

BULLETIN

News from SubTerra, Inc.®

Highwall Repair Using Shotcrete and Rock Bolts State of Idaho

SubTerra, Inc was subcontracted to review a third party design then analyze, design and provide recommendations for construction of a rock bolt(s) and shotcrete support for a highwall slope repair. The original design reviewed by **SubTerra** included widely spaced bolts and a thin shotcrete layer that was not capable of reacting the design rock loads.

SubTerra's scope of work included:

1. Review geotechnical data and analysis of potential rock loads to be supported.
2. Design the shotcrete support system to withstand the developed rock loads with a suitable factor of safety.
3. Recommend construction methods to be used.

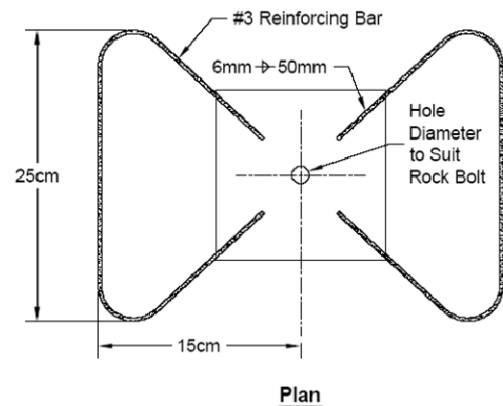
Our design combined recently developed shotcrete elements with conventional reinforced concrete design.

It is generally acknowledged that shotcrete can be used to seal a freshly excavated surface and restrict dilation of the rock mass. Thus, part of its contribution to ground support is to preserve the strength of the in situ materials. However, this effect is seldom factored into ground support calculations. It is also acknowledged that the bond that develops between shotcrete and a strong rock arguably improves the support capabilities of a relatively thin shotcrete layer (e.g., by creating a thicker beam). However, there was little potential for bond development in the relatively weak highwall formation and

the shotcrete would therefore behave as a thin shell.

The developed design included pattern bolting through the installed shotcrete layer into the inter-bedded material. When properly designed, these intermediate supports would reduce the maximum bending moment to a level that could be accommodated by the fiber reinforced shotcrete section.

The design incorporated anchor, spider, or bow-tie plates at rock bolts that would provide localized shear support and facilitate load transfer to the anchor bolts.



We followed up with review and comment on the shotcrete specification, need for pre-construction testing and nozzle men training/certification, and comments on field QA/QC, shotcrete inspection and testing.