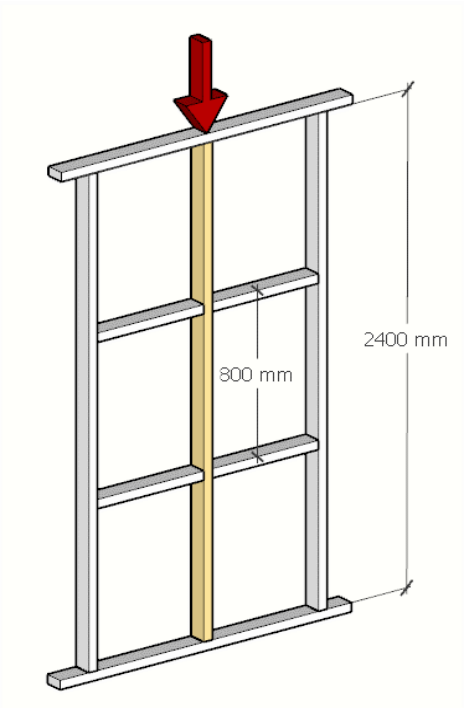
Column design example 1 Design to NZS-AS 1720.1 2022



Select a sawn timber member to carry a permanent axial compressive load of 10 kN

N^*_c = 10 kN

say the column is 2.4m long stud and restrained about the strong axis at the ends,
restrained about the weak axis @0.8 crs

Using SG10 timber, actual size of 100x50 is 90x45

d = 90 mm b = 45 mm

need to satisfy:

$N_{d,c} \geq N_c^*$

$N_{d,c} = \Phi\ k_1\ k_4\ k_6\ k_{12}\ f'c\ Ac$

ϕ	0.8	from section ZZ2.3
k_1	0.57	for a permanent action - tables 2.3 and G1
k_4	1.00	moisture condition "seasoned" timber
k_6	1.00	temperature factor

we need to consider buckling of the column about both axes $N_{d,cx}$ and $N_{d,cy}$

Effective length factor

g_{13}	0.9	from table 3.2 for studs in framing

For buckling about the strong axis x-x

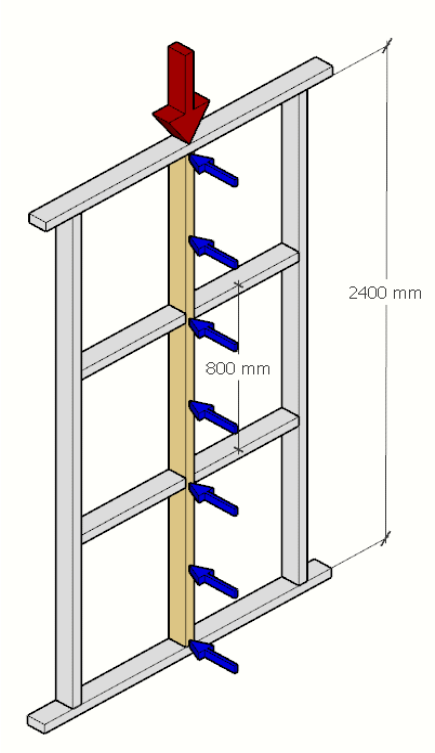
L	2.4	m				
L_{ax}	2.4	m				
S_3	L_{ax} / d =	26.7	and	g_{13} L / d =	24	3.3.2.2
S_3	24					
ρ_c	1.00	table ZZ3.2				
$\rho_c\ S_3$	24					
$k_{12\ x\text{-}x}$	0.35					

For buckling about the weak axis y-y

L_{ay}	0.8						
S_4	L_{ay} / b =	17.8	and	g_{13} L / b =	48	3.3.2.2	
S_4	18						
ρ_c	1.00	table ZZ3.2					
ρ_c S_4	18						
$k_{12\ y\text{-}y}$	0.61						
f'_c	20	MPa	table ZZ2.1				
$N_{d,cx}$	12.8	kN					
$N_{d,cy}$	22.6	kN					

$N_{d,cx}$ and $N_{d,cy}$ are greater than N_c* so criteria satisfied

Column design example 2 Design to NZS-AS 1720.1 2022



Consider column example 1 with, in addition to the vertical load, a short term transverse load applied out of plane causing a bending moment about the X-X axis of 360Nm. Restraints as above.

M^*_x =	0.36	kNm
$Z = b.d^2 / 6$	60750	mm^3
ϕ	0.8	from section ZZ2.3

we are considering a short term loading condition here, so the duration of load factor used throughout is

k_1 =	1.0	table 2.3
g_{31}	1.0	
g_{32}	1.0	
k_9	1.0	
L_{ay}	800	mm distance between restraints (joist spacing)
ρ_b	0.81	Table ZZ3.1
S_1	7.5	3.2.3.2a
$\rho_b.S_1$	6.0	
k_{12}	1.0	3.2.4
f'_b	20.0	MPa for SG10, from table ZZ2.1

M_d $\phi\ k_1\ k_4\ k_6\ k_9\ k_{12}\ f'_b\ Z$

M_d 0.97 kNm

$N_{d,cx}$	22.5	kN
$N_{d,cy}$	39.6	kN

$(M^*_x / M_{d,x})^2 + N^*_c / N_{d,cy}$ = 0.39 < 1.0 so OK

$M^*_x / M_{d,x} + N^*_c / N_{d,cx}$ = 0.81 < 1.0 so OK

Example prepared by David Reid to NZS3603:1993 for NZ Timber Design Society website

Updated to NZS-AS1720.1 for Timber Design Centre June 2023