

S-Mite, A Non-Explosive Alternative

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Introduction

Rock fracturing is often necessary during the application of engineering geology. Whether construction plans require footings founded into indurated bedrock, or fracturing of boulders during construction and/or facility maintenance, the use of explosives can present a variety of problems. The proximity to existing structures, concern about fly-rock, requirements for assumption of additional liabilities and red tape due to multi-regulatory agency approvals all factor into explosive use. S-Mite, a non-hazardous and non-explosive demolition agent was successfully applied to fracture boulders along the right abutment of Santa Felicia Dam,

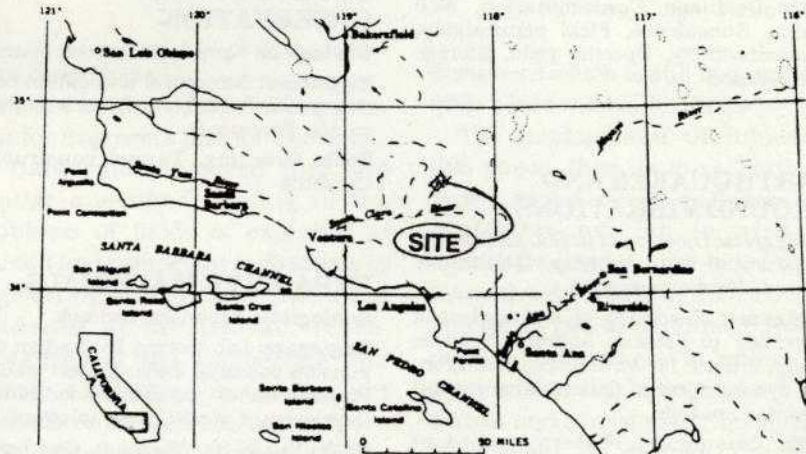


Figure 1 - Location Map, Santa Felicia Dam, Piru, California.



Figure 2 - Wedge-shaped failure that resulted in boulder accumulation along the right dam abutment.

Piru, California. This dam was constructed in 1955. It is 200 feet high and stores 89,000 acre feet of water for multi-use (see Figure 1).

Statement of Problem

A localized wedge-shaped failure of indurated sandstone bedrock resulted in seven boulders up to 12 feet in diameter, landing on the right dam abutment. Their position created the potential for altering surface water runoff. This would result in accelerated erosion along the abutment (see Figure 2). Another boulder was perched precariously above and appeared ready to fall at anytime. It created a stability hazard and also had to be removed.

Heavy equipment could not be used to move the boulders as the helispot was down slope and in a direct path. Uncontrolled boulder movement could have resulted in its damage and closure of dam operation. The use of explosives was considered. Explosive use would have required multi-agency approvals at both the state and federal level due to the size of the dam and assumption of additional liabilities. The concerns were proximity to the dam axis conduit, flyrock and downslope movement of the perched boulder.

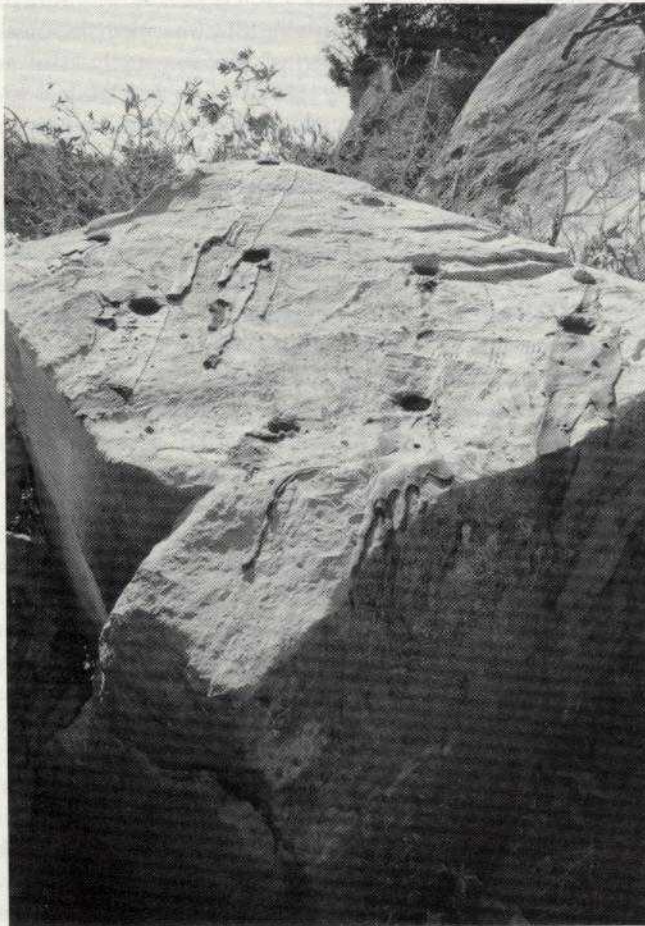


Figure 3 - Boulder #3 with holes drilled and loaded with S-Mite.



Figure 4 - Fractured boulders 24 hours after loading with S-Mite.

Because of the impracticality of explosives, S-Mite, manufactured by Sumitomo Cement, was selected to fracture the boulders to a size that could be safely handled by heavy equipment. S-Mite is a special type of inorganic lime compound. It is non-hazardous and non-explosive. When hydrated, enormous expansive stress is generated.

Application

S-Mite was transported to the site in a powder form packed in 20 kg (44 lb.) containers. Two-inch diameter holes were drilled into the boulders. Spacing and placement were very similar to that used during blasting. S-Mite requires accurate measuring of temperature, water quality and quantity for proper hydration to occur. Ambient air and borehole temperature were measured. The appropriate amount of water was carefully calculated and mixed. Holes were loaded by pouring.

The reaction occurs slowly, usually taking from 10 to 20 hours. This allows the loaded material to "lock" in the hole, pushing out, not up the open hole top. After the expansion is completed, a light gray powder is left. This powder is non-hazardous. Figure 3 shows a boulder that has been loaded with S-Mite and Figure 4 shows the same boulder 24 hours later.

Results

Twenty-two cases of S-Mite B were used. All boulders were fractured to a size that could be easily and safely moved (see Figure 4). The fractures were linear in nature and penetrated the full thickness. No special permits were required. All waste generated was non-hazardous.

Acknowledgements

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