

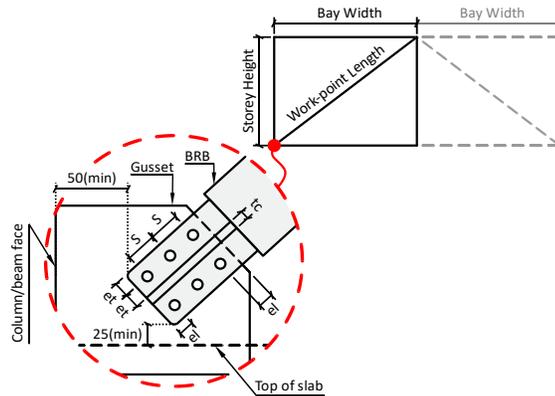
BOLTED BRB DESIGN TABLES

Stiffness Modification Factor of BRB (Q)											
BRB			Work-point Length, Lwp (m)								
Ac (mm ²)	Fy (MPa)	Py (kN)	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	
670	300	200	1.48	1.37	1.31	1.27	1.24	1.21	1.19	1.18	
1340	300	400	1.50	1.39	1.32	1.28	1.24	1.22	1.20	1.18	
2000	300	600	1.49	1.38	1.32	1.27	1.24	1.21	1.19	1.18	
2670	300	800	1.62	1.48	1.39	1.33	1.29	1.26	1.23	1.21	
3340	300	1000	1.56	1.44	1.36	1.31	1.27	1.24	1.21	1.20	
4000	300	1200	1.69	1.52	1.43	1.36	1.31	1.28	1.25	1.23	
4670	300	1400	1.64	1.49	1.40	1.34	1.29	1.26	1.24	1.21	
5340	300	1600	1.66	1.50	1.41	1.35	1.30	1.27	1.24	1.22	
6000	300	1800	1.73	1.55	1.44	1.37	1.32	1.28	1.26	1.23	
6670	300	2000	1.68	1.52	1.42	1.35	1.31	1.27	1.24	1.22	
7340	300	2200	1.85	1.63	1.50	1.42	1.36	1.32	1.28	1.26	
8000	300	2400	1.81	1.60	1.48	1.40	1.35	1.30	1.27	1.25	
8670	300	2600	1.76	1.57	1.46	1.38	1.33	1.29	1.26	1.24	
9340	300	2800	1.87	1.64	1.51	1.42	1.36	1.32	1.29	1.26	
10000	300	3000	1.95	1.68	1.54	1.45	1.39	1.34	1.30	1.27	
11340	300	3400	1.86	1.63	1.50	1.42	1.36	1.32	1.28	1.26	
12670	300	3800	1.97	1.70	1.55	1.46	1.39	1.34	1.31	1.28	
12000	350	4200	2.04	1.74	1.58	1.48	1.41	1.36	1.32	1.29	
13150	350	4600	2.06	1.75	1.59	1.48	1.42	1.36	1.32	1.29	

Yield Length Ratio (YLR)											
BRB			Work-point Length, Lwp (m)								
Ac (mm ²)	Fy (MPa)	Py (kN)	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	
670	300	200	0.64	0.69	0.73	0.76	0.78	0.80	0.82	0.83	
1340	300	400	0.61	0.67	0.71	0.75	0.77	0.79	0.81	0.82	
2000	300	600	0.61	0.67	0.71	0.74	0.77	0.79	0.80	0.82	
2670	300	800	0.55	0.62	0.67	0.70	0.73	0.76	0.78	0.79	
3340	300	1000	0.56	0.63	0.67	0.71	0.74	0.76	0.78	0.80	
4000	300	1200	0.51	0.59	0.64	0.68	0.71	0.74	0.76	0.78	
4670	300	1400	0.52	0.59	0.65	0.69	0.72	0.74	0.76	0.78	
5340	300	1600	0.49	0.57	0.63	0.67	0.70	0.73	0.75	0.77	
6000	300	1800	0.48	0.56	0.62	0.66	0.70	0.72	0.75	0.76	
6670	300	2000	0.48	0.57	0.62	0.67	0.70	0.73	0.75	0.77	
7340	300	2200	0.42	0.51	0.58	0.63	0.66	0.69	0.72	0.74	
8000	300	2400	0.42	0.52	0.58	0.63	0.67	0.70	0.72	0.74	
8670	300	2600	0.43	0.52	0.59	0.63	0.67	0.70	0.73	0.75	
9340	300	2800	0.41	0.51	0.57	0.62	0.66	0.69	0.72	0.74	
10000	300	3000	0.37	0.48	0.55	0.60	0.64	0.67	0.70	0.72	
11340	300	3400	0.38	0.48	0.55	0.60	0.64	0.68	0.70	0.73	
12670	300	3800	0.34	0.45	0.53	0.58	0.63	0.66	0.69	0.71	
12000	350	4200	0.32	0.43	0.51	0.57	0.61	0.65	0.68	0.70	
13150	350	4600	0.30	0.42	0.50	0.56	0.60	0.64	0.67	0.69	

Circular Casing Diameter (mm)											
BRB			Work-point Length, Lwp (m)								
Ac (mm ²)	Fy (MPa)	Py (kN)	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	
670	300	200	168	168	168	219	219	219	219	273	
1340	300	400	219	219	219	219	219	273	273	273	
2000	300	600	219	219	273	273	273	273	324	324	
2670	300	800	273	273	273	273	273	324	324	324	
3340	300	1000	273	273	273	273	324	324	324	356	
4000	300	1200	273	273	273	324	324	324	356	356	
4670	300	1400	273	273	324	324	324	324	356	406	
5340	300	1600	273	273	324	324	324	356	406	406	
6000	300	1800	324	324	324	324	356	356	406	406	
6670	300	2000	324	324	324	324	356	406	406	457	
7340	300	2200	356	356	356	356	356	406	406	457	
8000	300	2400	356	356	356	356	406	406	457	457	
8670	300	2600	356	356	356	356	406	406	457	457	
9340	300	2800	356	356	356	356	406	457	457	508	
10000	300	3000	356	356	356	406	406	457	457	508	
11340	300	3400	356	356	356	406	406	457	508	508	
12670	300	3800	406	406	406	406	457	457	508	508	
12000	350	4200	406	406	406	406	457	508	508	508	
13150	350	4600	406	406	406	457	457	508	508	508	

Bolted Connection Sizes (mm)										Material Grade			
BRB		Bolt								Gusset	Core	Lug	Gusset
Ac (mm ²)	Py (kN)	tc	Grade	Dia.	n	et	el	s	tg				
670	200	12	10.9	12	6	25	25	40	20	G300	G300	G350	
1340	400	16	10.9	16	6	30	30	50	25				
2000	600	20	10.9	20	6	30	30	60	32				
2670	800	25	10.9	24	6	40	40	75	32				
3340	1000	25	10.9	24	6	40	40	75	32				
4000	1200	32	10.9	30	6	45	45	90	40				
4670	1400	32	10.9	30	6	45	45	90	40				
5340	1600	32	10.9	30	8	45	45	90	40				
6000	1800	40	10.9	30	8	45	45	90	50				
6670	2000	40	10.9	30	8	45	45	90	50				
7340	2200	40	10.9	36	8	55	55	110	50				
8000	2400	40	10.9	36	8	55	55	110	50				
8670	2600	40	10.9	36	8	55	55	110	50				
9340	2800	50	10.9	36	8	55	55	110	50				
10000	3000	50	10.9	36	10	55	55	110	50				
11340	3400	50	10.9	36	10	55	55	110	50				
12670	3800	50	10.9	36	10	65	65	110	50				
12000	4200	50	10.9	36	12	60	60	110	50				
13150	4600	50	10.9	36	12	65	65	110	50				



Bolted end connection

BIM Modelling Notes:

- The recommended minimum clearances to adjacent members are measured from BRB end as shown above. The clearances can be smaller, provided that they remain sufficient to allow for gusset welding and BRB installation.
- Bolt hole to be standard size.

Structural Design Notes:

- "Ac" is the minimum cross-sectional area of the yielding segment of the BRB core, and "Fy" is the specified minimum yield stress of the BRB core, and "Py" is the nominal design yield strength equal to "FyAc".
- The effective WP to WP stiffness of BRB is defined by $K_{eff} = Q(EAc/Lwp)$, where "E" is the modulus of elasticity of steel, and "Lwp" is the work-point length.
- Q factors, yield length ratios, and casing sizes are approximations based on a 45° brace angle and the assumed beam/column sizes. Different geometry and beam/column sizes will result in different values. It is recommended to allow for a typical ±15% tolerance in Q factors and yield length ratios.
- The effective area from BRB end to WP is taken to be 5 times that of the BRB end region.
- Factors of 1.2 for material overstrength "Ry", 1.4 for strain hardening "u", and 1.15 for compression strength adjustment "β" are considered to conservatively estimate the maximum expected tensile and compressive strengths of typical BRBs at 2% core strain.
- Welds connecting the gusset plates to adjacent members should be complete penetration butt welds or fillet welds sized to meet the yield strength of the gusset plate.
- Values given are intended for preliminary design only. Contact GRAYSON for project-specific information.



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