Pull order A	nchor Number	Anchor type	Anchor width (mm) Ancl	hor depth (mm	n) Bond type	Batch number	Anchor location	Placement date	Placement Score	Placement notes Cwmorthin Site A			Dry Approx load	first deformation (kl	N) Peak Load	Failure mechanism	n Failure narrative
1	BP5	Bolt Product 8mm twist	16	96	KMR resin	226	Cwmorthin, Back Vein	10/12/14	2	Pillar, not enough resin used	(Dack vein) Pillar 06/01/15	Yes	No	7	26	Resin/rock	Resin extracted as a plug, with the upper section looking dirty
2	BP6	Bolt Product 8mm twist	16	96	KMR resin	225	Cwmorthin, Back Vein	10/12/14	2	Pillar, not enough resin used	06/01/15	No	No	3	28.99	Resin/rock	Resin extracting as a plug
3	IC27	IC	12	82	KMR resin	TJY	Cwmorthin, Back Vein	24/12/14	3	Pillar	06/01/15	Yes	No	5	28.66	Resin/rock	Slight spalling. Maintained high load throughout extraction. Resin extra
4	IC30	IC	12	82	KMR resin	TJV	Cwmorthin, Back Vein	24/12/14	3	Pillar	06/01/15	No	No	-	29.37	Resin/rock	Slight spalling. Maintained high load throughout extraction, with resin
5	G4	Goujon anchor, Coeur hanger	12	60	Expansion	-	Cwmorthin, Back Vein	09/12/14	3	Pillar	06/01/15	No	No	5	37.48		Some indication of rock damage
6	C3	Collinox	10	70	SPIT Ampule	-	Cwmorthin, Back Vein	09/12/14	3	Pillar	06/01/15	No	No	9	31.13	Resin/rock	Resin cracked around peak load, then extracted relatively steadily
7	C1	Collinox	10	70	SPIT Ampule	-	Cwmorthin, Back Vein	09/12/14	3	Pillar	06/01/15	Yes	No	9	30.58	Resin/rock	Resin cracked around peak load, then extracted relatively steadily
8	G2	Goujon anchor, Coeur hanger	12	60	Expansion	-	Cwmorthin, Back Vein	09/12/14	3	Pillar	06/01/15	Yes	No	5	35.6		Spalling along the cleavage plane
y	IC31	IC	12	82	KMR resin	TJO	Cwmorthin, Back Vein	24/12/14	3	Pillar Cwmorthin Site A (Bac	06/01/15 :k Vein) Working F	No Face	Yes	6	31.8	Resin/rock	Slight spalling. Maintained high load throughout extraction
10	BP11	Bolt Product 8mm twist	16	96	KMR resin	227	Cwmorthin, Back Vein	10/12/14	3	Cleavage (working face)	06/01/15	Yes	No	6	34.5		Spalling 10-15cm around head. Twisted out leavening resin
11	G8	Goujon anchor, Coeur hanger	12	60	Expansion	-	Cwmorthin, Back Vein	09/12/14	3	Cleavage (working face)	06/01/15	Yes	No	5	18		Significant rock failure (approx. 30cm around anchor). Anchor was pla
12	G7	Goujon anchor, Coeur hanger	12	60	Expansion	-	Cwmorthin, Back Vein	09/12/14	3	Cleavage (working face)	06/01/15	No	No	5	22		Significant rock failure 30-40cm long
13	C9	Collinox	10	70	SPIT Ampule	-	Cwmorthin, Back Vein	09/12/14	3	Cleavage (working face)	06/01/15	Yes	No		30.5		Small amount of surface spalling, pulled out relatively steadily with res
14	C10	Collinox	10	70	SPIT Ampule	-	Cwmorthin, Back Vein	09/12/14	3	Cleavage (working face)	06/01/15	No	No	6	32.61	Resin/rock	Small amount of surface spalling, pulled out relatively steadily with res
15	IC29 BP14	IC	12	82	KMR resin	TJX	Cwmorthin, Back Vein	24/12/14	3	Cleavage (working face)	06/01/15	Yes	No	3	35.19	Resin/rock	Very clean hole. Maintained high load throughout extraction
10	C12	Bolt Product 8mm twist Collinox	16	96 70	KMR resin SPIT Ampule	228	Cwmorthin, Back Vein Cwmorthin, Back Vein	10/12/14	3	Cleavage (working face) Cleavage (working face)	06/01/15	No	No Yes	4	37.02 28.23	Anchor/resin Resin/rock	Unscrewed leaving resin plug (cork screw) Slight surface spalling, steady extraction
19	G13	Goujon anchor, Coeur hanger	10	60	Expansion	-	Cwmorthin, Back Vein	09/12/14	3	Cleavage (working face) Cleavage (working face)	06/01/15	No	Yes	0	28.23		Large rock failure at peak load, at least 50cm long, approx. 2-3cm de
10	IC28	IC	12	80	KMR resin	TUY	Cwmorthin, Back Vein	24/01/14	3	Cleavage (working face)	06/01/15	No	Yes	2	35.92		Very small amount of spalling, maintained high load throughout extract
20	BP15	Bolt Product 8mm twist	16	96	KMR resin	230	Cwmorthin, Back Vein	10/12/14	1	Cleavage (working face), possibly compromised by previous anchor	06/01/15	No	Yes	3	31.58		Large spalling, likely relating to the crack generated by G13
21	IC26	IC	12	82	KMR resin	TJU	Cwmorthin, Back Vein	24/12/14	1	Cleavage (working face), possibly compromised by previous anchor	06/01/15	No	No	3	33.06		Large spalling, likely relating to the crack generated by G13
										Cwrnorthin Site B (
22	BP6	Bolt Product 8mm twist	16	96	KMR resin	221	Cwmorthin, stripy Vein	10/12/14	3	Pillar	06/01/15	Yes	No	6	36.64	Anchor/resin	Slight spalling, twisted out leaving resin. Maintained high load on extra
23	G5	Goujon anchor, Coeur hanger	12	60	Expansion	-	Cwmorthin, stripy Vein	09/12/14	3	Pillar	06/01/15	Yes	No	4	38.03	Hanger snapped	Clean break of the hanger with some deformation of anchor
24	C1	Collinox	10	70	SPIT Ampule	-	Cwmorthin, stripy Vein	09/12/14	3	Pillar	06/01/15	No	No	10	32.16	Resin/rock	Clean extraction with resin still attached
25	IC21	IC	12	82	KMR resin	TJL	Cwmorthin, stripy Vein	24/12/14	3	Pillar	06/01/15	No	No	6	24	Resin/rock	Suspect error with reset of gauge. Probably more like 24kN peak load
26	C4	Collinox	10	70	SPIT Ampule	-	Cwmorthin, stripy Vein	09/12/14	3	Pillar	06/01/15	Yes	No	7	34.21	Resin/rock	Clean extraction with resin still attached
27	IC22	IC	12	82	KMR resin	TJV	Cwmorthin, stripy Vein	24/12/14	3	Pillar	06/01/15	Yes	No	9	35.89	Resin/rock	Clean extraction maintaining high loads throughout
28	G2	Goujon anchor, Coeur hanger	12	60	Expansion	-	Cwmorthin, stripy Vein	09/12/14	3	Pillar	06/01/15	No	No	5	37.27		Hanger snapped, anchor slightly bent
29	BP3	Bolt Product 8mm twist	16	96	KMR resin	223	Cwmorthin, stripy Vein	10/12/14	3	Pillar	06/01/15	No	No	3	41.87	Anchor/resin	Twisted out leaving some resin in place. Fast extraction, quicker pum
30	IC24	IC	12	82	KMR resin	TJT	Cwmorthin, stripy Vein	24/12/14	2	Commorthin Site B (stripy Veir Cleavage (working face)	06/01/15	/Cleavag No	No	2	37.1	Resin/rock	Very clean extraction maintaining high loads throughout
31	IC24	IC	12	82	KMR resin	TJB	Cwmorthin, stripy Vein	24/12/14	3	Cleavage (working face)	06/01/15	No	No	10	33.94	Resin/rock	Very clean extraction maintaining high loads throughout
32	BP15	Bolt Product 8mm twist	16	96	KMR resin	222	Cwmorthin, stripy Vein	10/12/14	3	Cleavage (working face)	06/01/15	No	No	3	31.98	Complex	Initial anchor/resin failure but significant spalling at the end of the extra
33	C7	Collinox	10	70	SPIT Ampule	-	Cwmorthin, stripy Vein	09/12/14	3	Cleavage (working face)	06/01/15	No	Yes	2	34.12	Besin/rock	Very slight spalling, extraction with resin plug
34	BP11	Bolt Product 8mm twist	16	96	KMR resin	227	Cwmorthin, stripy Vein	10/12/14	3	Cleavage (working face)	06/01/15	No	No	3	46.1	Anchor/resin	Twisted out with slight spalling. Maintained high load
35	BP12	Bolt Product 8mm twist	16	96	KMR resin	224	Cwmorthin, stripy Vein	10/12/14	3	Cleavage (working face)	06/01/15	No	Yes	3	42.44	Anchor/resin	Rig jammed during extraction. Spalling as anchor twisted out (approx
36	IC23	IC	12	82	KMR resin	TJS	Cwmorthin, stripy Vein	24/12/14	3	Cleavage (working face)	06/01/15	No	Yes	6	35.55	Resin/rock	Very clean extraction maintaining high loads throughout
37	G10	Goujon anchor, Coeur hanger	12	60	Expansion	-	Cwmorthin, stripy Vein	09/12/14	3	Cleavage (working face)	06/01/15	No	Yes	4	38.12	Hanger snapped	Hanger snapped, anchor slightly bent
38	G8	Goujon anchor, Coeur hanger	12	60	Expansion	-	Cwmorthin, stripy Vein	09/12/14	3	Cleavage (working face)	06/01/15	No	No	3	36.5	Rock cone failure	Significant "dinner plate" failure approx. 2-3cm deep and 30cm long
39	C9	Collinox	10	70	SPIT Ampule	-	Cwmorthin, stripy Vein	09/12/14	3	Cleavage (working face)	06/01/15	No	No	10	31.86	Resin/rock	Slight surface spalling, clean extraction with some resin attached
40	C14	Collinox	10	70	SPIT Ampule	-	Cwmorthin, stripy Vein	09/12/14	3	Cleavage (working face)	06/01/15	No	No	12	32.4	Resin/rock	Very slight surface spalling, clean extraction with resin attached
41	G13	Goujon anchor, Coeur hanger	12	60	Expansion	-	Cwmorthin, stripy Vein	09/12/14	3	Cleavage (working face)	06/01/15	No	No	5	37.56	Hanger snapped	Hanger snapped, anchor slightly bent
42	IC16	IC	10	82	KMR resin	TJK	Cambrian	23/12/14	2	Cambria Pillar. soft rock	07/01/15	No	No	6	34.83	Resin/rock	Clean extraction
42	C2	Collinox	10	70	SPIT Ampule	-	Cambrian	23/12/14	1	Pillar, soft rock. Install error, hole drilled to deep (90mm not 70mm)	07/01/15	No	No	9	18.53	Resin/rock	Clean extraction with resin clearly attached
40	G7	Gouion anchor, Coeur hanger	12	60	Expansion	-	Cambrian	23/12/14	2	Pillar, soft rock	07/01/15	No	No	4	20.23	Besin/rock	Relatively clean extraction
45	BP12	Bolt Product 8mm twist	16	96	KMR resin	283	Cambrian	23/12/14	2	Pillar, soft rock	07/01/15	Yes	No	3	41.44	Complex	Twisting out initially (resin/anchor bond failure), followed by rock failure
46	BP11	Bolt Product 8mm twist	16	96	KMR resin	263	Cambrian	23/12/14	2	Pillar, soft rock	07/01/15	No	No	4	33.13		Slight twisting at early stages followed by significant (40cm) rock failu
47	G6	Goujon anchor, Coeur hanger	12	60	Expansion		Cambrian	23/12/14	2	Pillar, very soft rock	07/01/15	Yes	No	3	11.46		Some spalling, then relatively clean extraction
48	C1	Collinox	10	70	SPIT Ampule	-	Cambrian	23/12/14	1	Pillar, very soft rock. Possibly compromised by G6	07/01/15	Yes	No	6	22.91		Rock failure along the cleavage plane
49	IC17	IC	12	82	KMR resin	TJH	Cambrian	23/12/14	1	Pillar, very soft rock. Possibly compromised by G6	07/01/15	Yes	No	7	25.39	Complex	Small amount of rock spalled, and cracking followed by usual clean re
50	BP13	Bolt Product 8mm twist	16	96	KMR resin	282	Cambrian	23/12/14	3	Cleavage Plane (top of fallen block)	07/01/15	No	No	2	41.72	Complex	Spalling around mid way through extraction, with cone failure. Mixed
51	BP14	Bolt Product 8mm twist	16	96	KMR resin	287	Cambrian	23/12/14	3	Cleavage Plane (top of fallen block)	07/01/15	Yes	No	3	37.95	Anchor/resin	Small amount of surface spalling
52	IC18	IC	12	82	KMR resin	TJG	Cambrian	23/12/14	3	Cleavage Plane (top of fallen block)	07/01/15	No	No	8	37.4	Resin/rock	Very clean extraction maintaining high load throughout
53	G9	Goujon anchor, Coeur hanger	12	60	Expansion	-	Cambrian	23/12/14	3	Cleavage Plane (top of fallen block)	07/01/15	Yes	No	3	35.25	Rock cone failure	Cone failure approx 15cm, as well as a larger (approx 30cm long) sur
54	C21	Collinox	10	70	SPIT Ampule	-	Cambrian	23/12/14	3	Cleavage Plane (top of fallen block)	07/01/15	No	No	13	31.72	Resin/rock	Clean extraction with resin plug evident
55	G8	Goujon anchor, Coeur hanger	12	60	Expansion	-	Cambrian	23/12/14	3	Cleavage Plane (top of fallen block)	07/01/15	No	No	4	36.15	Hanger snapped	Anchor bent and hanger snapped in one place
56	IC19	IC	12	82	KMR resin	TJC	Cambrian	23/12/14	3	Cleavage Plane (top of fallen block)	07/01/15	Yes	No	6	37.12	Anchor/resin	Very clean extraction maintaining high load throughout
57	C3	Collinox	10	70	SPIT Ampule	-	Cambrian	23/12/14	3	Cleavage Plane (top of fallen block)	07/01/15	Yes	No	12	30.04	Resin/rock	Clean extraction with resin plug evident
58	IC20	IC	12	82	KMR resin	TJJ	Cambrian	23/12/14	3	Cleavage Plane (top of fallen block)	07/01/15	No	Yes	3	34.34	Anchor/resin	Very clean extraction maintaining high load throughout, again!!
59	BP20	Bolt Product 8mm twist	16	96	KMR resin	290	Cambrian	23/12/14	3	Cleavage Plane (top of fallen block)	07/01/15	No	Yes	3	39.8	Resin/rock	Clean extraction with resin plug evident
60	G10	Goujon anchor, Coeur hanger	12	60	Expansion	-	Cambrian	23/12/14	3	Cleavage Plane (top of fallen block)	07/01/15	No	Yes	3	27		Significant spalling approx 40cm
61	C5	Collinox	10	70	SPIT Ampule	-	Cambrian	23/12/14	2	Cleavage Plane (top of fallen block), possibly compromised by G10	07/01/15	No	Yes	6	30.68	Rock cone failure	Significant spalling, piece approx 2cm deep and 30cm long. Possibly
62	BP12	Bolt Product 8mm twist	16	96	KMR resin	242	Braich Goch, Corris	18/12/14	3	Pillar, front plane.	13/01/15	Yes	No	5	29.59	Anchor/resin	Some surface spalling, anchor "unscrewed" leaving the resin in place
63	C2	Collinox	10	70	SPIT Ampule		Braich Goch, Corris	18/12/14	3	Pillar, front plane.	13/01/15	Yes	No	8	29.59	Resin/rock	Clean extraction with resin visible between the broad thread of the an
64	G7	Goujon anchor, Coeur hanger	12	60	Expansion	-	Braich Goch, Corris	18/12/14	3	Pillar, front plane.	13/01/15	Yes	No	6	35.33		Catastrophic spalling around 50cm long, 20cm wide and 3cm+ deep
65	BP11	Bolt Product 8mm twist	16	96	KMR resin	288	Braich Goch, Corris	18/12/14	2	Pillar, front plane, possibly compromised by rock failure of G7	13/01/15	No	No	1	31.91	Anchor/resin	Slight surface spalling, with anchor twisting out leaving the resin in pla
66	C1	Collinox	10	70	SPIT Ampule	-	Braich Goch, Corris	18/12/14	3	Pillar, front plane.	13/01/15	No	No	8	21.89		Small amount of surface spalling, anchor extracted clean with resin vi
67	G6	Goujon anchor, Coeur hanger	12	60	Expansion	-	Braich Goch, Corris	18/12/14	3	Pillar, front plane.	13/01/15	No	No	4	36		Anchor bent, hanger snapped in one place
68	BP14	Bolt Product 8mm twist	16	96	KMR resin	289	Braich Goch, Corris	18/12/14	3	Braich Goch/Co Cleavage (working face)	orris Cleavage 13/01/15	Yes	No	2	38.43	Anchor/resin	Some surface spalling, with anchor twisting out leaving the rein in pla
69	C4	Collinox	10	70	SPIT Ampule	209	Braich Goch, Corris Braich Goch, Corris	18/12/14	3	Cleavage (working face) Cleavage (working face)	13/01/15	Yes	No	4	38.43	Resin/rock	Some surface spalling, with anchor twisting out leaving the rein in pla Some surface spalling, then anchor extracted clean with resin visible
00	G9	Goujon anchor, Coeur hanger	12	60	Expansion	-	Braich Goch, Corris	18/12/14	3	Cleavage (working face)	13/01/15	Yes	No	2	34.65		Anchor bent and hanger snapped in one place
70	BP13	Bolt Product 8mm twist	16	96	KMR resin	287	Braich Goch, Corris	18/12/14	2 (Cleavage (working face), anchor proud of the rock approx 10mm, install error	13/01/15	No	No	2	36.05		Some surface spalling (approx 10cm) then anchor twisted out leaving
70 71		Collinox	10	70	SPIT Ampule	-	Braich Goch, Corris	18/12/14	3	Cleavage (working face), and to product interfock approx formini, install circle	13/01/15	No	No	6	32.68	Resin/rock	Some surface spalling, then anchor extracted clean with resin visible
70 71 72	C3						Braich Goch, Corris	18/12/14	3	Cleavage (working face)	13/01/15	No	No	5	37.99		Anchor bent and hanger snapped in one place
70 71 72 73		Goujon anchor, Coeur hanger	12	60	Expansion	-	Braich Goch, Corris						INO	5	37.99	Tranger snappeu	
70 71 72 73 74	C3		12	60 96	Expansion KMR resin	285	Braich Goch, Corris Braich Goch, Corris	18/12/14	3	Cleavage (working face)	13/01/15	No	Yes	4	43.07	Anchor/resin	Very small surface spalling then anchor twisted out leaving resin
72 73	C3 G8	Goujon anchor, Coeur hanger	12 16 10			285			3					5 4 5			

Placement Score: Subjective assessment based on the quality of the placement, based on the quality of the rock assessed during the placement (such as soft rock or proximity to a crack), quality of the placement (such as sitting proud or placement error) or scored down if a previous anchor has possibly compromised a placement. Score: 1 - Poor. 2 - Suspect. 3- Good.

Note on both the IC and BP Anchors. Due to time constraints, neither the BP or IC anchor had their heads recessed into the rock (which requires drilling and chiseling a hole for the eye of the anchor). It would be fair to assume both anchors, but particularly the IC anchor as it would be almost 10mm further into the rock, would perform even better than the results posted here if they were recessed! This should be taken into consideration when comparing these results with test in other rock types.

in extracted with the anchor appeared to be acting as a wedge as the lower section of the anchor became visible resin extracted with the anchor dily vas placed a little over 20cm away from a clear crack vith resin around the anchor between the broad threads vith resin between the broad threads of the anchor. Anchor slightly bent extraction n extraction ak load r pumping! e extraction (20cm) pprox. 10cm) long k failure along the cleavage plane ck failure along cleavage plane lean resin/rock failure and extraction lixed resin/anchor bond failure) surface flake ssibly related to the previous anchor G10 n place the anchor + deep n in place resin visible between the broad threads in place isible between broad threads eaving resin isible between broad threads sible between broad threads