Good Progress Made in Building

Great Boulder Dam

San Francisco Engineer Inspects Work Done, and Describes What He Saw and What Has Been Accomplished

Consulting Engineer and

It was with extreme interest, as an engineer, that I recently spent two days as a visitor and guest at Boulder City to inspect the beginnings of the Hoover dam.

Leaving San Francisco on May 28, I arrived at Mohave in twelve hours, and in five hours more by automobile via Barstow covered the 248 miles from Mohave to Boulder City.

This is the present construction camp, situated on a desert plateau 2000 feet above the sea, and is occupied by about 5000 inhabitants, most of whom are employes of the Six Companies that have the contract for building the Hoover dam.

An extensive commissary department occupies two buildings, capable of seating 1100 men.

The Interior Department of the Government has retained jurisdiction over Boulder City, and Forest Rangers search all incoming cars for liquor or other contraband.

Innovations in dam building have been introduced by the contractors, first by the use of rubber belting, and second by the use of auto trucks.

Large Rubber Belts Used as Conveyors

Down near the dam large rubber belts thirty-two inches wide and one inch thick, 760 feet long, are used to convey the gravel and sand from the dumps up to the mixing plant on top of a large steel structure. So it may be said that belting performs an important function in the operations.

Motor trucks, with fourteen-cubic yards capacity of solid rock, transport the materials out of the tunnels to the waste piles. Motor vehicles are in general use all over the plant, which is evidence of the progress of the times during the last twenty years.

From Barstow to the dam is a pole line of the California-Nevada Power Company, which carries electrical energy for all kinds of construction purposes. The price paid by the contractor to the utility is 6 mills per k. w. h. for construction purposes, and 6 cents k. w. h. for lighting purposes. There is a further $200,000 a year as a standby charge. It is computed that in six years the $200,000 a year will reimburse the company for the capital outlay. Electricity is a very flexible commodity to have around dam construction.

Making plans for this dam was a unique undertaking. It is the highest dam ever conceived by man and will carry unprecedented stresses.

Floods of Colorado River Hard to Manage

The difficult part is in handling the floods of the Colorado river. This is a body of water 300 feet wide and the day I was there carried 103,000 second feet of water, with a depth of 28 feet and a velocity of 11 feet per second. In order to construct a dam it is necessary to take this great body of water out of the river bed and through the

mountains. This is done by means of running four tunnels in the solid bedrock—Nos. 1 and 2 on the Nevada side and Nos. 3 and 4 on the Arizona side of the river. Those tunnels have all been excavated in solid lava rock and, strange to say, not one stick of timber was needed to keep the rock in place. These tunnels are excavated to a diameter of 56 feet and are lined with a thickness of 3 feet of concrete, which makes a clear internal section of 50 feet diameter.

The flow of the river is quite abnormal. In June and July it may reach 150,000 second feet, whereas in the balance of the year it has a normal flow of 10,000 second feet.

The level of the tunnels is about

twenty feet below the elevation of the present water surface and to deflect the water in the river into the tunnels it will be necessary to construct diverting dams. The four tunnels are more than adequate in size to carry 150,000 second feet of water. The problem now is one of lining them with concrete, so that they will be as solid as rock for all time. This will require a thickness of three feet of concrete and an adequate plant has been provided so that each of the four tunnels will be lined by October.

The problem then is putting in a diverting dam to deflect the water, which they hope to complete during the coming winter.

At present 1520 men are employed and at the peak period of excavating the tunnels last year 3500 men were engaged.

The Union Pacific built a branch railway twenty-two miles long from Las Vegas to Boulder City. The Government built ten and one-half miles of railway from Boulder City to the Nevada canyon wall above the crest of the projected dam, at a cost of $455,509. The Government also built the highway from Boulder City to the crest of the dam eight miles long, and the contractors built a road from this to a point on the river below the dam. The contractors built twenty-one miles of standard gauge railway connecting the Government line through Hemenway wash north of the dam down to the river's side and to the gravel deposits on the Arizona side immediately above the dam.

Preparatory work on any project is a desirable investment, and in adopting this plan the contractors were wise, as they now have facilities for transporting the 5,000,000 cubic yards of gravel that will go into the concrete of the dam. They are fortunate in finding a large deposit of gravel immediately east of the river on the Arizona side, which is handled by steam shovel onto the

railway cars, transferred across the bridge, and hauled within a mile of the dam where the gravel is separated and washed. The Colorado river is so saturated with mud that in its natural condition it is not suitable for washing. This water, when free from sediment, makes a soft, cool, delicious drinking water.

The gravel is separated into four sizes—sand, pea gravel, gravel below three inches and small bowlders nine inches and under. It is the detritus from the weathering and washing of the hills and mountains for 700 miles up the river bed to the Union Pacific Railroad on the headwaters near Wyoming, and, strange to say, it is extremely hard, much of it composed of quartz and silicate pebbles, which have been transported for all the hundreds of miles along the river bed.

The mechanical problem the contractors will have to handle is that no breach be made in their transportation system, as concrete en masse will have to go into the dam at the rate of 15,000 cubic yards a

day. It is estimated that 3,400,000 cubic yards of concrete will go into the Hoover dam proper and the rest of the materials into tunnels, power houses and auxiliary structures.

The contractors have so far beaten their time schedule by eight months, and if appropriations by the Government are made, there is no reason why they should not have this structure finished before the designated time. The Government furnishes supplies, cement and all materials required.

From an analysis of the situation the contractors are going to do their part of the job. The United States Government is represented on the ground by Walker K. Young of the Bureau of Reclamation. He is an experienced construction engineer and has about 100 assistants.

The total construction bid is $48,-890,995.50. Appropriations so far amount to $13,285,000 for the tunnel excavation. On this preliminary work the contractors must have

reaped a rich harvest.

There are several parties interested in this enterprise—the people paying the bills, the contractors doing the work, the United States Government, the States of Arizona and California, which may get water and power below the dam, the border land in Mexico, which will receive the surplus water, and Imperial valley, which needs water for irrigation.

Problem That Confronts City of Los Angeles

Los Angeles is confronted with the greatest problem in carrying its part of the Colorado river water through the mountains. The people voted $220,000,000 in bonds to build 265 miles of aqueduct, which includes 93.7 miles of tunnels. This water is obtained at a low level from the Colorado river near Parker, above Yuma, and will have to be desilted and pumped to an altitude of 1523 feet to penetrate the ridge between Los Angeles and the Colorado river. This pumping will entail an annual cost of $6,106,000 at low rate for power. Water is so essential to the very life of Southern California that the pumping costs may be ignored.

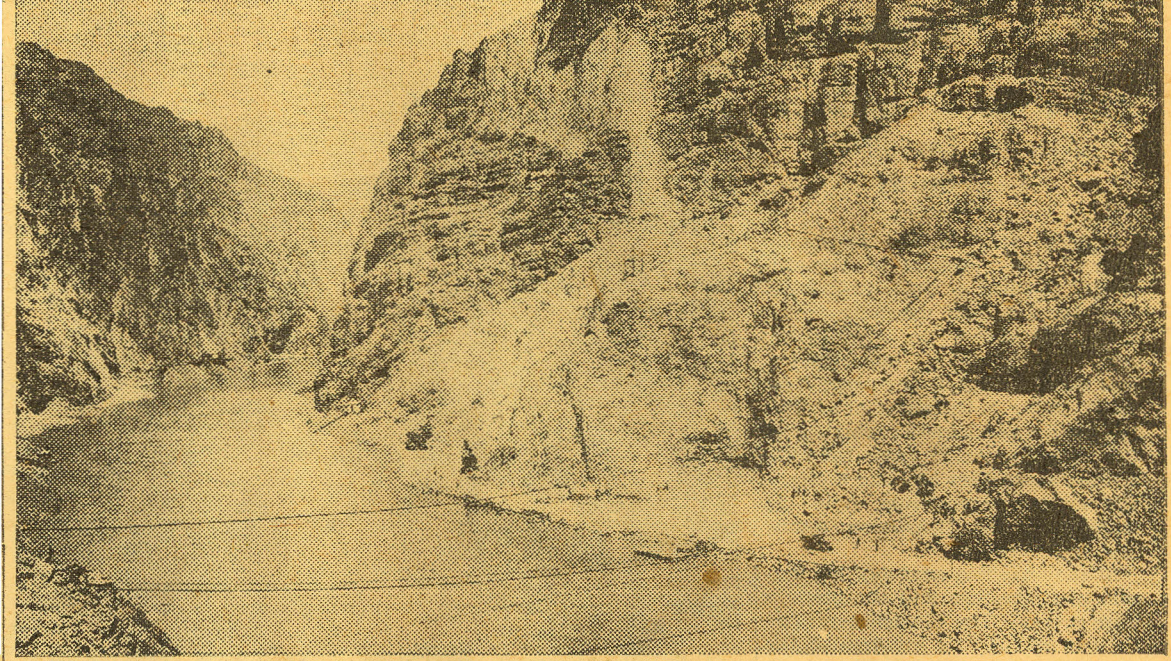
The people of San Diego have a well defined plan for bringing the water over at a lower level, with more water at lower unit costs.

The estimated cost of the Boulder canyon power development is $146,000,000. Under present economic conditions in Southern California the value of Boulder canyon power is determined not by the cost of competitive hydroelectric power, but by the cost of producing power in large steam-generating units located at tidewater and operating on fuel oil or natural gas.

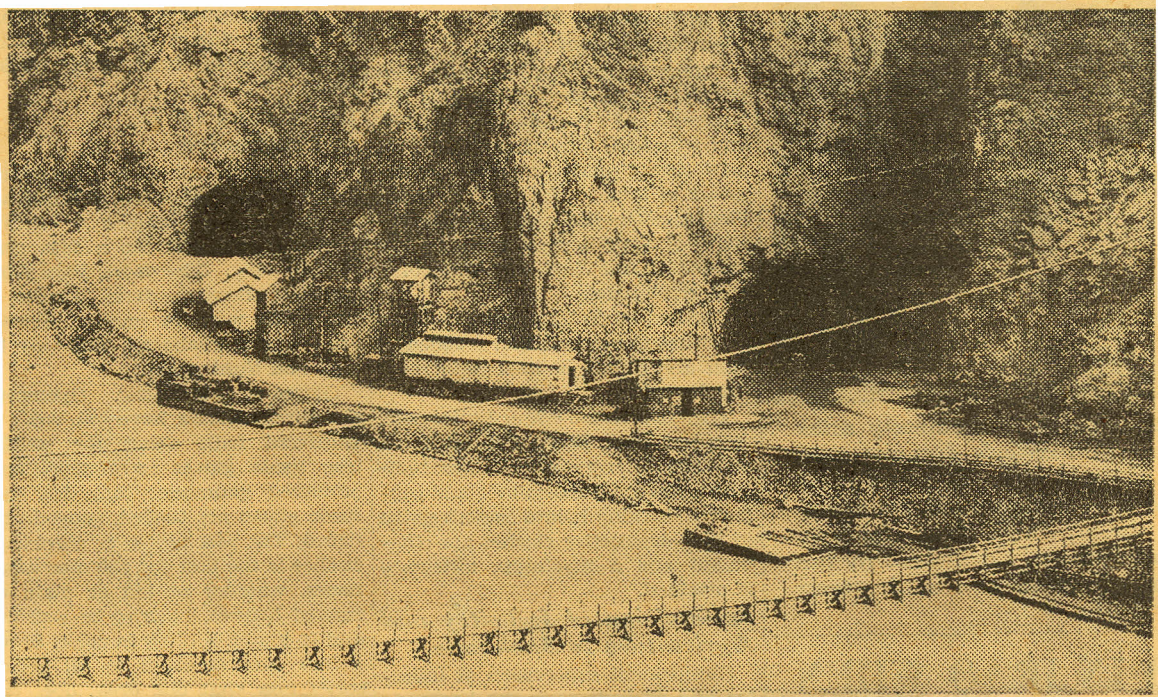
It will take 280 miles of pole lines to reach the load centers of Southern California. Transmission will be at 220,000 volts.

The estimated cost of the completed dam is $98,000,000 and the estimated annual cost of operation and maintenance $291,000. It is computed that the annual cost of storage water will be 62 cents per acre foot. The suggestion was made that 50 or 60 cents per acre foot would be a reasonable charge for Uncle Sam to make for water.

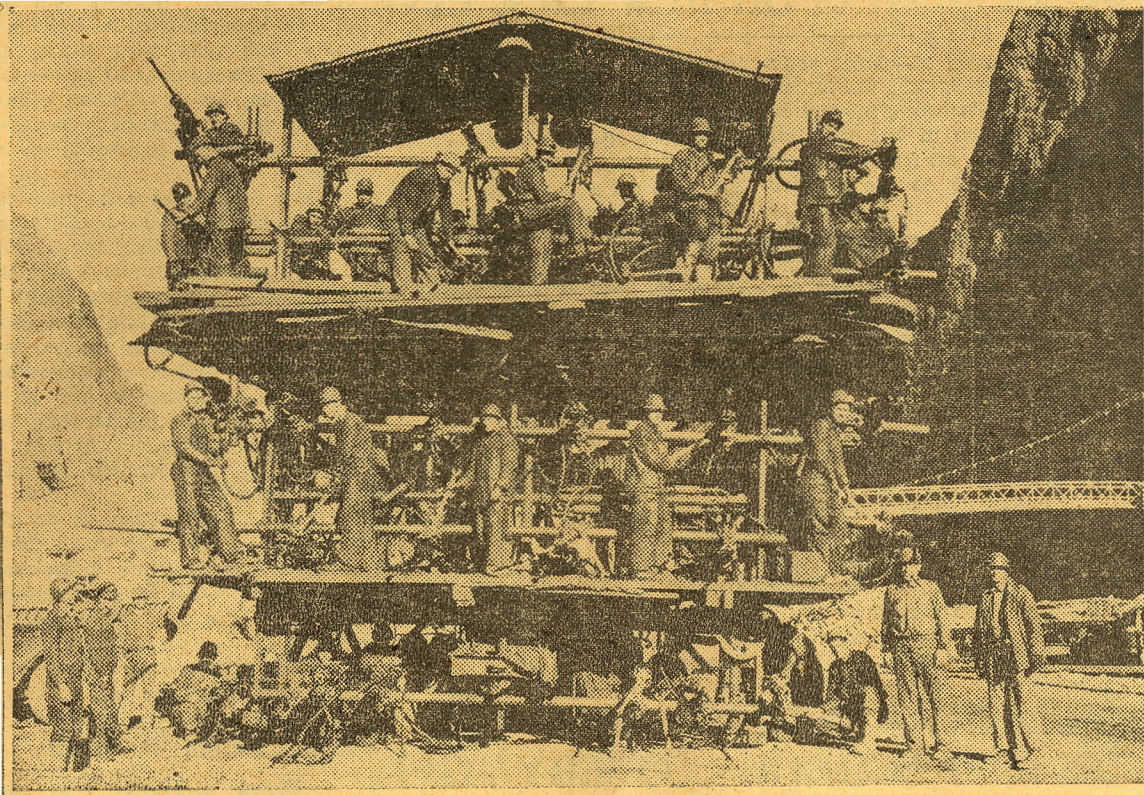
It is safe to assume that the figures for both water and power will be adequate to repay the cost to the Government, so its activities may be regarded in the light of a fairy godfather.



Site of great Hoover dam, looking south



Tunnels Nos. 1 and 2 on the Arizona side of the Colorado



"Drilling Jumbo" used in construction work of Hoover dam