Supplementary Information

The following information is associated with Network Rail Standard:
NR CIV/SD/590 Rev A

Additional Content Access

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CAD Drawing

- CIV/SD/590

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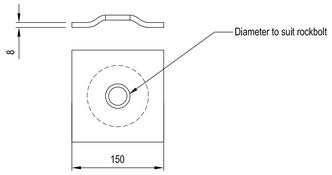
DO NOT SCALE THIS DRAWING

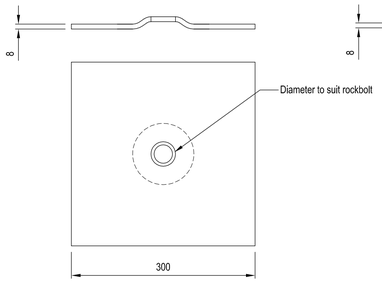
DRAWING No. NR/CIV/SD/590

TYPICAL STEEL DETAILS

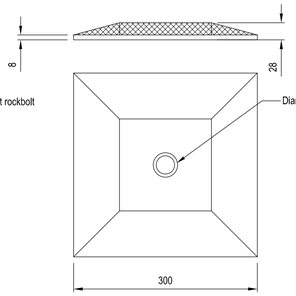


150mm DEFORMABLE DOMED STEEL END PLATE
Scale 1:5

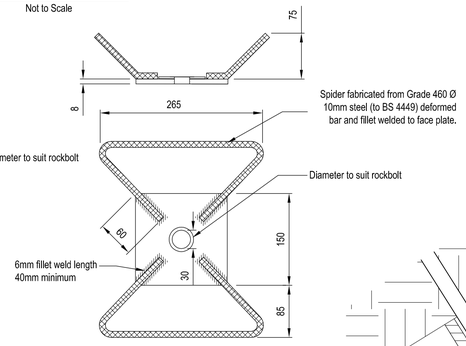
TORQUE NUT FOR STEEL BOLT DETAIL
Not to Scale



300mm DEFORMABLE DOMED STEEL END PLATE
Scale 1:5



300mm SQUARE STEEL END CELL
Scale 1:5



STEEL SPIDER PLATE
Scale 1:5

SYSTEM	MATERIAL TYPE	SIZES FOR OPTIMUM BOND PERFORMANCE			SIZES FOR LOWER BOND PERFORMANCE		
		NOMINAL BIT SIZE	RESIN CAPSULE SIZE	NOMINAL ANNULUS	MAXIMUM BIT SIZE	RESIN CAPSULE SIZE	MAXIMUM ANNULUS
22mm Rockbolts	Stainless Steel Grade 304	27mm	24mm	7mm	32mm	28mm	10mm
25mm Rockbolts	Stainless Steel Grade 304	32mm	28mm	7mm	38mm	36mm	13mm
24mm Rockbolts	Composite GRP	32mm	28mm	8mm	32mm	28mm	8mm
28mm Rockbolts	Composite GRP	32mm	28mm	7mm	41mm	36mm	13mm
32mm Rockbolts	Composite GRP	38mm	36mm	6mm	43mm	36mm	11mm

NOTE: The recommended annulus for resin is 3.5mm greater than the bolt by radius or 7mm greater by bolt diameter. An annulus size may be greater than 3.5mm by radius (or 7mm by diameter) provided adequate bond performance values are achieved using the short encapsulation pull test method. The Scheme Designer will specify if lower bond performance criteria is acceptable.

RESIN SYSTEMS

INSTALLATION EQUIPMENT	DRILL RODS	HOLE SIZE DRILL BITS	METHOD
• Leg / Mast mounted Drill • MC Hand Held Drill MC (sidewall) • Hydraulic MC	19/22mm hexagonal, R19 extend rods, R25 or 7 degree taper to suit ground and hole size required. The hole size needs to be controlled to ensure correct annulus for resin bond.	27mm - 43 twin wing spade semi spade button chisel TC / PCD	• Drill hole and flush to ensure hole is clean from loose debris. • Insert resin to back of hole. If two speed resin used insert fast-set resin first. • Prepare rockbolt by adding end fittings & torque nut. • Insert bolt up to resin but not through it. • Couple bolt to bolt spinner on drill machine. • Spin bolt through resin to back of hole ensuring adequate mixing of filler and catalyst and spin for 5 seconds at back of hole. • Stop rotation and maintain full M/C thrust for 60 seconds to allow fast resin to cure. • Apply M/C rotation to break out torque nut and run nut up bolt thread and tighten up. • Drop M/C off bolt and relocate for next hole.

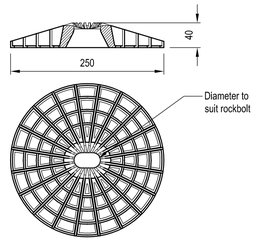
GROUT SYSTEMS

INSTALLATION EQUIPMENT	DRILL RODS	METHOD 1 : POST GROUTING	METHOD 2 : PRE-GROUTED (TREMMIED THIXOTROPIC GROUT)
• Leg / Mast mounted Drill • MC Hand Held Drill MC (sidewall) • Hydraulic MC	To suit ground and hole size required. The hole size is not limited due to grout volume and is not fixed as with resin	• Drill hole and flush to ensure hole is clean of loose debris • Prepare bolt for installation - attach grout and breather as required • Install bolt to back of hole and seal mouth of hole • Grout hole until grout returns down breather pipe • After grout curing period, add end fittings.	• Drill hole and flush to ensure hole is clean of loose debris. • Insert grout insertion pipe to back of hole and pump in thixotropic grout whilst steadily. withdrawing the pipe from the hole to leave a hole full with thixotropic grout. • Insert rockbolt to back of hole and hold in place with temporary fixers until grout has cured. • Add end fittings and tighten up.

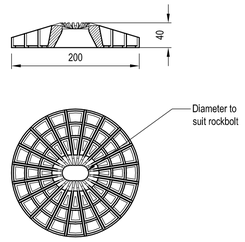
COMBINED RESIN AND GROUT SYSTEMS

INSTALLATION EQUIPMENT	DRILL RODS	METHOD
• Leg / Mast mounted Drill • MC Hand Held Drill MC (sidewall) • Hydraulic MC	To suit ground and hole size required. The hole size needs to be controlled for the resin bonded part of the hole, but is not critical for the grouted part.	• Drill hole and flush to ensure hole is clean of loose debris. • Insert resin to back of hole. • Insert grout insertion pipe up to resin capsule and pump in thixotropic grout whilst steadily withdrawing the pipe from the hole to leave the remaining hole full with thixotropic grout. • Prepare rockbolt by adding end fittings & torque nut. • Insert rockbolt up to resin position in the hole. • Couple bolt to bolt spinner on drill machine. • Spin bolt through resin to back of hole ensuring adequate mixing of filler and catalyst and spin for 5 seconds at back of hole. • Stop rotation and maintain full M/C thrust for 60 seconds to allow fast set resin to cure. • Apply M/C rotation to break out torque nut and run nut up bolt thread and tighten up. • Drop M/C off bolt and relocate for next hole.

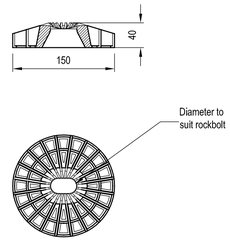
TYPICAL GRP DETAILS



250mm DIA. END PLATE
Scale 1:5

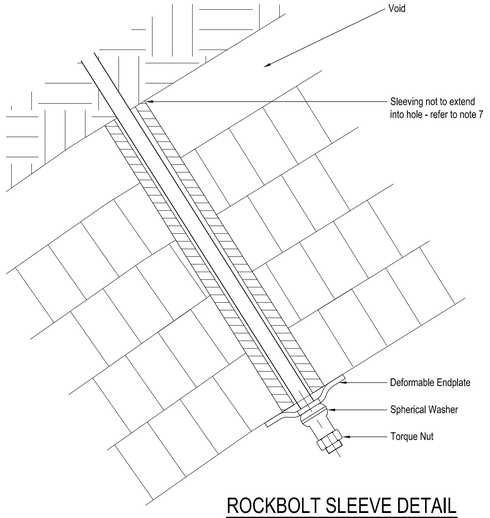


200mm DIA. END PLATE
Scale 1:5



150mm DIA. END PLATE
Scale 1:5

TORQUE NUT FOR GRP BOLT DETAIL
Not to Scale



ROCKBOLT SLEEVE DETAIL
Scale 1:5

SAFETY, HEALTH AND ENVIRONMENT RISK ASSESSMENT

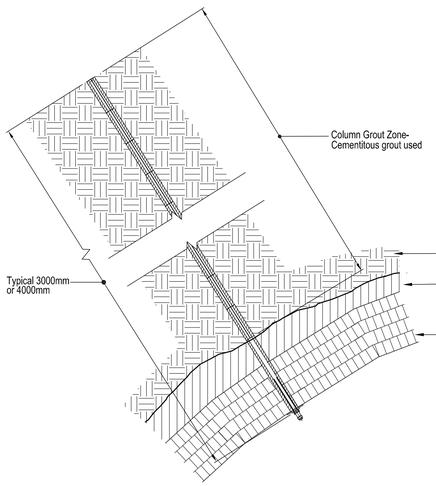
Designer's note - Construction (Design and Management) Regulations 2007

The following are significant hazards/risks associated with the works outlined in this set of drawings.
A site specific risk assessment shall always be undertaken prior to commencing any of the works described on site.

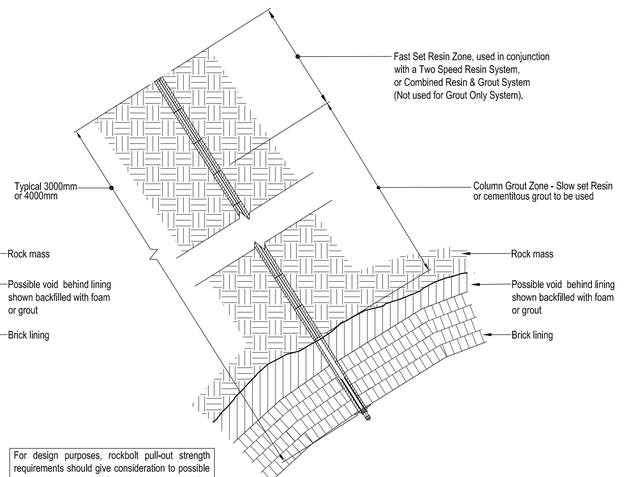
It is assumed that a competent contractor is aware of the risks associated with general construction activities undertaken in the railway environment.

RISK	STAGE	MITIGATING MEASURES
Risk of localised damage to the tunnel lining during rockbolt installation.	C	Where significant voiding is present, loading of the lining should be avoided during Rockbolt installation unless the void is pre-filled. Further guidance is provided in the TUM. The masonry lining (brick / stone) should be monitored for any deformation during installation. Should excessive deformation occur, installation should be stopped. Further guidance is provided in the TUM.

NOTE: C = CONSTRUCTION, O = OPERATION , D = DEMOLITION



TYPICAL ROCKBOLT DETAIL FOR GROUT ONLY SYSTEM
SCALE 1:25



For design purposes, rockbolt pull-out strength requirements should give consideration to possible reduced bond length of rockbolts due to voiding behind lining.

TYPICAL ROCKBOLT DETAIL FOR TWO SPEED RESIN SYSTEM OR COMBINED RESIN/GROUT SYSTEM
SCALE 1:25

NOTES

1. All dimensions are in millimetres unless stated otherwise
2. Location of testing: to be representative of the prevailing rock type and particular consumables specified in the design. For further information on testing refer to standard detail drawing NR/CIV/SD/591.
3. Length of testing holes: tests to be carried out at 2m and 3m depth horizons. Multi horizon tests may be required to represent all rock horizons along the bolt length. For further information on testing refer to standard detail drawing NR/CIV/SD/591.
4. Rockbolts are to be installed in accordance with manufacturer's specification. Typical installation methods are provided.
5. Endplates (and spider plates) are available in a range of sizes and materials including GRP, galvanised and stainless steel. Mixed metals should be avoided. Where Rockbolts are stainless steel, galvanised end plates / spider plates should not be used, and vice versa.
6. Where rockbolts are to be installed into a masonry lined tunnel the following applies:

   a) Drill holes shall be examined after the lining has been penetrated for the presence of voiding. This can be carried out using a crack detector or optical device. The scheme Designer will advise if voids should be filled prior to installation as this is dependent on the individual application of the rockbolts. Further guidance on identifying voids and appropriate mitigation measures are detailed in the TUM.

   b) During installation the masonry lining (brick/stone) should be monitored for any deformation. The scheme Designer will advise on allowable deformation limits, and appropriate actions or mitigation procedures. Further guidance on lining deformation is detailed in the TUM.
7. Void sleeving must not extend significantly into borehole as this will affect bond performance. Where end plates are to be loaded significantly, voids must be pre-filled. The scheme Designer will advise on the requirements for void grouting. Further information is detailed in the TUM.
8. All rockbolt types specified in the design must undergo bond performance testing, as specified in SEPT's in Standard Detail Drawing NR/CIV/SD/591, and only those with adequate bond performance figures may be used for the permanent works. The scheme Designer will specify the pass/fail criteria for bond stiffness.
9. This drawing is to be read in conjunction with Network Rail Standard Detail Drawing:

   NR/CIV/SD/591 - Standard Procedure for Performance Testing of Rockbolts using S.E.P.T.
10. This drawing is to be read in conjunction with Network Rail Document:

    NR/CIV/TUM/590 - Technical User Manual (TUM) for Rockbolt and Consumables Testing

Rev	Date	Description of revision	Design'd	C'kd
A	JUL-10	FIRST ISSUE	BJW	PH

Network Rail

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Approved	P. Clark	Senior Prog. Engineering Manager	PC	JUL-10
	Name	Position	Signature	Date

Master copy with original signatures held by Network Rail HQ
CIVIL ENGINEERING STANDARD DESIGN

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STANDARD TUNNEL DETAILS

ROCKBOLT CONSUMABLES STANDARD DETAILS

Scale	AS SHOWN	
Drawing Number	NR/CIV/SD/590	REV. A

Full document details: NR NR-CIV-SD-590 ISSUE A 2010
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