusive* feature eliminates choking and packing . . . insures dependable, continuous production of uniform, cubical aggregate.



TRAYLOR ENGINEERING & MANUFACTURING CO.
351 Mill St., Allentown, Pa.

West Coast Branch: 919 Chester Williams Bldg., Los Angeles, California.
Northwest Distr.: Balzer Machinery Company, 2136 South East 8th Ave.,
Portland, Oregon.

Traylor
Jaw, Reduction and Gyratory Crushers
Rod Mills • Crushing Rolls
Apron and Grizzly Feeders

A “TRAYLOR” LEADS TO GREATER PROFITS

**TRAYLOR
GYRATORY CRUSHERS**
7 sizes for primary reduction
in plants requiring
large daily capacity.



**TRAYLOR
JAW CRUSHERS**
15 sizes for primary reduction
in average size plants.



**TRAYLOR
REDUCTION
CRUSHERS**
6 sizes for
secondary reduction

joined the general sales department of Caterpillar in March, 1945 as a consultant; was named manager of the sales and service division the same year, and in 1948 became assistant Eastern sales manager. GORDON J. FOWLER, Western Division district representative since 1946, has been promoted to assistant sales manager, Eastern Division.

★ ★ ★

C. F. "CLINT" HALLADAY, president of *Associated Equipment Distributors*, has named the members of the organization's nineteen standing committees for 1950. Chairmen of five of these committees are Westerners. They are: Joint AED-AGC Committee, J. A. BENSON, *Benson Tractor*

NEWS of DISTRIBUTORS AND FACTORY BRANCHES

Co., Houston; Membership Committee, R. L. ARNOLD, *Arnold Machinery Co.*, Salt Lake City; Planning and Promotion Committee, G. W. GAGEL, *Machinery & Supplies Co.*, Kansas City, Mo.; Publications Policy Committee, A. F. GARLINGHOUSE, *Garlinghouse Bros.*, Los Angeles; Standardization of Repair Parts Books Committee, P. A. DUFFORD, *Intermountain*

Equipment Co., Boise, Idaho. The Advisory Board of AED is comprised of: W. W. BUCHER, Chairman, *R. E. Brooks Co.*, New York City; A. F. GARLINGHOUSE; M. R. HUNTER, Sr., *Hunter Tractor & Machy. Co.*, Milwaukee, Wis.; J. S. GILMAN, *Wm. H. Ziegler Co.*, Minneapolis, Minn.; and G. W. VAN KEPPEL, *G. W. Van Keppel Co.*, Kansas City, Mo.

★ ★ ★

The appointment of ALFRED WHITTAKER as Pacific Coast manager, Woven Wire Fabrics Division of *John A. Roebling's Sons Co.*, has been announced by S. K. HORNOR, manager of sales. His territory includes California, Washington and Oregon, as well as Nevada, Arizona, Idaho and New Mexico. Whittaker will make his headquarters at the Los Angeles office of *John A. Roebling's Sons Co. of California*.

★ ★ ★

Air-Mack, Seattle, Wash., has been named as agent for the *Gardner-Denver Co.*, Quincy, Ill.

★ ★ ★

JAMES R. PATTERSON succeeds C. S. FERGUSON, resigned, as West Coast manager of the Chemicals Division of *General Electric Company's Chemicals Division* at Anaheim, Calif. He will have charge of engineering, manufacture and sales of the division's products in the entire West.

★ ★ ★

The appointment of H. H. (HENRY) CROWDER as Southwestern District Manager for the *Lull Manufacturing Co.*, Minneapolis, Minn., was recently announced by L. H. LULL, president of the company. He will make his headquarters at Dallas, Tex., and will work with Lull distributors in Texas, Arkansas, Louisiana, Oklahoma and New Mexico.

★ ★ ★

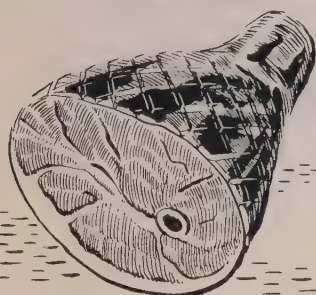
The *Euclid Road Machinery Co.* of Cleveland has appointed H. P. BEHL as district representative in the Northeastern California territory, which includes a major part of Nevada. A. E. SORESEN continues as manager of the Euclid branch at Emeryville, Calif. Behl was sales office manager at Cleveland and special representative in the sales development department prior to this appointment. He will make his residence in Sacramento.

★ ★ ★

Announcement has been made of the appointment of C. H. MCINTYRE as salesman representing *The Republic Supply Co.* in the Sacramento, Calif., area. R. W. JOHNSON, vice-president in charge of sales, in making the announcement, stated that McIntyre will be working directly out of the Oakland headquarters. "Chuck" McIntyre has been with Republic Supply for over eleven years, and for the last four years has been a salesman in the Bakersfield area.

★ ★ ★

Shepherd Tractor & Equipment Co. of Los Angeles, Caterpillar distributor, was well represented at a series of sales conferences held recently by *Caterpillar Tractor Co.* at Stockton, Calif., birthplace of the track-type tractor. JACK HENDRICK-



HAM and CONCRETE BOTH NEED CURING

HUNT PROCESS

Is The LEADING Concrete Curing Compound

The Name "HUNT PROCESS"

Means Unquestioned Acceptance By Engineers and Contractors

Write today for complete information

HUNT PROCESS COMPANY - 7012 Stanford - LOS ANGELES

DISTRIBUTORS

BOISE, IDAHO—J. G. Doerr
DALLAS, TEXAS—The Lofland Co.
DENVER, COLO.—Colorado Bldrs. Supply Co.
HONOLULU, T.H.—Grace Bros., Ltd.
KANSAS CITY, MO.—Carter-Waters Corp.
MEMPHIS, TENN.—John A. Denie's Sons Co.
OKLAHOMA CITY, OKLA.—R. C. Hardcastle Co.

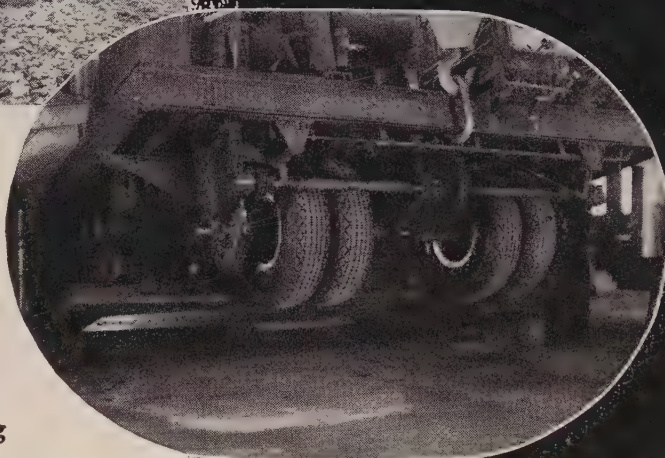
PHOENIX, ARIZ.—Baker-Thomas-Woolsey Wholesalers
PORTLAND, ORE.—P. L. Crooks & Co., Inc.
RENO, NEV.
SALT LAKE CITY, UTAH—American Asphalt Roof Corp.
SAN FRANCISCO, CALIF.—A. R. Reid Co.
SEATTLE, WASH.—Charles R. Watts & Co.
VANCOUVER, B. C.—A. E. Foreman & Sons

ANOTHER

AID to better STONE SPREADING



Right: Detail of rubber tired stone attachment.



HERE is A. I. Savin handling the stone spreading job on the New Hampshire Turnpike. This machine is equipped with the new Foote Rubber Tired Stone Attachment which replaces the rear Rollers, normally supplied for laying asphalt.

The Foote Rubber Tired Stone Attachment makes the full power of the four-wheel drive of the Adnun useable, assuring traction capable of handling heavy aggregate trucks. In addition it eliminates the chances of pitting rear rollers when laying large stone.

Here is another of the many plus advantages that make the Adnun more versatile than any other black top paver. Your Adnun lays any type of black top, hot or cold, *plus* stone, slag, sand or soil cement. Don't buy a one-purpose Black Top Paver. We will be glad to send you more details.

Are you pouring concrete? Ask for the booklet, "How Would You Do These Jobs?" It tells about the time and labor savings possible with the Foote HighLift Boom.

THE FOOTE COMPANY, INC.
Subsidiary of Blaw-Knox Co.
Nunda, New York

ADNUN

TRADE MARK REGISTERED

BLACK TOP PAVER

WESTERN MACHINERY COMPANY
Phoenix, Arizona

C. H. GRANT COMPANY
San Francisco, California

LIVELY EQUIPMENT COMPANY
Albuquerque, New Mexico

CONTRACTORS EQUIPMENT COMPANY
Portland, Oregon

LEROI-RIX MACHINERY COMPANY
Los Angeles, California

COLORADO BUILDERS' SUPPLY CO.
Denver, Colorado

LANG COMPANY, INC.
Salt Lake City, Utah

AIR-MACK EQUIPMENT CO.
Seattle, Washington

WESTERN EQUIPMENT COMPANY
Spokane, Washington; Boise, Idaho Falls, Idaho



NEWS of DISTRIBUTORS AND FACTORY BRANCHES

SON, HANK SWENSON, ANDY FRIEDRICH, VIRGIL HAYES, GROVER STETLER and ART EVANS all attended. Each reports the conference the best and most informative of its kind he ever attended. The conferences were arranged to give dealers and their sales personnel the opportunity to review up-to-the-minute sales and product application material.

☆☆☆

Appointment of *Pittsburgh-Des Moines Steel Co.* as an approved applicator for the Nelson stud welding method of installing corrugated steel and protected metal roofing and siding has been announced by C. A. FEGTLY, Pacific Coast manager of Pittsburgh-Des Moines. The franchise issued by the *Nelson Stud Welding Division of Morton Gregory Corp.* covers the southern San Francisco Bay region, and is designed to facilitate the use of this method in new construction and reroofing projects in this territory. Pacific Coast headquarters of Pittsburgh-Des Moines Steel Co. is located in Santa Clara, Calif.

☆☆☆

Chain Belt Co. of Milwaukee recently announced the appointment of ROBERT R. HORTON as Midwest District Manager for the Construction Machinery Division of the company. He will continue to maintain his headquarters at the home office of the firm in Milwaukee. The Construction Machinery Division of Chain Belt Co. manufactures Rex Mixers, Moto-Mixers, Pavers, Pumpcretes and De-watering Pumps.

☆☆☆

Election of F. S. NICKERSON as vice-president of *Mack-International Motor Truck Corp.*, and his appointment as manager of the company's Central Division Sales territory is announced by A. F. FENNER, vice-president and general sales manager for Mack's Central, Southwest and Western Divisions. Nickerson will make his headquarters in Mack's Chicago office.

NEWS of MANUFACTURERS

Joy Manufacturing Co., Pittsburgh, Pa., recently announced the appointment of DARRELL SMITH as manager of distributor sales, with offices in Pittsburgh. His broad knowledge of Joy products and their application to the construction markets stems from 25 years of field service.

☆☆☆

L. H. LULL, president of *Lull Manufacturing Co.*, Minneapolis, Minn., announces the appointment of HERBERT C. LULL as sales manager of the company, in which capacity he will direct the sales promotion of all products manufactured by the com-

UNIT BID SUMMARY

Dam . . .

Oregon—Lane County—Corps of Engineers—Earth Embankment

Morrison-Knudsen Co., Inc., Peter Kiewit Sons' Co., Macco Corp., Boise, Idaho, with a bid of \$18,696,031, were low before the Portland District, Corps of Engineers, for completion of the earth embankment dam structure and construction of the concrete spillway structure, including construction of appurtenances, for Lookout Point Reservoir on the Middle Fork, Willamette River, about 23 mi. southeast of Eugene. Unit bids were submitted as follows:

(1) Morrison-Knudsen Co., Inc., Peter Kiewit Sons' Co., Macco Corp.	\$18,696,031
(2) Winston Bros. Co., Raymond Concrete Pile Co., Foley Bros., Inc., Yount Constructors, Inc., Al Johnson Construction Co.	19,892,713
(3) J. A. Jones Construction Co., Wunderlich Contracting Co., Chas. H. Tompkins Co., Inc.	20,778,214
(4) C. F. Lytle Co., Amis Construction Co., Massman Construction Co., Kansas City Bridge Co., S. J. Groves & Sons Co., San Ore Construction Co.	21,295,780
(5) Guy F. Atkinson Co., Inc., Bressi & Bevanda Constructors, Inc., W. E. Kier Construction Co., A. Teichert & Sons, Inc.	21,856,082
— The Arundel Corp., L. E. Dixon Co., American Pipe & Construction Co.	21,964,412
— United Construction Co., Western Contracting Corp., Condon-Cunningham Co.	23,220,504
— Meridan Dam Constructors (Stolte, Inc.; Parish Bros.; Fred J. Early, Jr., Co., Inc.; The Duncanson-Harrelson Co.; United Concrete Pipe Corp.; Ralph A. Bell; Haas & Rothschild)	23,298,189
(6) Engineer's Estimate	18,980,375

EXCAVATION AND EMBANKMENT

	(1)	(2)	(3)	(4)	(5)	(6)
1,500 ac. ft. dewatering	42.00	18.00	50.00	25.00	5.00	14.48
1 job diversion of water	\$180,000	\$200,000	\$150,000	\$367,963	\$475,000	\$96,540
1 job clearing	\$602,000	\$750,000	\$400,000	\$807,000	\$960,000	\$804,690
1 job salv. merchantable timb. (credit to the govt.)	500.00	\$6,000	\$5,000	\$6,000	\$2,500	\$8,950
60,000 cu. yd. stripping quarry site	1.55	1.80	3.00	.47	1.50	2.07
606,000 cu. yd. com. excav. for embank. foundn.	.40	.75	.70	.56	.75	.39
5,000 cu. yd. solid rk. excav. for embank. foundn.	3.40	5.70	10.00	3.41	1.50	2.79
8,600 cu. yd. excav. and grading for access roads and railroad	.65	1.10	.50	.55	.60	.47
400,000 cu. yd. stripping borrow areas	.34	.45	.30	.59	.21	.56
90,000 cu. yd. excav. from stockpiles	.45	.60	.30	.78	.42	.49
34,000 cu. yd. com. excav. for spillway struct.	.50	.75	.50	.74	.69	.50
56,000 cu. yd. solid rk. excav. for spillw'y struct.	2.60	2.50	5.00	1.96	2.10	3.13
40,000 sq. yd. final foundn. cleanup for spillway struct.	2.70	3.00	5.00	2.35	4.32	1.80
1,000 sq. ft. line drilling	1.50	1.25	5.00	1.56	1.25	1.16
27,000 cu. yd. struct. backfill, in place	.45	.75	.50	.39	.40	.39
1,179,000 cu. yd. embankment, imperv. zone, in pl.	.78	.74	.70	.75	.70	.915
5,733,000 cu. yd. embank., random gravel zone, in place	.42	.645	.50	.58	.47	.535
70,300 cu. yd. compacted fill for railroad emb., in place	.35	.10	.25	.12	.10	.12
1,000 roller hrs. additional rolling	12.50	10.00	10.00	7.50	12.50	12.80
92,700 cu. yd. uncompacted fill for railroad emb., in place	.20	.05	.15	.05	.05	.09
146,400 cu. yd. uncompacted fill for earth dam berms, in place	.10	.05	.20	.05	.06	.14
138,000 cu. yd. filter zone, in place	2.00	2.00	2.00	2.74	1.90	1.94
64,300 cu. yd. dumped stone revetment, in pl.	1.80	1.10	4.00	2.35	2.00	2.35
60,000 cu. yd. rock toe, in place	.60	1.10	.50	.23	.75	.40
30,000 cu. yd. rock fill, in place	.30	1.10	1.00	.47	1.25	.54
29,000 M gal. sprinkling	1.80	2.00	2.50	1.50	1.90	2.20
2,500 cu. yd. roadway surfacing	2.80	1.00	5.00	3.10	2.20	2.00
20 acre seeding	50.00	200.00	100.00	109.50	110.00	54.50
10,000 cu. yd. topsoiling	1.10	.70	1.00	.63	.60	.86
660 lin. ft. guard rail, in place	3.40	2.70	5.00	3.60	2.80	3.20
33 ea. sight posts, in place	13.00	8.00	15.00	12.00	12.00	9.00
1 job installation of two settlement gauges	\$3,400	\$5,700	\$10,000	\$5,793	\$8,000	\$14,485

FOUNDATION EXPLORATION AND GROUTING

600 lin. ft. drilling grout holes (1½-in. dia.) depth 0 to 50 feet	2.00	2.50	5.00	1.80	3.00	2.72
300 lin. ft. drilling grout holes (1½-in. dia.) depth 50 to 100 ft.	2.00	2.50	5.00	1.80	3.50	3.29
150 lin. ft. drilling grout holes (1½-in. dia.) depth 100 to 150 ft.	2.00	2.70	5.00	1.90	5.50	3.40
500 lin. ft. drilling NX exploratory core drill holes, depth 0 to 50 ft.	10.00	5.50	7.00	6.10	5.50	7.80
200 lin. ft. drilling NX exploratory core drill holes, depth 50 to 100 ft.	10.00	5.50	7.00	6.10	6.00	8.80
100 lin. ft. drilling NX exploratory core drill holes, depth 100 to 150 ft.	10.00	5.50	8.00	6.10	6.00	9.20
450 lin. ft. drilling and casing overburden	7.70	5.50	8.00	6.10	8.00	9.00
500 bag pressure grouting	4.60	2.65	5.00	1.90	2.00	2.70
5 job minimum paymt. for pump conn. and pressure grouting	5.00	5.00	5.00	5.00	5.00	5.00
24,000 lb. misc. pipe and fittings for grouting, and drainage, in place	.70	.70	.50	.75	.40	.53

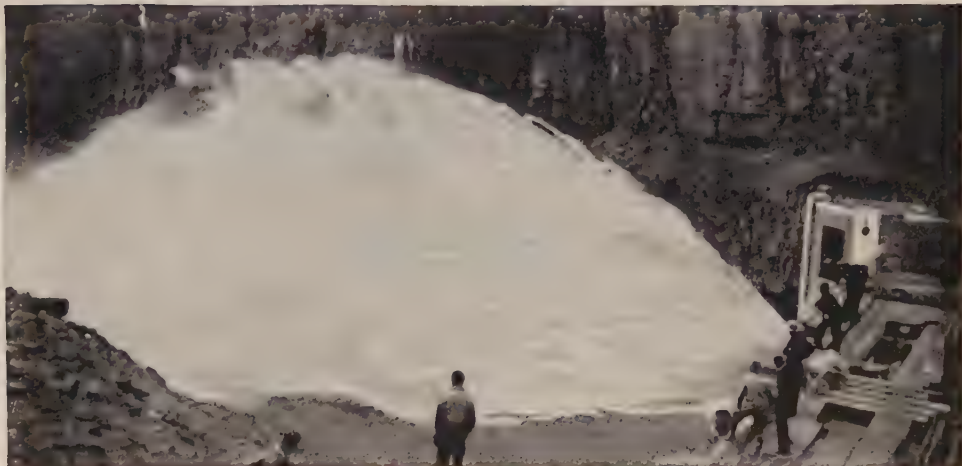
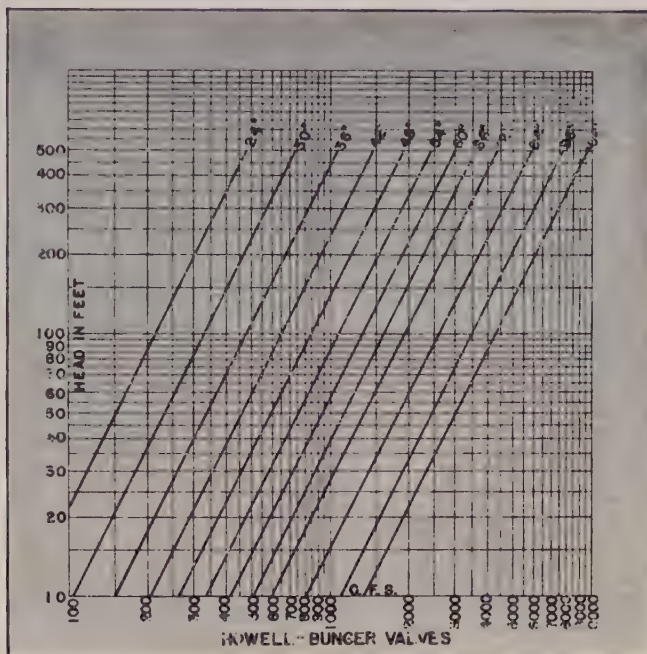
CONCRETE WORK

662,000 bbl. cement, Portland, Type II or IIA	4.50	4.15	4.25	4.40	4.40	4.86
731,500 cu. yd. concrete, mass	9.90	10.35	12.00	11.30	12.12	9.06
19,400 cu. yd. conc., gravity retaining wall	15.00	11.15	15.00	14.70	18.50	13.35
19,400 cu. yd. conc., grav. retain. wall upstream	15.00	11.80	15.00	15.90	19.50	11.85
52,000 cu. yd. conc., stilling basin walls	15.00	10.40	15.00	14.70	19.75	12.80
17,600 cu. yd. conc., stilling basin slab	68.50	51.00	60.00	75.00	100.00	64.30
1,500 cu. yd. conc., trash rack structure	31.00	18.70	20.00	24.30	42.00	19.30
5,900 cu. yd. conc., piers	64.50	34.00	50.00	50.00	68.00	43.00
3,700 cu. yd. conc., structural	13.30	35.00	30.00	20.00	14.00	15.15
1,000 cu. yd. conc. for imperv. zone	10.15	10.25	20.00	13.30	14.00	13.50
2,200 cu. yd. conc. for concreted revetment	1.50	1.30	2.00	1.15	1.10	1.61
23,000 lin. ft. drill. for and grout. anchor bars	8.00	1.00	3.00	4.70	3.50	3.90
500 lin. ft. 6-in. diam. porous conc. drain tile, in place	3.40	1.50	2.50	3.15	3.00	3.34
4,700 lin. ft. 8-in. diam. open joint drain tile, in place	1.30	1.35	1.75	2.10	2.00	1.41
18,500 lb. copper water and grout stops, in place						

(Continued on next page)



for **FREE DISCHARGE**
These Pictures *and* Graph
Tell the Story-



Howell-Bunger Valve

*If It's Hydraulics~
Put It Up to Us!*

HIGH DISCHARGE efficiency, simplicity of design and low cost are the outstanding advantages of this unusual Valve, described in Bulletin No. 144. Send for it.

S. MORGAN SMITH Co.
YORK, PENNA. U.S.A.

NEWS of MANUFACTURERS

pany and will supervise the work of its sales representatives. Another recent appointment was that of PAT LAMB as West Coast sales representative, with headquarters at Fullerton, Calif. He will work with Lull distributors in California, Oregon, Washington, Idaho, Nevada and Arizona. Before coming to the Lull company, Lamb was associated with *Industrial Equipment Co.* of Los Angeles as sales manager.

☆☆☆

O. G. MANDT, president of *Mandt Manufacturing Co.*, formerly located at Columbus, Ohio, announced moving of the firm's general offices to 10421 Haggerty Ave., Dearborn, Mich., where all production has been affiliated with that of the *Transmission & Gear Co.* of that city. The latter company has been supplying transmissions, axles and drives for truck mixers, cranes and loaders used in heavy construction, to Mandt for its swing loaders and excavators. Under the new arrangement, all engineering and manufacturing are by the *Transmission & Gear Co.*, which has completed an additional factory devoted entirely to the assembly of Mandt units.

☆☆☆

The appointment of JAY BARBEAU as traffic manager of the *Kaiser Gypsum Division of Kaiser Industries, Inc.*, Oakland, has been announced by CLAUDE HARPER, general manager.

☆☆☆

EDWARD W. STEPHENS, 51, manager of belting sales for *The Goodyear Tire & Rubber Co.*, Akron, Ohio, died May 8 following a long illness. Stephens, an engineer with imagination and creative ability, designed conveyor belts for some of the biggest construction jobs of recent years, including Grand Coulee, Shasta and Anderson Ranch dams, as well as Bull Shoals dam now under construction with the aid of a 7-mi. conveyor belt designed by Stephens.

☆☆☆

T. C. CARTER, vice president of *Great Lakes Carton Corp.* of Los Angeles, one of the major processors of perlite in the United States, has announced that volcanic perlite ore, prepared for furnacing to any specification, is now available from the company's deposit at Socorro, N. Mex. Extensive facilities, including equipment for milling, screening, classifying and drying, have been installed to make this service possible. Large storage bins which will carry stocks of prepared ore in various sizes have been provided.

☆☆☆

H. C. RAMSEY, president of *Worthington Pump & Machinery Corp.*, Harrison, N. J., recently announced that WALTER H. FELDMANN resigned as president of the corporation's subsidiary company, *Electric Machinery Mfg. Co.*, of Minneapolis, and was named vice-president in charge of sales for Worthington. At the same time, JOHN J. SUMMERSBY became vice-

STRUCTURAL STEEL AND MISCELLANEOUS METAL WORK

17,000 lb.	parapet handrailing, in place.....	.65	.40	.50	.565	.45	.46
2,500,000 lb.	steel reinf. in place.....	.10	.095	.10	.13	.125	.10
88,000 lb.	corrosion resisting steel, in place.....	.66	.66	.60	.772	.64	.62
250,000 lb.	struct. steel for bridge, in place.....	.14	.14	.12	.188	.18	.15
64,000 lb.	struct. steel fixed and embedded, in pl.	.21	.18	.20	.28	.22	.24
61,000 lb.	steel stairs and ladders, in place.....	.51	.50	.40	.631	.40	.38
820,000 lb.	fabricated steel penstocks, in place.....	.24	.24	.25	.355	.26	.28
96,000 lb.	fabricated steel vent pipe, in place.....	.32	.30	.25	.313	.30	.29
40,000 lb.	misc. metal, in place.....	.55	.50	.50	.646	.46	.51
29,000 lb.	pipe handrailing, in place.....	.60	.44	.50	.642	.50	.41
8,000 lb.	welded steel tanks, in place.....	.36	.28	.30	.454	.32	.33
39,000 lb.	cast iron pipe and fittings, in place.....	.43	.27	.30	.407	.35	.40
58,000 lb.	misc. steel pipe, valves and fittings, in place.....	.50	.29	.30	.50	.44	.39
1 job	six 24-in. penstock filling valves, 3 manually operated and 3 motor operated, compl. with motors, starters and disconnecting equipment, in place.....	\$19,000	\$16,000	\$12,000	\$26,600	\$24,000	\$14,950

INSTALLATION OF GOVERNMENT FURNISHED EQUIPMENT

1 job	install. of 4 tainer regulating valves	\$13,200	\$27,000	\$15,000	\$21,138	\$30,000	\$22,400
1 job	install. of hydraulic piping, and fittings	550.00	130.00	1,000	780.00	\$3,000	\$2,445
1 job	installation of air compressor compl.	455.00	650.00	500.00	780.00	\$1,000	\$1,150
1 job	install. of emerg. generator, compl.	885.00	1,300	500.00	780.00	\$1,250	\$1,190
1 job	install. of sump pumps, compl.	250.00	1,300	1,000	\$1,565	\$1,500	\$1,555
307,000 lb.	install. of gate guides and seal frames for penstocks and outlets.....	.09	.07	.15	.09	.11	.15
206,000 lb.	install. of crest gate anchorages and trunnion girders.....	.10	.07	.10	.08	.09	.12

WATER AND SEWER SYSTEM

1 job	domestic water and sewer systems, complete.....	\$16,000	\$16,000	\$15,000	\$15,500	\$20,000	\$20,100
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BUILDINGS

1 job	elevator bldg., complete.....	\$8,500	\$15,000	\$10,000	\$16,000	\$16,000	\$5,050
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ELECTRICAL WORK

1 job	main power distribution switchboard and lighting panelboard.....	\$8,250	\$7,900	\$7,000	\$9,554	\$13,700	\$7,055
47,000 lb.	conduit, rigid steel, 1/2-in. to 3-in.....	.74	.80	.60	.86	.85	.70
100 lin. ft.	conduit, transite, embedded, 3-in.	1.50	3.50	1.50	3.90	1.25	2.58
360 lin. ft.	conduit transite, embedded, 4-in.	1.70	4.20	2.00	4.60	1.55	3.10
4,620 lb.	wire, copper, insulated.....	1.75	2.30	1.50	2.50	1.35	1.30
3,236 lb.	wire, copper, bare, and bar copper bare.....	2.00	1.25	1.00	1.50	1.50	1.00
50 lb.	boxes, sheet metal, galvanized.....	3.20	7.60	1.50	8.50	5.00	2.26
1,708 lb.	boxes, cast iron, galvanized.....	1.50	3.00	2.00	3.25	2.00	2.00
6 ea.	magnetic contactors, latch-in type.....	41.00	90.00	80.00	90.00	280.00	117.00
1 job	fixtures, lighting.....	\$6,600	\$8,300	\$7,000	\$9,150	\$10,106	\$6,260
1 ea.	transformer, 25 KVA 480-120/240 volts, 1 phase, 60 cycles, dry type.....	415.00	690.00	500.00	750.00	620.00	490.00
64 ea.	receptacles, plug, 480 volt, 3 phase, 4 pole, or 120 volt, 1 phase, 3 pole, with threaded cap housing.....	36.00	26.00	18.00	28.50	32.00	18.00
60 ea.	outlet, 120 volt, convenience or switch, with covers as required.....	11.00	11.80	5.00	13.00	9.00	11.75
36 ea.	1-in. by 15-ft. "Copperweld," or equal ground rod, incl. cable connectors, in place.....	22.00	73.00	25.00	80.00	30.00	28.25
500 lin. ft.	cable, parkway, 2-conductor No. 6, underground, in place.....	.65	2.40	1.50	2.50	1.55	3.68
2 ea.	street lighting standard compl., in pl.	140.00	290.00	250.00	313.00	325.00	198.00

Irrigation . . .

California—Stanislaus County—U.S.B.R.—Grading and Concrete

United Concrete Pipe Corp. and Vinnell Co., Baldwin Park, California, with a bid of \$1,504,907, were low before the Bureau of Reclamation as joint bidders on earthwork, concrete lining, and structures of the Newman Wasteway, sta. 1+40 to 148+25 service lateral. The work is located near Newman, and is part of the Central Valley Project, Delta-Mendota Canal. Unit bids were submitted as follows:

	Schedule 1	Schedule 2
(1) United Concrete Pipe Corp. and Vinnell Co.....	\$473,117	\$1,031,790
(2) A. Teichert & Son, Inc.....	427,139	1,122,715
(3) Haas & Rothschild.....	493,708	1,107,757
(4) Western Contracting Corp.....	460,851	1,189,334
(5) Morrison-Knudsen Co., Inc. and M. H. Hasler Construction Co.....	463,581	1,244,941
— Peter Kiewit Sons' Co.....	593,389	1,273,537
— Clyde W. Wood & Sons, Inc.....	466,922	
— P. & J. Artukovich, Inc.....	649,116	
(6) Engineer's Estimate.....	436,427	1,082,292

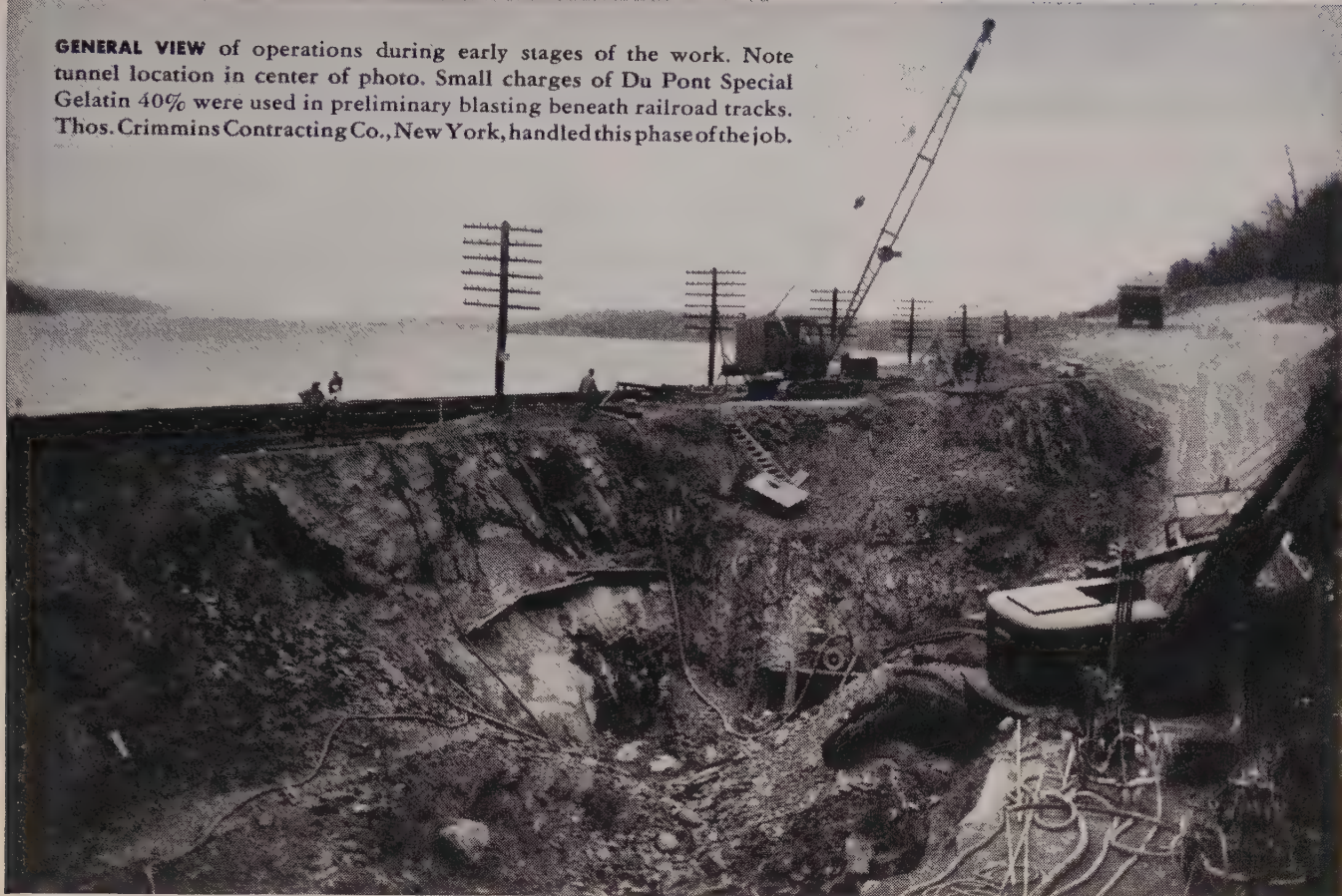
Stipulations: (1) Will not accept award of Schedule 1 without award of Schedule 2. If awarded both schedules together, deduct \$1.00 per cu. yd. from bid on concrete in structures, Schedule 2. (3) If awarded Schedules 1 and two together, deduct \$1.25 per cu. yd. from bids on concrete in structures, both schedules. (4) All or none. (5) All or none. (6) All or none.

SCHEDULE 1

	(1)	(2)	(3)	(5)	(5)	(6)
200,000 cu. yd. excavation for wasteway.....	.16	.17	.24	.24	.16	.20
100,000 cu. yd. overhaul.....	.02	.01	.10	.01	.01	.02
1,000 cu. yd. compacting embankments.....	.25	.15	1.00	.95	.44	.50
500 cu. yd. excav. for drainage channels and dikes.....	.40	.40	.50	.25	.50	.35
15,000 cu. yd. excav. for structs.....	.50	1.00	1.20	1.40	.80	.60
5,000 cu. yd. backfill about structs.....	.40	.40	.50	.55	.60	.50
6,500 cu. yd. backfill about vertical side walls of wasteway lining.....	.30	.30	.50	.35	.60	.50
2,600 cu. yd. compacting backfill.....	2.00	2.00	4.00	3.10	2.00	2.50
38,100 sq. yd. trimming earth found. for conc. lining.....	.60	.50	.60	.90	.45	.35
500 sq. yd. dry rock paving.....	6.00	6.00	10.00	6.50	5.00	6.00
90 cu. yd. grav. or rk. beddings under dry rk. pav.	6.00	7.00	10.00	8.00	5.00	6.00
550 cu. yd. gravel subbase under structs.....	6.00	6.00	6.00	6.50	5.00	5.00
1,330 cu. yd. conc. in structs.....	45.00	42.00	36.00	60.90	66.00	50.00
7,900 cu. yd. conc. in wasteway lining and side walls.....	23.00	19.00	22.00	15.90	20.00	18.00
13,900 bbl. furn. and handling cement.....	4.00	3.60	4.00	3.05	3.75	3.50
976,000 lb. furn. and placing reinf. bars.....	.09	.08	.086	.08	.078	.09
250 sq. ft. furn. and plac. elastic filler mat in joints.....	2.00	1.50	1.30	2.40	2.00	2.00

(Continued on next page)

GENERAL VIEW of operations during early stages of the work. Note tunnel location in center of photo. Small charges of Du Pont Special Gelatin 40% were used in preliminary blasting beneath railroad tracks. Thos. Crimmins Contracting Co., New York, handled this phase of the job.



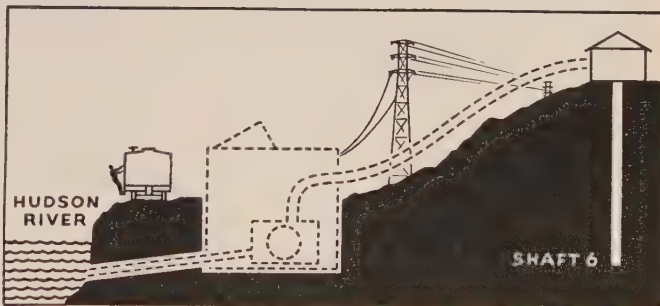
N.Y. "taps" the Hudson

ANOTHER JOB FOR DU PONT DYNAMITES

Contractors chose dependable Du Pont Special Gelatin 40% for all land-blasting operations in constructing an intake tunnel, chlorination plant, pump house and 700-foot pipe line—major sections of a \$3,000,000.00 N. Y. Board of Water Supply Project now under way at Chelsea, N. Y., where the Hudson River is being tapped to augment metropolitan New York's water supply.

Hard limestone, capped by a layer of varying thicknesses of shale, proved no obstacle for this versatile, widely used dynamite. Charges of just moderate size (because of proximity of busy railroad tracks) readily broke up the rock for easy removal by truck in driving the tunnel and excavating for building foundations. Du Pont Electric Blasting Caps also are used exclusively.

Whatever your job of construction . . . if large or small, "run of mill" or difficult blasting is required, there are Du Pont explosives and blasting supplies especially suitable for the work. Ask the Du Pont explosives representative in your area for complete information and recommendations. E. I. du Pont de Nemours & Co. (Inc.), Hoge Bldg., Seattle 4, Wash.—Midland Savings Bldg., Denver 2, Colo.—111 Sutter St., San Francisco 4, California.



DIAGRAMMATIC SKETCH of proposed 120-foot intake tunnel of 8-foot diameter, chlorination plant, pump house and upgrade pipe line to 680-foot Shaft 6 of existing Delaware Aqueduct Water System into which water from Hudson will be delivered. The Tuller Construction Co. and A. J. Dillenbeck, Red Bank, N. J., are general contractors.

DU PONT EXPLOSIVES

Blasting Supplies and Accessories



BETTER THINGS FOR BETTER LIVING . . . THROUGH CHEMISTRY

NEWS of MANUFACTURERS

president in charge of purchases; FREDERIC W. THOMAS became general manager of purchases; and CARLETON REYNELL, general representative, sales and purchasing departments.

☆☆☆

H. F. GARVIN PELSUE, former president of Metropolitan Sand & Gravel Co., New York City, and a past president of the National Ready Mixed Concrete Assn., is now associated with the *Jaeger Machine Co.*, Columbus, Ohio, in charge of research. He also heads Jaeger's advisory engineering service to ready mixed concrete producers. Pelsue was for 20 years in production and sales with Graham Brothers, Inc., of Los Angeles, including seven years as executive vice president before moving to New York in 1942.

☆☆☆

WESLEY L. GUILLES, who has just returned from Alaska and his duties as representative at the U. S. Air Force winter maneuvers for *Flexible Tubing Corp.*, Branford, Conn., has been named a technical representative for the firm, according to FREDERICK K. DAGGETT, president. JACK F. CHAPIN has been appointed development engineer for the company, in charge of product and process engineering.

☆☆☆

F. S. ELFRID, general manager of the explosives division of *Olin Industries, Inc.*, East Alton, Ill., has been elected a member of the firm's Board of Directors, according to JOHN M. OLIN, president. Elfred joined the Olin organization in 1937 as a member of its executive staff. He is also a member of the Board of Directors of the *Equitable Powder Manufacturing Co.*, East Alton. ROBERT W. LEA, president of *Johns-Manville Corp.*, has also been elected a member of the Olin Board of Directors.

☆☆☆

Definite plans by *Pioneer Engineering Works, Inc.*, of Minneapolis, Minn., to expand the scope of its sales and services to the lime and cement producing industries have been announced by K. E. BRUNSDALE, sales manager. Heading the increased activities in this field will be C. E. "SAM" LOVEWELL, who will serve as sales engineer for the company. A graduate civil engineer, Lovewell, for five years prior to joining Pioneer was chief engineer and sales manager for the Carney Company, Mankato, Minn. Because of his background and broad experience in various organizations of the industry, Lovewell is well qualified to discuss equipment needs with operators, superintendents and plant officials.

☆☆☆

W. A. ROBERTS, executive vice president of the *Allis-Chalmers Mfg. Co.*, Milwaukee, Wis., recently announced the appointment of FLOYD J. MISCHKE as export manager of the company's Tractor Division. Mischke succeeds M. J. PROUD, who died April 16 in San Jose, Costa Rica.

16 lin. ft. placing rubber water stops in joints.....	2.00	1.00	2.50	2.50	3.00	1.50
8 M.b.m. furn. and erect. untr. timber in struts.....	200.00	300.00	185.00	220.00	190.00	225.00
1 M.b.m. furn. and erect. tr. timber in struts.....	300.00	350.00	280.00	260.00	250.00	275.00
80 lin. ft. furn. and lay. 24-in. diam. std. str. conc. culvert pipe	6.00	6.00	6.50	5.80	12.00	6.50
3 mi. furn. and erect. right-of-way fence.....	\$1,000	900.00	\$1,000	\$1,050	\$1,100	\$1,000
10 gates furn. and install. 16-ft. metal fence gates.....	50.00	40.00	60.00	50.00	100.00	50.00
4,200 lb. installing misc. metalwork	.15	.15	.12	.15	.25	.20
570 lb. furn. and install. misc. metalwork	.50	.40	.50	.65	.50	.40

SCHEDULE 2

2,300,000 cu. yd. excav. of wasteway	.12	.15	.14	.11	.148	.13
26,000 cu. yd. excav. for lateral	.15	.16	.20	.30	.20	.35
100,000 sta. yd. overhaul	.02	.01	.10	.01	.01	.02
1,800 cu. yd. compacting embankments	.25	.15	1.00	.95	.44	.50
1,300 cu. yd. excav. for drainage channels and dikes	.40	.40	1.00	.35	.50	.30
74,000 cu. yd. excav. for struts	.60	1.00	1.20	1.40	.80	.60
26,000 cu. yd. backfill about struts	.40	.40	.50	.55	.60	.45
13,500 cu. yd. compacting backfill	2.00	2.00	3.00	3.10	2.00	2.50
4,300 sq. yd. dry rock paving	6.00	6.00	8.00	6.50	5.00	6.00
720 cu. yd. grav. or rk. bedding under dry rk. pav.	6.00	7.00	6.00	8.00	5.00	6.00
3,100 cu. yd. gravel subbase under struts	6.00	6.00	6.00	6.50	5.00	5.00
7,400 cu. yd. concrete in struts	46.00	42.00	39.00	58.90	66.00	45.00
11,100 bbl. furn. and handling cement	4.00	3.60	4.00	3.05	3.75	3.50
1,148,000 lb. furn. and placing reinf. bars	.09	.08	.086	.08	.078	.09
1,120 sq. ft. furn. and plac. elastic filler mat in joints	2.00	1.50	1.20	2.40	2.00	2.00
750 lb. furn. and plac. metal water stops in joints.....	1.00	.30	.60	.50	1.00	.40
211 M.b.m. furn. and erect. untr. timber in struts.....	200.00	300.00	185.00	220.00	190.00	225.00
24 M.b.m. furn. and erect. tr. timber in struts.....	300.00	350.00	280.00	260.00	250.00	275.00
2,950 lin. ft. manuf. and driving conc. piles.....	7.00	9.00	7.30	7.10	3.40	8.00
7,500 lin. ft. furn. treated timber piles.....	1.00	1.20	1.00	1.25	1.75	1.25
7,500 lin. ft. driving treated timber piles.....	1.00	1.50	2.00	2.00	1.25	1.50
160 lin. ft. furn. & lay. 15-in. diam. conc. culv. pipe	4.00	4.00	4.00	4.10	6.00	3.75
750 lin. ft. furn. & lay. 18-in. diam. conc. culv. pipe	5.00	5.00	5.00	4.60	7.00	4.50
275 lin. ft. furn. & lay. 24-in. diam. conc. culv. pipe	6.00	6.00	6.50	5.80	12.00	6.50
100 lin. ft. furn. & lay. 30-in. diam. conc. culv. pipe	7.00	8.00	8.00	7.10	16.00	8.50
160 lin. ft. furn. & lay. 36-in. diam. conc. culv. pipe	10.00	10.00	11.50	9.10	21.00	11.00
7 mi. furn. and erect. right-of-way fence.....	\$1,000	900.00	\$1,000	\$1,050	\$1,100	\$1,000
12 gates furn. and install. 16-ft. metal fence gates	50.00	40.00	60.00	50.00	100.00	50.00
165 lin. ft. furn. and inst. 24-in. diam. No. 3 gauge steel pipe	15.00	25.00	25.00	16.80	23.00	28.00
75 lin. ft. furn. and inst. 24-in. diam. No. 12 gauge steel pipe	12.00	12.00	13.00	10.90	15.00	8.00
165 lin. ft. furn. and inst. 36-in. diam. No. 3 gauge steel pipe	25.00	35.00	38.00	26.80	36.00	42.00
90 lin. ft. furn. and inst. 36-in. diam. No. 10 gauge steel pipe	15.00	18.00	19.00	15.20	21.00	16.00
211,000 lb. furn. and erecting struct. steel	.05	.06	.043	.07	.04	.10
2,100 lb. furn. and install. slide gates and gate hoists	.50	.50	.40	.50	.40	.40
27,000 lb. install misc. metalwork	.10	.15	.08	.15	.20	.20
6,300 lb. furn. and install. misc. metalwork.....	.50	.40	.45	.65	.40	.40

Bridge and Grade Separation . . .

Oregon—Lane County—State—Interchange

Tom Lillebo, Reedsport, Oregon, with a bid of \$462,124, was low before the Oregon State Highway Department for construction of the East Eugene Traffic Interchange, Bridge No. 7214 and approaches, on the Coburg County Road. Unit bids were submitted as follows:

(1) Tom Lillebo	\$462,124	(6) E. C. Hall Co.	\$511,752
(2) Charles C. MacClosky Co.	470,178	— Lee Hoffman	515,023
(3) State Construction Co.	500,812	— C. J. Montag & Son	529,097
(4) Lindstrom Bros.	501,193	— Birkemeier & Saremal	543,211
(5) J. G. Watts Construction Co.	505,700	— M. P. Butler & Carl M. Halvorson	573,176

FERRY STREET UNIT

	(1)	(2)	(3)	(4)	(5)	(6)
All specified, clearing and grubbing.....	\$3,000	\$1,200	\$2,750	\$3,900	\$5,000	\$2,000
1,360 sq. yd. removal of pavement.....	.90	1.00	1.25	.45	.90	.75
160 sq. yd. removal of walks and driveways.....	.90	2.00	1.25	.35	.90	.75
580 lin. ft. removal of curbs and gutters.....	.50	1.00	.80	.35	.50	.50
4 only removal of catch basins	15.00	50.00	16.50	35.00	15.00	50.00
70 cu. yd. structural excav., unclassified.....	3.50	6.00	3.85	3.50	3.50	3.00
40 cu. yd. trench excav., unclassified.....	3.50	7.00	3.85	3.50	3.50	3.00
28,000 cu. yd. borrow excav., unclassified.....	.32	.32	.35	.34	.32	.30
9,100 cu. yd. general excav., unclassified.....	.25	.25	.30	.56	.25	.30
5,000 yd. sta. short overhaul	.015	.05	.02	.02	.015	.02
36,400 yd. mi. truck haul on borrow	.18	.18	.20	.18	.18	.20
0.51 mi. finishing roadbed and slopes	800.00	800.00	880.00	400.00	800.00	800.00
250 lin. ft. 18-in. concrete pipe.....	2.20	3.00	2.40	2.56	2.20	3.00
380 lin. ft. 8-in. sewer pipe	1.25	2.00	1.40	1.00	1.25	1.00
2 only adjustment of manholes	50.00	90.00	50.00	40.00	100.00	75.00
10 only concrete catch basins	55.00	75.00	125.00	70.00	75.00	75.00
200 cu. yd. concrete curb and gutter	45.00	34.00	50.00	35.00	40.00	40.00
140 only 3/4-in. x 18-in. dowel bars	.25	1.00	.25	.60	.50	.50
920 sq. yd. concrete walks	3.00	3.00	3.00	3.00	3.50	2.75
110 lin. ft. conc. expansion joints in walks	.15	.50	1.00	.32	.25	.25
60 cu. yd. conc. median strip	40.00	35.00	40.00	30.00	50.00	40.00
All specified, recesses for traffic control markers	140.00	200.00	200.00	100.00	100.00	500.00
10 only conc. sight posts.....	11.00	15.00	11.00	12.00	12.00	10.00
1,250 sq. yd. rock slope protection	2.00	2.00	2.20	1.00	2.00	2.50
13,300 cu. yd. selected roadbed topping.....	.42	.42	.48	.34	.25	.50
15,000 cu. yd. mi. hauling roadbed topping	.18	.18	.20	.18	.18	.20
2,100 cu. yd. 3/4-in. - 0-in. matl. in leveling course and shoulders	1.85	2.45	2.60	2.50	1.85	2.25
400 M gal. sprinkling	2.50	3.00	3.30	2.50	2.50	3.00
.51 mi. preparation of base	125.00	300.00	275.00	300.00	125.00	300.00
220 cu. yd. 3/4-in. - 0-in. matl. in binder course.....	2.75	3.00	3.30	3.00	2.75	3.00
6,400 ton Class "B" asphaltic concrete	5.70	5.90	6.50	5.90	5.70	5.90
120 cu. yd. aggregate in seal coat	3.50	4.00	3.30	3.00	3.00	3.00
20 ton emulsified asphalt in seal coat.....	38.00	40.00	45.00	40.00	38.00	40.00
2,300 lin. ft. asphaltic conc. traffic markers.....	.45	1.00	1.05	.95	.45	1.00
1,800 cu. yd. excav. for struts	5.00	5.00	5.00	12.00	5.00	6.00
30 cu. yd. struct. excav. below eleva. shown	8.00	30.00	10.00	20.00	10.00	10.00
4,200 cu. yd. Class "A" conc.	48.50	51.00	55.00	55.00	55.00	59.00
1,030,000 lb. metal reinforcement	.09	.08	.09	.0875	.10	.09
2,765 lin. ft. metal rail	10.50	12.00	8.00	10.00	12.00	10.00
36 ton furn. and placing RC-3 asph. in binder crse.	38.00	36.00	39.60	36.00	38.00	36.00
44 ton furn. and plac. RT-4 tar in binder crse.....						

(Continued on next page)

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Washington Freeway

... Continued from page 62

the bridge is 42,000 vehicles per day, with 3,600 vehicles for peak-hour operation. These figures show that the bridge is now overloaded during the season of heavy traffic and that by 1960 the annual average daily volume will be about equal to the 24-hr. capacity of the bridge, with the peak-hour traffic volume exceeding the rated practical peak-hour capacity by 75%.

Within Vancouver the commercial development of the city has been in a north-south direction, parallel to and including the route of U. S. 99. There are three parallel business streets, Columbia, Washington and Main, all leading directly to the north approaches to the Interstate Bridge. Washington St., the official arterial route, is 56 ft. between curbs. Parking meters are installed on all three streets and throughout the commercial district. There are no alleys or driveways for accommodating building service transportation, and all loading and unloading is from vehicles parked in the street, causing considerable double parking.

Intersecting routes

The Evergreen Highway, or Primary State Highway No. 8, enters the city from the east over two routes, both connecting to the Interstate Bridge in the downtown commercial district. The route of Primary State Highway No. 8 is up the north bank of the Columbia River Gorge and is the shortest route to all points in Washington east of the Cascade Mountain Range.

There are four state highways, primary and secondary, entering radially the City of Vancouver. There are numerous county roads serving suburban residential districts, the principal one being the St. Johns Road, carrying a traffic volume of 3,540 vehicles per day. Seven of the principal routes feed 25,000 vehicles into the commercial center of the city each day, a daily volume which is added to the heavy traffic within the city.

Recent estimates show that about 77,500 motor vehicle trips are made each 24-hr. week day on the streets of Vancouver. Of this number, 12,850 trips over the streets of the city are made by vehicles that do not stop in the city, but they unwillingly add to the congestion, delays and inconveniences of local traffic in the commercial district.

Along the easterly limits of the commercial district, the Fort Vancouver Military Reservation, 1½ mi. in length, is, in effect, a barrier to the free movement of traffic originating in the large residential areas to the east. The barrier effect of the military reservation has been to cause a considerable volume of traffic to travel the business streets of the city that would normally follow more desired lines of travel if suitable routes were provided. The military reservation has, for many years, hampered the logical development of metropolitan Vancouver.

It seems inevitable that coincident

Continued on page 142

FOURTH AVE. CONNECTION UNIT

All specified, clearing and grubbing.....	\$1,200	\$1,200	\$1,320	\$1,255	\$3,000	\$1,000
12 cu. yd. removal of walks and driveways.....	5.00	10.00	6.00	3.00	5.00	.50
80 lin. ft. removal of curbs and gutters.....	.50	1.00	.80	.35	.50	.50
200 cu. yd. struct. excav., unclassified.....	3.00	3.00	3.30	3.50	3.00	3.00
22,500 cu. yd. borrow excav., unclassified.....	.32	.32	.35	.34	.32	.30
22,500 yd. mi. truck haul on borrow.....	.20	.20	.22	.18	.20	.20
140 lin. ft. 18-in. concrete pipe.....	2.50	2.50	2.75	2.56	2.50	3.00
270 lin. ft. 30-in. concrete pipe.....	6.00	6.00	6.60	6.56	6.00	6.00
10 cu. yd. concrete curb and gutter.....	45.00	40.00	50.00	35.00	50.00	40.00
10 only ¾-in. x 18-in. dowel bars.....	.25	1.00	.25	.60	.50	.50
96 sq. yd. concrete walks.....	3.00	3.00	3.00	3.00	3.50	2.75
14 cu. yd. concrete median strip.....	40.00	35.00	50.00	30.00	50.00	40.00
3,300 cu. yd. selected roadbed topping.....	.44	.44	.50	.34	.25	.50
3,300 yd. mi. hauling roadbed topping.....	.20	.20	.22	.18	.20	.20
500 cu. yd. ¾-in. x 0-in. matl. in leveling crose and shoulders.....	1.85	2.35	2.60	2.50	1.85	2.30
100 M gal. sprinkling.....	2.50	3.00	3.30	2.50	2.50	3.00
50 cu. yd. ¾-in. - 0-in. matl. in binder course.....	2.75	3.00	3.30	3.00	2.75	3.00
1,500 ton Class "B" asphaltic conc.	5.70	6.00	6.50	5.90	5.70	5.90
30 cu. yd. aggregates in seal coat.....	3.50	4.00	3.30	3.00	3.50	3.00
5 ton emulsified asphalt in seal coat.....	38.00	40.00	45.00	40.00	38.00	40.00
50 cu. yd. excav. for structs.	5.00	6.00	5.00	6.00	5.00	4.00
30 cu. yd. Class "A" conc.	50.00	55.00	55.00	50.00	60.00	64.00
2,700 lb. metal reinforcement.....	.10	.09	.09	.0875	.10	.09
10 ton furn. and placing RC-3 asph. in binder crse.	38.00	36.00	39.60	36.00	38.00	36.00
12 ton furn. and placing RT-4 tar in binder crse.						

New Mexico—Hidalgo County—State—Steel

P. R. Burn, Las Cruces, N. M., with a bid of \$146,121, was awarded the contract by the New Mexico State Highway Department for construction of a steel bridge across the Gila River on Highway NM-82. Unit bids were as follows:

(1) P. R. Burn.....	\$146,121	— F. D. Shufflebarger.....	\$168,553
(2) Sharp & Fellows.....	147,340	— Skousen-Hise Construction Co.....	181,529
(3) Lee Moor Construction Co.....	149,349	— Miller & Smith Construction Co.....	194,842
(4) Brown Construction Co.....	151,505	(6) Engineer's Estimate.....	151,292
(5) J. H. Ryan.....	168,214		

	(1)	(2)	(3)	(4)	(5)	(6)
Lump sum, removal of old structures.....						
149 cu. yd. excavation for structures.....	5.00	12.50	6.00	10.00	40.00	10.00
134.71 cu. yd. Class "AE-AR" concrete substructure.....	60.00	50.00	65.00	60.00	60.00	60.00
410.49 cu. yd. Class "AE-AR" concrete superstructure.....	60.00	50.00	65.00	60.00	60.00	60.00
78,639 lb. reinforcing steel.....	.10	.12	.10	.11	.10	.12
401,098 lb. structural steel.....	.145	.139	.14	.14	.132	.15
125 cu. yd. excavation for bank protection.....	2.00	2.50	2.00	2.00	4.00	2.50
360 cu. yd. wire enclosed riprap.....	8.00	8.00	8.00	5.00	10.00	6.00
9,500 lb. wire fabric.....	.20	.21	.20	.20	.20	.20
170 lin. ft. steel stakes.....	1.50	1.50	1.00	2.50	3.00	2.50
2 ea. monument and marker.....	50.00	50.00	50.00	50.00	100.00	50.00
6,432 lin. ft. steel bearing piles.....	5.86	6.45	6.25	7.00	7.00	6.00

Montana—Sanders County—State—Steel and Concrete

Hansen & Parr Construction Co., Spokane, Washington, with a bid of \$392,604, was awarded the contract by the State Highway Commission of Montana for construction of a 727-ft. steel and concrete bridge, known as the Clark Fork River Bridge, on the Idaho Line-Plains highway. Unit bids were submitted as follows:

(1) Hansen & Parr Construction Co.....	\$392,604	(5) W. P. Roscoe Co.....	\$475,781
(2) J. C. Boespflug.....	402,122	(6) McKinnon-Decker Co.....	542,086
(3) Carl M. Halvorson.....	424,872	(7) Utility Builders, Inc.....	665,417
(4) McLaughlin Construction Co.....	474,222		

	(1)	(2)	(3)	(4)	(5)	(6)
987,000 lb. structural steel.....	.1575	.17	.15	.20	.188	.17
195,700 lb. reinforcing steel.....	.125	.135	.12	.15	.13	.14
1,486.60 cu. yd. Class A concrete.....	65.00	60.00	60.00	55.00	62.00	80.00
788.64 cu. yd. Class AD concrete.....	65.00	55.00	60.00	61.00	68.00	80.00
458.8 cu. yd. Class S concrete.....	30.00	25.00	60.00	42.00	40.00	80.00
11.6 cu. yd. Class B concrete.....	40.00	40.00	60.00	52.00	62.00	80.00
695 cu. yd. st. ex. (abt. 1 and pr. 5—bent 2).....	2.00	2.00	10.00	15.00	21.50	5.00
2,740 cu. yd. st. ex. (prs. 1 thru. 4).....	12.00	14.50	22.00	25.00	21.50	36.00
1,436.21 lin. ft. st. bridge rail.....	6.30	9.00	8.00	8.00	11.00	10.00
138 ea. cast iron pile shoes.....	3.50	9.00	20.00	10.00	15.00	5.00
2,760 lin. ft. untr. timber found. piling.....	2.00	2.00	2.00	.50	2.60	3.00
2 ea. test piles.....	300.00	\$1,000	500.00	\$2,000	200.00	500.00

California—Del Norte County—State—Steel Girder Bridge and Grading

N. M. Ball Sons, Berkeley, Calif., with a bid of \$393,374, was low before the California Division of Highways for construction of a two-span steel girder bridge with reinforced concrete deck and 4.7 mi. grading between Smith River Bridge and ¼ mi. north of Winton Corners. Unit bids were submitted as follows:

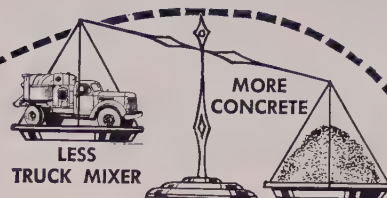
(1) N. M. Ball Sons.....	\$393,374	(4) Mercer Fraser Co., Inc., Mercer,	
(2) Piombo Construction Co.....	404,414	Fraser Gas Co., Inc., J. L. Conner	
(3) John Burman & Sons and G. M. Carr,		Jr.....	\$419,920
Bati Rocca.....	415,248	(5) Johnson Drake & Piper, Inc.....	489,887

	(1)	(2)	(3)	(4)	(5)
58 acres clearing and grubbing.....	800.00	750.00	400.00	450.00	845.00
10 ea. removing trees, size 1.....	40.00	45.00	30.00	35.00	22.00
5 ea. removing trees, size 2.....	80.00	80.00	40.00	50.00	28.00
3 ea. removing trees, size 3.....	150.00	120.00	80.00	100.00	33.00
3 ea. removing trees, size 4.....	400.00	170.00	200.00	300.00	44.00
1 ea. removing trees, size 6.....	900.00	215.00	200.00	500.00	55.00
93 ea. removing and grubbing trees, size 1.....	65.00	70.00	45.00	50.00	35.00
33 ea. removing and grubbing trees, size 2.....	120.00	125.00	70.00	75.00	40.00
2 ea. removing and grubbing trees, size 3.....	250.00	180.00	100.00	200.00	80.00
2 ea. removing and grubbing trees, size 4.....	700.00	250.00	150.00	400.00	90.00
1 ea. removing and grubbing trees, size 5.....	900.00	300.00	180.00	500.00	100.00
5 ea. removing and grubbing trees, size 6.....	1,400	350.00	180.00	600.00	115.00
3 ea. removing existing stumps, size 1.....	25.00	15.00	12.00	10.00	17.00
3 ea. removing existing stumps, size 2.....	45.00	20.00	25.00	15.00	22.00
1 ea. removing existing stumps, size 3.....	100.00	35.00	50.00	25.00	28.00
1 ea. removing existing stumps, size 4.....	270.00	40.00	75.00	35.00	35.00
7 ea. removing and grubbing existing stumps, size 1.....	40.00	30.00	10.00	20.00	20.00
26 ea. removing and grubbing existing stumps, size 2.....	65.00	50.00	30.00	30.00	25.00
8 ea. removing and grubbing existing stumps, size 3.....	150.00	80.00	50.00	50.00	30.00
1 ea. removing and grubbing existing stumps, size 4.....	400.00	100.00	75.00	75.00	38.00
2 ea. removing and grubbing existing stumps, size 5.....	550.00	145.00	100.00	100.00	75.00
2 ea. removing and grubbing existing stumps, size 6.....	900.00	170.00	200.00	150.00	85.00

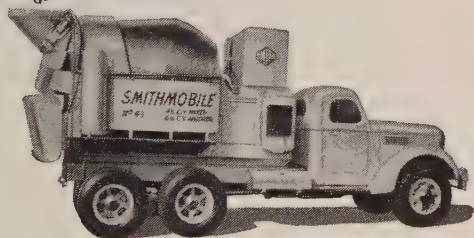
(Continued on next page)

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Washington Freeway

... Continued from page 140

with the planning and development of a limited-access rural highway or an urban freeway organized opposition to this type of highway improvement will develop more rapidly than organized public support.

Opposition to the freeway type of urban arterial usually springs from minority groups organized by leaders who fear the effect upon established business enterprise that may result from rerouting the accustomed flow of traffic through the city's streets.

Active opposition to major changes in the movement of traffic appears necessary to arouse public interest. This affords all concerned the opportunity to present their views and to discuss the effect on all phases of public welfare, including the economics of highway transportation. Road users and the owners of commercial enterprises generally are not fully informed as to the effects of traffic congestion, which is manifest by interference with pedestrian traffic, over parking, double parking, stop lights and traffic accidents.

When public interest in the location and construction of a freeway has been aroused and the supporting and opposing groups have crystalized their opinions and formulated their arguments, it is desirable to hold public meetings. Such meetings provide the highway and traffic engineers with the opportunity to present the freeway plan to the public and to point out the advantages of making the proposed improvement. Highway officials will gain a better understanding of the underlying reasons for most of the opposition, some of which will be valid. Adjustments will be made that will clear away much of the active opposition.

Highway officials will receive public support for a freeway plan that assures relief from the blighting effect of traffic congestion.

In Vancouver the highway department was represented by the local District Engineer. City officials, civic leaders, service groups and the press were fully informed during the development period of the freeway project. At all times, the highway department had the support and cooperation of the press and civic groups.

However, with the publication of the plans for the freeway and traffic interchanges, aggressive opposition developed and a grievance committee called on the Governor of the State for action on the freeway problem. At the request of the Governor, the city officials called a mass meeting in Vancouver with the result that the city officials declared that the City of Vancouver approved the freeway project as planned by the State Highway Department.

R. H. Kenyon is Engineer, Plans and Contracts, Washington Department of Highways at Olympia. D. D. Forgey, District Engineer at Vancouver, is in charge of the location and design of the freeway. T. W. McLaughlin is location engineer and J. A. Gallagher is district traffic engineer.

1 ea. removing and grubbing existing stumps, size 7.....	\$1,100	200.00	200.00	150.00	100.00
141,200 cu. yd. roadway excav.	.30	.28	.42	.38	.75
4,900 cu. yd. struct. excav.	3.00	2.15	2.00	2.00	4.00
990 cu. yd. struct. excav. (bridge)	14.00	10.00	15.00	11.90	22.00
1,250 cu. yd. ditch and channel excav.	1.50	.85	2.00	1.50	2.00
48,000 sq. yd. compacting orig. ground	.06	.05	.04	.05	.05
600,000 sta. yd. overhaul	.005	.01	.006	.005	.01
32,000 cu. yd. imp. borrow	.90	.90	1.00	1.00	1.40
23,500 ton imp. base matl.	1.06	1.60	1.50	1.65	1.50
Lump sum, dev. wat. supply and furn. wat. equip.	\$5,000	\$2,000	\$4,000	500.00	\$3,000
3,100 M gal. applying water	1.60	.50	1.25	2.00	1.10
251 sta. finishing roadway	8.00	12.50	15.00	20.00	6.50
1,034 cu. yd. Cl. "A" P.C.C. (struct.)	50.00	62.00	66.00	61.80	50.00
258 cu. yd. Cl. "A" P.C.C. (footing blocks)	25.00	33.00	35.00	42.65	35.00
415 lin. ft. conc. railing	6.00	6.00	7.00	6.00	6.50
146,000 lb. bar reinf. steel	.08	.09	.09	.11	.10
359,000 lb. struct. steel	.10	.12	.145	.165	.13
Lump sum, clean. and paint. girder spans	\$3,000	\$4,500	\$5,000	\$4,500	\$3,300
830 cu. yd. sacked conc. riprap	18.00	26.00	25.00	21.00	26.00
167 ea. furnish. and placing r/w monu.	6.00	6.00	5.00	4.00	5.00
16 ea. hauling and placing r/w monu.	6.00	5.00	4.00	3.00	3.00
10.0 mi. new property fence	\$2,000	\$2,000	\$1,700	\$1,584	\$1,400
19 ea. 14-ft. drive gates	53.00	50.00	50.00	60.00	52.00
17 ea. 16-ft. drive gates	66.00	55.00	60.00	65.00	63.00
140 lin. ft. 12-in. R.C.P. (std. str.)	3.00	2.30	2.50	2.50	2.50
1,968 lin. ft. 18-in. R.C.P. (std. str.)	5.00	4.10	3.50	3.50	4.20
444 lin. ft. 24-in. R.C.P. (std. str.)	6.00	5.70	5.50	5.60	7.00
312 lin. ft. 36-in. R.C.P. (std. str.)	10.00	9.10	9.50	10.20	9.00
96 lin. ft. 54-in. R.C.P. (std. str.)	23.00	22.00	22.50	19.80	26.00
690 lin. ft. 8-in. C.M.P. (16 ga.)	2.00	1.90	1.80	2.20	1.75
108 lin. ft. 12-in. C.M.P. (16 ga.)	2.60	2.50	2.50	2.98	2.10
720 lin. ft. 8-in. P.M.P. under drains (16 ga.)	1.80	1.60	1.75	2.10	1.60
110 cu. yd. filter matl.	5.00	3.40	4.00	5.80	3.50
5 ea. salv. spillway assemb.	5.00	20.00	10.00	3.00	5.00
134 lin. ft. salv. spillway assemb. down drains	1.00	1.30	1.00	2.00	1.00
1 ea. redwood covers for drop inlets	12.00	20.00	15.00	7.00	25.00

Highway and Street ...

Wyoming—Laramie County—State—Roadmix

Brown Construction Co., Pueblo, Colorado, with a bid of \$320,600, was awarded the contract by the Wyoming Highway Department for construction of 13.7 mi. of the Torrington-Cheyenne road in Laramie County. Unit bids were submitted as follows:

(1) Brown Construction Co.	\$320,600	(4) Peter Kiewit Sons' Co.	\$338,011
(2) Reed Co.	326,972	(5) Blanchard Bros.	354,107
(3) Knisely-Moore	327,826	(6) Summit Construction Co.	364,889

	(1)	(2)	(3)	(4)	(5)	(6)
352,000 cu. yd. excavation	.20	.155	.165	.17	.175	.16
79,400 cu. yd. excav. (selected embankment)	.30	.32	.22	.38	.295	.32
629,000 sta. yd. overhaul	.01	.01	.01	.01	.01	.01
228,000 cu. yd. mi. haul	.07	.12	.12	.125	.12	.13
750 hr. sheep's foot roller operation	8.00	9.00	10.00	8.00	11.00	9.00
220 hr. equipment roller operation	10.00	10.00	12.00	10.00	11.00	12.00
300 hr. pneumatic tired roller operation	3.00	4.90	5.00	5.00	5.50	5.00
4,600 M gal. watering (emb.)	1.00	1.50	1.75	1.50	2.25	2.00
1,006 lin. ft. 18-in. C.M.P.	4.00	3.45	3.00	2.00	3.60	4.00
822 lin. ft. 24-in. C.M.P.	5.00	4.65	4.00	6.00	4.75	6.00
118 lin. ft. 30-in. C.M.P.	6.00	5.50	5.50	8.00	4.85	9.00
640 lin. ft. 36-in. C.M.P.	9.00	8.30	7.50	10.00	7.75	11.00
140 lin. ft. 84-in. C.M.P.	30.00	30.00	30.00	30.00	26.50	35.00
158 lin. ft. relaying pipe	3.00	2.00	2.00	2.00	3.00	3.00
164 lin. ft. relaying pipe for detour	4.00	2.50	3.00	3.00	3.00	3.00
304 cu. yd. excavation for pipe culverts	2.00	1.50	1.50	2.00	2.00	1.50
175 cu. yd. structure excavation	3.00	2.00	2.00	2.50	2.00	3.00
400 cu. yd. dry excavation for bridges	2.00	2.00	3.00	1.00	3.00	5.00
190 cu. yd. wet excavation for bridges	5.00	10.00	8.00	5.00	10.00	9.00
46.4 cu. yd. Class D concrete	60.00	40.00	50.00	50.00	45.00	56.00
65,198 M.b.m. treated timber	220.00	225.00	225.00	200.00	225.00	260.00
1,752 lin. ft. treated timber piling	2.50	2.10	2.00	1.90	2.25	3.00
480 lin. ft. metal plate guard rail	2.00	3.00	3.00	2.50	2.90	3.25
Lump sum, removing existing structures	5.00	4.50	5.00	6.00	5.00	4.50
445 hr. mechanical tamping	10.00	15.50	10.00	12.00	10.00	10.50
420 cu. yd. Class 1 riprap	20.00	15.50	15.00	17.00	12.00	30.00
20 cu. yd. grouted riprap	.14	.145	.12	.15	.15	.13
80,800 lin. ft. standard r/w fence	.15	.155	.135	.17	.165	.14
14,000 lin. ft. r/w fence (6 wire)	.20	.20	.18	.25	.30	.19
3,700 lin. ft. Type "A" r/w fence	.12	.08	.11	.07	.07	.06
5,800 lin. ft. removing and resetting r/w fence	5.00	6.95	9.00	12.00	9.00	9.00
100 ea. brace panels	10.00	8.25	11.00	10.00	15.00	12.00
70 ea. end panels	1.00	1.00	1.10	1.00	1.00	1.10
300 ea. fence posts	.80	.13	.15	.25	.10	.11
100 rod barbed wire	1.00	1.20	1.00	.30	1.00	.85
40 rod 32-in. woven wire	2.00	1.75	1.65	1.60	1.50	1.70
2,320 lin.-ft. portable snow fence	.50	.43	.40	.50	.54	.61
57,000 ton crushed gravel base course (1-in. max.)	.60	.43	.42	.65	.64	.70
15,700 ton cr. gravel surfacing (3/4-in. max.) Type B	4.00	4.80	3.75	6.00	5.50	6.00
1,700 ton stone chips (Type B)	.05	.06	.07	.06	.07	.07
327,000 ton mi. haul of surfacing material	.50	.25	.42	.10	.20	.30
2,150 cu. yd. binder	.10	.12	.11	.10	.30	.12
1,420 cu. yd. mi. haul of binder	1.50	2.00	1.75	2.00	2.25	3.50
1,150 M gal. watering (base)	5.00	4.90	5.00	6.00	6.50	9.00
490 hr. roller operation	22.00	33.20	30.00	23.00	29.00	28.35
370 ton asphaltic material MC-prime	24.00	29.50	32.00	25.00	28.00	31.50
700 ton asphaltic material MCF-3	25.00	36.91	34.00	25.00	35.00	33.00
220 ton asphaltic material RCF-4	.05	.048	.065	.05	.07	.05
213,000 sq. yd. processing	5.00	5.00	10.00	10.00	10.00	10.00
89 ea. r/w markers	Lump sum, miscellaneous force account					
2 ea. removing and resetting cattleguard	300.00	75.00	50.00	150.00	100.00	75.00
1.5 mi. old road obliteration	200.00	250.00	100.00	400.00	150.00	300.00
2 ea. prov. and maint. field test. lab. bldg.	500.00	300.00	500.00	400.00	500.00	400.00
NON-PARTICIPATING IN FEDERAL AID						
5,000 cu. yd. excavation	.24	.155	.165	.17	.175	.16
9,000 cu. yd. sta. overhaul	.01	.01	.01	.01	.01	.01
10 cu. yd. mi. haul	.08	.12	.12	.11	.12	.13
62 M gal. watering (emb.)	1.00	1.50	1.75	1.50	2.25	2.00
40 lin. ft. relaying pipe	3.00	2.00	2.00	2.00	3.00	3.00

(Continued on next page)

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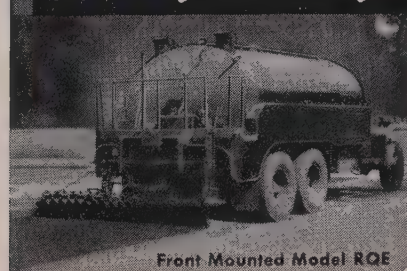
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atchee, Wash.... **EQUIPMENT SALES**
CO., Phoenix, Ariz. . . . **LARSON**
EQUIPMENT CO., Los Angeles, Calif.
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TOOTH CO., Boise - Twin Falls, Ida.
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Nev. . . . **J. K. WHEELER MACHINERY**
CO., Salt Lake City, Utah.



Rear Mounted Model RRE

5 cu. yd. excav. for pipe culverts.....	2.00	1.50	1.50	2.00	2.00	1.50
5 hr. mechanical tamping	5.00	4.50	5.00	6.00	5.00	4.50
8,000 lin. ft. r/w fence (6 wire).....	.15	.155	.135	.17	.16	.14
5 ea. brace panels	5.00	6.95	9.00	12.00	9.00	9.00
5 ea. end panels	10.00	8.25	11.00	10.00	15.00	12.00
6 mi. removing and resetting telephone line.....	300.00	130.00	150.00	250.00	150.00	110.00
12 ea. telephone poles (20-ft.)	20.00	20.00	30.00	12.00	7.00	11.00
250 ea. telephone poles (12-ft.)	7.00	4.00	20.00	3.00	2.45	5.50
140 rod telephone wire	1.00	.105	.25	.35	.15	.12

California—Los Angeles County—State—Grade and Surf.

A. Teichert & Son, Inc., Sacramento, Calif., with a bid of \$1,874,737, was low before the California Division of Highways for construction of 5.3 mi. of highway between Frenchman's Flat and 0.5 mi. north of Los Alamos Creek. The contract involves grading and surfacing with plant-mixed asphaltic concrete, widening two existing bridges, and constructing two new bridges. Unit bids were as follows:

(1) A. Teichert & Son, Inc.	\$1,874,737
(2) United Concrete Pipe Corp., Westbrook & Pope, R. A. Bell.....	1,881,231
(3) H. Earl Parker, Inc., and N. M. Ball Sons.....	1,933,163
(4) Peter Kiewit Sons' Co.	1,950,024
(5) Fredrickson & Watson Construction Co. and M & K Corporation.....	1,954,011
(6) Yount Constructors, Inc. and Winston Bros. Co.....	2,156,849
— Guy F. Atkinson Co.	2,162,135
— Clyde W. Wood & Sons, Inc.	2,202,677
— Cox Bros. Construction Co. and J. E. Haddock, Ltd.....	2,449,224

	(1)	(2)	(3)	(4)	(5)	(6)
4,600 cu. yd. removing conc.	5.50	4.50	4.50	3.80	3.00	2.50
Lump sum, removing timber bridge railing.....	\$1,200	600.00	\$3,450	\$1,000	\$2,600	\$1,000
280 sta. clearing and grubbing.....	50.00	40.00	100.00	20.00	60.00	55.00
1,100,000 cu. yd. roadway excav.	.74	.71	.77	.883	.789	.83
3,400 cu. yd. struct. excav. (misc.)	4.00	4.00	3.25	3.45	4.00	3.00
5,500 cu. yd. struct. excav. (bridges)	5.00	15.00	8.00	4.20	8.25	3.50
2,260 cu. yd. struct. backfill (bridges)	2.00	4.60	4.00	2.30	3.00	2.00
3,250 cu. yd. ditch and channel excav.	1.50	1.75	.50	2.30	1.50	2.00
40,000 cu. yd. selected rock slope protection.....	.65	.60	.25	.45	.60	1.00
15,500,000 sta. yd. overhaul	.003	.006	.005	.004	.0035	.005
94,000 ton imp. subbase matl.	1.00	1.00	1.17	1.00	1.20	1.50
Lump sum, dev. wat. supply and furn. wat. equip.....	\$14,000	\$6,000	\$10,000	\$20,000	\$26,000	\$8,000
38,500 M gal. applying water	1.25	1.30	1.25	1.50	1.00	1.70
280 sta. finishing roadway	20.00	23.00	10.00	12.00	25.00	17.00
98,000 tons untreated rock base	1.40	1.00	1.17	1.15	1.30	1.50
260 ton liq. asph. SC-2 (pen. tr. and pr. ct.).....	21.00	17.00	24.00	18.50	18.00	18.00
45,000 ton min. aggr. (P.M.S.)	2.60	2.70	3.00	2.60	2.90	3.30
2,400 ton paving asph. (P.M.S.)	16.00	16.00	15.50	14.00	15.00	15.00
38,000 lin. ft. dikes (P.M.S.)	.10	.12	.12	.10	.12	.17
120 ton asphaltic emuls. (pt. bdr. and sl. ct.).....	35.00	35.00	44.00	45.00	30.00	28.00
600 ton screenings (sl. ct.)	6.00	5.75	6.00	7.50	5.50	7.00
7,800 lin. ft. raised traffic bars	.80	1.00	1.00	.65	1.15	.70
4,120 cu. yd. Cl. "A" P.C.C. (struct.)	50.00	47.00	44.03	40.00	45.00	55.00
460,000 lb. structural steel	.13	.13	.142	.11	.11	.12
Lump sum, salv. and erecting struct. steel	\$17,000	\$20,000	\$15,696	\$16,000	\$17,000	\$16,500
Lump sum, cleaning and painting struct. steel.....	\$12,000	\$10,000	\$5,400	\$12,000	\$13,000	\$16,500
425,000 lb. bar reinforcing steel	.08	.075	.088	.08	.085	.085
550 lb. misc. iron and steel	.40	.50	.42	.30	.30	.80
11 ea. deck drains	30.00	25.00	14.00	12.50	12.00	35.00
1,362 lin. ft. corrugated metal bridge railing.....	3.50	4.00	4.16	2.90	3.20	4.50
684 lin. ft. temporary timber bridge railing.....	3.00	4.00	1.78	2.00	3.10	2.80
Lump sum, jacking and repairing existing span.....	\$2,000	\$1,200	950.00	\$1,900	\$1,700	\$2,000
350 ea. steel dowels (channel change struct.).....	6.00	6.00	9.65	3.45	7.00	1.70
92,000 lb. steel rail (channel change struct.)	.08	.08	.071	.07	.07	.11
1,250 cu. yd. Cl. "A" P.C.C. (slope paving)	27.00	24.00	28.58	80.00	33.00	55.00
140 cu. yd. Cl. "A" P.C.C. (curbs and gutters).....	45.00	35.00	42.00	63.00	40.00	60.00
14 ea. right-of-way monuments	7.00	6.00	7.00	8.50	5.00	6.00
740 lin. ft. metal plate guard railing	3.00	3.50	3.20	2.75	3.40	3.40
680 ea. metal culv. mks. and guide posts.....	4.00	3.50	3.00	2.20	3.40	3.40
15 ea. horizontal reflector units	10.00	7.00	7.50	9.00	8.00	8.00
1.7 mi. new property fence	\$1,000	\$1,200	\$1,400	\$1,000	\$3,000	\$2,000
4 ea. drive gates	50.00	50.00	75.00	42.00	35.00	70.00
1,730 lin. ft. 18-in. C.M.P. (16 ga.)	2.50	2.50	2.55	2.40	2.60	3.50
1,450 lin. ft. 24-in. C.M.P. (14 ga.)	4.00	3.50	4.05	3.40	3.90	4.00
150 lin. ft. 30-in. C.M.P. (14 ga.)	5.00	4.00	5.00	4.50	5.00	6.50
360 lin. ft. 36-in. C.M.P. (12 ga.)	8.00	7.00	8.00	6.40	7.00	7.00
80 lin. ft. 48-in. C.M.P. (12 ga.)	12.00	11.50	10.75	8.30	10.00	10.00
340 lin. ft. 54-in. C.M.P. (8 ga.)	20.00	18.00	18.00	14.00	17.00	15.00
35 ea. 18-in. x 8-in. x 4-ft. 6-in. cor. met. down drain inlet tapers	25.00	20.00	13.50	12.00	24.00	20.00
1,640 lin. ft. 8-in. cor. metal down drain pipe (16 ga.)	1.50	1.50	1.20	1.65	2.00	1.70

Nevada—Washoe County—State—Grade and Surf.

Isbell Construction Co., Reno, was awarded a \$312,569 contract by the Nevada Department of Highways for clearing, grubbing, drainage and plant-mix surfacing of 2.5 mi. of highway for widening the Reno-Carson highway to four lanes between Hash and Huffaker Lanes. Unit bids were submitted as follows:

(1) Isbell Construction Co.	\$312,569
(2) Dodge Construction, Inc.	313,525
(3) Silver State Construction Co.....	\$316,623

	(1)	(2)	(3)
Lump sum, signs	\$1,500	\$2,500	500.00
Force account, clearing	500.00	500.00	500.00
32 ea. remove trees (7-in. to 12-in.)	20.00	25.00	15.00
17 ea. remove trees (1-ft. 1-in. to 1-ft. 6-in.)	50.00	50.00	20.00
6 ea. remove trees (1-ft. 7-in. to 2-ft. 0-in.)	75.00	100.00	40.00
2 ea. remove trees (2-ft. 1-in. to 3-ft. 0-in.)	100.00	150.00	100.00
4 ea. remove trees (over 3-ft. 0-in.)	150.00	200.00	125.00
22 ea. remove stumps	25.00	50.00	20.00
17,573 lin. ft. remove fence	.15	.20	.05
91 cu. yd. remove concrete	15.00	20.00	10.00
35 cu. yd. remove mortar rubble masonry	10.00	10.00	10.00
3,347 lin. ft. remove culvert pipe	2.00	2.00	1.00
36 ea. remove headwalls	20.00	15.00	20.00
4 ea. remove timber bridges	25.00	100.00	100.00
380 lin. ft. remove timber guard rail	.30	1.00	.50
Lump sum, remove timber culvert	200.00	100.00	200.00
Force account, move timber footbridges	100.00	100.00	100.00
Force accounts, move signs	800.00	800.00	800.00
2,400 sq. yd. remove composite surface	1.50	1.25	.25
12,560 cu. yd. roadway excavation	.85	.75	.40
2,000 cu. yd. drainage excavation	2.00	1.00	.40
16 sta. V-type ditches	20.00	10.00	5.00
4,870 cu. yd. borrow	.78	.40	.25
50,530 yd. sta. overhaul	.02	.015	.02
12,870 yd. mi. overhaul	.20	.15	.20

(Continued on next page)

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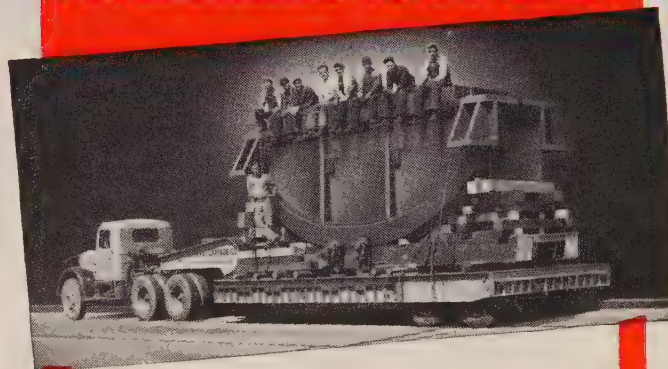
For complete information, blueprints or specifications on the Fruehauf Carryall for *your* job, write —

World's Largest Builders of Truck-Trailers

FRUEHAUF TRAILER COMPANY

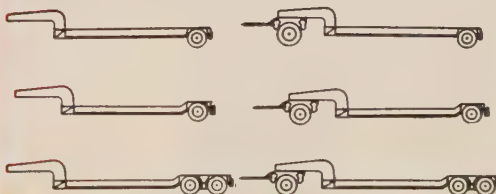
Western Manufacturing Plant, Los Angeles

Sales and Service: Los Angeles • San Francisco • Portland
Seattle • San Diego • Fresno • Sacramento • Spokane
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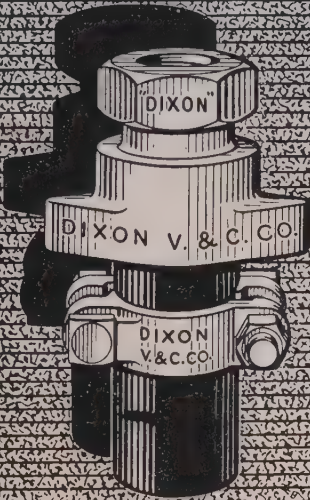
Fruehauf Carryalls are available in capacities from 10 to 74 tons in the standard models . . . to 110 tons in "specials". Frame designs as single- or double-drop "Semi" or full Trailers. No matter what your hauling problem may be, there's a Fruehauf Carryall to fit your job.

DESIGNED TO YOUR SPECIFICATIONS



WORLD'S LARGEST BUILDERS OF TRUCK-TRAILERS

Rugged Simplicity



"DIXON" Air Hammer Coupling

Plain, durable construction...with each part an outstanding example of functional design and exacting workmanship. Backed by a reputation for long, low-cost service in all heavy-duty air tool operations. Cadmium plated—rustproof.

Stocked by Manufacturers and Jobbers of Mechanical Rubber Goods.

*Reg. U. S. Pat. Off.

DIXON

VALVE & COUPLING CO.

Main Office and Factory: PHILADELPHIA 22, PA.
BRANCHES: CHICAGO - BIRMINGHAM - LOS ANGELES - HOUSTON

4,200 cu. yd. structure excavation	2.75	3.00	2.00
3,280 cu. yd. backfill	2.00	2.00	1.00
600 cu. yd. sand for backfill	3.00	2.00	2.50
2,238 M. gal. water	1.50	1.50	1.00
Lump sum, furnish water equipment	\$1,500	\$2,500	\$2,500
200 hr. power roller	6.50	6.00	4.00
1,160 ft. hr. tamping roller	.60	1.00	.50
24,565 ton Type 1 gravel base	1.10	1.00	1.50
16,860 ton Type 2 gravel base, one inch	1.30	1.75	1.75
120 ton liquid asphalt, Type MC-1 (prime)	38.00	30.00	27.00
78 ton emulsified asphalt (seal)	37.00	35.00	35.00
595 ton screenings	5.00	4.00	4.00
829 ton liquid asphalt, Type SC-5 and SC-6 (plant-mix)	23.50	25.00	25.00
15,060 ton Class F-2 plant-mix surface	2.60	3.00	3.50
520 cu. yd. Class A concrete	80.00	60.00	70.00
40,110 lb. reinforcing steel	.12	.12	.12
248 sq. yd. mesh reinforcement	.50	.50	.50
104 lin. ft. structural steel rail	11.75	10.00	8.00
.8 M.f.b.m. redwood	300.00	500.00	200.00
332 lin. ft. 8-in. corrugated metal pipe	2.00	2.50	2.00
174 lin. ft. 24-in. corrugated metal pipe	5.25	5.00	4.00
72 lin. ft. 58-in. x 36-in. corr. metal arch pipe	12.00	12.50	15.00
2,188 lin. ft. 24-in. reinforced concrete pipe	7.00	7.00	5.00
96 lin. ft. 30-in. reinforced concrete pipe	10.00	9.00	7.00
82 lin. ft. 36-in. reinforced concrete pipe	16.00	11.00	10.00
2,640 lin. ft. relay culvert pipe	1.50	1.00	1.00
1,127 cu. yd. Class A concrete curb and gutter	33.00	35.00	50.00
4,310 lb. structural steel	.40	.50	.25
63 ea. culvert markers and guide posts	6.00	6.00	6.00
3,465 lin. ft. reconstruct fence	.50	.35	.20
11,053 lin. ft. field fence, Type A	.35	.50	.35
1,459 lin. ft. field fence, Type B	.45	.60	.35
224 lin. ft. lawn fence	1.50	2.00	1.00
136 lin. ft. special timber fence, Type 1	3.60	2.00	2.00
227 lin. ft. special timber fence, Type 2	4.50	2.00	2.00
6 ea. 16-ft. metal gates	100.00	75.00	50.00
2,570 lin. ft. Type B-4B fence	.35	.25	.35
Force account, miscellaneous work	150.00	150.00	150.00
74 lin. ft. pipe railing	6.00	5.00	2.00
28 cu. yd. concrete slope pavement	35.00	40.00	40.00
Lump sum, construct septic tank	\$1,000	\$1,500	500.00

California—Modoc County—State—Grade and Surf.

Rand Construction Co., Inc., Bakersfield, Calif., with a bid of \$303,851, was awarded the contract by the California Division of Highways for grading and plant-mixed bituminous surfacing on cement-treated base of about 8.9 mi. of the highway between Toms Creek and Cedarville. Unit bids were submitted as follows:

(1) Rand Construction Co.	\$303,851	(5) McGillivray Construction Co.	\$338,738
(2) Harms Bros.	331,183	(6) Fredrickson & Watson Construction Co.	370,807
(3) A. Teichert & Son, Inc.	337,051		
(4) Clements Co.	337,619		

	(1)	(2)	(3)	(4)	(5)	(6)
500 cu. yd. roadway excav.	1.00	1.00	1.00	1.00	.50	1.00
115 cu. yd. struct. excav.	3.00	5.00	4.00	3.00	3.50	3.50
30 cu. yd. ditch and channel excav.	2.00	2.50	3.00	3.00	3.50	3.00
8,200 ton imp. borrow	.79	.90	.70	.90	.55	1.00
12,500 sq. yd. scarifying, reshaping and compacting existing roadbed	.15	.10	.10	.10	.10	.10
Lump sum, dev. wat. supply and furn. wat. equip.	\$7,225	\$5,000	\$2,000	\$2,000	\$4,400	\$3,000
1,250 M. gal. applying water	1.50	2.00	2.00	2.00	3.50	2.00
468 sta. finishing roadway	5.00	10.00	7.00	5.00	7.50	9.00
54,500 ton min. aggr. (cem. tr.)	1.10	1.10	1.35	1.65	1.40	1.69
5,800 bbl. Portland cement (cem. tr.)	5.35	5.00	5.50	5.50	5.00	5.80
175,000 sq. yd. mix. and compact. (cem. tr.)	.13	.22	.30	.20	.21	.21
26,500 ton min. aggr. (P.M.S.)	4.00	3.90	3.40	3.25	3.60	4.00
1,430 ton paving asph. (P.M.S.)	26.58	30.00	28.00	31.00	30.00	30.00
180 ton liq. asph. SC-2 (pr. ct.)	28.93	40.00	37.00	40.00	50.00	37.00
710 ton sand (pr. ct.)	2.30	7.00	3.00	5.00	4.00	6.00
73 ton asphaltic emuls. (sl. ct.)	33.30	42.00	40.00	38.00	50.00	49.00
37,000 lin. ft. shap. and compact. P.M.S. rolled gutters	.10	.15	.15	.15	.15	.21
26,000 lin. ft. shap. and compact. P.M.S. dikes	.10	.15	.10	.15	.20	.16
2,000 lin. ft. placing P.M.S. (ditches and slope drains)	.20	.50	1.50	1.00	1.50	1.20
64 ea. center line monuments	35.00	30.00	30.00	15.00	40.00	39.00
458 ea. instal. culv. mkrs. and guide posts	3.50	3.50	5.00	5.00	4.00	4.15
76 lin. ft. 12-in. C.M.P. (16 ga.)	2.00	2.50	3.00	3.00	2.25	2.50
54 lin. ft. 24-in. C.M.P. (14 ga.)	4.20	5.30	6.00	6.00	5.00	3.50
2 ea. remov. and resetting headwall	30.00	45.00	60.00	50.00	100.00	100.00
47 ea. spillway assemblies	30.00	35.00	30.00	30.00	40.00	33.00
1,500 lin. ft. 8-in. C.M.P. downdrains (16 ga.)	1.85	2.25	2.00	2.00	1.75	2.00
32 ea. spillway assemb. downdrains slit jts.	10.00	12.50	20.00	10.00	15.00	18.00
328 lin. ft. saly. exist. pipe culverts	2.00	1.00	1.00	1.00	1.00	1.00

Montana—Lake County—State—Grade and Surf.

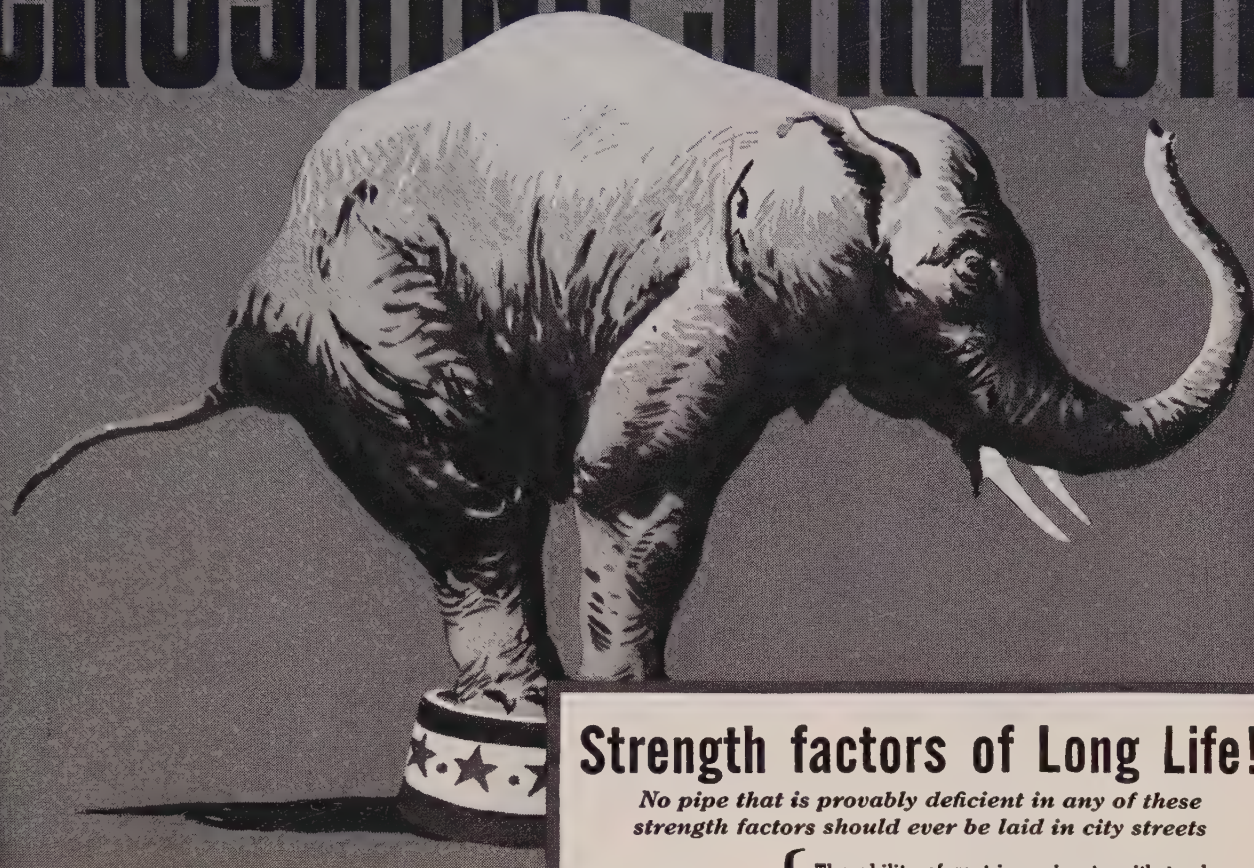
Kiely Construction Co., Butte, Mont., with a bid of \$299,444, was low before the State Highway Commission of Montana for 6.87 mi. of grading, gravel surfacing and plant-mix bituminous surfacing on the St. Ignatius to Pablo highway. Unit bids were submitted as follows:

(1) Kiely Construction Co.	\$299,444	(4) Union Construction Co., Inc.	\$349,907
(2) S. Birch & Sons Construction Co.	328,092	(5) F & S Contracting Co.	351,402
(3) McLaughlin, Inc.	329,335		

	(1)	(2)	(3)	(4)	(5)
125,178 cu. yd. unc. exc. and borrow	.30	.30	.33	.32	.44
1,104 yd. culvert excavation	2.50	3.00	3.00	2.00	3.00
475,656 sta. yd. overhaul	.015	.02	.01	.03	.03
16,816 ton Type A top ¾-in. gr.	1.25	1.25	1.60	1.47	2.50
1,465 ton cr. grav. cover mat.	4.00	3.60	4.00	5.00	6.00
123,111 ton sel. bor. base course	.80	.92	.95	1.05	.80
9,786 ton plant mix bitu. surf.	5.25	6.00	5.40	4.90	5.00
117,806 gal. 150-200 pen. asph. cem. plant-mix	.18	.17	.16	.18	.20
26,383 gal. MC-1 asph. road oil, prime	.20	.17	.165	.20	.20
32,452 gal. RC-4 asph. road oil, seal	.20	.17	.17	.20	.20
705 unit roll. cov. and cush. mat.	7.00	6.00	7.50	6.00	10.00
125 unit rolling embankment	7.00	7.70	6.00	9.00	10.00
4,680 M. gal. watering	1.00	2.50	2.00	2.00	1.00
364 lin. ft. 15-in. corr. met. pipe cul.	3.50	3.00	3.50	4.00	3.00
288 lin. ft. 18-in. corr. met. pipe cul.	5.00	5.00	4.50	5.00	4.50
70 lin. ft. 24-in. corr. met. pipe cul.	7.00	6.00	6.00	6.00	5.50
157 lin. ft. 36-in. corr. met. pipe cul.	12.00	11.00	11.00	12.00	12.00
12 lin. ft. 24-in. corr. met. perf. pipe	6.00	6.00	5.50	8.00	7.00
786 lin. ft. 18-in. corr. met. syph. pipe	7.00	6.00	5.00	7.00	5.00

(Continued on next page)

CRUSHING STRENGTH



Without crushing strength—or, for that matter—without all of the strength factors listed opposite—no pipe laid 100 years ago in city streets would be in service today. But, in spite of the evolution of traffic from horse-drawn vehicles to heavy trucks and buses—and today's vast complexity of subway and underground utility services—cast iron gas and water mains, laid over a century ago, are serving in the streets of more than 30 cities in the United States and Canada. Such service records prove that cast iron pipe combines all the strength factors of long life with ample margins of safety. No pipe that is provably deficient in any of these strength factors should ever be laid in city streets. Cast Iron Pipe Research Association, Thos. F. Wolfe, Engineer, 122 So. Michigan Ave., Chicago 3.



Strength factors of Long Life!

No pipe that is provably deficient in any of these strength factors should ever be laid in city streets

CRUSHING STRENGTH

The ability of cast iron pipe to withstand external loads imposed by heavy fill and unusual traffic loads is proved by the Ring Compression Test. Standard 6-inch cast iron pipe withstands a crushing weight of more than 14,000 lbs. per foot.

BEAM STRENGTH

When cast iron pipe is subjected to beam stress caused by soil settlement, or disturbance of soil by other utilities, or resting on an obstruction, tests prove that standard 6-inch cast iron pipe in 10-foot span sustains a load of 15,000 lbs.

SHOCK STRENGTH

The toughness of cast iron pipe which enables it to withstand impact and traffic shocks, as well as the hazards in handling, is demonstrated by the Impact Test. While under hydrostatic pressure and the heavy blows from a 50 pound hammer, standard 6-inch cast iron pipe does not crack until the hammer is dropped 6 times on the same spot from progressively increased heights of 6 inches.

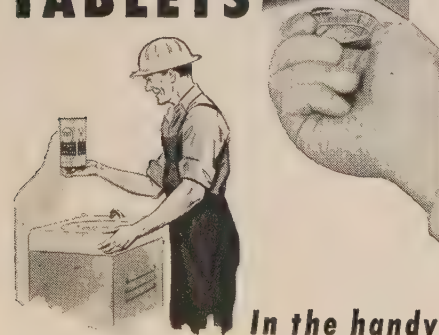
BURSTING STRENGTH

In full length bursting tests standard 6-inch cast iron pipe withstands more than 2500 lbs. per square inch internal hydrostatic pressure, which proves ample ability to resist water-hammer or unusual working pressures.

CAST IRON PIPE SERVES FOR CENTURIES

Beat Heat Fatigue

with
McDonald
1.4.U
SALT
TABLETS



In the handy

throw away dispensing carton.

In three types — (1) popular enteric coated tablet (eliminating risk of nausea), (2) salt plus dextrose, and (3) plain salt tablets. Disposable cartons in two sizes — economy dispenser of 1,000 or handy 500-tablet dispenser.

WRITE FOR CIRCULAR

B. F. McDONALD CO.

Manufacturers & Distributors
of Industrial Safety
Equipment

5102 South Hoover Street
Los Angeles 37, California

Other Offices in San Francisco & Houston,

126 lin. ft. 24-in. corr. met. syph. pipe	9.00	9.00	7.50	8.00	5.50
1,058 lin. ft. relay pipe culverts	2.00	2.00	3.00	3.00	1.50
108.6 cu. yd. Class A conc.	80.00	80.00	80.00	94.00	80.00
34.3 cu. yd. Class B conc.	80.00	75.00	80.00	90.00	80.00
6,725 lb. reinforcing steel	.22	.15	.20	.18	.20
160 cu. yd. gravel backfill	4.00	2.50	3.00	2.00	3.00
220 cu. yd. hand-laid riprap	6.00	17.00	20.00	18.00	15.00
0.360 M.b.m. lumber in headgates	300.00	250.00	250.00	200.00	300.00
11 ea. headg. moved and reset	40.00	20.00	50.00	20.00	25.00
5 ea. weirs moved and reset	40.00	20.00	30.00	25.00	25.00
2 ea. conc. proj. markers	25.00	20.00	25.00	25.00	15.00
55 ea. conc. right-of-way monuments	10.00	8.00	4.50	5.00	5.00
37 ea. conc. station markers	10.00	12.00	6.00	10.00	7.00
1,030 ton Type A stkl. grav. ½-in.	1.25	2.00	1.40	1.50	3.50

Utah—Tooele County—State—Grade and Surf.

W. W. Clyde & Co., Springville, Utah, with a bid of \$359,357, was low before the State Road Commission of Utah for construction of 10.4 mi. of the Low-Knolls highway. The work consists of grading, drainage and a plant-mixed bituminous surfacing. Unit bids were submitted as follows:

(1) W. W. Clyde & Co.	\$359,357	— R. M. Jensen & Hunsaker Sand and Gravel Co.	\$435,869
(2) Silver State Construction Co.	393,919	— Gibbons and Reed	439,028
(3) Reynolds Construction Co.	395,305	— Floyd S. Whiting	448,907
(4) Strong Co.	401,844	— A. O. Thorn & Sons	500,261
(5) Whiting & Raymond	414,910	(7) Engineer's estimate	425,455
(6) L. T. Johnson Construction Co.	422,480		
— Dodge Construction Co.	423,161		

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
40,500 ton plant-mixed bitum. surfacing	1.90	1.80	1.90	2.00	2.05	2.15	2.00
429,000 gal. bitum. matl., Type 120-150 pen.	.10	.11	.12	.11	.1175	.11	.105
139,000 gal. bitum. matl., Type MC-1	.115	.11	.12	.12	.12	.13	.12
14,000 gal. bitum. matl., Type RC-2	.12	.11	.12	.12	.11	.14	.12
44,500 gal. bitum. matl., Type RC-4	.12	.11	.12	.13	.13	.14	.12
10,000 gal. bitum. matl., Type SC-3	.105	.11	.12	.11	.115	.11	.105
0.996 mi. scarifying and mixing	600.00	500.00	1,000	800.00	550.00	1,000	700.00
0.996 mi. obliteration of old roads	200.00	100.00	500.00	200.00	100.00	200.00	100.00
2,250 ton cover material	2.50	3.00	3.00	2.40	2.75	2.50	2.50
3,000 ton cover matl. (place in stkl.)	1.50	2.00	2.00	2.10	1.75	2.00	2.00
51,000 ton cr. rock or cr. gravel surf. course	.47	.58	.60	.72	.60	.60	.65
10,000 ton cr. rock or cr. grav. sur. crse. (pl. in stkl.)	.42	.40	.50	.50	.48	.45	.55
130,000 ton grav. or cr. rock base course	.42	.48	.50	.58	.56	.55	.60
345,000 cu. yd. unclassified excavation	.18	.24	.18	.16	.21	.21	.22
850,000 st. yd. overhaul, Class "A"	.01	.01	.01	.01	.01	.0125	.01
10,500 yd. mi. overhaul, Class "B"	.12	.20	.15	.12	.10	.15	.12
2,600 1000 gal. watering	2.50	2.50	2.00	2.50	3.00	2.80	3.00
6,200 hr. rolling	3.50	3.00	4.00	4.00	4.00	4.00	5.00
21 lin. ft. 15-in. concrete pipe	2.75	3.00	3.00	3.00	2.90	3.00	3.00
564 lin. ft. 18-in. concrete pipe	3.40	4.00	3.20	3.65	3.45	3.75	3.40
1,407 lin. ft. 24-in. concrete pipe	4.60	5.00	4.40	4.50	4.65	5.25	4.70
336 lin. ft. 30-in. concrete pipe	6.90	7.00	7.30	7.00	6.90	8.50	6.80
474 lin. ft. 36-in. concrete pipe	9.70	9.00	10.00	9.50	9.40	11.50	9.50
76 lin. ft. 48-in. concrete pipe	14.30	15.00	15.50	15.00	14.80	18.00	14.50
600 cu. yd. excav. for struts	1.50	1.00	2.00	.80	1.50	1.50	1.50
4,000 cu. yd. channel excavation	.30	.23	1.00	.40	.40	.50	.30
126 acre clear and grubbing	20.00	30.00	20.00	25.00	15.00	15.00	15.00
21 ea. guide posts	5.00	5.00	7.00	5.00	5.00	6.00	5.00
110 ea. right-of-way markers	5.00	6.00	6.00	5.00	4.50	5.00	5.00

Colorado—Larimer County—B.P.R.—Grade and Surf.

Colorado Constructors, Inc., Denver, Colo., with a bid of \$113,224, was low before the Bureau of Public Roads for grading to a 44-ft. width and surfacing from 29.5 to 37.5-ft. width with road-mix asphalt surfacing of 0.25 mi. of the South St. Vrain highway. Unit bids were submitted as follows:

(1) Colorado Constructors, Inc.	\$113,224	(5) Peter Kiewit Sons' Co.	\$129,852
(2) L. J. Hesser	121,095	(6) R. L. Hanes & Co.	131,669
(3) Lindstrom & Williams	121,252	(7) Engineer's estimate	145,361
(4) Edward Selder	127,511		

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
2,000 cu. yd. stripping and storing topsoil	.35	.50	.60	.40	.70	.75	.70
14,000 cu. yd. unclassified excav.	.85	.50	.60	.70	.75	1.10	.70
1,920 cu. yd. unclass. excav. for struts	4.00	5.00	5.00	6.00	3.00	2.50	6.00
19,000 cu. yd. unclass. excav. for borrow, Case 1	.40	.40	.60	.40	.35	.40	.60
7,000 cu. yd. mi. spec. overhaul of borrow (1000-ft. frechaul)	.20	.25	.20	.15	.20	.30	.20
1,500 cu. yd. replacing topsoil	.50	.80	.50	.60	1.20	1.25	.80
820 unit watering of embankment Item 29	1.00	1.00	1.50	1.00	1.50	1.00	1.50
60 unit watering of base course Item 52A	1.00	2.00	1.50	1.00	1.50	1.50	1.50
Lump sum, providing and maintaining water plant or plants	200.00	300.00	200.00	150.00	350.00	100.00	300.00
220 hr. sheepfoot or tamping roller for emb. Item 29	10.00	12.00	10.00	6.00	6.00	5.00	5.00
2,052 hr. power roller for base course item	7.00	10.00	8.00	6.00	10.00	12.00	6.00
Lump sum, prov. and maint. sheepfoot or tamping roller or rollers on the project	200.00	300.00	200.00	150.00	1,400	750.00	500.00
Lump sum, prov. and maint. power roller or rollers on the project	200.00	300.00	400.00	150.00	750.00	250.00	500.00
2,000 ton cr. grav. or cr. stone base crse, Cl. 2, Grad. D-1	1.50	3.00	3.50	3.50	2.25	1.25	2.50
3,000 gal. MC cut-back asph., Grade 0-1, for prime coat	.18	.20	.18	.20	.17	.20	.20
65 ton cover aggr. for Type 3 seal coat, grading B	5.00	6.00	6.50	6.00	8.00	10.00	7.00
2,000 gal. RC cut-back asph., Grade 3-4, for seal coat	.17	.20	.18	.20	.20	.20	.20
8,000 sq. yd. (Cl. C-1 pavmt.) road-mix surfacing laid, Case 1	.15	.20	.12	.15	.20	.15	.15
900 ton (Cl. C-1 pavmt.) new road-mix aggre., grading B	1.50	4.00	3.25	2.50	2.50	1.25	2.75
10,000 gal. MC cut-back asph., Gr. 3, for Cl. C-1	.16	.20	.17	.20	.18	.20	.20
702 cu. yd. conc. Cl. A (air-entrained conc., low-alkali cement)	45.00	45.00	46.00	55.00	55.00	57.00	70.00
74,700 lb. reinforcing steel	.11	.11	.11	.11	.12	.13	.12
171,200 lb. struct. steel—furn., fabr. and erected	.14	.15	.135	.15	.17	.15	.17
78 lin. ft. 8-in. C.G.S.M. culvert pipe	1.75	2.00	2.00	2.00	3.00	2.00	2.50
70 lin. ft. 15-in. C.G.S.M. culvert pipe	3.00	3.00	3.25	3.00	4.00	3.00	3.00
28 lin. ft. 18-in. C.G.S.M. culvert pipe	3.60	4.00	3.75	3.50	5.00	3.50	4.00
30 lin. ft. 24-in. C.G.S.M. culvert pipe	5.30	5.00	5.50	5.00	6.00	5.00	6.00
30 lin. ft., remove, clean and stockpile salvaged culvert pipe	2.00	2.00	2.00	3.00	5.00	5.00	3.00
1,240 lin. ft. comb. conc. walk, curb and gutter	3.45	5.00	2.00	3.00	4.00	5.00	3.00
Lump sum, remove old bridge	\$2,000	\$1,000	\$3,000	\$2,000	\$2,500	\$3,900	500.00

K-B

KAY-BRUNNER

announces the appointment of

WICKER-WOOD

Equipment Co., Inc.

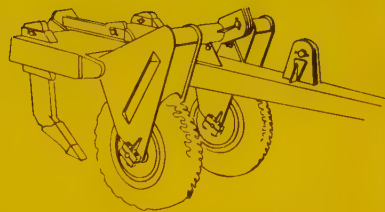
as a General Distributor of

K-B

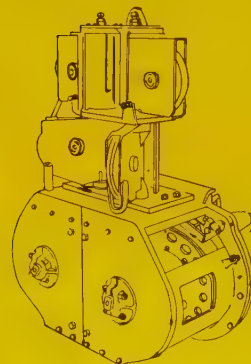
EARTHMOVING EQUIPMENT

YOU'LL BENEFIT from this new combination of job-proved KAY-BRUNNER equipment and the ready-willing-and-able sales and service attention of WICKER-WOOD EQUIPMENT CO., INC.

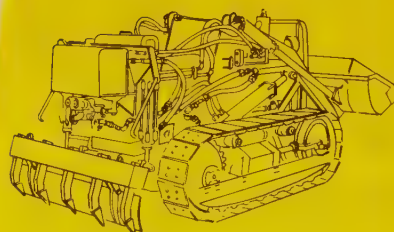
Put us to work for you on your next job.



Rubber-tired Ripper



Cable Power Control Unit



Hydraulic Scarifier



earthmoving equipment is manufactured in the West and is built to meet the requirements of Western users.



KAY-BRUNNER STEEL PRODUCTS INC.
EQUIPMENT DIVISION
2721 Elm Street, Los Angeles 65

WICKER-WOOD EQUIPMENT CO., INC.
6900 Tujunga Ave.
P.O. Box 8, North Hollywood, Calif.
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RIPPERS • HYDRAULIC CONTROL SYSTEMS • TAMPING ROLLERS • DOZERS AND TRAIL BUILDERS
CARRYING SCRAPERS • LAND LEVELERS • POWER CONTROL UNITS

NEW EQUIPMENT

MORE COMPLETE INFORMATION of any of the new products or equipment briefly described on the following pages may be had by sending your request to Equipment Service, Western Construction News, 609 Mission Street, San Francisco 5, Calif. For quicker service, please designate the item by number.

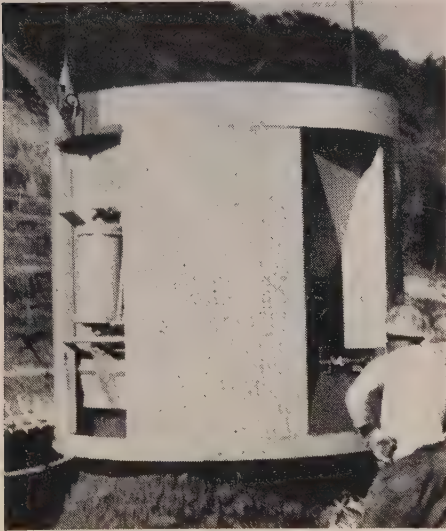
601

Concrete Bucket

Manufacturer: Blaw-Knox Co., Pittsburgh, Pa.

Equipment: Concrete bucket with air-operated clam gate and rectangular discharge openings.

Features claimed: Designed for handling low-slump concrete containing large aggregates and air entraining agents, the circular Model CAC concrete bucket can load and discharge all concrete rapidly and



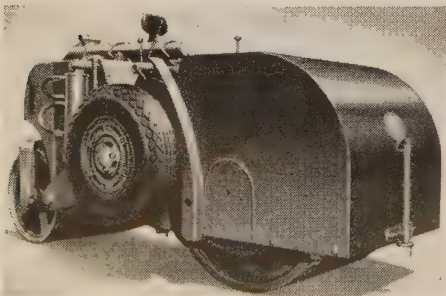
completely. Part of the load can be deposited in one location and the remainder in another if desired. The transition from the circular hopper to the rectangular discharge throat produces hopper slopes which are 70 deg. with the horizontal, with corners that are practically vertical. Model CAC buckets are furnished in 2, 3, 4, and 8-cu. yd. sizes. The 8-cu. yd. model is available as a 1 or 2-compartment bucket.

602

Tandem Roller

Manufacturer: Huber Manufacturing Co., Marion, Ohio.

Equipment: Tandem retractable wheel



5-ton roller, powered by a 4-cylinder V-type air cooled gasoline engine.

Features claimed: This portable, self-contained unit travels easily and quickly from one job to another. It can be towed

behind either a truck or the Huber Road Maintainer at normal highway speeds. The roller uses its own power to raise and lower the trailing mechanism that is built integral with the frame. While the roller is being towed, the rolls ride 9 in. from the ground.

603

Lifting Clamp

Manufacturer: Merrill Brothers, New York, N. Y.

Equipment: Adjusta-Clamp.

Features claimed: The clamp will lift any metal object up to 12-in. thick that its adjustable jaws can grip. Larger openings are supplied upon special order. The clamp will lift material from horizontal to vertical position without changing the grip of the movable jaws.

604

Earth Borer

Manufacturer: Hydrauger Corp., Ltd., San Francisco, Calif.

Equipment: Scooter Model Hydrauger.

Features claimed: Faster and lower cost service pipe installations are available from a newly developed Hydrauger, earth boring tool. The 8-in. wide, 150-lb. machine features a full length sled mount and air driven cable winch that pulls the entire machine along as it advances the boring bit forward into the ground. Up to 70 ft. of



drill stem can be laid out ahead of the machine, and pulled into the earth formation by means of the winch and cable. Rapid boring of both 2 and 2½-in. holes is done by rock, hardpan, or clay type bits. It is used principally for house service leads and through-embankment pipes. Two sizes of motors, 3.2 and 5.1 hp., are available. The unit uses 1-3/16-in. hollow boring bars in sectional lengths up to 10 ft. The drill stem assembly is withdrawn from the bore under air winch power and the service pipe can

be drawn into the hole as the stem is withdrawn.

605

Scarifiers

Manufacturer: Preco Incorporated, Los Angeles.

Equipment: Back Rip Scarifiers, with 4 steel alloy curved shanks, which are mounted on the back-side of bulldozer moldboards.

Features claimed: Back Rip Scarifiers, which rip the ground when the tractor backs up and float on top of the ground



when moving forward, have teeth which rip and loosen packed soil, black top and hard ground. They rake out rocks and roots and smooth the ground, making forward blading easier and faster. The equipment does not interfere at any time with blading operations, while dead-head time is fully utilized.

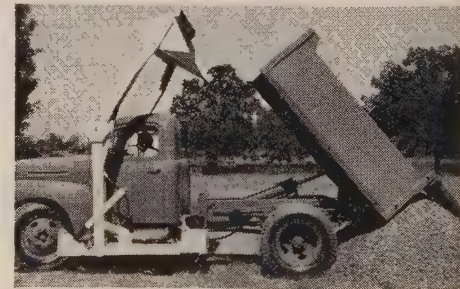
606

Loader for Dump Trucks

Manufacturer: Ernest Holmes Co., Chattanooga, Tenn.

Equipment: Holmes-Owen self-loading unit for dumping trucks.

Features claimed: This unit attached to a dump truck permits a one-man operation for light digging, grading, scooping-up of materials, loading, hauling and unloading



independent of any outside assistance. The loader is powered by four independently operated hydraulic cylinders, two on each side. The loader unit can be mounted on most standard dump trucks. It is particularly recommended for cleaning up after a contracting or highway job. Leverage obtained from the hydraulic cylinders assures sufficient power without assistance from the truck's motor.

607

Carbide-Tipped Bit

Manufacturer: New England Carbide Tool Co., Inc., Cambridge, Mass.

Equipment: Cyclo-Twist rotary drill masonry bit.

Features claimed: Two spiral low-angle flutes are turned in the steel drill body. The diameter of the body is the same as the diameter of the hole to be drilled, giving maximum steel support to the carbide tip. Advantages include no cleaning of hole, no

stalling or slowing down of drilling, uniform dust removal, and lower cutting temperature. Sizes range from 3/16 to 1 in.

608

1/2-Yard Payloader

Manufacturer: Frank G. Hough Co., Libertyville, Ill.

Equipment: Model HE tractor shovel.

Features claimed: Like other Payloaders, the Model HE is a complete Hough-built tractor-with-shovel. It will dig, load trucks,



grade, level, backfill, spread, transport and remove snow, and handle bulk materials. It will also lift, lower, push, and haul. The 1/2-cu. yd. Payloader has a full-reversing transmission with 4 forward and 4 faster reverse speeds. The coupling with forward-reverse control is separate from the regular gear shift. Bucket capacities are now available in 12 cu. ft., 1/2-cu. yd., 3/4-cu. yd., 1 1/4-cu. yd., and 1 1/2-cu. yd.

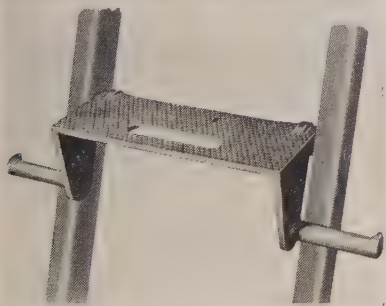
609

Ladder Platform

Manufacturer: Res-Tep, Inc., Euclid, Ohio.

Equipment: "Res-Tep" adjustable ladder platform.

Features claimed: The easily-handled ladder platform attaches to any round lad-



der rung and is quickly changed from rung to rung. It eliminates ladder fatigue caused by poor balance on a rung. The surface is 12 in. wide and 5 in. deep, with a diamond tread, and weighs 4 lb.

610

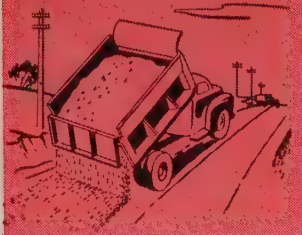
Dual Drive Truck Unit

Manufacturer: Cook Bros. Equipment Co., Los Angeles, Calif.

Equipment: C-B Center Chain Drive and Dual Gear Drive Units.

Features claimed: The rugged drives meet any hauling requirement, on or off the highway. They are easily installed on any new or used truck, and each model is designed for a special hauling requirement and to match the size and power of the truck used. Installations have been made on trucks with engine displacements varying from under 300 cu. in. up to the

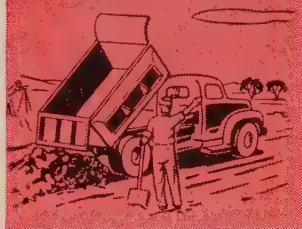
New "NO-SURGE" DUMPING
with LOWER OIL PRESSURE



New, STRONGER, MORE
FLEXIBLE SUB-FRAMES



New 55° DUMP ANGLE



New LOWER
MOUNTING HEIGHT



LIFTS MORE . . .

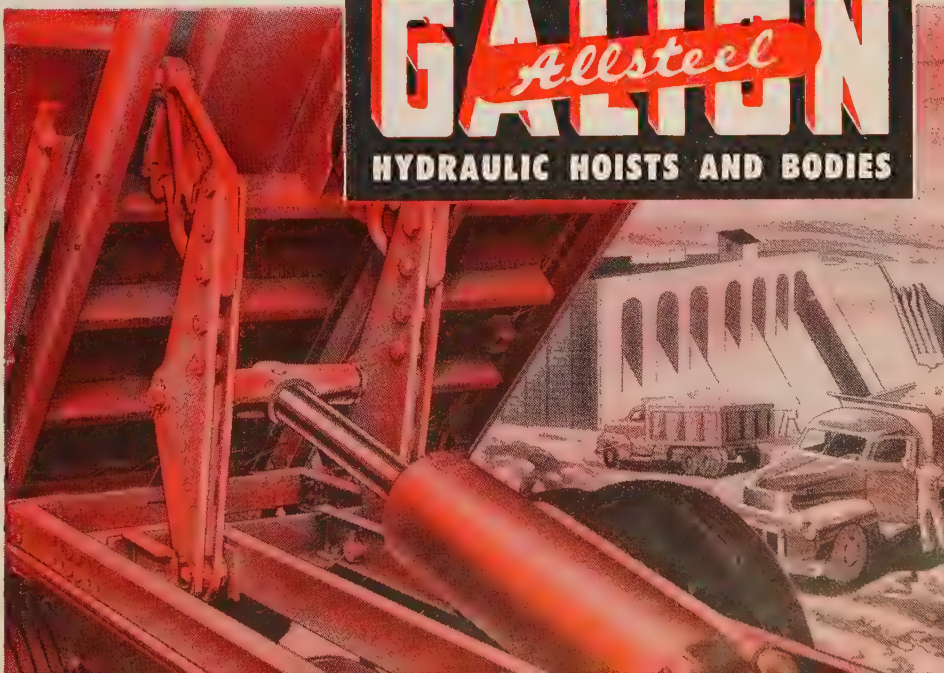
LASTS LONGER

New, Improved Galion Fulcrumatic

EQUALIZING DOUBLE-LIFT ARM HYDRAULIC HOISTS

Galion Fulcrumatic lift is today's greatest advancement in dump truck "lift-ability". Job proven over the years, these improved double lift arm Fulcrumatic hoists now give even smoother, faster dumping action, plus EXTRA years of dependable service. For loads from 5 to 25 tons, there's a Galion Fulcrumatic Hoist to speed up your material handling work. See your truck dealer or Galion distributor for complete details.

The GALION Allsteel Body Co., Galion, Ohio



largest gasoline-type automotive engine built. Chain drives are built in 5 sizes, 8 to 20-ton capacity, and are a complete package unit, readily installed on truck or removed for servicing. Gear drives are in 3 models, providing a wide range of ratios. Being several hundred pounds lighter than other types, they are able to carry a greater payload. Like the chain drive, the gear drive is a package unit ready for installation.

611

Portable Saw

Manufacturer: Mall Tool Co., Chicago, Ill.

Equipment: Model 87 MallSaw.

Features claimed: Weighing only 12 lbs., model 87 rips, crosscuts, and angle cuts



rough or finished lumber. Either right or left blades are available to suit preference. A bevel-depth attachment permits straight

cuts from 11/16 in. to 2-31/32 in., and up to 45 deg. bevel cuts from 3/4 to 1 1/2 in. The operator is protected from the saw blade by a telescoping blade guard. Ball and needle bearings are used throughout, and both 115 and 230-volt AC-DC models are available.

612

Machinable Electrode

Manufacturer: Eutectic Welding Alloys Corp., New York, N. Y.

Equipment: Eutectrode 25 Formula 1950.

Features claimed: The electrode has none of the inadequacies of conventional nickel electrodes, such as softness, poor color match, dissimilar coefficient of expansion, and poor bonding properties with scaly or impure cast iron. The new core alloy gives welds of greater strength, 60,000 p.s.i., and hardness, Brinell 210-250, and a close color match. The FrigidArc coating eliminates the need for preheating. Eutectic continues to offer its EutecTrode 24 for cold welding of grey cast iron. However, the new product is for handling difficult to weld alloy cast irons and overlays.

613

Sewage Treatment

Manufacturer: American Well Works, Aurora, Ill.

Equipment: American camp grit channel and regulator designed to maintain any constant velocity regardless of quantity of flow, for proper removal of grit in sewage treatment.

Features claimed: The grit channel and regulator provide an accurate and practical method of operation as well as a safety factor for the designing engineer. Features include choice of head loss to accommodate

plant hydraulic conditions, lower total head losses due to inherent advantages in rectangular control section, simplified concentration of grit for less operator time, wide range of adjustment and velocity selection, no construction problems, constant velocity, and simplicity of control.

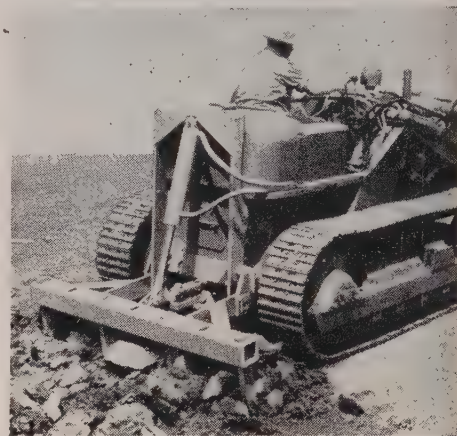
614

Heavy-Duty Ripper

Manufacturer: Shaw Sales & Service Co., Los Angeles, Calif.

Equipment: Heavy-duty ripper for Allis-Chalmers Tracto-Shovels.

Features claimed: The Shaw Ripper is a complete unit with standard equipment



composed of ripper frame, 4 shanks and ripper points, hydraulic cylinder, and all necessary fittings. The frame is built to take up to 7 ripper shanks at varying intervals depending upon nature of the work. Points can be removed from shanks for

FIR-TEX

Absorptive Form Liner

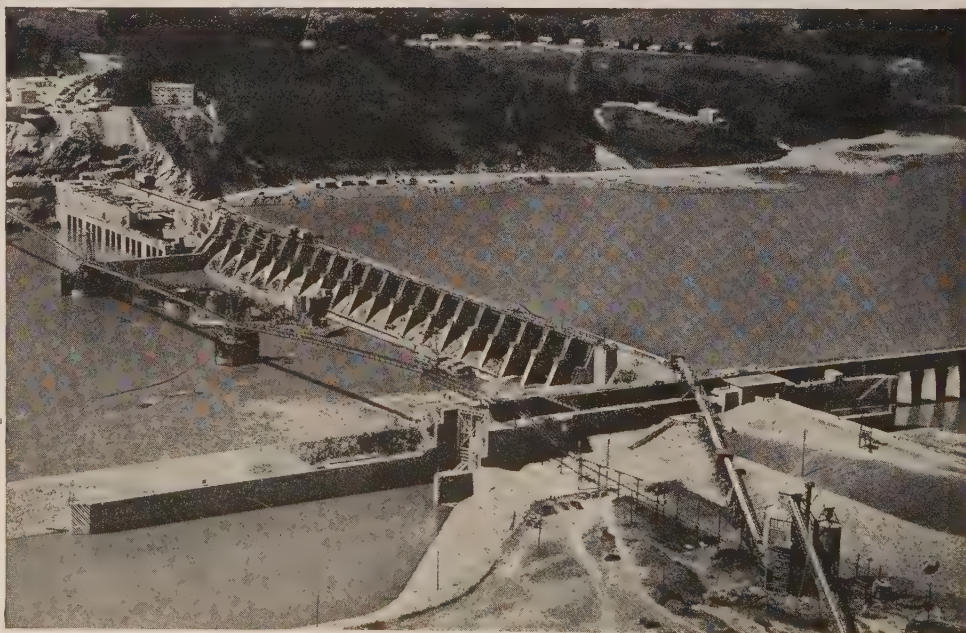
Produces Smoother, Harder
Denser Concrete on

WATTS BAR TVA DAM

FIR-TEX Absorptive Concrete Form Liner is a highly absorptive felted board, with a chemically treated surface which resists bonding.

The mechanical vibration of concrete increases the tendency of air and water bubbles to float to the surface and to the face of the mass. When a non-absorptive form liner is employed, these bubbles have no avenue of escape and consequently remain to become voids in the face of the concrete.

The action of the Fir-Tex Liner is like that of a vacuum cleaner. It absorbs all excess air and water adjacent to surface. The removal of bubbles permits the cement to flow into those spaces so that this surface sets solidly into a smooth attractively textured mass of extreme density and resistance to moisture. This structural change in the concrete extends to a depth of about 1 1/4 inches from the face. Not only has the structure been given architectural beauty, but its weather resistance has been so greatly increased that eminent engineers have referred to its surface as "case hardened".



Watts Bar TVA Dam, Eastern Tennessee. This multiple purpose dam will extend navigation channel 72 miles upstream, aid in controlling floods, and generate power vitally needed for the Victory Program.



See section 3

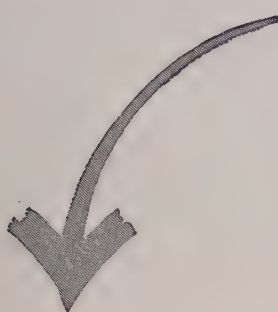
FIR-TEX INSULATING BOARD CO.

Equitable Building, Portland 4, Oregon

BARRETT* PROTECTIVE PRODUCTS

COVER EVERY PIPE-COATING NEED

- 1 Pipeline Enamel
- 2 Millwrap Enamel
- 3 A.A. Enamel
- 4 Asbestos Felt
- 5 Materials for Special Uses



BARRETT*
A.A. ENAMEL

The trade name Barrett* A. A. Enamel designates a plasticized enamel for protecting oil, natural gas, and refined product lines. It is not affected by exposure to the bitterest cold, or most torrid heat. It will not crack at -20° F., nor flow at 160° F. Because it withstands this wide range of temperature, it makes satisfactory pipe protective work possible at any season.

Like other Barrett* coal-tar enamels, Barrett A. A. Enamel is non-absorptive, non-porous, and retains its dielectric properties without regard to soil conditions. It forms a strong, flexible shield against corrosion, and also withstands stresses produced by pipe movements or backfill consolidation.



Above: Midwinter in Pennsylvania—Barrett A. A. Enamel will not crack at -20° F.
At right: Midsummer in the Arizona desert—Barrett A. A. Enamel will not flow, even at 160° F.

✓ Memo: FOR CORROSION ENGINEERS

Barrett coal-tar materials for special uses are all dependable, durable and economical. Eternium* Paint for exposed metal work. CA-50 Heavy-Duty Cold Application Coating for concrete and metal exposed to extremely corrosive conditions. Marine Enamel for ships, barges and off-shore service vessels. Service Cement and Pipeline Fabric for field joints—no torching required. Asbestos Pipeline Felt for soil stress shield. Tank Bottom Compound for sour crude storage. 34 YB Paint for exposure to salt water spray conditions.



THE BARRETT DIVISION
ALLIED CHEMICAL & DYE CORPORATION
40 Rector Street, New York 6, N. Y.

*Reg. U. S. Pat. Off.

resharpening or replacement when worn. Shank locking is by metal wedge—easily inserted and easily removed. The ripper can be attached easily and quickly to the tractor. With only 1,000 lb. of weight (on rear end), ripper does not impose undue excess weight on tractor but can act as a balancing unit when used in conjunction with front-mounted shovel or bulldozer.

615

Multiple V-Belt

Manufacturer: B. F. Goodrich Co., Los Angeles, Calif.

Equipment: Multiple V-belt with 40% power increase.

Features claimed: A 40% power increase over comparable sizes is obtainable in the new belt. The increase was made possible without stiffening the belt construction or

reducing any of the safety factors. The belt is also available for use where dissipation of static is essential.

616

Overload Release

Manufacturer: American Pulley Co., Philadelphia, Pa.

Equipment: Mechanical overload release that protects machinery against damaging shocks and overloads.

Features claimed: Users of slow-speed machinery that can be equipped with American Reduction Drives can now automatically protect expensive equipment against heavy shocks, impact, and choke-load conditions with a new, mechanical torque-arm overload release. The unit applies to elevators, conveyors, mixers, blenders, and all other types of slow-speed ma-

chinery. It is quickly installed without any alterations to the drive and affords positive, instantaneous protection against damage. It is considered an improvement over shear pin devices because it can be actuated time after time without replacing any parts.

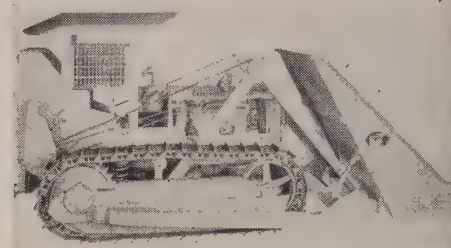
617

Small Overshot Loader

Manufacturer: John Austin, Inc., Denver, Colo.

Equipment: Austin Model 4-C overshot loader for tractor mounting, with rated capacity of 1 cu. yd. and a 20-sec. loading cycle.

Features claimed: Readily attachable to utility size tractors, the loader will handle bank-run material at a rate of 125 cu. yd.



per hr. on a 50-min. hour with no increase in fuel consumption over normal dozing operations. The overshot action, which eliminates swinging and blocking, is powered by a Caterpillar Model 24 cable control unit driving a single cable through a wrap-around series of sheaves; this results in even tension at both sides, maximum power at start of the loading cycle, and maximum speed for the balance of the cycle.

618

Cross Section Drafting Paper

Manufacturer: The Ogilvie Press, Brooklyn, N. Y.

Equipment: Veltex No. 450.

Features claimed: The cross section ruling on sheets of Veltex No. 450 will not reproduce on the prints. Veltex originals may be used for blueprint, black and white, or Ozalid reproductions. Best results are obtained with a fast paper. No. 450 is a 100% rag resin-treated vellum. It will not become brittle or discolor with age.

619

Air-Cooled Engines

Manufacturer: Kohler Co., Kohler, Wis.

Equipment: Models K7-1 and K12-1 air-cooled engines.

Features claimed: With 2 and 3 hp., respectively, models K7-1 and K12-1 are designed for durable use on small equipment and tractors, water pumps, conveyors and other uses. Features include a moisture-proof crankshaft magneto, mechanical oil-bathed fly-weight governor, metered positive splash lubrication, and a special carburetor to insure satisfactory operation at angles up to 30 deg.

620

Masonry Drills

Manufacturer: Kennametal, Inc., Latrobe, Pa.

Equipment: Twist type masonry drills with vacuum-sintered cemented carbide blades.

Features claimed: An angled cutting point practically eliminates the motionless dead center, giving the drill greater biting power. A faster spiral cleans out dust at an accelerated rate, permitting continuous



PREFORMED

gives you

LONGER LIFE; because Preforming helps to keep WIRE ROPE free from internal stress, reduces twisting and turning in the groove — thus cutting down *both* internal and external wear.

EASIER HANDLING; because it is relaxed and more flexible. These features insure smoother spooling.

MORE ECONOMY; because replacements are far less frequent.

*We Invite
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"HERCULES"
REG. U.S. PAT. OFF.
RED-STRAND
WIRE ROPE

MADE ONLY BY
A. LESCHEN & SONS ROPE CO.

ESTABLISHED 1857
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NEW YORK 6
LOS ANGELES 21

CHICAGO 7
SAN FRANCISCO 7

HOUSTON 3
PORTLAND 9

DENVER 2
SEATTLE 4

lling. The drills fit standard rotary electric drill chucks, and will cut all forms of masonry. Twelve sizes, from 1/4 to 1 in., are available in increments of 1/16 in.

621

Force Hood

Manufacturer: General Scientific Equipment Co., Philadelphia, Pa.

Equipment: Rubber coated protective force hood.

Features claimed: Coated with a recently improved rubber, the fabric in the G-S



Safety Hood is impervious to moisture, most acids, caustics, oils, and solvents, and protects against extreme temperatures and hot molten metal splashes. In addition, visibility is retained for long, durable life. The hood is fitted with a large plastic window for easy visibility and protects face, head, and neck while working on acid storage tanks or pipelines, and while degreasing, paint spraying, sand blasting, and similar operations. Unit may be worn with goggles or respirator.

622

Tractor-Drive Generator

Manufacturer: D. W. Onan & Sons, Inc., Minneapolis, Minn.

Equipment: Belt-drive generator for tractors.

Features claimed: Tractor owners can now provide their own low-cost emergency electric power with a new type generator designed for belt-drive and producing regular highline type electricity. Available in 5, and 10-thousand watt capacities, the tractor-drive generators supply exactly the same 115/230-volt, 60-cycle current as that delivered by commercial power lines. Mounted control box, voltmeter, and protective circuit breaker are featured in the kit.

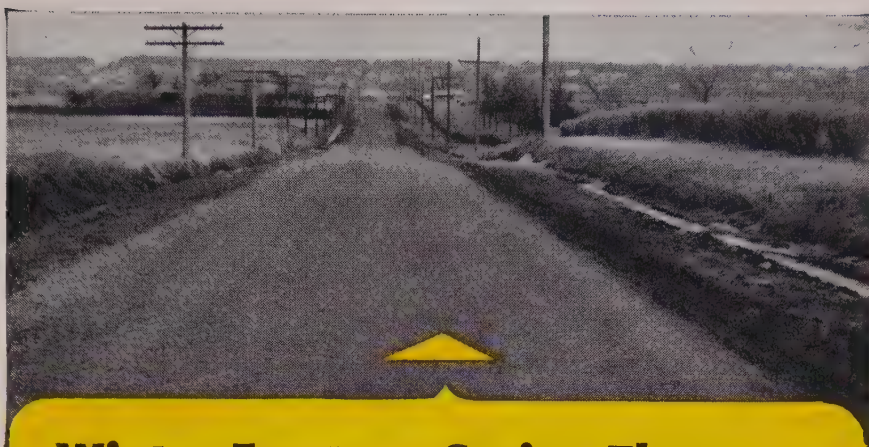
623

Surveying Pentaprism

Manufacturer: Stratex Instrument Co., Los Angeles, Calif.

Equipment: Constant deviation pentaprism with saddle leather, belt loop case.

Features claimed: The Wasatch layout pentaprism can check instantly and accelerate the solving of problems involving angles of 90 deg. and multiples thereof, as applied to ground and drill hole layouts, field inspections, stope surveys, etc. Pentaprisms are unique in engineering optics in that foresite images are erect and positive, contrasted to the negative images characteristic of older right prisms or arrangements of mirrors. It is carried in a "light-



Winter Frosts... Spring Thaws... Months of Use and Abuse... PROVE ATHEY LOW-COST ROAD REBUILDING METHODS

Will County, Illinois, urgently needed a new surface on a section of old highway, surfaced with bank-run gravel and an oil mix.

Johnston Road Builders, Inc., went to work on the project. Their motor grader scarified the surface 6" deep, producing material made up of 6" and 8" rocks and gravel, that had to be reduced. *An Athey Force-Feed Loader-Portable Breaker Plant was assigned the job.* The team picked up the material... crushed it to 1 1/2" minus grade... returned it to the roadbed in even windrows — 100 to 125 tons per hour!

Oil mixed, rolled and compacted, the material made a new, smooth surface that withstood seven months of the hardest travel and weather! *This, plus the savings in material, time and money could not be equalled with any other method!*

These savings can be yours — with an Athey road-rebuilding team on your job. See your Athey-"Caterpillar" Dealer for more details — today!



The modern Athey method of road-rebuilding gave Will County unequalled savings, as well as a strong, smooth-surfaced road. Look at the big rocks that were picked up, crushed and made into the good road at top... still smooth after 7 months of the hardest use!

Athey Products Corporation, 5631 West 65th Street, Chicago 38, Illinois



Athey

FORCE-FEED LOADER

house" mount, protected by a revolving shutter. Backsight alignment is accomplished by two pairs of vee sights, opposed at 90 deg. to each other. The backsight is aligned as though the observer were aiming a pistol, after which the foresight appears in the prism at 90 or 270 deg., depending upon the sights used. The complete instrument is 4½ in. long, weighs 2½ oz., and is fabricated of aluminum alloy finished in durable jet corundum. Reflecting surfaces of the borosilicate optical prism are flash coated with aluminum.

624

Improved Dumpcrete

Manufacturer: Maxon Construction Co., Dayton, Ohio.

Equipment: Dumpcrete with higher swinging baffle inside the body, relocated to improve discharge action of concrete.

Features claimed: With design especially planned for fast delivery and placement of



pre-mixed concrete, the Dumpcrete body permits greater production and ease of operation. Concrete overflow is now eliminated because sides of the hopper section of the chute have been made higher. For driver convenience, strap steps are pro-

vided on front and rear running boards, and gate discharge handles are more easily accessible. New type cast steel anchor bracket assemblies are furnished for securing the Dumpcrete to the truck chassis frame.

625

Traffic Regulator

Manufacturer: General Electric Company.

Equipment: Type F stop and go street light.

Features claimed: The controller can "grow" with traffic needs, and has been designed to fit in with existing systems with easy adaptation should future traffic needs require additional equipment. In this case, the controller need not be replaced, but can be adapted by simply mounting additional dial units, relays, and other accessories. The dial units, adjustable for daily peak loads, are mechanically and electrically connected in one operation.

626

Sectionalized Package Conveyor

Manufacturer: Hewitt-Robins Inc., New York, N. Y.

Equipment: Robins sectionalized conveyor.

Features claimed: The conveyor can be shipped as a package and installed in the field without the help of trained personnel in about one-fourth the time required for conventional type conveyors. Designed primarily for small scale operations, aggregates can be conveyed at 300 tons per hour. The conveyor comes in sections of 15½, 18½ and 21½-ft. lengths that can be bolted together according to the needs of the job

at special joints designed to facilitate assembling and assure correct alignment.

627

Spray Gun

Manufacturer: Eclipse Air Brush Co., Newark, N. J.

Equipment: Model "47" nozzle in the GAT-2 gun.

Features claimed: The nozzle design reduces fumes and provides an unusual

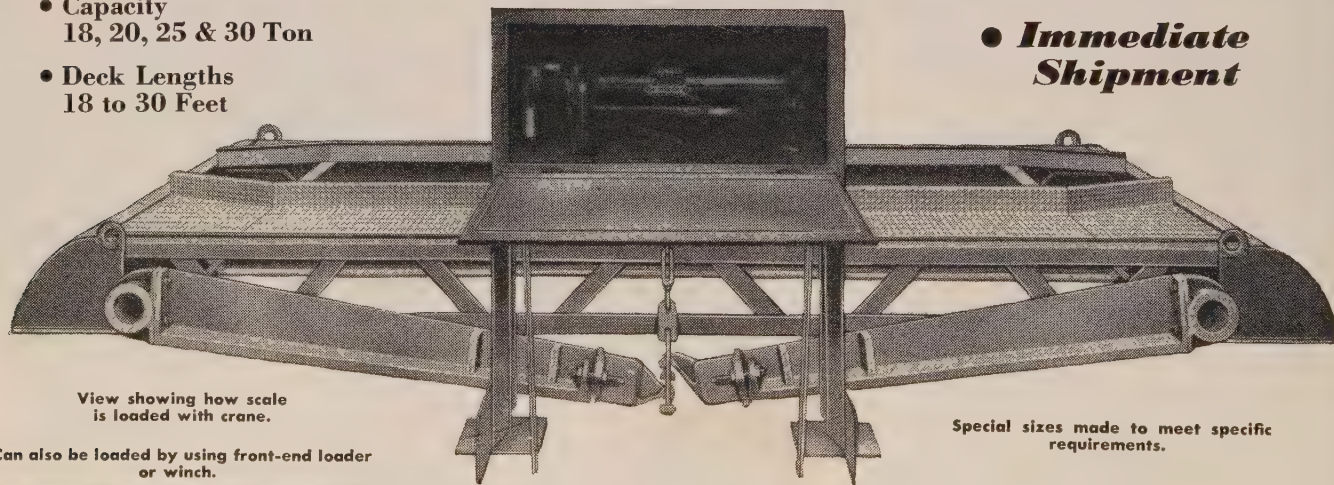


range of spray patterns, available with only the turn of a simple thumb screw at the back of the gun. The gun features a new four-finger trigger, allowing use for longer periods of time without finger fatigue and handling with gloved hands. The firm recommends its use particularly for high speed production painting in such fields as heavy

THURMAN *Portable* TRUCK SCALE

- Capacity
18, 20, 25 & 30 Ton
- Deck Lengths
18 to 30 Feet

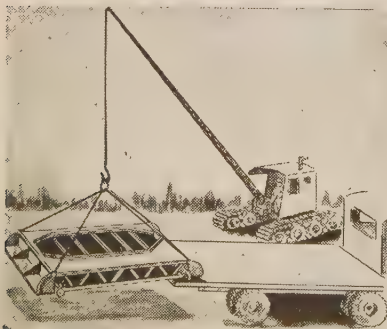
- *Immediate
Shipment*



View showing how scale is loaded with crane.

Can also be loaded by using front-end loader or winch.

Special sizes made to meet specific requirements.



THE THURMAN PORTABLE TRUCK SCALE can be moved from job to job by removing 6 nuts which hold side arms in place. The rest of the scale can be lifted as a unit. Scale can be moved and readied for use in a few minutes as no adjustments are necessary.

EXTRA LARGE STEEL BASES support the scale, thus requiring no concrete footings. Scale furnished with Chrome-plated weighbeam—other vital parts are electro-plated to prevent rust and corrosion.

Wire or Write for Name of Nearest Dealer

THURMAN SCALE DIVISION

Established 1918

154 NORTH FIFTH STREET

COLUMBUS 15, OHIO

ducts finishing, marine and railroad, building construction, and plant maintenance. An unusual characteristic permits the operator to project a stream of atomized material in a workable pattern to normally accessible surfaces up to six feet beyond its reach.

628

and Hoist

Manufacturer: American Chain & Cable Co., Inc., York, Pa.

Equipment: Wright Safeway hand hoists.

Features claimed: The hoists are made capacities of ½ to 4 tons, with compact,



lose headroom. Their construction features simplicity of design, a modern gear drive, Weston type brake, steel load chain, steel housing, self-lubrication, and drop forged top and bottom hooks.

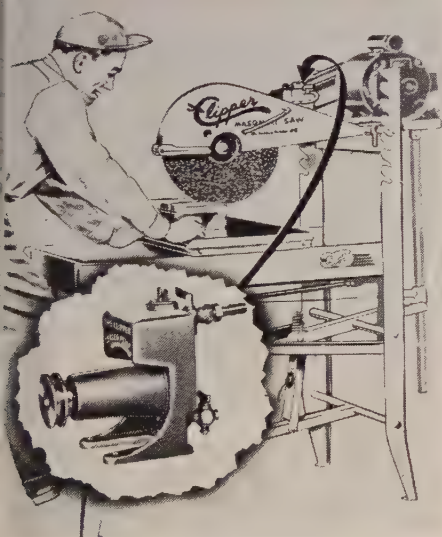
629

Wet or Dry Pump

Manufacturer: Clipper Manufacturing Co., Kansas City, Mo.

Equipment: Factory-sealed water pump in the Model HD Clipper masonry saw.

Features claimed: This factory-sealed water pump eliminates the necessity of disconnecting the pump when cutting dry. To



switch from wet to dry cutting the operator merely turns the petcock on the outlet of the pump. There is never a need to remove the V-belts on this pump as it cannot be damaged by dry cutting. This model handles all masonry materials from 12-in. concrete block to 1-in. quarry tile.

630

Car Unloader

Manufacturer: Lippmann Engineering Works, Milwaukee, Wis.

Equipment: Belt-type car unloader.

Features claimed: This machine is used to convey stone, sand, and gravel from hopper cars onto a portable belt conveyor for stock piling or transfer into waiting trucks. The machine is powered either by an electric or gasoline motor. At the forward end of the chute is an adjustable gate for adjusting the height of the flow of ma-

terial. The unloader is perfectly balanced and can be "snaked" under the railroad car by one man because of its perfect balance and light weight.

631

Jaw Crusher Plates

Manufacturer: Traylor Engineering & Mfg. Co., Allentown, Pa.

Equipment: Jaw crusher plates with curved surfaces.

Features claimed: Curved jaw plates are said to eliminate the possibility of crusher packing and choking. The curves over the faces of the plates are so designed as to give each succeeding zone in the crushing chamber greater capacity than the preceding zone, thus allowing free fall of the material as it progresses through the crushing chamber. The plates are available as orig-

inal equipment on all Traylor Jaw Crushers, or installed as replacement plates in practically all jaw crushers.

632

Air Motors

Manufacturer: Smith-Johnson Corp., Los Angeles, Calif.

Equipment: Senacon Special Air Motors, with heavy foot-mounted brackets.

Features claimed: A lightning-fast piston rod movement provides rapid action on the cushioned advance or pull strokes, or both strokes, in these high speed motors. They operate on a 5 to 175-p.s.i. air pressure with a thrust of 4.91 times air pressure and a pull of 4.6 times air pressure. Standard stroke lengths are from 2.5 in. to 18 in., and special stroke lengths are also available. Various types of controls are available, including

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Installing guardrail can be difficult and time-consuming when you are winding up a highway construction job. Or you can do it the easy way by using FLEX-BEAM Guardrail.

This modern safety aid is tops in protection, yet easy to install. A small, unskilled crew does the job quickly and economically. Individual 12-foot sections are simply set in place and bolted, using hand tools. There are no end anchorages, turn-buckles or castings. No stretching required. Posts stay in perfect alignment. FLEX-BEAM sections can be shop-curved to fit any desired radius from 20 to 150 feet.

Another thing, FLEX-BEAM Guardrail has smooth lines and graceful curves that help "dress up" any job. Write us for complete information. Ask, too, about FLEX-BEAM Bridge Rail.

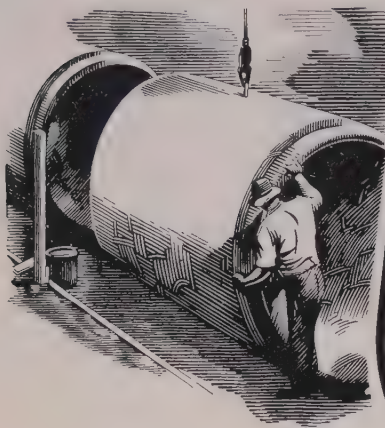
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from your local manufacturer

In addition to all the other advantages of reinforced concrete pipe, it is made right in your own district—with local materials, local labor, and local capital.

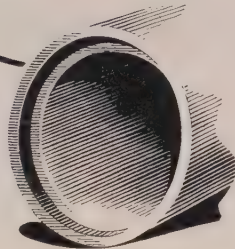
Thousands of permanent installations, serving millions of people, testify to the efficiency and economy of reinforced concrete pipe for culverts, storm drains and sanitary sewers.

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single pressure control, dual pressure control, remote control (solenoid or air pilot) and electrically controlled air valve. A threaded piston rod gland may also be used for mounting through machine member, or shelf mounting, instead of the foot mounting brackets on either end of the cylinder.

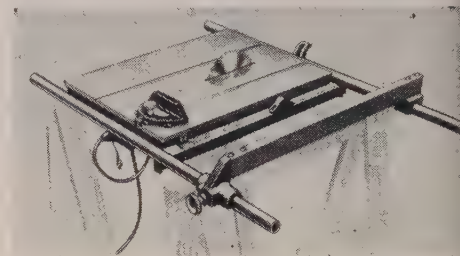
633

Saw Table

Manufacturer: Porter-Cable Machine Co., Syracuse, N. Y.

Equipment: Tilting Arbor saw table, 26 x 20 in. with 45-in. front and rear rails, designed for use with the Speedmatic portable saw.

Features claimed: The top of this 44-lb. table is designed to flip over to allow 60-sec.



attachment of the portable saw in position. When dropped back into place, the table automatically locks in position. The non-rust rugged cast aluminum table has a switch box in front for maximum ease and safety. Absolute accuracy in finish cuts is assured by the heavy-duty rip fence and large, fully calibrated miter gauge.

634

Crankcase Oil

Manufacturer: D-A Lubricant Co., Indianapolis, Ind.

Equipment: Improved crankcase oil for Diesel and gasoline engines.

Features claimed: This oil will combat sludge and engine deposits under severe operating conditions, even when used with fuels containing up to 1% sulphur. With its greater dispersant action the oil is reported to give far greater engine protection than ordinary heavy-duty oils. In addition, the oil prevents rust and moisture corrosion in engines that are idle or in storage.

635

Portable Electric Plant

Manufacturer: D. W. Onan & Sons, Inc., Minneapolis, Minn.

Equipment: Model 04AH power plant.

Features claimed: Designed for applications needing a portable 400-watt source of 60-cycle, AC power, the electric generating plant will operate for 5 hours on a single gallon of gasoline. Power is from a 4-cycle air-cooled Onan engine. Supplied with current from a 12-v. battery, remote starting AH models are electrically cranked, using the generator as a powerful motor. Start-stop buttons are located on the plant, or can be installed anywhere within 250 ft. of the unit.

636

Aluminum Rafter Square

Manufacturer: Sargent & Co., New Haven, Conn.

Equipment: Model 500 24 x 2-in. body with 16 x 1½-in. tongue.

Features claimed: Retaining the standard body and tongue, the model 500 is made of aluminum alloy with the strength of steel and an alumilite finish which is completely

corrosion proof. Two-thirds of the weight has been eliminated in the new square, with no loss of "feel," important to the carpenter.

637

Tractor-drawn Scraper

Manufacturer: Wooldridge Manufacturing Co., Sunnyvale, Calif.

Equipment: Model TC-170 scraper with curved ejector and 65-in. apron opening.

Features claimed: Loading speed for the scraper is greatly increased by a 3-piece cutting edge, together with use of rear-



lift fulcrum leverage and boiling bowl loading. Increased ground clearance gives greater maneuverability, and re-engineered blade arrangement adds to stability, ease of control, and cable life. The new curved ejector and large apron opening have been engineered for faster discharge of all types of loads. Formed steel construction gives greater structural strength and trim appearance to the scraper.

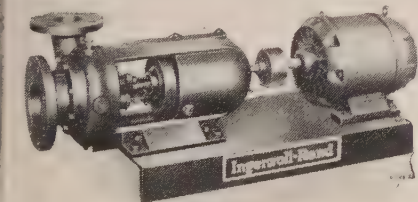
638

Centrifugal Pumps

Manufacturer: Ingersoll-Rand Co., Philadelphia, N. J.

Equipment: Cradle-mounted centrifugal pumps.

Features claimed: This pump has all the features of the Ingersoll-Rand Motorpump, including deep water-cooled stuffing box, mothering gland, ring oil lubricated ball



bearings, a heavy cradle shaft and bearing, sturdy channel steel baseplate, and an all-metal coupling. The impeller is of the latest hydraulic design, mechanically and hydraulically balanced. Sizes range from 3/4 to 5-in. discharge, with range from 1/4 to 75 hp. The pumps may be driven by direct electric motor, electric motor and V-belt, turbine through reduction gears, direct turbine, V-belt gasoline engine or direct gasoline engine.

639

Portable FM Unit

Manufacturer: Radio Specialty Manufacturing Co., Portland, Ore.

Equipment: Radio Specialty type 1144 FM communication unit for the 30 to 50 megacycle band with power output of 1 to 1 1/2 watts.

Features claimed: Total weight of this portable unit, which can be carried like a pack board, is less than 25 pounds. Heavy duty type battery packs or vibrator power supply from a car battery can be used to boost the power output to 7 1/2 watts. Controls on top of the unit provide easy access

● Here's another typical money-saving fastening triumph for DRIVE-IT—fastening seat brackets at the Grand Rapids Speedrome.

Wherever steel or wood must be fastened to concrete, steel or other hard materials there's a spot for DRIVE-IT to save you money. Reports of 75% to 85% savings over old-fashioned methods are common. With Drive-It, a drive-pin plus a power charge does the job in a split-second—and *better* than the old "dig and drill" method.

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if the radio is being used on the floor of a truck, boat or aircraft. The unit meets specifications of the Forestry Department and Federal Communications Commission.

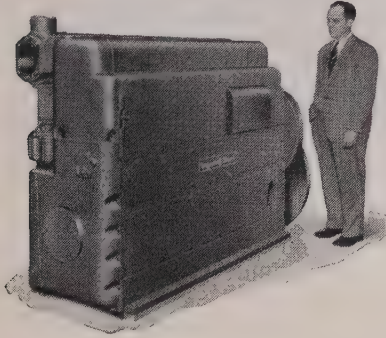
640

Light-weight Diesel

Manufacturer: Ingersoll-Rand Co., Philadelphia, N. J.

Equipment: Heavy-Duty Diesel Engine N. R. 270, Model TS, in the 195-375-hp. range.

Features claimed: The TS Diesel can easily be made portable, but is not automotive-type; it is small in size, but with



big-engine design; light in weight, but with moderate speed; powerful, but with low exhaust temperature; perfectly balanced, but with no balancing devices. It is a 4-cycle, 7-in. bore, 8½-in. stroke, single-acting engine with a weight of about 30 lb. per hp., and a fuel consumption of 0.40 lb. per hp.-hr. The TS Diesel, in the 900-1000-

r.p.m. range, has cylinders which are provided with replaceable, wet-type liners and individual heads with overhead valves and intake and exhaust valve-seat inserts. The Diesel is designed for mounting either on a simple concrete base, or on welded-steel skids where portability is desired.

641

40-Ton Trailer

Manufacturer: La Crosse Trailer Corp., La Crosse, Wis.

Equipment: Heavy-duty, tandem axle low-bed trailer of 40-ton capacity, within the 8-ft. width limit.

Features claimed: This trailer is equipped with "walking beams" supporting rear axles. This design gives maximum horizontal and vertical oscillation of each wheel (about 10 in. both ways), which is said to insure uniform distribution of load over any type of road or terrain. The trailer is fitted with extra large (12¼ x 6), constant-rise S-cam brakes, actuated by either air or vacuum for safe, smooth stops. Available with flat or drop type platform, the new trailer is fitted with eight 10:00 x 15 20-ply tires, conservatively rated at 50,960 lb. capacity.

642

Tube Cut-off Machine

Manufacturer: Gilman Engineering & Mfg. Corp., Janesville, Wis.

Equipment: Portable stainless tube cut-off machine.

Features claimed: Using the abrasive wheel method, the Gilman cut-off machine walks around any tube of from 4 to 24-in. diameter and cuts off the tube to an accu-

racy within .010 of an inch. As the use of stainless steel tubing for conveyance of corrosive liquids is increasing, the abrasive wheel method is to be preferred, since stainless properties are completely lost when a tube is subjected to blowtorch cut-off methods.

643

Electric Motor

Manufacturer: Sterling Electric Motors, Inc., Los Angeles.

Equipment: Kloss-Tite Fan-Cooled electric motor.

Features claimed: This motor is now available with face mounted and bracket having NEMA style "C" dimensions, in ratings of ¾ to 20 hp. Obtainable in either the footless type or standard horizontal type with feet, the face mounted motors are ideal for close coupled pumps or blowers, or for built-in use in machines.

644

Conveyor Backstop

Manufacturer: The American Pulley Co., Philadelphia, Pa.

Equipment: A simplified backstop to prevent backing up of inclined conveyors and bucket elevators.

Features claimed: The backstop is the first standard stock backstop taper-bushed to shaft size. It is a ratchet device that automatically operates when power interruption or any other prime mover failure occurs. Immediately upon reversal, the pawl engages the ratchet, locks the shaft in place, and holds it in position until forward power is again applied. No shock is transmitted to the driven machine.

Speed Equipment Hauling with these dependable



W-W LOWBEDS

Ten to one hundred ton capacity models with "rocker-beam," single or tandem axles—models designed for every heavy hauling need.

Flat gooseneck gives additional loading space. Standard Budd disc wheels in either 15" - 18" or 20" sizes. Extra capacity, individually actuated air brakes, special loading ramps; heavy duty construction—all are incorporated in these western-built lowbeds to give you greater load capacity using less tractor pull.

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Albuquerque, N. M.

LITERATURE FROM MANUFACTURERS...

Copies of the bulletins and catalogs described in this column may be had by addressing a request to the Western Construction News, 609 Mission Street, San Francisco 5, California.

645

SEWAGE SLUDGE DEWATERER—Oliver United Filters, Inc., New York, N.Y., has published a 4-page bulletin on the firm's continuously automatic operating sewage sludge dewaterer. Schematic diagrams and photographs of field installations are featured in the bulletin, as well as dimensions for each size unit.

646

BOTTOM DUMP EUCLID—Several improved features of the new model FDT bottom-dump Euclid carriers are illustrated in the 16-page catalog recently published by the Euclid Road Machinery Co., Cleveland, Ohio. Field and close-up photographs of the units are featured in the booklet, together with data on new tire options, air assist clutch, engine, driver seat, and new trailer hopper design for wet and sticky materials.

647

LIGHT DUTY TRUCK—Four Wheel Drive Auto Co., Clintonville, Wis., has prepared a folder giving all data about the new model light-duty four wheel drive truck. Entitled, "The story of the LD," the folder gives a complete description of the newly designed truck.

648

SPECIALTY ELECTRODE—Eutectic Welding Alloys Corp., New York, N.Y., has published a bulletin describing the recently introduced welding rod, EutecRod 15. The rod is a white metal alloy that begins to bond at the exceptionally low temperature of 354 deg. F., and is used for sealing cracks and building up defects on cast iron and other metals. The bulletin gives directions for EutecRod 15 use. Any welder can master the technique with only a few minutes' study and practice.

649

TREATED WOOD—Dow Chemical Co., Midland, Mich., has issued a 3-page set of instructions covering recommendations for buying wood treated with pentachlorophenol to resist decay. The guide covers wood treated by pressure, hot and cold immersion, Dri-Vac, cold soaking, and dipping to resist fungi, wood-destroying insects, and moisture changes. It is helpful in setting up specifications for "penta" treated wood and wood products.

650

FLOATING ROOFS—Chicago Bridge & Iron Co., Chicago, Ill., has published a 20-page book illustrating with photographs and sectional drawings the Horton Floating Roofs. The book gives the history of floating roofs, all types, and explains the actions of the double-deck, pontoon, and pan floating types of roofs. The Horton seal, with pantograph hangers on a double-deck floating roof, is one of many diagrammatic views shown. Tank capacity, reduction of fire hazard, corrosion stability, evaporation loss, and accessories are covered.

651

TWO-STAGE COMPRESSOR—Ingersoll-Rand, New York, N.Y., has issued an 18-page booklet on the firm's heavy duty, crosshead type, air compressor. The two-stage compressors deliver at 100 p.s.i.,

It's JAEGER built to give you BIGGER DAILY PAYLOADS



LIGHTER WEIGHT by 600 to 1600 lbs.
but no change in heavy gauge
of drums and blades!

LOWER PRICE
by hundreds of dollars!

LESS MAINTENANCE
by an average of 50%!

MORE SPEED to make
more payload trips per day!

New 24 rpm drum-charging speed. Endloads dry material at rate of 10 seconds per yard.

New 60 lb. pressure jet. Distributes water at 100 gallons a minute.

Highest speed discharge of wet or dry concrete—20-25 seconds per yard for 4" slump material, 1" slump in 60 seconds.

An instant-opening, instant-closing, positively self-aligning hopper.

A hopper seal that ends seal troubles. Self-lubricated from 5 lb. reservoir, gives



2—3—4½—5½ YD. SIZES
End-Loader or "Sealed Drum"
Top Loader Types. Fluid drive
(if you want it). Truck engine
drive also available.

longest leak-proof service, and is easily replaceable in 30 minutes without removing hopper.

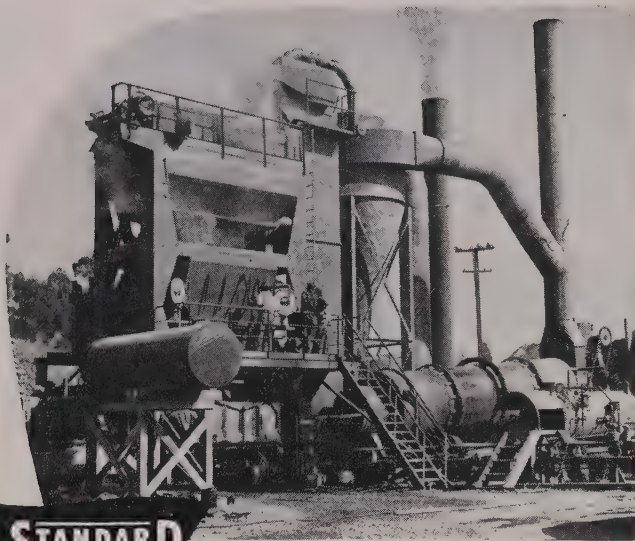
New "spider" drum drive—a major design improvement.

Power and 2-speed transmission in one unit. Permanent gear alignment.

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SMITH BOOTH USHER CO. Los Angeles 54
A. H. COX & CO. Seattle 4 and Wenatchee
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..... Salt Lake City and Denver 2

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..... Sidney, Miles City, Glasgow
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J. D. COGGINS & CO. Albuquerque
SCHRIVER MACHINERY CO. Phoenix
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the explosive wave travels 20,350 feet along the Pentaerythritetranitrate (PETN) core of Primacord-Bickford Detonating Fuse.

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COAST MANUFACTURING & SUPPLY CO.

Livermore, California



and are rated in sizes from 125 to 350 hp. Named the XLE, the new compressor is shown in field and industrial installations, and pictured in cross-section drawings in color. Sizes, ratings, numerous cut-away drawings, and engineering data on the water-cooled compressor are featured in the booklet.

652

SELF-LOADING TRUCK UNIT—Ernest Holmes Co., Chattanooga, Tenn., has produced a loading unit which allows a dump truck driver to dig, load, haul and dump his load without any outside assistance. This Holmes-Owen truck loader is shown in operation and fully described in a 4-page pamphlet published by the company.

653

WELDING TRANSFORMER—The first welder in the low cost field to retain the full 75-volt open-circuit voltage is the new Model 400E welding transformer, about which literature is available from its manufacturer, A. O. Smith Corp. of Milwaukee. This 400-amp. transformer has a welding range of 70 to 585 amp.

654

STREAMLINED WATER TANK—Chicago Bridge & Iron Co. has published an 8-page pamphlet on the Watersphere, a modern, streamlined, elevated water tank for providing gravity water pressure for general service and fire protection. The Watersphere is built entirely of steel plates. Butt-welded construction is used throughout. The spherical tank is supported on a single cylindrical column, the flared base of which rests on, and is anchored to, a circular concrete foundation. The pamphlet contains full-page unretouched illustrations of typical installations from 25,000 to 150,000-gal. capacity, in addition to a complete description of the Watersphere. Standard sizes are available up to 250,000-gal. capacity.

655

PORTABLE WASHING PLANTS—How to attain higher capacities with greater mobility in washing operations is the theme of the new portable washing plant bulletin published by Lippmann Engineering Works, Milwaukee. The 8-page bulletin gives complete information on Lippmann's new Washmore and super-capacity portable washing plants, with schematic flow diagrams on each. Information includes capacity and dimensional tables and comparison charts showing competitive products.

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MURPHY Portable
CONTRACTOR'S SCALE
GOES Anywhere!

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This rugged, all-steel, heavy duty scale is a proven time saver and money saver for contractors, road builders, and material handlers! Scale can be hauled completely assembled by simply removing tip end of transverse lever at bolted splice and tightening hold down bolts (see photo). No dismantling or reassembling! No wasted motion in moving from job to job!

Capacity	Platform
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PLYWOOD CATALOG—Douglas Fir Plywood Association, Tacoma, Wash., has just published the 20-page 1950 Basic Catalog for Douglas fir plywood. It is punched to fit looseleaf handbooks of Industrial Uses for Plywood, and is written to replace the old plywood catalog at the front of the handbook. The new catalog is a reprint of a plywood architectural catalog and refers primarily to construction uses. It presents, however, basic information on plywood types and grades, as well as information on the structural properties, finishing and other properties.

PINE PANELS—Western Pine Association announces that single copies are available of a 4-page folder showing full-size details of the 17 paneling patterns adopted as standard for the Western pine industry. The new standard designs will be known as the WP series and are numbered from 1 to 20. They represent a consolidation and simplification of 35 patterns heretofore known as the KP and IE series, many of which were similar in detail. Quantity lots of the folder are available at 2½ cents per copy.

GLASS PIPE—Fischer & Porter Co., Glass Division, Hatboro, Pa., announces release of catalogs illustrating and describing glass pipe and fittings in ¼-in. through ¾-in. sizes and precision-bore glass specialties. The pipe and fittings catalog includes complete information on a recently-introduced metal-to-glass and glass-to-glass pipe coupling available in ¼-in. through 1-in. sizes, replacing three-bolt triangular metal flanges and other devices. The second catalog gives data and photographs on the precision-bore round, square, and capillary tubing for use in high-accuracy barometers and manometers, burettes, and other precision glass apparatus.

LUBRIPLATE—Fiske Brothers Refining Co., Newark, N. J., has available a 44-page illustrated book giving a complete description and listing recommendations for all industrial applications of Lubriplate line of lubricants. The book lists manufacturer's recommendations for cement and quarry plants, tractors, mining, marine, and construction industries.

HD-19 SERVICE MANUAL—A new 287-page service manual featuring Allis-Chalmers' HD-19 torque converter-equipped crawler has been published by the firm's Tractor Division. Instructions include a complete guide on operation, maintenance, and repair of the post-war tractor. Chapters one through nineteen feature a general description of the tractor, complete specifications, and a detailed pictorial and written description of the various assemblies, including adjustment, repair, and rebuilding instructions. Another chapter features special equipment available, such as logging guards and pusher plates. The last three chapters are devoted to general maintenance instructions—including fits and tolerances of component parts—and trouble shooting information with a list of field tests which can be made to help determine the cause of mechanical difficulty. Copies of the HD-19 tractor service manual can be obtained for \$5.00.

I. H. CRAWLERS—Performance and cost features of International crawler tractors are graphically presented in two 2-page folders just released by International Harvester Co., Chicago, Ill. A read-at-a-glance

explanation of the simple, direct transmission train is featured in the folder, "Is Your Horsepower Going to the Track?" The second folder displays the three-point track suspension and illustrates the action of the front stabilizer in preventing misalignment and minimizing leverage loads.

INSTRUMENT MANUAL—General Electric Co., Meter and Instrument Divisions, has published a revised edition of the "Manual of Electric Instruments." Available for \$1.00, the handbook describes the fundamentals of construction and the operating principles of all major types of electric instruments. Designed for both school and industry, the thirteen chapters of the manual explain thermocouples, synchrosopes, frequency meters, and many others in the 150 extensively illustrated pages. An added feature of this library-type book is its full reference index.

LEAF COLLECTOR—LaPorte Welding & Machine Co., Laporte, Ind., has released a 4-page folder describing the Road Boss Leaf Collector, recently put into production. The collector is operated by one man and uses a specially designed suction unit with blades that tend to cut leaves and twigs, and pass stones, nails, and glass. It is designed for quick installation on either Ford or Ferguson tractors, and weighs 2,800 lb. ready for installation.

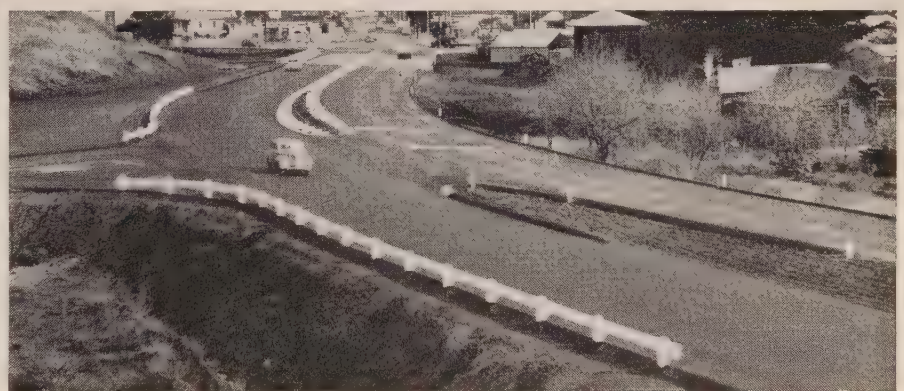
LIGHT PLANNING—Benjamin Electric Mfg. Co., Des Plaines, Ill., has released a 32-page book entitled "A Planning Guide to Improved Plant Lighting." The guide covers planned lighting from the management viewpoint, and breaks the problem into three parts: Economics—production

time, fatigue, floor area, morale, accidents, public relations; Program Development—objectives, how much and what kind of light, timetable, and specifications; and Equipment Selection—featuring maintenance factors and operating costs.

WAGON DRILL—"Drive Your Wagon Drill and Compressor" is the title of a newly released bulletin by the **Le Roi Co.,** Milwaukee, Wis., describing the one-man operated, self-contained, self-propelled wagon drilling unit. Using the 105 Tractair tractor-compressor for a platform, a Mobil-drill swinging boom and universally mounted guide shell for 6-ft. steel change drills at any angle, including vertical or horizontal holes at any elevation. One man can handle every phase of drilling, including the simplified moving of equipment between drilling location and blasting sites.

DIESEL ENGINE—Complete specifications and other data are available from the International Harvester Co., Chicago, Ill., on the series UD-9A Diesel automotive engine for motor graders and power unit for stationary installations. New features of the basic "9" engine include: redesigned precombustion chamber and piston; the "A" series fuel injection pump; and simplified injection nozzles. The compression ratio has been stepped up from 14.4 to 15.7:1. Horsepower is 62.5 at 1,600 r.p.m., compared to a previous 53, on the power unit. The automotive engine is governed at 1,800 r.p.m. and delivers 70 hp.

STEEL PRODUCTS—Hercules Steel Products Corp., Galion, Ohio, announces publishing of seven colorful bulletins covering the firm's different products. The bul-



U. S. HIGHWAY GUARD RAIL

Installation on San Luis Obispo Freeway, San Luis Obispo, California

FOR COMPLETE PROTECTION—a guard rail that **GUARDS** is a necessity. The U. S. Guard Rail with heat-treated, spring-steel shock absorbing bracket is assurance of such protection to driver and vehicle. Low maintenance cost.

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ARIZONA: Arizona Hardware Company, Phoenix • **IDAHO:** The Sawtooth Company, Boise • **MONTANA:** Montana Power & Equipment Co., Helena • **NEVADA:** Paul Tholl, Sparks • **OREGON:** Contractors Equipment Corp., Portland • **UTAH:** The C. H. Jones Equipment Co., Salt Lake City • **WASHINGTON:** Air-Mack Equipment Co., Seattle

letins include: 1. Cement spreader, featuring action shots and cost data in the laying of soil-cement surfaces for highways, airports. 2. Coal handling power chute, with general description and field reports. 3. Medium duty hoists and dump bodies, describing center-lift hoist and dump bodies for every type hauling and dumping work. 4. JDX low-mount hydraulic hoist, introducing a new unit for grain or standard platform bodies. 5. Line envelope stuffer, contains brief descriptive material on all Hercules hoists, bodies, and accessories. 6. Split-shaft power take-off, describing the four models with complete data on construction features and applications. 7. Tire and tool pack dump body, features tire and tool pack utility compartment and the KT and KDT hoists for use with this type body.

668

TRACTORS—Several new machines which have been added to the Caterpillar line are illustrated in a new products catalog recently released by **Caterpillar Tractor Co.**, Peoria, Ill. The booklet includes illustrations and complete specifications on Caterpillar Diesel tractors, motor graders, engines, bulldozers, scrapers, and hydraulic controls.

669

GRIT CHAMBERS—An 8-page technical supplement on grit removal by velocity regulation has been issued by the **American Well Works**, Aurora, Ill., for the sewage treatment field. It illustrates and explains the latest development in American Camp Grit Chambers which now makes it possible to maintain any constant velocity regardless of quantity of flow and thus assure efficient operation throughout varying plant flows and sewage character-

istics. The supplement gives helpful design data, and describes the features of the improved American Camp Grit Channel and the American Camp Regulator, which provide an accurate, economical, practical method of operation as well as a safety factor for the designing engineer.

670

GRABS—A grab for nearly every conceivable lifting or handling problem can be found in a catalog issued by **Downs Crane & Hoist Company**, Los Angeles. It contains 24 pages of illustrations and information concerning hooks, tongs, grips, slings and piling pullers for use on construction and marine contracting work. The booklet catalogs equipment for safe, fast handling of heavy loads, such as pulling piling, lifting odd shapes, handling loose bundles, bales, structural steel, plus rigging equipment, and demolition hooks. Specifications for each type of equipment are given.

671

STATIONARY COMPRESSORS—**The Jaeger Machine Co.**, Columbus, Ohio, has published a bulletin which describes its complete line of Jaeger "Air-Plus" Stationary Compressors, giving detail specifications and presenting their many features. The compressors mentioned are available in six capacities—60 to 365 cu. ft. per min. Usually driven by electric motor through V-belts, they are easily adaptable to gasoline or Diesel engine power.

672

WELDING TECHNIQUES—New production welding techniques are discussed in an 8-page brochure published by the **Eutectic Welding Alloys Corp.**, New York, N. Y. Selected from hundreds of

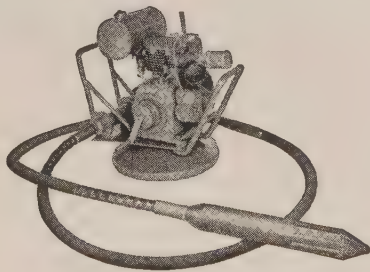
documented case histories, the 15 chosen for this brochure cover a wide field of industrial applications in many major industries which use production welding. The brochure examines such problems as finishing costs, scaling, distortion, softening of heat-treated metals, burn through, weld failure from impact, joining of dissimilar metals, and others. The stories on the production welding of steel, aluminum, copper, cast iron, bronze, and stainless steel show how considerable savings may be effected in the manufacture of refrigeration equipment, electronic devices, machinery, transformers, precision instruments, foundry castings and other appliances.

673

CONCRETE INSERT—**Unistrut Products Co.**, Chicago, in an illustrated 4-page bulletin describes a new, lower cost Unistrut concrete insert that will permit attachment of fittings at any point along the entire insert face without disturbing attachments previously made. The bulletin describes a method of making your own inserts from short pieces of Unistrut channel and anchor-type drive-in end caps.

674

HYDRAULIC COMPRESSION TESTING MACHINES—Two new catalogs on Riehle Testing Machines are now being offered by **American Machine and Metals, Inc.**, of East Moline, Ill. One covers Hydraulic Compression Testing Machines and other equipment for testing concrete, brick, tile and other construction materials. The other catalog describes Riehle's new low-cost Model MA Universal Hydraulic Testing Machines. Both pamphlets are illustrated and include details of construction, specifications and dimensions.



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which have made them highly successful all over the world.

DEPENDABLE FLEXIBLE DRIVE. All sections are interchangeable, in multiples of 7' and 12' lengths. No special sections are required. Each casing has ball bearing connector. Each alloy steel core has slip joint which does not separate in service. It prevents stretching and overheating. No limit to length of drive.

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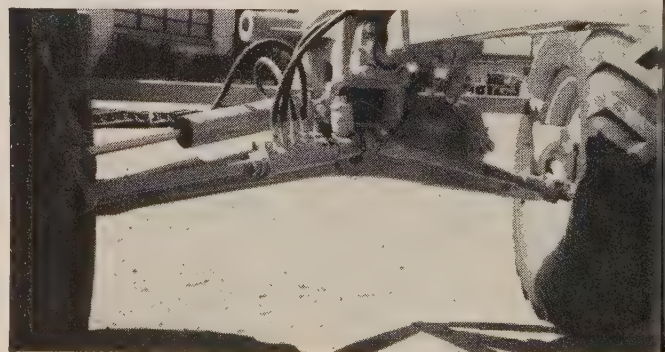
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675

RETRACTABLE WHEEL ROLLER—Huber Manufacturing Co., Marion, Ohio, describes the new Huber Retractable Wheel Roller in its recently published bulletin. The 5-ton tandem unit is a portable, self-contained unit readily adaptable for most applications in the road building and maintenance field.

676

ROAD BUILDING UNIT—A 12-page, 2-color bulletin from the Huber Manufacturing Co., of Marion, Ohio, enumerates the features of the Huber motor grader, a heavy-duty, diesel-powered road building unit with hydro-mechanical controls. A choice of two power units is offered on the Huber motor grader: one, the 6-cylinder, 130-hp. Hercules DRXC diesel engine; the other, the 6-cylinder, 100-hp. International IHC diesel engine.

677

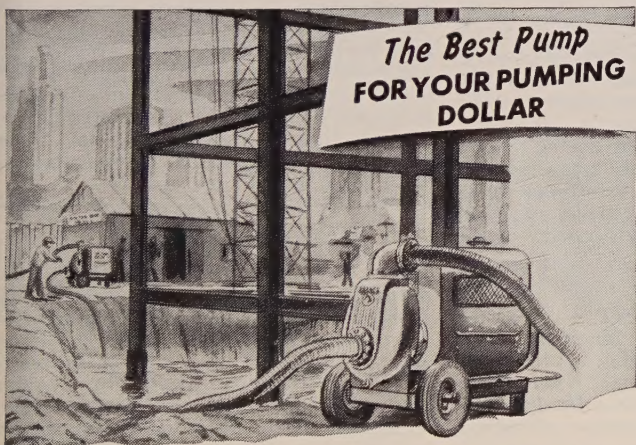
ALKALI CORROSION RESISTANCE—A technical bulletin has been issued by International Nickel Co., Inc., New York City, on the resistance of nickel and its alloys to corrosion by caustic alkalis. Methods of testing and testing results are given. Nickel alloy irons as well as the higher non-ferrous nickel alloys and pure nickel are discussed. Performances of the materials are cited in such fields as soda manufacture, transportation, and production of such products as viscose rayon, soap, pulp, and paper. The 24-page bulletin contains over 20 illustrations and over 40 tables.

678

HARDFACING REPRINT—A reprint of the article entitled "Hardfacing Applications in the Steel Industry," has been announced by Air Reduction Sales Co., a division of Air Reduction Company, Inc. The article, which originally appeared in "The Welding Journal," was written by Airco hardfacing specialist J. J. Barry and covers the topic of hardfacing as applied to steel industry problems. Sections are included on types of electrodes, service conditions, typical applications, techniques and methods, and economies obtained.

679

ARC WELDING AT WORK—New techniques and uses of welding are illustrated and described in Hobart Arc Welding News, a 24-page booklet of photographs and articles from all over the country. It has been made available by Hobart Brothers Co., Troy, Ohio.



IT'S THE BARNES "33,000 FOR 1"

From all angles, the Barnes "33,000 for 1" automatic centrifugals are the best pumps for the money you invest in pumping equipment.

For operating economy, they are unmatched. They deliver 33,000 gallons of water for every gallon of gas they burn. That's equal to 4 1/8 railroad tank cars. For day after day reliability, they have no equals. And for low cost maintenance Barnes "33,000 for 1" pumps can't be topped. Write for complete details today!

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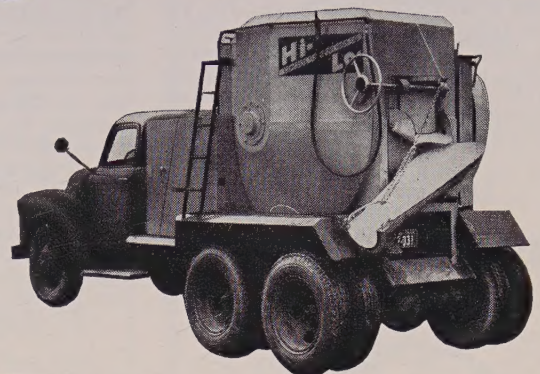
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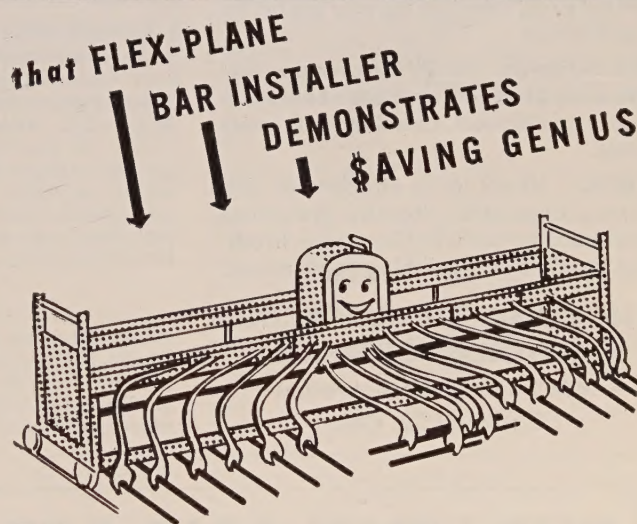


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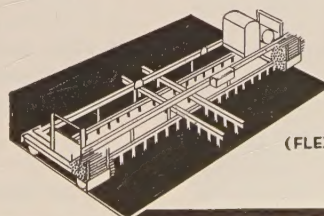
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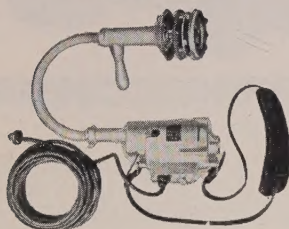
680

POWER DIESELS—A publication by **Caterpillar Tractor Co.**, presents the company's latest and most powerful Diesel engines. Entitled "Caterpillar Diesel Engines," the 16-page illustrated color booklet contains complete information on models D397, D386, D375, and D364, including the outstanding advantages, qualities, specification and performance charts of each.

681

SPECIAL ALLOY STEEL—**Jones & Laughlin Steel Corp.**, Pittsburgh, Pa., announces publication of a 36-page brochure "For Longer Wear, Less Repair" describing Jallo, a new special alloy steel which is capable of being heat-treated to excellent physical properties. Jallo is being used in

"BERG" CONCRETE SURFACER MODEL A



"Berg" equipment is used extensively for surfacing and finishing applications on concrete construction.

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the mining, quarrying and earth-moving industries with outstanding success where abrasion and impact resistance are major factors in the service life of steel, according to the booklet. A complete presentation of Jallo case histories in these various fields is presented. Also included in the booklet are complete technical data with tables on chemical composition, grain size, and various physical properties relating to surface hardness and yield strength.

682

ROAD BUILDING EQUIPMENT—**All Purpose Spreader Co.**, Elyria, Ohio, has published a booklet describing its line of wideners, base pavers, trench rollers, widening chippers and other equipment. According to the booklet, the widener has the capacity to receive and deposit enough gravel, dirt, or comparable material to keep a fleet of dump trucks busy, and has ample power to push the dump truck as it pours its load into the hopper. A 24-in. conveyor belt is supported on rollers with dust-proof, tapered bearings, spaced 6 in. apart to withstand the shock when the load is first dumped into the hopper.

683

CEILING OUTLETS—**The Barber-Colman Co.**, Rockford, Ill., has a catalog describing its line of Venturi-Flo ceiling air distribution outlets. The Model J Venturi-Flo has the following features: adjustable air pattern, easily removable inner assembly, and careful design to minimize smudging and ceiling discoloration without the need of smudge rings and similar non-functional members. This model is equally adaptable to flush ceiling installations or to installation on exposed ducts. The efficiency of this design permits temperature differentials as high as 35 deg. F. between supply and room air.

684

SUCCESSFUL HARD-FACING—The widespread interest of welders, engineers, tool designers, maintenance foremen has led to publication of a new edition of the **Mir-O-Col Alloy Company's** "Welder's Guide to Successful Hard-Facing." The booklet explains the different types of hard-facing, economy methods for its use, recommended metals for the process, explains and illustrates methods, and gives helpful hints to welders.

685

CENTRIFUGAL PUMP—**Peerless Pump Division of Food Machinery and Chemical Corp.**, Los Angeles, is producing a new vertical, centrifugal Hydro-Line pump, which is described in a 4-page pamphlet now available. The pump is designed

to meet a need where installation space is limited. Capacities up to 5,000 g.p.m. are obtained with this pump; maximum head is 1,500 ft. Ideal applications include the pumping of hydrocarbons such as gasoline, oil, l.p. gases, hot or cold water, acids, bases and salt solutions at temperatures from normal to 400 deg. F. The Hydro-Line consists essentially of a vertical, close-coupled, rotative shaft turbine pump, enclosed in steel jacket or barrel.

686

FORK LIFT—A hydraulic lift attachment for the Moto-Bug has been designed by the **Kwik-Mix Co.**, Port Washington, Wis. Development of the lift is described in a new catalog released by the company. The manually operated hydraulic pump lifts a capacity load of 500 lb. Forks tilt to the rear to assure better load balance and are adjustable to a minimum width of 3 in. for clearing narrow aisles and doorways. Numerous photographs in the two-color catalog illustrate additional improvements and developments made on the versatile Moto-Bug. These include the large steering wheel and a 5-ft. scraper blade or snowplow attachment.

687

GLASS BLOCK—A new type of light directing glass block is presented in detail in a booklet made available by the Insulux Division of **American Structural Products Co.**, Toledo, Ohio. Designed to transmit more daylight under conditions usually considered adverse, Insulux Light directing Glass Block No. 363 accepts most daylight and diffuses it more evenly to the front and rear walls of a room.

688

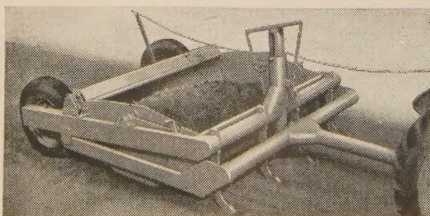
CULVERT END SECTION—**Armco Drainage & Metal Products, Inc.**, Middletown, Ohio, has published a 4-page folder which explains how the new Armco culvert end sections put an end to troublesome drainage problems. The folder cites three big drainage needs that are met by Armco end sections (1) increased culvert efficiency, (2) meeting all requirements for present day road design, and (3) quick installation by a small, unskilled crew.

689

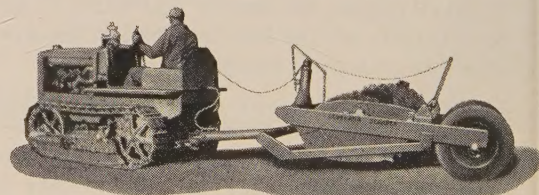
FLEXIBLE TUBING—In a descriptive catalog, **Flexible Tubing Corp.**, Braintree, Conn., fully explains its new lightweight, flexible tubing, said to be wear and heat resistant, portable, retractable and easy to assemble. Spiratube is reported to be usually resistant to rupture or collapse under pressure or vacuum in many services. It is designed to satisfy most ducting requirements.

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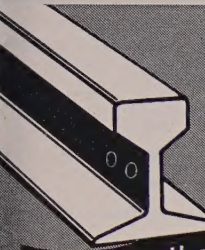
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requirements from 3 to 30 in. ID for air and other gases, and powdered, granular, or other light solids. Spiratube patented construction is described as consisting of a rust-proof, spring-steel helical core, covered inside and out by double-seam stitched cotton duck, coated with neoprene. Complete specifications, application data, engineering tables, and sizes are contained in the manufacturer's catalog.

690

SOIL STABILIZERS—Harnischfeger Corp., Milwaukee, Wis., has printed a 4-page color folder, entitled "World-Wide Trend to Stabilized Roads Means Many More Miles from Tight Budgets." In a large cutaway drawing the booklet shows how the P & H Single Pass Soil Stabilizer uniformly applies all liquids, thoroughly blends the material before passing it through the liquid spray, accomplishes pug mill mixing, and spreads processed material evenly.

691

INDUSTRIAL RAINCOATS—A new catalog section has been published by the B. F. Goodrich Co. devoted to its industrial work suits, made both with rubber and with Koroseal. The section pictures and

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describes the Koroseal industrial raincoat and the rubber economy work coat. Koroseal is claimed to have unusual resistance to scuffing, scratching, and to have high tensile strength and greater resistance to abrasion than rubber.

692

OIL SEALS—"Johns-Manville Clipper Seal" is a 16-page handbook of useful data, published by **Johns-Manville** of New York, for anyone needing information on oil seals. Photographs show where to use Clipper Seals and how to install them. Drawings illustrate how the lip and heel construction of these non-metallic oil seals can be varied. The booklet is divided into sections on the principle of Clipper Seals, their construction, advantages in various applications, installation data, and other information of interest to oil seal users.

693

MECHANICAL AND HYDRAULIC JACKS—Complete specifications and application information on all sizes and types of mechanical and hydraulic jacks are included in an illustrated catalog issued by **Templeton, Kenly and Co.**, Chicago. The 32 pages of this letter-size (for filing) catalog carry full details of the 123 models of ratchet-lowering, hydraulic and screw type jacks that comprise the standard Simplex line. A new method of grouping the jacks by type, giving a short identification of

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each jack's major uses, makes the catalog easier and simpler to use. Jacks of particular interest to industrial plants, constructors, railroads, oil fields, ship builders, mines, utilities, and other specific industries are quickly identified and located.

694

VAPOR GENERATOR—Littleford Bros., Inc., of Cincinnati, Ohio, has published an 8-page pamphlet which covers the different power uses of the Kwik-Steam vapor generator. According to the pamphlet this generator is the fastest, most modern steam-producing unit ever offered to the construction industry. From a cold start the Littleford generators are said to produce steam in 2 minutes' time. They are designed to give low cost operation to owners of ready-mixed concrete plants, asphalt plants and pile driving equipment.

695

WATER MAIN INSTALLATION—American Water Works Association, Inc., New York, has made available in booklet form its Standard Specifications for Installation of Cast-iron Water Mains. These specifications, which sell for 35¢ per copy, cover several procedures for laying and testing a system of water mains and for the furnishing of sheeting, blocking and joint materials incidental thereto. The specifications and the addenda attached are intended to serve as a part of the contract documents.

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Practical, Down-to-Earth Welding Rods
Alloys as they are supposed to be

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