

Supplementary Materials: Long-Term Stability Evaluation and Pillar Design Criterion for Room-And-Pillar Mines

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Table S1. The failed and stable pillar cases in India.

No.	Status	H , (m)	w_{pr} , (m)	w_{cr} , (m)	h , (m)	ρ	δ	SF_0	$d_{m'}$, (m)	SF_p
1	F	30	3.6	5.7	4.5	2.6	45	6.0	3.4	0.0
2	F	30	3.6	5.4	6	2.5	45	5.3	5.0	0.0
3	F	36	3.9	6	3	2.6	26	4.1	1.9	0.0
4	F	30	4.5	4.5	5.4	3.1	25	4.5	3.9	0.0
5	F	23	4.7	5.6	8.1	2.6	24	4.4	6.7	0.0
6	F	90	5.4	6	3.8	2.1	45	5.0	2.3	0.0
7	F	129	7.5	6	3.6	2.6	38	3.9	2.1	0.5
8	F	54	5.4	6	3.6	2.6	33	5.1	2.2	0.1
9	F	56	5	6.5	3.6	2.6	33	4.0	2.2	0.0
10	F	42	4.5	4.5	4.8	2.6	47	7.9	3.3	0.0
11	F	70	2.9	3.2	1.8	2.6	26	3.7	1.1	0.1
12	F	51	3	3.6	1.8	2.6	26	4.7	1.1	0.2
13	F	160	19.8	4.2	6.6	2.6	27	5.2	3.3	2.0
14	F	140	18.6	5.4	8.4	2.6	25	4.0	4.3	0.9
15	S	36	5.4	6	3	2.6	48	12.6	1.8	0.9
16	S	48	9.9	6	6	2.5	50	14.2	3.6	0.6
17	S	270	8.1	3.6	3	2.6	46	4.1	1.7	1.1
18	S	75	9.9	6.6	2.7	2.5	28	8.0	1.5	3.3
19	S	38	7.2	3.9	5.1	2.5	33	12.4	3.0	0.2
20	S	30	9	6	5.1	2.5	21	9.5	3.0	0.6
21	S	102	10.1	2.4	4.8	2.5	35	9.2	2.3	2.1
22	S	75	6.3	4.2	3	2.5	35	7.6	1.7	1.0
23	S	106	16	4	3.5	2.6	29	11.0	1.9	5.6
24	S	38	18.3	4.2	5.1	2.5	33	30.0	2.7	12.8
25	S	266	40	5	4.8	2.5	43	9.9	2.5	7.1
26	S	30	6	6	2.1	2.6	19	8.8	1.2	2.6
27	S	36	9.3	7.2	3.6	2.1	40	20.5	2.0	4.9
28	S	80	5.8	5.5	2	2.6	29	5.4	1.1	1.6
29	S	85	7	3.9	1.8	2.5	41	13.2	1.0	5.8

Note: S for stable pillar; F for failed pillar.

Table S2. The failed pillar cases in ordinary coal fields of South Africa.

No.	H , (m)	w_{pr} , (m)	w_{cr} , (m)	h , (m)	SF_0	$d_{m'}$, (m)	SF_p	No.	H , (m)	w_{pr} , (m)	w_{cr} , (m)	h , (m)	SF_0	$d_{m'}$, (m)	SF_p
1	76.2	4.88	6.1	1.37	3.7	0.8	1.5	41	57.9	6.1	7.62	3.96	2.7	2.4	0.1
2	55.5	7.43	6.62	3.8	4.5	2.2	0.5	42	41.1	4.27	6.4	3.05	3.1	1.9	0
3	78.2	10.53	6.47	5.16	4.2	3	0.5	43	25.9	3.66	8.53	3.05	2.6	2	0

4	73.5	8.4	6.6	3.65	4.1	2.1	0.8	44	21.3	3.96	8.23	4.57	2.9	3.3	0
5	57.66	5.3	5.66	2.89	3.7	1.7	0.3	45	29.6	5.18	7.01	5.49	3.6	3.8	0
6	165.7	15	5	5.94	3.1	3.2	0.8	46	27.4	3.66	7.92	2.13	3.4	1.3	0.2
7	195	17	6	4.88	3.1	2.7	1.2	47	36.6	4.57	7.62	2.44	3.7	1.4	0.3
8	205	17	6	5.88	2.6	3.3	0.8	48	33.5	6.1	6.71	5.49	4.3	3.6	0
9	167.6	15.85	5.49	5.49	3.3	3	1	49	30.5	4.57	7.62	3.66	3.4	2.3	0
10	193.2	15.85	5.49	5.49	2.8	3	0.9	50	53.3	5.18	6.4	3.66	2.9	2.3	0
11	184.7	15.85	5.49	5.49	3	3	0.9	51	68.6	3.35	5.79	1.52	2.2	0.9	0.4
12	36.6	6.1	7.62	4.88	3.7	3.1	0	52	88.4	7.16	6.55	4.88	2.3	3	0
13	62.5	6.1	7.62	2.44	3.5	1.4	0.8	53	57.9	5.18	6.4	5.49	2.1	3.8	0
14	101	9	6	3.8	3.5	2.2	0.7	54	61	4.72	6.86	3.51	2.1	2.2	0
15	100	8.5	6.5	3.3	3.3	1.9	0.8	55	30.5	3.35	6.4	2.59	3.1	1.6	0
16	97	9	6.6	3.7	3.4	2.1	0.7	56	13.5	3.9	5.5	6	6.3	5.1	0
17	51.5	6	6	3.9	3.9	2.4	0.1	57	24	6.2	5.8	2.4	12.4	1.4	3
18	28.5	3.8	5.8	2.7	4.5	1.7	0	58s	21.3	6.1	6.1	2.44	12.8	1.4	2.9
19	34	3.5	6.7	2.7	2.7	1.7	0	59s	21.3	6.1	6.1	4.27	8.9	2.6	0.1
20	34	3.5	6.7	2.7	2.7	1.7	0	60s	33.53	5.49	6.71	2.31	6.5	1.3	1.3
21	90	7.5	6	4.8	2.6	2.9	0.1	61s	45.72	5.49	6.71	2.31	4.8	1.3	0.9
22	57	3.6	5.4	1.35	3.6	0.8	0.9	62s	51.82	5.49	6.71	2.31	4.2	1.3	0.8
23	62	7.5	6.4	4	4.1	2.4	0.4	63s	43.59	6.1	6.1	2.12	6.9	1.2	2
24	62	7.3	6.2	4	4	2.4	0.3	64s	51.82	6.1	6.1	2.12	5.8	1.2	1.7
25	56	5.1	6.5	3.3	2.8	2	0.1	65s	27.4	10.7 ×4.5	4.57	2.44	18.1	1.4	2.4
26	33	6.4	6.4	4.88	5.4	3.1	0	66s	21.3	5.49	6.71	3.05	8.5	1.8	0.6
27	22	3.5	6.5	1.6	6.2	0.9	1	67s	33.53	6.1	5.49	2.13	9.9	1.2	2.9
28	62	6.1	6.1	4	3.2	2.4	0.1	68s	45.72	7.62	6.1	2.44	8.2	1.4	2.7
29	62	6.1	6.1	4	3.2	2.4	0.1	69s	23.1	5.49	6.1	1.83	12.2	1	3.9
30	41	6.4	6.4	6.2	3.7	4.1	0	70s	42.67	5.49	6.71	2.13	5.4	1.2	1.3
31	41	6.4	6.4	6.2	3.7	4.1	0	71s	51.82	5.49	6.71	2.13	4.5	1.2	1.1
32	41	6.4	6.4	6.2	3.7	4.1	0	72s	60.92	5.49	6.71	2.13	3.8	1.2	0.9
33	35.5	5.5	5.5	2.2	7.9	1.3	1.8	73s	22.86	6.1	6.1	3.05	10.3	1.8	1.2
34	32	3.3	6.4	2.3	3.1	1.4	0	74s	42.67	6.71	5.49	1.83	9.8	1	4
35	32.5	3.2	6.5	2.1	3	1.3	0.1	75s	51.82	6.71	5.49	2.13	7.3	1.2	2.5
36	43	4.8	6.2	2.8	4	1.7	0.2	76s	60.92	6.71	5.49	1.83	6.9	1	2.8
37	86.4	7.5	6.5	4.6	2.6	2.8	0.1	77s	76.2	7.62	6.1	1.37	7.2	0.7	4.2
38	102	7.6	6.2	4.5	2.4	2.7	0.1	78s	173.74	15.85	5.49	2.29	5.6	1.2	3.7
39	61	6.1	6.1	4.57	3	2.9	0	79s	181.36	18.29	6.1	2.44	5.6	1.3	3.8
40	61	6.1	7.62	3.05	3.1	1.8	0.3								

Note: the s after case number stands for the pillar data that Salamon not used, as such pillar failures may because of weak roof or floor conditions (York et al. 2000), the data was not used in this paper.

Table S3. The failed pillar cases in Vaal Basin, Free State and Klip river coal fields of South Africa.

No.	H_r (m)	w_{pr} (m)	w_{cr} (m)	h_r (m)	SF_0	$d_{m'}$ (m)	SF_p	No.	H_r (m)	w_{pr} (m)	w_{cr} (m)	h_r (m)	SF_0	$d_{m'}$ (m)	SF_p
1	29	5.4	6.3	2.9	2.7	2.8	0.0	31	152.4	12.19	6.1	4.88	1.1	4.4	0.0

2	60	7	6	1.82	2.7	1.6	0.6	32	41	13.1	6	5.5	4.2	4.9	0.2
3	53	5.6	6.1	1.8	2.2	1.6	0.3	33	35	9	6	2.7	5.0	2.4	0.8
4	21	6.75	5.25	3.2	5.8	3.0	0.0	34	45	6	6	3.5	1.9	3.4	0.0
5	19	6	6	3	5.0	2.9	0.0	35	46	5.78	6.22	3.29	1.8	3.2	0.0
6	23	6	6	2.9	4.2	2.7	0.0	36	51	5.76	6.24	3.41	1.5	3.4	0.0
7	40	7	5	2.8	3.6	2.6	0.1	37	113.7	12	6	2.75	2.2	2.4	0.6
8	42	4.5	5.5	2	2.1	1.9	0.0	38	103.5	11.66	6.34	2.94	2.1	2.6	0.5
9	50	7	5	2.3	3.3	2.1	0.4	39	47	5.9	6.1	3.21	1.8	3.1	0.0
10	55	7	5	2.2	3.1	2.0	0.4	40	90	9.1	5.9	2.53	2.1	2.2	0.4
11	87.8	6.1	6.1	1.98	1.4	1.8	0.2	41	98	10	6	3	1.9	2.7	0.3
12	70	7.5	5	1.8	3.0	1.6	0.8	42	59.6	8.9	6.1	3.57	2.4	3.3	0.1
13	63.5	7.5	5	2.1	3.0	1.9	0.6	43	40	5.7	6.3	3.15	2.0	3.1	0.0
14	61	6	5	1.9	2.5	1.7	0.3	44	103.7	11.13	6.37	3.05	1.9	2.7	0.4
15	61	7.5	5	1.9	3.3	1.7	0.8	45	99.6	11.44	6.06	3.07	2.2	2.7	0.4
16	74	10	5	4	2.4	3.6	0.1	46	105.9	11.5	6	3.04	2.1	2.7	0.4
17	74	7.7	4.8	2	2.8	1.8	0.6	47	106.4	11.5	6	3.11	2.0	2.7	0.4
18	112	10.55	6.45	2.82	1.8	2.5	0.4	48	106.5	11.56	5.94	3.05	2.1	2.7	0.5
19	108	10.55	6.48	3.18	1.7	2.8	0.3	49	103	14.02	5.98	3.38	2.5	2.9	0.6
20	82	10	5	2.8	2.7	2.5	0.5	50	105.5	14.15	5.85	3.06	2.6	2.6	0.8
21	96	12	6	2.9	2.5	2.5	0.6	51	99	14.24	5.76	3.34	2.7	2.9	0.7
22	70	12.5	5.5	2.9	3.7	2.5	1.1	52	99	14.65	5.35	3.3	2.9	2.9	0.9
23	88	11	6	2.9	2.4	2.5	0.5	53s	87.8	7.62	6.1	1.68	2.2	1.5	0.7
24	112	11.5	5.5	2.9	2.1	2.5	0.5	54s	17.07	4.57	4.57	2.44	5.6	2.3	0.0
25	96	12	6	6	1.5	5.4	0.0	55s	17.07	4.57	10.7	2.44	2.0	2.3	0.0
26	82	12	6	3	2.8	2.6	0.7	56s	27.4	10.7 ×4.57	4.57	2.44	7.2	2.2	0.0
27	104	12	6	3	2.2	2.6	0.5	57s	27.4	9.75 ×4.57	4.57	2.44	6.7	2.2	0.0
28	128	12.8	5.5	5.5	1.4	4.8	0.0	58s	12.8	4.57	6.1	1.83	6.6	1.7	0.3
29	128	9.75	5.49	3.66	1.3	3.3	0.1	59s	29.6	10.7 ×4.57	4.57	2.44	6.7	2.2	0.0
30	57.9	5.18	6.4	3.66	1.1	3.8	0.0								

Table S4. The stable pillar cases in ordinary coal fields of South Africa.

No.	H , (m)	w_{pr} , (m)	w_{cr} , (m)	h , (m)	SF_0	$d_{m'}$, (m)	SF_p	No.	H , (m)	w_{pr} , (m)	w_{cr} , (m)	h , (m)	SF_0	$d_{m'}$, (m)	SF_p
1	36.2	5.7	6.27	3.8	5.0	2.3	0.1	160	108.51	8.53	6.71	2.29	3.8	1.3	1.6
2	39.95	6.89	6.08	3.7	6.2	2.2	0.5	161	46.1	7.1	6.9	3.8	4.9	2.2	0.4
3	55.2	8.98	6.96	3.95	5.5	2.3	1.0	162	50	9.3	5.7	3.65	7.8	2.1	1.8
4	30.35	8.96	6.06	3.85	11.3	2.2	2.1	163	58.3	8.47	6	3.8	5.6	2.2	0.9
5	41.35	8	5.98	3.6	7.6	2.1	1.2	164	59.3	11	6	3.7	7.7	2.1	2.4
6	57.34	9.07	5.99	3.84	6.2	2.2	1.2	165	196	15	6	2.6	4.1	1.4	2.5
7	63.15	8.02	6.11	1.65	8.2	0.9	4.4	166	64.92	20.57	6	3.5	13.9	1.9	8.5
8	40.86	7.55	7.63	2.92	6.5	1.7	1.6	167	55	11.8	6.2	3.41	9.3	1.9	3.6
9	30.55	8.07	7.11	3.2	9.6	1.8	2.2	168	65	10.98	6.02	3.2	7.7	1.8	2.9
10	49.82	7.63	7.67	3.05	5.2	1.7	1.2	169	51	8.89	6.11	3.27	7.4	1.9	2.0
11	47.07	8.29	6.89	3.37	6.4	1.9	1.4	170	68	11.66	6.34	3.4	7.3	1.9	2.8

12	66.95	7.77	7.5	3	4.1	1.7	1.0	171	46	8.6	6.4	3.55	7.1	2.0	1.5
13	25.98	3.11	5.53	1.34	5.9	0.8	1.1	172	74	11.31	5.69	3.41	7.0	1.9	2.5
14	26.83	2.91	5.09	1.33	5.7	0.8	0.9	173	68	10.87	6.13	3.37	6.9	1.9	2.4
15	42.61	4.38	5.07	1.61	6.2	0.9	1.7	174	68	12.9	7.1	4.06	6.7	2.3	2.3
16	23	4	5.68	1.58	8.9	0.9	2.0	175	54	8.92	6.08	3.58	6.6	2.0	1.5
17	23.76	4.3	5.21	1.5	11.0	0.8	3.2	176	70	10.68	6.32	3.25	6.6	1.8	2.4
18	23.54	4.24	5.38	1.54	10.3	0.9	2.8	177	49	8.57	6.43	3.69	6.5	2.1	1.2
19	26.75	4.54	4.97	1.65	10.5	0.9	2.9	178	51	8.65	6.35	3.64	6.4	2.1	1.3
20	19.4	4.26	5.22	1.4	13.9	0.8	4.5	179	72	12.89	7.11	4.15	6.3	2.3	2.1
21	20.8	4.24	5.18	1.38	13.1	0.8	4.3	180	77	10.04	5.96	2.94	6.2	1.6	2.4
22	23.33	4.37	5.08	1.33	12.8	0.7	4.6	181	57	9.35	6.65	3.65	6.1	2.1	1.4
23	58.89	8.06	5.7	3	6.3	1.7	1.6	182	75	10.7	6.3	3.41	6.0	1.9	2.0
24	96.2	8.06	5.77	3.1	3.7	1.8	0.9	183	78	10.7	6.3	3.35	5.8	1.9	2.0
25	33.94	8.17	5.52	2.38	13.3	1.3	5.1	184	54	8.52	6.48	3.69	5.8	2.1	1.1
26	39.1	6.63	6.36	2.6	7.3	1.5	1.7	185	56	8.59	6.41	3.63	5.8	2.1	1.1
27	36.5	7.25	6.3	2.68	8.7	1.5	2.3	186	64.92	9	6	3.6	5.6	2.1	1.2
28	24.15	6.1	6.25	2.65	10.5	1.5	1.9	187	73	10.63	6.37	3.85	5.6	2.2	1.5
29	25.7	6.15	6.17	2.6	10.2	1.5	2.0	188	81	13.01	6.99	4.31	5.6	2.4	1.8
30	18.58	4.86	6.16	2.78	9.5	1.7	0.6	189	64.92	9	6	3.72	5.5	2.1	1.1
31	21.5	5.09	5.96	2.75	9.2	1.6	0.7	190	75	10.03	6.97	3.07	5.5	1.7	2.0
32	44.95	5.03	6.01	2.68	4.3	1.6	0.4	191	84	12.97	7.03	4.31	5.3	2.4	1.7
33	26.51	4.32	6.68	2.65	5.1	1.6	0.2	192	79	13.58	6.42	5.89	5.2	3.4	1.0
34	97.27	8.63	6.04	1.37	6.7	0.7	4.2	193	74	9.9	7.1	3.33	5.1	1.9	1.6
35	165.45	11.66	6.32	1.45	5.3	0.8	3.7	194	71	12.32	6.68	5.84	5.0	3.4	0.7
36	167.68	12.98	6.43	1.45	5.8	0.8	4.3	195	73	10.21	6.79	3.93	5.0	2.2	1.2
37	183.83	12.99	6.93	1.23	5.6	0.6	4.3	196	83	13.66	6.34	6.13	4.8	3.5	0.8
38	54	6	6.54	1.2	7.3	0.7	4.0	197	75	11.03	5.97	5.5	4.7	3.2	0.6
39	112	17	5.5	1.05	15.6	0.5	13.2	198	77	10.22	6.78	4.05	4.7	2.3	1.1
40	98.15	12.56	5.23	2.65	7.3	1.4	3.9	199	71	10.7	6.3	5.5	4.6	3.2	0.5
41	64.79	13.03	5.37	3.08	10.3	1.7	4.9	200	76	10.8	6.2	5.5	4.4	3.2	0.5
42	80.5	6.58	6.39	1.65	4.7	0.9	2.1	201	66	10.92	7.08	6.45	4.2	3.9	0.2
43	54.6	5.67	6.37	1.6	5.7	0.9	2.3	202	76	8.85	7.15	3.48	4.1	2.0	1.0
44	25.15	4.39	6.54	1.65	7.8	0.9	2.0	203	77	9.81	7.19	4.86	3.7	2.8	0.4
45	35.73	5	6.12	1.73	7.1	1.0	2.1	204	93.8	14	6	3.6	6.5	2.0	2.9
46	55.7	6.85	6.13	1.7	7.3	0.9	3.3	205	93.8	14.92	6	3	7.8	1.6	4.3
47	52.5	5.66	6.38	1.7	5.6	0.9	2.1	206	93.8	14.7	6	3.2	7.4	1.7	3.8
48	35.5	4.6	6.81	2	5.0	1.2	0.9	207	109	17.5	6.48	3.67	6.6	2.0	3.5
49	40.33	4.53	6.52	1.83	4.8	1.0	1.0	208	106	16.47	7.5	3.5	6.1	1.9	3.2
50	22.62	4.8	6.2	1.65	10.7	0.9	3.2	209	92.28	17.07	6.93	3.87	7.1	2.1	3.5
51	28.75	5	6.08	2	8.1	1.1	1.8	210	122	21	6.71	3.29	7.5	1.8	4.7
52	22.3	6.24	5.74	3.5	10.6	2.1	0.7	211	122	21.2	6.71	3.29	7.5	1.8	4.8
53	37.7	7.05	5.94	3.06	7.9	1.8	1.4	212	97.54	9.14	6.1	3.2	4.1	1.8	1.2
54	36.26	6.23	6.82	2.63	6.6	1.5	1.3	213	106.68	15.24	6.1	4.88	5.0	2.7	1.7
55	50.17	5.85	7.04	2.6	4.2	1.5	0.7	214	45.72	4.88	6.1	1.65	5.5	0.9	1.7
56	37.08	6.29	6.65	2.78	6.5	1.6	1.1	215	60.96	4.88	6.1	1.55	4.3	0.9	1.5
57	61.1	7.08	6.61	4.49	3.4	2.7	0.1	216	60.96	7.01	6.71	2.59	4.8	1.5	1.3
58	42	5.38	6.78	3.96	3.5	2.5	0.0	217	30.48	2.74	5.49	1.55	3.7	0.9	0.2

59	39.33	8.05	6	2.68	9.7	1.5	3.1	218	85.34	7.62	6.1	3.2	3.7	1.8	0.7
60	59.16	7.17	6.57	3.51	4.3	2.1	0.5	219	167.64	14.33	3.69	1.98	7.0	1.1	4.7
61	45.72	5.49	5.18	1.83	7.3	1.0	2.3	220	108.51	7.62	6.71	2.29	3.3	1.3	1.2
62	76.2	6.71	5.49	2.74	4.2	1.6	0.9	221	42.67	4.27	5.49	2.59	4.0	1.6	0.2
63	85.34	8.23	5.49	3.2	4.4	1.8	1.0	222	140.21	17.37	5.49	2.44	7.3	1.3	4.9
64	121.92	12.8	5.49	2.29	6.4	1.2	3.8	223	160.93	14.94	6.31	2.96	4.5	1.6	2.5
65	97.54	9.75	5.49	3.2	4.8	1.8	1.5	224	180.44	15.24	5.97	2.99	4.2	1.6	2.3
66	108	9	6	1.14	7.2	0.6	5.0	225	163.98	15	6.22	2.8	4.6	1.5	2.6
67	108	9	6	1.1	7.4	0.6	5.2	226	146	16.46	5.49	2.41	6.7	1.3	4.4
68	150	9	6	1.15	5.2	0.6	3.6	227	198.12	17.16	5.7	2.83	4.5	1.5	2.8
69	208	17	6	1.2	7.3	0.6	6.1	228	182.88	15.85	5.49	4.88	3.2	2.7	1.2
70	208	17	6	1.1	7.8	0.6	6.5	229	36.58	7.32	4.88	1.83	14.1	1.0	6.4
71	166	17	6	1.48	8.0	0.8	6.3	230	91.44	7.62	6.1	1.68	5.2	0.9	2.7
72	174	17	6	1.17	8.9	0.6	7.4	231	60.96	9.14	6.1	4.88	4.9	2.9	0.4
73	64.47	9	6	1.89	8.6	1.0	4.6	232	76.2	10.67	6.1	4.88	4.8	2.8	0.7
74	50	10	6	3.8	8.0	2.2	2.0	233	91.44	12.19	6.1	4.88	4.6	2.8	1.0
75	34.6	12.21	5.6	3.4	16.4	1.9	6.6	234	45.72	6.1	6.1	3.05	5.2	1.8	0.6
76	77.65	12	5.84	3.8	6.5	2.1	2.2	235	178.49	19	6	2.3	6.2	1.2	4.4
77	55.75	10.28	6	2.8	9.1	1.5	3.8	236	195.15	20	6	2.1	6.3	1.1	4.7
78	55.75	11	6	3	9.4	1.7	3.9	237	203.42	19	6	1.7	6.6	0.9	5.2
79	79.92	9	6	2.9	5.3	1.6	1.7	238	203.42	19	6	1.7	6.6	0.9	5.2
80	34.15	8	6	3	10.3	1.7	2.6	239	42.67	5.49	5.49	2.59	5.9	1.5	0.8
81	36.53	7	6	3	8.1	1.7	1.5	240	91.44	6.1	6.1	1.68	3.8	0.9	1.6
82	45.72	4.27	5.49	1.19	6.2	0.7	2.5	241	48.77	7.32	6.4	2.44	6.9	1.4	2.2
83	68.58	5.18	5.49	1.19	5.6	0.7	2.7	242	83.92	11.47	6	3	6.5	1.7	2.8
84	91.44	6.1	5.49	1.19	5.3	0.6	3.0	243	87.6	12	6	2.8	6.9	1.5	3.3
85	76.2	7.62	6.1	1.37	7.2	0.7	4.2	244	45.72	6.1	6.1	3.96	4.3	2.4	0.1
86	30.48	5.49	6.71	2.59	6.7	1.5	0.9	245	60.96	7.62	6.1	3.96	4.5	2.3	0.4
87	63.64	14	6	3	10.8	1.6	5.6	246	45.72	6.1	6.1	1.68	7.6	0.9	3.1
88	70.79	12	6	2.2	10.0	1.2	5.8	247	60.96	7.62	6.1	1.68	7.8	0.9	4.0
89	118.62	15	6	3.5	5.6	1.9	2.7	248	76.2	9.14	6.1	3.96	4.5	2.3	0.8
90	108.75	14	6	3	6.3	1.6	3.3	249	91.44	12.19	6.1	3.96	5.3	2.2	1.7
91	53.86	7	6	5	3.9	3.1	0.0	250	76.2	9.14	6.1	1.68	7.9	0.9	4.6
92	98.72	13	6	4	5.3	2.2	1.9	251	33.53	6.71	5.49	3.96	7.5	2.4	0.4
93	170	22	6	2.6	6.9	1.4	4.9	252	115.82	9.14	6.1	1.83	4.9	1.0	2.7
94	154	21.37	6.26	2.72	7.0	1.4	4.9	253	169	21.81	6.19	2.58	6.8	1.4	4.9
95	171.7	21.19	6.81	2.9	5.8	1.5	3.9	254	70	12	6	2.6	9.1	1.4	4.7
96	151	23.85	6.15	3.34	7.0	1.8	4.7	255	104	11	6	3	5.0	1.7	2.1
97	137	21.82	5.84	2.84	8.1	1.5	5.6	256	110.5	12	5	2.8	6.1	1.5	3.0
98	106	15.84	6.35	3.16	6.9	1.7	3.8	257	110.5	12	5	3	5.9	1.6	2.7
99	91.44	6.1	6.1	1.52	4.1	0.8	1.9	258	70	20.57	5	2.6	16.9	1.4	11.9
100	60.96	9.75	5.49	2.29	9.5	1.3	4.6	259	70	15.44	5	2.6	13.1	1.4	8.0
101	114	12.8	5.49	1.98	7.6	1.1	4.9	260	93	10	6	2.9	5.1	1.6	2.0
102	146.3	17.37	5.49	2.13	7.6	1.1	5.4	261	84	11	5.89	2.77	6.7	1.5	3.0
103	91.44	12.8	5.49	2.07	9.2	1.1	5.7	262	84	11.5	5.89	2.77	7.0	1.5	3.3
104	114	17.37	5.49	1.98	10.3	1.1	7.5	263	47.24	6.1	7.62	5.18	2.8	3.3	0.0
105	106.68	9.14	6.1	1.68	5.7	0.9	3.3	264	64.01	6.1	6.25	3.44	3.3	2.0	0.2

106	140.21	12.8	5.49	2.44	5.4	1.3	3.0	265	91.44	10.67	6.1	4.27	4.3	2.4	1.0
107	93.88	9.75	5.49	1.98	6.8	1.1	3.7	266	38.1	4.27	5.49	1.52	6.4	0.9	1.8
108	39.62	6.1	6.1	2.59	6.6	1.5	1.3	267	106.68	12.19	6.1	4.27	4.3	2.4	1.3
109	91.44	6.1	6.1	1.55	4.0	0.9	1.8	268	88.39	9.14	6.1	3.05	4.6	1.7	1.5
110	62.48	10	6	2.2	9.2	1.2	4.7	269	85.34	7.62	6.1	3.05	3.8	1.7	0.8
111	62.48	15	6	2.1	14.9	1.1	10.0	270	108.51	8.84	6.4	2.29	4.2	1.3	1.8
112	62.48	9	6	2.25	7.9	1.2	3.6	271	79.4	24	6	3	14.4	1.6	10.2
113	70	15	6	3	10.5	1.6	5.8	272	138.89	17.78	6	3	6.3	1.6	3.8
114	122.17	12	6	2.8	5.0	1.5	2.4	273	138.89	31.06	6	3	10.2	1.6	7.8
115	122	15.4	6.6	2.5	6.6	1.3	4.1	274	79.4	19.47	6	3	12.0	1.6	7.7
116	122	15.4	6.6	2.5	6.6	1.3	4.1	275	60.96	7.01	6.71	3.35	4.0	2.0	0.5
117	94	10.22	6.78	3	4.6	1.7	1.8	276	30.48	6.1	6.1	3.2	7.5	1.9	0.7
118	94	10.2	6.8	2.8	4.8	1.5	2.0	277	44.2	6.1	6.1	4.27	4.3	2.6	0.0
119	45.72	6.1	6.1	2.9	5.3	1.7	0.7	278	42.8	7	6	2.2	8.4	1.2	2.9
120	60.96	7.62	6.1	2.9	5.5	1.6	1.4	279	67.8	11	6	4	6.4	2.3	1.7
121	76.2	9.14	6.1	2.9	5.5	1.6	1.9	280	67.8	11.73	6	4	6.9	2.3	2.1
122	91.44	10.67	6.1	2.9	5.6	1.6	2.3	281	36.3	8	6	3.7	8.5	2.1	1.3
123	40.07	8	6	3.2	8.4	1.8	1.9	282	51.8	10.98	6.02	2.88	10.3	1.6	4.5
124	40.07	7.5	6	3.2	7.7	1.8	1.5	283	124.9	18.27	5.73	2.67	7.9	1.4	5.2
125	56.11	7.5	6	3.5	5.2	2.0	0.8	284	110	17.82	6.18	3.46	7.1	1.9	4.0
126	111.91	13.4	6	3	5.8	1.6	2.9	285	146.2	19.89	6.29	2.91	6.6	1.6	4.4
127	121.02	13	6	3.5	4.7	1.9	2.0	286	68.9	12.9	6	3	9.1	1.6	4.4
128	143.26	12.8	5.49	1.68	6.7	0.9	4.6	287	34.5	5.5	6.5	5.5	3.7	3.7	0.0
129	140.72	15	6	2.7	5.6	1.5	3.3	288	33.8	8	6	2.4	12.1	1.3	4.4
130	83.43	12	6	2.8	7.3	1.5	3.5	289	52.8	8	6	3	6.7	1.7	1.7
131	101.21	12	6	2.3	6.8	1.2	3.8	290	38.37	8.1	6.4	5.9	5.7	3.7	0.0
132	114.35	12	6	2.3	6.0	1.2	3.4	291	52.8	11.3	6	3	10.2	1.7	4.4
133	119.41	15	6	2.3	7.3	1.2	4.7	292	45.72	6.1	6.1	4.57	3.9	2.9	0.0
134	114.3	12	6	2.6	5.6	1.4	2.9	293	219.46	21.73	5.58	3.17	4.8	1.7	3.1
135	104.76	12	6	4.8	4.1	2.7	0.9	294	76.2	7.62	6.1	4.57	3.2	2.7	0.1
136	130.75	15	6	2	7.4	1.1	5.0	295	106.68	6.71	5.49	1.19	5.2	0.6	3.1
137	44.55	12	6	2.5	14.6	1.4	7.8	296	36.58	6.1	6.1	3.66	5.7	2.2	0.2
138	44.55	12	6	3	13.0	1.6	5.9	297	51.82	7.62	6.1	3.66	5.5	2.1	0.7
139	40.3	8	6	2.1	11.1	1.2	4.8	298	137.16	12.8	5.49	3.66	4.2	2.0	1.6
140	37.36	10	6	2.8	13.1	1.6	5.3	299	91.44	9.14	6.1	4.57	3.4	2.7	0.4
141	70.76	14	6	2.6	10.6	1.4	6.1	300	45.72	7.62	6.1	4.88	5.2	3.0	0.1
142	44.55	6	6	3.3	5.0	2.0	0.4	301	19.81	7.62	6.1	3.2	15.8	1.8	3.1
143	87.53	12	6	3.6	5.9	2.0	2.2	302	29.77	14	5	3	25.5	1.6	13.3
144	90.22	8.53	6.71	2.9	4.0	1.6	1.2	303	58.53	11.42	6	3.5	8.4	2.0	3.0
145	115.82	7.62	6.1	1.83	3.9	1.0	1.8	304	58.53	14	6	3.5	10.6	1.9	4.8
146	84.84	7	6	2.26	4.2	1.3	1.4	305	42.59	15	6	3.7	15.0	2.0	6.9
147	84.84	7	6	2.26	4.2	1.3	1.4	306	13.22	8	6	2.6	29.3	1.5	9.6
148	84.84	7	6	2.26	4.2	1.3	1.4	307	65.78	10	5	2.2	9.9	1.2	5.1
149	61.5	9.47	6	1.98	9.4	1.1	5.0	308	54.65	10	5	2.2	11.9	1.2	6.1
150	61.5	9.26	6	1.98	9.1	1.1	4.7	309	54.99	9.47	5	3	9.1	1.7	3.1
151	58.71	11	6	2.3	10.6	1.3	5.6	310	45.72	6.55	6.4	3.51	5.0	2.1	0.4
152	58.71	7	6	2	6.6	1.1	2.6	311	82	12	6	3	7.1	1.6	3.2

153	108.63	12.5	6	3.38	5.2	1.9	2.2	312	70.1	12	6	3.35	7.7	1.9	3.1
154	108.63	18.5	6	3.65	7.3	2.0	4.1	313	21.34	6.1	6.71	2.74	10.8	1.6	1.8
155	94.28	10	5	1.4	9.3	0.7	6.3	314	30.48	6.4	6.4	3.66	7.0	2.2	0.4
156	94.28	10	5	1.7	8.2	0.9	5.0	315	41.15	6.4	6.4	1.98	7.8	1.1	2.7
157	51.82	9.14	6.1	1.68	11.7	0.9	6.8	316	78.54	14	6	2.7	9.3	1.5	5.3
158	64.01	7.62	7.62	3.05	4.1	1.7	0.9	317	78.54	14	6	2.4	10.1	1.3	6.1
159	48.77	9.14	6.1	4.27	6.7	2.5	1.0								

Table S5. The stable pillar cases in Vaal Basin, Free State and Klip river coal fields of South Africa.

No.	H , (m)	$w_{p'}$, (m)	$w_{c'}$, (m)	h , (m)	SF_0	$d_{m'}$, (m)	SF_p
1	64.24	5.59	5.05	1	3.3	0.9	1.3
2	59.98	6.19	5.86	1.52	2.6	1.3	0.7
3	17.91	4.31	5.62	1.71	5.0	1.6	0.2
4	29.56	6.2	6	2.1	4.2	1.9	0.4
5	223.38	28	5	3.5	2.2	2.9	1.3
6	173.22	25	5	4.2	2.3	3.4	1.1
7	215.05	35	5	3	3.0	2.5	2.1
8	254.45	35	5	4	2.1	3.2	1.3
9	215.05	25	5	3	2.4	2.5	1.4
10	84.65	6	6	1.75	1.6	1.5	0.3
11	182.88	16.92	5.94	2.44	2.1	2.1	1.1
12	91.44	12.19	6.1	1.52	4.0	1.3	2.2
13	35.05	9.75	5.49	2.44	6.3	2.1	1.5
14	50.6	6.1	6.1	1.37	3.2	1.2	0.9
15	76.2	9.14	6.1	1.37	3.6	1.2	1.8
16	35.05	7.32	4.88	2.59	4.7	2.3	0.4
17	42	5	10	1.8	1.3	1.6	0.1
18	36	5	7	2.4	1.9	2.3	0.0
19	38	5	7	1.8	2.2	1.6	0.2
20	22	6	6	1.5	6.8	1.3	1.7