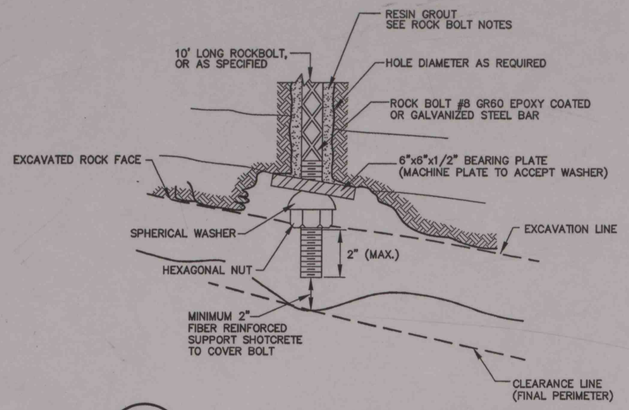
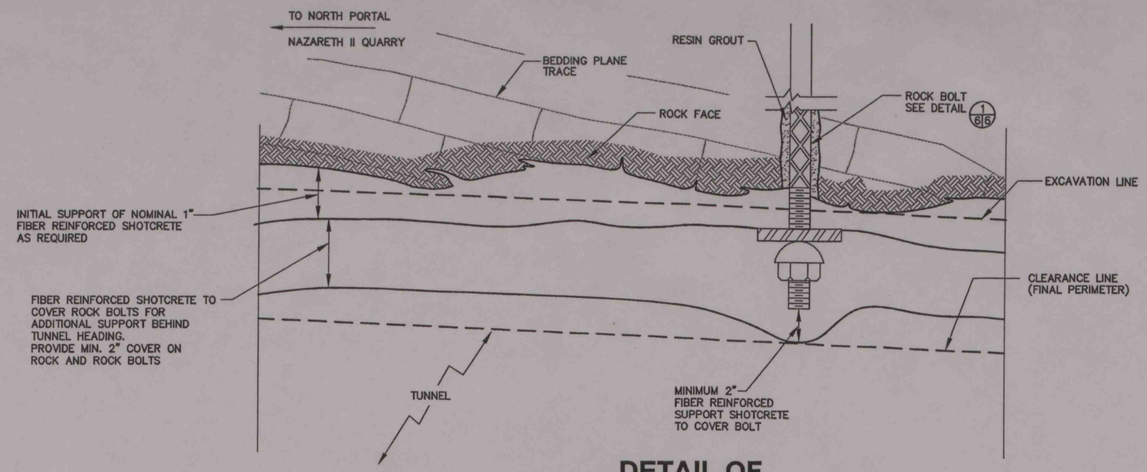


1/6|6 ROCK BOLT DETAIL

N.T.S.

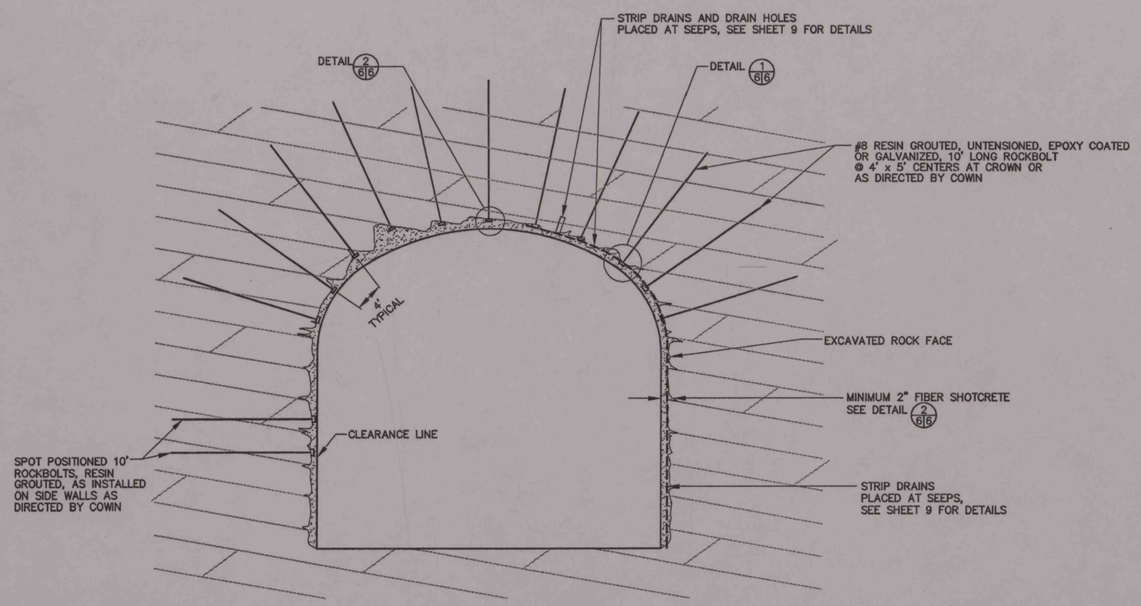


2/6|6 DETAIL OF ROCK SUPPORT AND LINING GROUND CATEGORY 1

N.T.S.

ROCK BOLT NOTES

1. ALL ROCK BOLTS AND HARDWARE TO BE EPOXY COATED OR GALVANIZED PER THE SPECIFICATIONS.
2. THE HOLE DIAMETER AND RESIN CARTRIDGE DIAMETER MUST BE COMPATIBLE WITH THE ROCK BOLT DIAMETER AS RECOMMENDED BY THE MANUFACTURER.
3. FOR TENSIONED ROCK BOLTS, THE APPROPRIATE BOND LENGTH SHOULD BE DETERMINED FROM FIELD TESTING.
4. FOR TENSIONED ROCK BOLTS, FAST SETTING RESIN WITH SET TIME BETWEEN ¾ MINUTE AND 2 MINUTES SHOULD BE USED FOR THE BOND ZONE. SLOW SETTING RESIN WITH A SET TIME BETWEEN 15 AND 30 MINUTES SHOULD BE USED FOR THE TENSIONED LENGTH.
5. UNTENSIONED ROCK BOLTS CAN USE SLOW SETTING RESIN OR A COMBINATION OF FAST AND SLOW SETTING RESIN.
6. ROCK BOLTS TO BE TESTED PER THE SPECIFICATIONS.
7. THE ROCK BOLTS INSTALLED IN THE TUNNEL WILL BE UNTENSIONED. TENSIONED ROCK BOLTS MAY BE INSTALLED DEPENDING UPON GROUND CONDITIONS AS DIRECTED BY COWIN.



ROCK SUPPORT AND LINING GROUND CATEGORY 1

N.T.S.

THIS DESIGN IS BASED ON THE SUBSURFACE CONDITIONS DESCRIBED IN GOLDER ASSOCIATES' REPORT TITLED "GEOTECHNICAL FEASIBILITY REPORT", DATED AUGUST 1998. IF ACTUAL SUBSURFACE CONDITIONS ENCOUNTERED DURING CONSTRUCTION ARE DIFFERENT THAN THOSE DESCRIBED IN THE "GEOTECHNICAL FEASIBILITY REPORT" OR SHOWN ON THE CONSTRUCTION DRAWINGS, GOLDER ASSOCIATES SHALL BE NOTIFIED AND GIVEN THE OPPORTUNITY TO REVIEW, AND IF APPROPRIATE, MODIFY THE DESIGN. LIKEWISE, IF QUESTIONS ARISE WITH RESPECT TO THE INTERPRETATION OF THE DESIGN BY ANY PARTY, GOLDER ASSOCIATES SHALL BE NOTIFIED AND GIVEN THE OPPORTUNITY TO PROVIDE CLARIFICATION.

TYPICAL GROUND CATEGORY 1 DESCRIPTION FOR TUNNEL

- GENERALLY 50 FEET TO 70 FEET BELOW GROUND SURFACE.
- CEMENT LIMESTONE FACIES, ROCK IS MEDIUM TO THICK BEDDED ROCK.
- BEDDING SPACING 0.1 FEET TO 2.5 FEET.
- JOINT SPACING 4 FEET, EXCEPT IN LOCAL ZONES WHERE JOINT SPACING MAY BE AS LITTLE AS 6 INCHES APART.
- LOCALLY, LARGE BLOCKS>1 FOOT CUBED IN THICK BEDDED ROCK; BLOCKS<1 FOOT CUBED IN THIN BEDDED ROCK.
- WHERE JOINTS ARE INFILLED, THE MATERIAL IS GENERALLY CALCITE, LOCALLY DOLOMITE, OCCASIONALLY QUARTZ.
- JOINTS SMOOTH & TIGHT, APERTURE LESS THAN 0.1 FOOT.
- IN ADDITION TO PATTERN BOLTING, STRATEGICALLY PLACED ROCK BOLTING REQUIRED TO SUPPORT PARTICULAR WEDGES, BLOCKS OR WEAK ZONES.
- ROCK BOLTING REQUIRED BEFORE NEXT ROUND IS EXCAVATED.
- TYPICAL ROUND LENGTH = 5 FT. OR AS DETERMINED BY COWIN AND ESSROC.

GENERAL TUNNEL SUPPORT INSTALLATION SEQUENCE

1. AFTER EACH HEADING BLAST, COWIN'S SUPERINTENDENT AND ESSROC'S REPRESENTATIVE SHALL EVALUATE ROCK CONDITIONS.
2. INSTALL CATEGORY 1 OR CATEGORY 2 ROCK SUPPORT AS REQUIRED. INSTALL SUPPLEMENTAL SUPPORT IF REQUIRED BY GROUND CONDITIONS. FOR CATEGORY 1 IF REQUIRED, PLACE A LAYER OF 1 INCH NOMINAL THICKNESS FIBER REINFORCED SHOTCRETE ON EXPOSED BLASTED SURFACES TO PROVIDE INITIAL SUPPORT.
3. FOR CATEGORY 1 SUPPORT INSTALL 10 FT. LONG RESIN GROUTED ROCK BOLTS ON 4 FT. TRANSVERSE AND 5 FT. LONGITUDINAL CENTERS AT NOMINAL SPACING.
4. PLACE REQUIRED AMOUNT OF SHOTCRETE TO OBTAIN A MINIMUM 2 INCH THICKNESS COVER ON ALL EXCAVATED AREAS.
5. REFER TO SHEET 7 FOR CATEGORY 2 SUPPORT DETAILS.
6. ADDITIONAL SUPPORT METHOD FOR LOCAL ZONES OF POOR ROCK SHOWN ON DETAIL 5/6|6

GENERAL NOTES

1. STRIP DRAINS TO BE INSTALLED AT SEEPS IN TUNNEL AS DETERMINED BY ESSROC AND COWIN DURING EXCAVATION. REFER TO SHEET 9 FOR DETAILS.

COMMONWEALTH OF PENNSYLVANIA — REGISTERED PROFESSIONAL — W. RANDALL SULLIVAN — ENGINEER — PE-053553-E

1/8/02

REV	DATE	DESCRIPTION	CAD BY	CHK BY	RVW BY

PROJECT: ESSROC ITALCEMENTI GROUP
CONNECTOR TUNNEL
NAZARETH, PENNSYLVANIA

SHEET TITLE: TUNNEL EXCAVATION AND GROUND CATEGORY 1 ROCK SUPPORT

Golder Associates — Atlanta, Georgia

PROJECT No.	013-3236	FILE No.:	PA19-136
CLIENT PROJ. No.		DRAFTING SUBTITLE:	03
DES BY	RV 01/01/99	SCALE:	AS SHOWN
CAD BY	BEC 03/29/99		
CHK BY	WLW 01/08/02		
RVW BY	WLS 1/8/02		

SHEET 6