Picture at left shows "holing" through of first short section of tunnel in Coachella division of Aqueduct. Middle, east portal of Coxcomb tunnel showing picturesque "chimney rock." Right, east portal of Bernasconi tunnel, reached by heavy access cut.
Progress of Tunnel Work On Colorado River Aqueduct Reviewed

All Forces Now Working Under Ground
New 24-Hour Record Reported by District

Construction inaugurated on 84 of the 91 miles of 16-ft. tunnel for the Colorado River Aqueduct is progressing satisfactorily and contractors and the Metropolitan Water District forces are getting well under way on the long grind which will end with the completion of the 13-mile bore through San Jacinto mountain four or five years hence, this particular project requiring the longest time of all the 21 tunnels to finish. Most of the contractors and all of the District's crews are now working underground and with the advent of winter and lower temperatures bringing better living and working conditions in the desert region traversed by the aqueduct operations will be materially accelerated.

Progress to date has revealed that in the main the formations through which the tunnels will be driven will not be much different from what test borings and reconnaissance surveys had led engineers and contractors to expect. Tunnels driven from portals are encountering in the first reaches weathered material which requires support and in some instances large boulders. As the bores penetrate farther into the mountain mass, however, harder material with less blocking is indicated. Generally granitic rock prevails with seams of softer material at intervals in some localities.

Whitewater Tunnel No. 2 through what is known as Gravel Hill, started at the east portal in the wall of a canyon, is being driven in a deposit of cemented sand and gravel which is quite firm but easily loosened with light charges of powder. Here work is being carried on with heading and bench excavation alternately in short stages. For the present it is only a jackhammer job. This tunnel is all timbered, in marked contrast to the Valverde tunnel where approximately 2,130 ft. of tunnel has been driven from two shafts at a depth around 200 ft. in hard granite requiring no supports.

The West Iron Mountain Tunnel has been driven from the west portal 1,962 ft. through compacted sand, some of it desert blow sand, requiring full timbering. Excavation here has been at the rate of 35 to 40 ft. per day. It is expected this tunnel will soon be in rock.

Up to November 1 approximately 4.19 miles of tunnel has been driven on all jobs, of which 1.86 miles was on contract jobs and 2.33 miles on the District force account jobs in the Coachella Division. About 60 per cent of the latter has required support. On some
jobs where support was needed the tunnels have been timbered while on others steel liner plates have been used.

Some of the tunnel jobs are bone dry. In others there has been a slight drip of water. The amount of water likely to be encountered in the San Jacinto tunnel has been the subject of considerable speculation. A pioneer drifter at the west portal developed a small flow of water but since excavation was started on the main tunnel all seepage has been diverted to the Potrero shaft and the drift is dry. In sinking the Potrero shaft for the tunnel some water was encountered near the top but as the work progressed and the shaft was lined with concrete the water appeared to be shut out. There is now apparently no prospect that there will be any serious difficulty from water seepage on the San Jacinto job.

While in the main the methods of tunneling are about the same on all jobs operations reflect the practice to which the contractors have been previously accustomed. On the San Jacinto job circular shafts have been sunk at the Potrero and Cabazon adits, the former now being down 370 ft. out of a total depth of about 800 ft. directly over the main tunnel and the latter having been completed to a depth of 261 ft. where it joins a horizontal adit which will be carried 936 ft. to the south and of which 410 ft. have been completed. The two shafts on the Valverde tunnel, No. 2 being 214 ft. in depth and No. 3 being 196 ft. deep, are rectangular in shape with rounded ends and have been driven full face, steel A frames being set up as the work progresses which can be moved to one side out of the way being provided.

On the West Portion of the East Eagle Mountain tunnel a drilling and mucking jumbo with a hinged platform at the end next to the mucker is being used. This jumbo runs on two rails and the tracks for the cars extend underneath. A train of cars is backed under the jumbo and the cars are loaded starting with the one next to the locomotive by a belt conveyor operating on the platform of the jumbo, the mucking machine is then moved and cars extended. The first two from the mucker are being used. This plan obviates the switching of cars. Relative merits of the different methods being used and the plant set-up will be more readily appraised when the work is well under way.

The district forces at the Thousand Palms camp in the Little San Bernardino Mountains report what the District engineers believe to be a new continental tunnel driving record when 73 ft. of tunnel was drilled, blasted, excavated and timbered in 24 hours. This followed a record of 65 ft. driven in 24 hours by the crews of the Yellow Canyon camp. The District's operations are now ahead of schedule according to the report of the engineers.

A summary of progress by the District shows 26 miles of tunnel being driven by District forces and 58 miles by thirteen contractors, with approximately 4000 men employed.

Already completed, or nearing completion, are 439 miles of high voltage transmission line; 154 miles of surfaced aqueduct highway; 189 miles of construction water line, and thirty-one construction camps.

Progress on Individual Projects

Progress on the various tunnel projects to November 1, 1933, was reported as follows:

San Jacinto Tunnel, 67,400 ft. in length, Wenzel & Henoch Construction Co., contractors-Driving from west portal 321 ft. of heading driven; Potrero shaft, 370 ft. completed out of new shaft 800 ft. of shaft to be sunk; Cabazon adit, 261 ft. of shaft completed and 410 ft. out of 936 ft. of horizontal adit completed.

Bernasconi Tunnel, 6220 ft. in length, Hamiton & Gleason, contractors-1261 ft. of tunnel driven from east portal.

Valverde Tunnel, 37,150 ft. in length, The Dravo Contracting Company, contractors—Working at two points, 669 ft. of tunnel driven from east portal and 305 ft. of tunnel driven from west portal of No. 2. Some excavation has been made for west portal of No. 1 which now stands 214 ft. in depth.

Cottonwood Tunnel, 20,100 ft. in length, J. F. Shea Company, contractors—Driving from ends, 1121 ft. of tunnel excavated from west portal and 1321 ft. excavated from east portal.

Mecca Pass Tunnels—No. 1, 325 ft. in length, No. 2, 970 ft. and No. 3, 4580 ft., Morrison-Knudsen Co., contractors—201 ft. of tunnel driven from east portal; approach cut excavated at west portal of Tunnel No. 2; some excavation made at shafts of Tunnels No. 1 and No. 3.

Hayfield Tunnel No. 2, 5360 ft. in length, Floyd Shoﬁner and J. N. Gordon, contractors—Driving from west portal 169 ft. of tunnel excavated.

Hayfield Tunnel No. 2, Hunkin-Conkey Construction Co., contractors—Work just started on adit from West Lake Canyon.

West Portion of East Eagle Mountain Tunnel, 10,650 ft. in length, L. E. Dixon Co. and Bessemer Tunnel Co., contractors—Driving from east portal 162 ft. of tunnel excavated.

San Jacinto Tunnel, 67,400 ft. in length, Wenzel & Henoch Construction Co., contractors—Driving of adit about 2150 ft. in length started, 145 ft. being excavated.

East Iron Mountain Tunnel, 15,669 ft. in length, Broderick & Gordon, contractors—Driving of adit about 2150 ft. in length started, 145 ft. being excavated.

West Iron Mountain Tunnel, 16,172 ft. in length, Utah Construction Co., contractors—Working from west portal 1962 ft. of tunnel driven.
Mountain Tunnel, 32,190 ft., Walsh Construction Co., contractors—Work just starting; 400 ft. driven on adit 1000 ft. long for Whipple Mountain Tunnel.

Coachella Tunnels, 138,445 ft. in length, construction by force account by the Metropolitan Water District—Tunnels now being driven by crews in all six construction camps. At Yellow Canyon 2275 ft. of tunnel driven, divided about equally east and west from adit 686 ft. in length.

At Fargo Canyon, 1936 ft. of tunnel driven east and west from adit 891 ft. in length.

At Berdoo Canyon, 2386 ft. of tunnel driven east and west from adit 2042 ft. in length.

At Pushawalla camp, adit 2935 ft. in length completed and tunnel work started.

At Thousand Palms Canyon, 3356 ft. of tunnel driven from portal cuts.

At Wide Canyon, 2335 ft. of tunnel driven, including small section 848 ft. long, known as Wide Canyon No. 2 which was holed through on October 2.

Aqueduct Costs Show Saving Over Estimates

Colorado River Aqueduct costs already have been cut $9,000,000, under the engineers' estimates, with one-third of the project under construction and contracted for, an official statement by General Manager and Chief Engineer F. E. Weymouth of the Metropolitan Water District, disclosed. This saving, Mr. Weymouth pointed out, is based upon actual unit costs of construction under way compared with the District's estimated cost for this work as provided for in the aqueduct bond issue. Furthermore it was effected after making ample allowances for contingency costs in addition to the District's present unit costs for force account work and the prices on which contracts were awarded.

General Manager Weymouth stated that during October 145,000 cubic yards of main tunnel excavation were moved by District forces "at an average cost of $4.00 per cubic yard, which figure includes labor, superintendence, field overhead, explosives, materials, supplies, miscellaneous expense, and an ample charge for plant and equipment." This cost, he pointed out, compares with a corresponding estimate of $5.25 per cubic yard. The average price for tunnel excavation by contract is $6.25.

The $9,000,000 saving, District records show, has been made on the basis of District commitments totaling approximately $60,000, or about one-third of the main aqueduct line.