

Rolling Rock

With some of the highest mountain passes, Colorado has to do its share of maintenance and precautionary measures to avoid rocky material falling onto highways from road cuts or slopes. But with a variety of netting and net mounting apparatuses available, it is difficult to identify what system is best for specific situations. Colorado Department of Transportation organized a controlled experiment to evaluate netting combinations and netting/post combinations. Individual posts were also evaluated simulating direct hits.

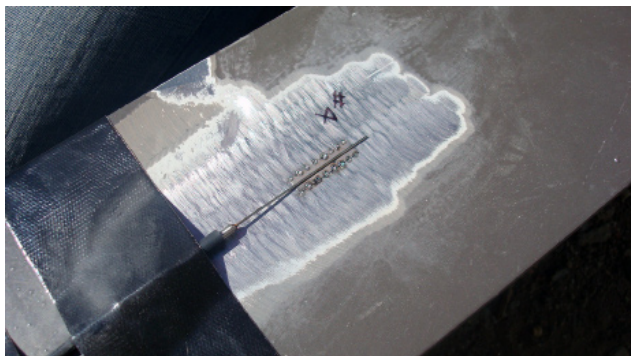
A crane was used to drop 3000, 5000, and 8000 pound engineered boulders (concrete and rebar polyhedrons) onto a runway constructed



on a steep hillside. Nets and posts were assembled at the runway bottom. Strategic high speed cameras were mounted to observe netting deflection. Posts were instrumented with fiber optic strain gauges. Because the boulder/beam intersection was brief, high rate sample fiber optic acquisition was collected 250 samples per second. The data were recorded and displayed in real time for the project coordinators.

Because of the high expected beam torque, the strain gauges were welded to the beam instead of epoxied. The strain gauges needed to be placed tactically on the beam to obtain the best readings while not being at risk for a direct hit. The welds held and the gauges continued to report strain after the beams were considered too mangled to further test. Care also taken to protect the optic cable between the strain gauge and the data collection station (located well out of boulder reach).

The project was concluded with some very interesting data and the exciting experience of trying to hit objects while dropping large rocks from a crane.



Upper left: CDOT's experimental runway.
Lower left: Close up of the weld under attack.