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NEWS | Dravo

FACT SHEET - Dworshak Dam, Orofino, Idaho

Second Highest Concrete Dam in the U. S.

Dworshak Dam, now being constructed on the North Fork of the Clearwater River near Orofino, Idaho, will be 693 feet high, the second highest concrete dam in the U. S. (Hoover Dam is 726 feet high.) It is a U. S. Army Corps of Engineers project. As part of the Columbia-Snake River water resources development program, it will provide flood protection, electric power, navigational and recreational benefits.

The dam will be 3,300 feet wide at its crest. It will be of concrete gravity design, requiring 6.7 million yards of concrete. It will take seven years to construct the entire project, including the power house, at a total cost of approximately $250 million. Site preparation began in 1965.

The $131-million contract awarded for construction of the dam is the largest ever let by the Corps.

The power house, to be built under a later contract, will house three generators initially, producing 400,000 kw. Ultimately, it may house six units, generating 1,060,000 kw.

The reservoir will extend 53 miles upstream and cover an area of 17,000 acres. Its water storage capacity will be 3.5 million acre-feet.

Dravo-Sponsored Construction Organization

The dam is being built by a joint venture - Dworshak Dam Constructors - sponsored by Dravo Corporation of Pittsburgh, Pa. Headquarters for Dravo's

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Western Construction Division is in Bellevue, Washington (outside Seattle). Other members of the joint venture are S. J. Groves & Sons Company, Minneapolis, Minn.; C. H. Leavell Company, El Paso, Tex.; Fishback & Moore, Inc., Los Angeles, Calif.; and D-K-C Constructors, Spokane, Wash.

The Corps of Engineers designed the project and is administering it through its Walla Walla District and a 100-man field office at Ahsahka, near the site.

The dam contract also called for excavation of nearly 2 million yards of common dirt and 1.8 million cubic yards of rock on the dam and quarry sites, construction of 2½ miles of roads around the project and building of a visitors center.

Newsworthy Construction Methods

The contractor is utilizing a number of techniques on the Dworshak job which are unique:

1) Fast Cableways

Dravo is placing the 6.7 million cubic yards of concrete in the dam by means of three very fast cableways. These cableways, stretching 2,915 feet across the river gorge, have been designed to carry 8-yard buckets of concrete from the batching plant to the dam site. All three cableways are mobile. Head and tail towers are mounted on a 740-foot-long track to permit complete coverage of the dam site.

One of the cableways was transferred from Mossyrock Dam in central Washington, where it set the current world's record for concrete placement with a single cableway. The others have been constructed to Dravo specifications by Washington Iron Works of Seattle.

They are designed to carry a bucket and load weighing a total of 25 tons at a speed of 2,200 feet per minute across the main gut and to lower it to the dam site at 950 feet per minute. The main gut, by U. S. Steel, is 3½ inches in diameter.

A comprehensive system of controls and communication has been developed for cableway operation. Dravo has installed television camera surveillance of the dam site so that operations can be monitored by the cableway operator in his control house and by the project manager in the field office. A two-way radio system will be employed also, to provide communication between the cableway operator and the dam site, and between the project headquarters and vehicles.

General Electric motors are used to power the cableways. The three 8-yard buckets were manufactured by Blaw-Knox.

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2) Rock Crushing Inside a Mountain

The Dworshak project will require production of 13 million tons of sand and aggregate, all of which must be produced out of solid granite. The contractor has developed a quarry on a promontory 1,200 feet above the dam. He has excavated into the mountain from the quarry site and constructed an underground chamber in which equipment has been installed to crush the quarried rock. This chamber is 82 feet long, 32 feet wide and 102 feet high.

The rock is chuted down to the chamber through a 420-foot-long vertical shaft 20 feet in diameter. After it is crushed to minus 6 inches, it is carried outside by means of a conveyor belt through a 10-foot diameter tunnel, 750 feet long.

Although this technique has been used in mining, this is a first-time application in construction.

The equipment required in the crushing chamber is massive. At the bottom of the shaft, a National Iron Company apron feeder 10 feet wide by 26 feet long (driven by two 40 h.p. 4-speed motors) feeds quarry rock as large as 4 feet in diameter to a 54-inch by 80-inch gyratory crusher (Nordberg Manufacturing Company) driven by a direct connected 500-h.p. motor. This crusher reduces the rock to minus 15 inches. The material flowing out of the bottom of the crusher is split by two F-98 Syntron feeders. These discharge over two Simplicity screens to take out the minus 6-inch material. The oversize feeds directly into two Nordberg 5½-foot standard cone crushers. These crushers reduce the rock to minus 6-inches. This rock, plus the rock removed by the screens, is then collected by a 54-inch conveyor belt and moved to a transfer point where a 48-inch conveyor belt 750 feet long and driven by a 500-h.p. motor takes the rock to a surge pile outside. From there it is carried into an aggregate plant, where it is processed into aggregate of various sizes and sand. The crushing plant was designed to Dravo's specs by Bullock Engineering, Inc., of Denver.

3) Aggregate Plant

The outside aggregate plant is capable of producing 1,600 tons of aggregate of various sizes per hour. It is being operated under subcontract by Curtis Construction Company of Spokane, Washington.

In this plant the crushed rock is screened, washed and crushed again into the various aggregate sizes required - 6 to 3-inch, 3 to 1½-inch, 1½ to 3/4-inch and sand.

The plant is designed with two separate circuits so that a failure will not bring operations to a halt. One circuit consists of two Nordberg 5-foot short-head cone crushers and a 4½-foot standard

cone crusher for reduction of rock to the required aggregate sizes. The other circuit consists of eight 54-inch Nordberg Gyrodisc crushers for production of sand.

A Syntron vibrating feeder and a Simplicity 6 x 12-foot double-deck screen are employed with each crusher.

A closed-circuit television camera is mounted directly above the throat of the crusher so that operators in the plant can tell if material is flowing evenly into it.

Some 43 conveyor belts of various sizes are employed to carry aggregate through the plant. (Flow diagram available on request.) The conveyor belts used to carry the aggregate to the batch plant were furnished by Star Line Equipment Company of Boise, Idaho.

4) Quarrying Operations

It was necessary to strip 2 million yards of unsuitable, weathered material from the quarry area before suitable rock was obtained. The quarry is being worked in 45-foot benches. The rock is blasted into minus 4-foot size, loaded into 100-ton KW Dart trucks by a P & H electric shovel with 14-yard Esco bucket, and dumped into the shaft to the crusher.

Two 12-inch Robbins drills are being used in the quarry - an RR 12 and a new RR 12E (electric). Ammonium nitrate prill is being used for explosive.

5) Six-Mixer Batching Plants

Two large C. S. Johnson batch plants, standing 135 feet high, are employed to produce approximately 10,000 yards of concrete per day. One is equipped with six 4-yard mixers and the other with four. All weighing and mixing of sand, aggregate, water, and cement is automatic. Cement storage requires eight silos, (1,300 barrels) and pozzolan another four silos. Both materials are handled pneumatically, employing an air injection system.

Concrete is carried from the batching plant to the cableway loading dock in three 2-hopper rail cars. Each hopper carries enough concrete to fill one eight-yard bucket.

A system of radio controls has been installed to switch the tracks remotely and permit movement of all three cars simultaneously between the batch plants and cableway loading dock.

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6) Refrigeration System to Meet Stiff Cooling Specs

Dworshak Dam Constructors spent $1.2 million for refrigeration equipment to cool aggregates and concrete mix to the Corps' specifications (no warmer than 45° F. during the first hour in the pour).

Normal summer heat at the Dworshak Dam site is 80° F. To bring the temperature of the aggregate and sand down to the specified 45° F. and keep it there during mixing and placing requires a variety of cooling measures. These include cooling the coarse aggregate with chilled water (35° F.), cooling the air in the batch plant, and adding flaked ice to the mix.

Some 280 pounds of ice will be used in each four-yard batch of concrete. Twelve ice-making machines will be required to produce the necessary total of 360 tons of ice per day.

(Details on refrigeration equipment available on request)

7) Starlight System to Light Dam Site

To flood the dam with light during the night and permit workmen to work around the clock requires a system comparable to that needed by a small town.

The cableway and dam site are lighted from two starlight systems spanning the river gorge on cables 3,800 feet long, from tower to tower.

Towers for the upstream line are 105 feet and 236 feet high - both anchored in huge concrete blocks. A total of 440 flood lights are hung on these two starlight cables, each one producing 1,500 candlepower. Together they produce an illumination of 2 foot-candles on the dam site.

The starlight cable is $2\frac{1}{4}$-inch Bethlehem high-strength steel. The electrical equipment was manufactured by General Electric Company. The dollies carrying the lights were made by Washington Iron Works of Seattle.

Manpower Requirements

During the height of construction, some 1,200 construction men will be employed on the project. Payrolls are expected to reach $220,000 a week.

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Management

Top management personnel in Dravo's Western Construction Division headquarters are: G. M. Shupe, general manager; C. O. Faris, assistant division manager, and E. B. Hamlin, assistant division manager.

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Brigadier General Elmer P. Yates is the Corp's North Pacific Division engineer, in Portland, and Colonel Robert J. Giesen is Walla Walla District engineer. Donald H. Basgen is resident engineer on the job site, and Robert Moore is assistant resident engineer.

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