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Structural + Civil Engineers

Embodied Carbon Reduction

Floor Loading Assumptions – the Low Hanging Fruit

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Built It !

TABLE 1607.1
MINIMUM UNIFORMLY DISTRIBUTED LIVE LOADS, L_o, AND MINIMUM CONCENTRATED LIVE LOADS[g]

OCCUPANCY OR USE	UNIFORM (psf)	CONCENTRATED (pounds)
1. Apartments (see residential)	—	—
2. Access floor systems		
Office use	50	2,000
Computer use	100	2,000
3. Armories and drill rooms	150[e]	—
4. Assembly areas		
Fixed seats (fastened to floor)	60[m]	
Follow spot, projections and control rooms	50	
Lobbies	100[m]	—
Movable seats	100[m]	
Stage floors	150[e]	
Platforms (assembly)	100[m]	
Other assembly areas	100[m]	
5. Balconies and decks[h]	1.5 times the live load for the area served, not required to exceed 100	—
6. Catwalks	40	300
7. Cornices	60	—
8. Corridors		
First floor	100	
Other floors	Same as occupancy served except as indicated	—
9. Dining rooms and restaurants	100[m]	—
10. Dwellings (see residential)	—	—
11. Elevator machine room and controlroom grating (on area of 2 inches by 2 inches)	—	300
12. Finish light floor plate construction (on area of 1 inch by 1 inch)	—	200
13. Fire escapes	100	
On single-family dwellings only	40	—
14. Garages (passenger vehicles only)	40[e]	Note a
Trucks and buses	See Section 1607.7	
15. Handrails, guards and grab bars	See Section 1607.8	
16. Helipads	See Section 1607.6	
17. Hospitals		
Corridors above first floor	80	1,000
Operating rooms, laboratories	60	1,000
Patient rooms	40	1,000
18. Hotels (see residential)	—	—
19. Libraries		
Corridors above first floor	80	1,000
Reading rooms	60	1,000
Stack rooms	150[b, n]	1,000
20. Manufacturing		
Heavy	250[n]	3,000
Light	125[n]	2,000
21. Marquees, except one- and two-family dwellings	75	—
22. Office buildings		
Corridors above first floor	80	2,000
File and computer rooms shall be designed for heavier loads based on anticipated occupancy	—	—
Lobbies and first-floor corridors	100	2,000
Offices	50	2,000

(continued)

TABLE 1607.1—continued
MINIMUM UNIFORMLY DISTRIBUTED LIVE LOADS, L_o, AND MINIMUM CONCENTRATED LIVE LOADS[g]

OCCUPANCY OR USE	UNIFORM (psf)	CONCENTRATED (pounds)
23. Penal institutions		
Cell blocks	40	—
Corridors	100	
24. Recreational uses:		
Bowling alleys, poolrooms and similar uses	75[m]	
Dance halls and ballrooms	100[m]	
Gymnasiums	100[m]	
Ice skating rink	250[n]	—
Reviewing stands, grandstands and bleachers	100[c, m]	
Roller skating rink	100[m]	
Stadiums and arenas with fixed seats (fastened to floor)	60[c, m]	
25. Residential		
One- and two-family dwellings		
Uninhabitable attics without storage[i]	10	
Uninhabitable attics with storage[i, j, k]	20	
Habitable attics and sleeping areas[k]	30	
Canopies, including marquees	20	—
All other areas	40	
Hotels and multifamily dwellings		
Private rooms and corridors serving them	40	
Public roomsm and corridors serving them	100	
26. Roofs		
All roof surfaces subject to maintenance workers		300
Awnings and canopies:		
Fabric construction supported by a skeleton structure	5[m]	
All other construction, except one- and two-family dwellings	20	
Ordinary flat, pitched, and curved roofs (that are not occupiable)	20	
Primary roof members exposed to a work floor		
Single panel point of lower chord of roof trusses or any point along primary structural members supporting roofs over manufacturing, storage warehouses, and repair garages		2,000
All other primary roof members		300
Occupiable roofs:		
Roof gardens	100	
Assembly areas	100[m]	
All other similar areas	Note l	Note l
27. Schools		
Classrooms	40	1,000
Corridors above first floor	80	1,000
First-floor corridors	100	1,000
28. Scuttles, skylight ribs and accessible ceilings	—	200
29. Sidewalks, vehicular driveways and yards, subject to trucking	250[d, n]	8,000[e]
30. Stairs and exits		
One- and two-family dwellings	40	300[f]
All other	100	300[f]

(continued)

TABLE 1607.1
MINIMUM UNIFORMLY DISTRIBUTED LIVE LOADS, L_o, AND MINIMUM CONCENTRATED LIVE LOADS[g]

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1. Apartments (see residential)	—	—
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Lobbies	100[m]	—
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Stage floors	150[n]	
Platforms (assembly)	100[m]	
Other assembly areas	100[m]	
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8. Corridors		
First floor	100	
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9. Dining rooms and restaurants	100[m]	—
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11. Elevator machine room and controlroom grating (on area of 2 inches by 2 inches)	—	300
12. Finish light floor plate construction (on area of 1 inch by 1 inch)	—	200
13. Fire escapes		
On single-family dwellings only	100 40	—
14. Garages (passenger vehicles only)	40[f]	Note a
Trucks and buses	See Section 1607.7	
15. Handrails, guards and grab bars	See Section 1607.8	
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18. Hotels (see residential)	—	—
19. Libraries		
Corridors above first floor	80	1,000
Reading rooms	60	1,000
Stack rooms	150[b, n]	1,000
20. Manufacturing		
Heavy	250[n]	3,000
Light	125[n]	2,000
21. Marquees, except one- and two-family dwellings	75	—
22. Office buildings		
Corridors above first floor	80	2,000
File and computer rooms shall be designed for heavier loads based on anticipated occupancy	—	—
Lobbies and first-floor corridors	100	2,000
Offices	50	2,000

(continued)

TABLE 1607.1—continued
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One- and two-family dwellings		
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Canopies, including marquees	20	—
All other areas	40	
Hotels and multifamily dwellings		
Private rooms and corridors serving them	40	
Public roomsm and corridors serving them	100	
26. Roofs		
All roof surfaces subject to maintenance workers		300
Awnings and canopies:		
Fabric construction supported by a skeleton structure	5[m]	
All other construction, except one- and two-family dwellings	20	
Ordinary flat, pitched, and curved roofs (that are not occupiable)	20	
Primary roof members exposed to a work floor		
Single panel point of lower chord of roof trusses or any point along primary structural members supporting roofs over manufacturing, storage warehouses, and repair garages		2,000
All other primary roof members		300
Occupiable roofs:		
Roof gardens	100	
Assembly areas	100[m]	
All other similar areas	Note 1	Note 1
27. Schools		
Classrooms	40	1,000
Corridors above first floor	80	1,000
First-floor corridors	100	1,000
28. Scuttles, skylight ribs and accessible ceilings	—	200
29. Sidewalks, vehicular driveways and yards, subject to trucking	250[d, n]	8,000[e]
30. Stairs and exits		
One- and two-family dwellings	40	300[f]
All other	100	300[f]

(continued)

4. Assembly areas		
Fixed seats (fastened to floor)	60[m]	
Follow spot, projections and control rooms	50	
Lobbies	100[m]	—
Movable seats	100[m]	
Stage floors	150[n]	
Platforms (assembly)	100[m]	
Other assembly areas	100[m]	

m. Live load reduction is not permitted.

22. Office buildings		
Corridors above first floor	80	2,000
File and computer rooms shall be designed for heavier loads based on anticipated occupancy	—	—
Lobbies and first-floor corridors	100	2,000
Offices	50	2,000

(continued)

MEETING ROOM CAPACITY
10 PEOPLE

11.3 PSF

FULL MEETING ROOM CAPACITY
23 PEOPLE

24.6 PSF

FULL STANDING CAPACITY
29 PEOPLE

29.2 PSF

29 PEOPLE OVER
96.8 SQUARE FEET

48.0 PSF

29 PEOPLE OVER
80.7 SQUARE FEET

58.5 PSF

29 PEOPLE OVER
72.6 SQUARE FEET

64.7 PSF

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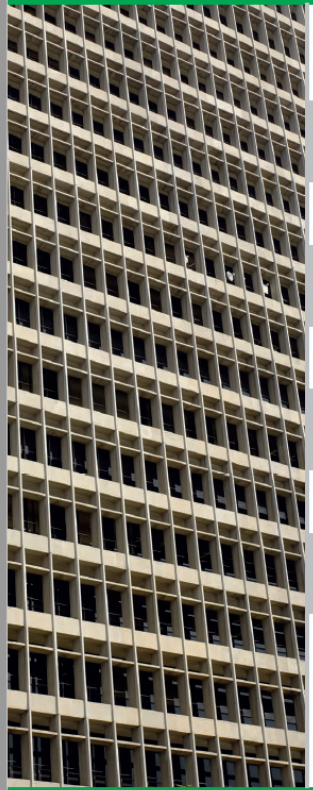


Design occupancy for office building with 16 floors and 30,000m² office area

Calculations are approximate to illustrate variation between disciplines.

Ventilation — 3,000 people

BSRIA Rules of Thumb Guidelines for Building Services 5th Edition, Table 3

10m² per person = 3,000 people

Space Planning — 3,750 people

BCO Specification for Offices, 2014

High Density	= 8m² per person	= 3,750 people
Low Density	= 13m² per person	= 2,308 people

Fire Design — 7,500 people

BS 9999:2017 Table 9, Typical Office Floor Space Factors

High Density	= 4m² per person	= 7,500 people
Low Density	= 10m² per person	= 3,000 people

Structural Design — 85,500 people

BS EN 1990, BS EN 1991-1-1

Ultimate Limit State, γ_q = 1.5 (partial factor for live load), α_n = 0.5 (reduction factor >10 storeys)

q_k = 3kN/m² over 95% of floor area (Typical value not including partitions or 5% more heavily loaded areas)

Total load ($\gamma_q \alpha_n q_k A$) = 64MN. Assuming each occupant = 0.75kN = **85,500 people**

Without area reduction α_n = *171,000 people*

Serviceability Limit State, γ_q = 1.0 (partial factor for live load), α_n = 0.5 (reduction factor for multi-storey)

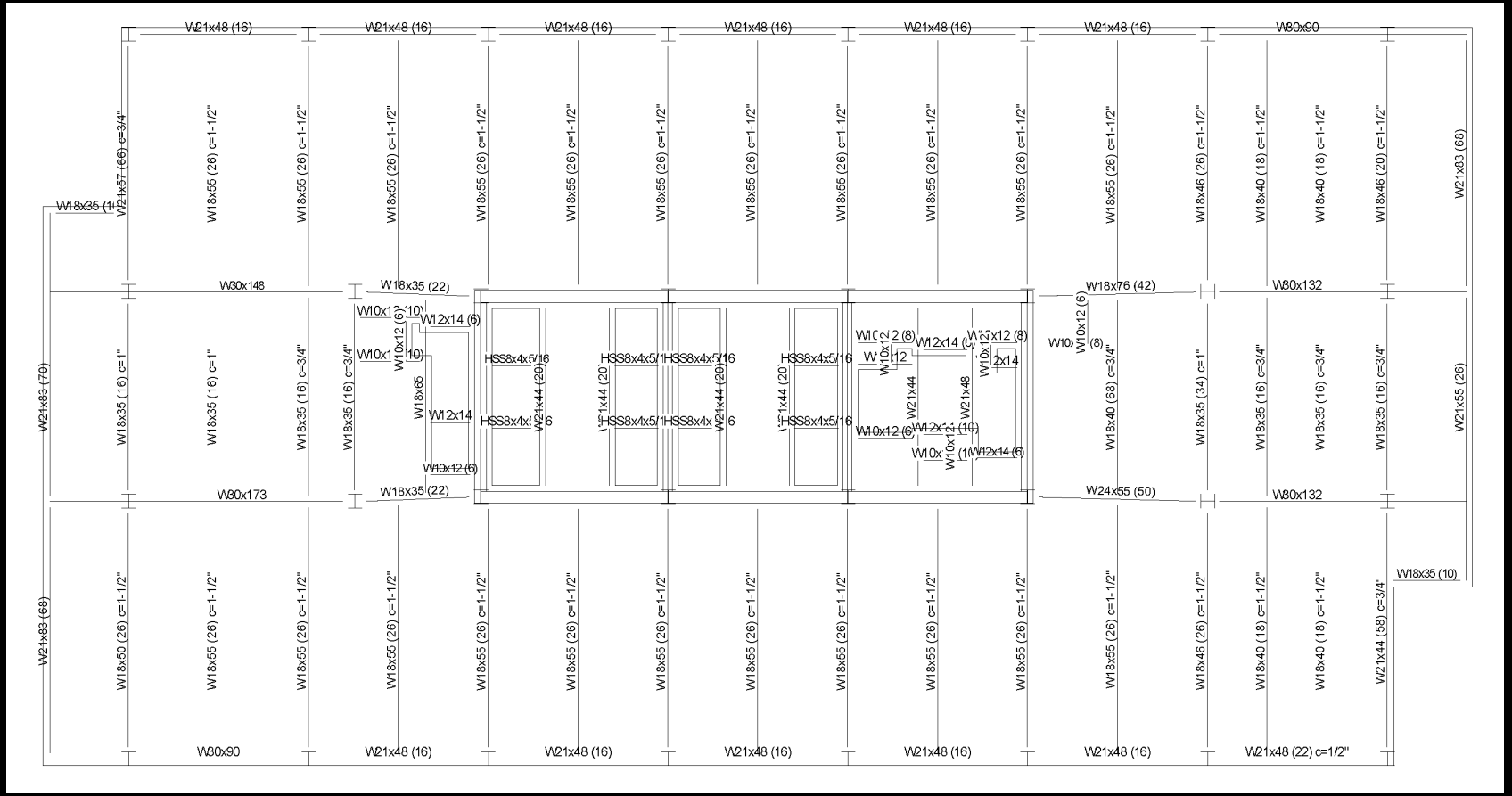
Total load ($\gamma_q \alpha_n q_k A$) = 43MN. Assuming single occupant 0.75kN = **57,000 people**

Without area reduction α_n = *114,000 people*

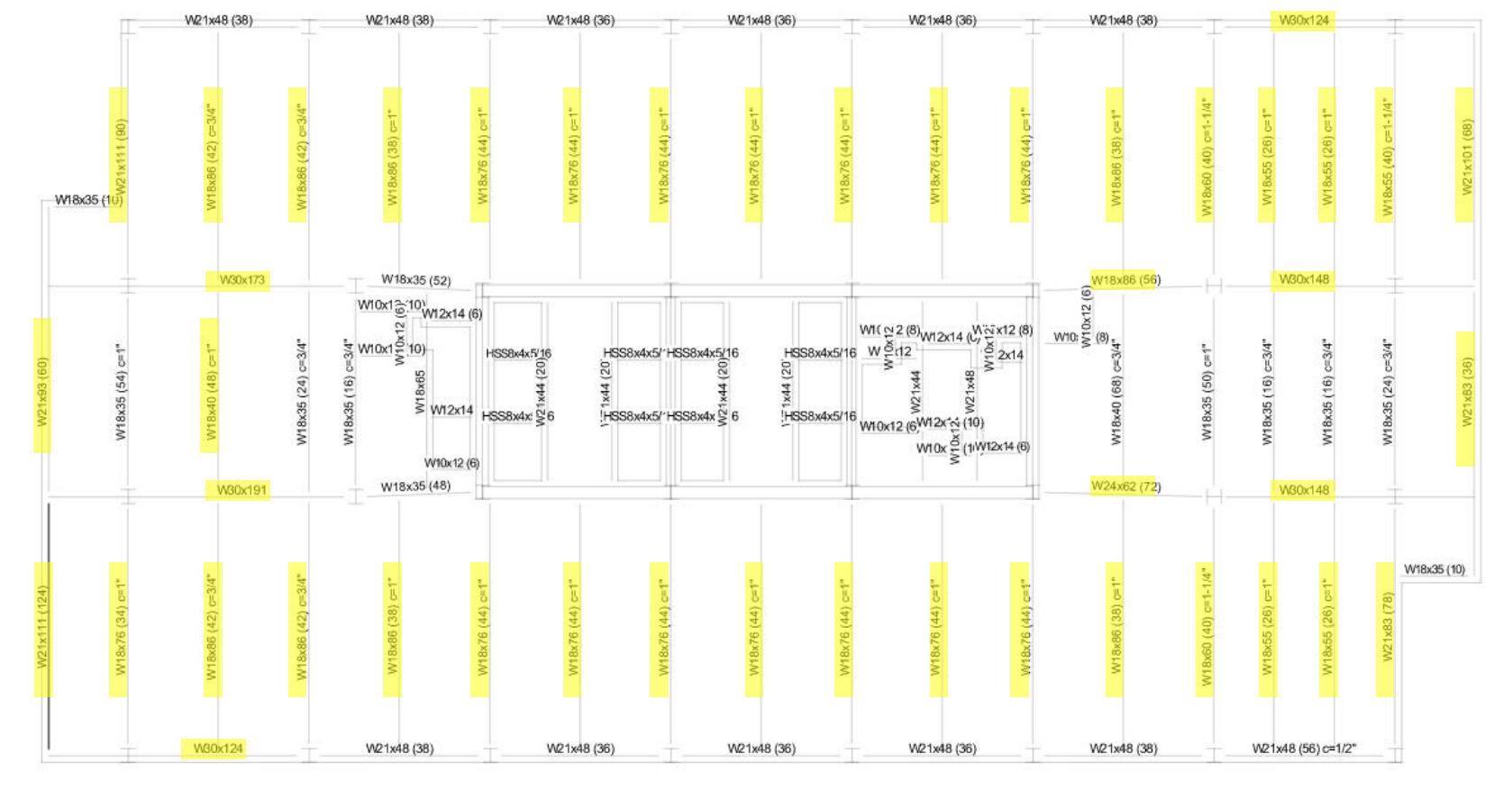
UNIVERSITY OF CAMBRIDGE

UNIVERSITY OF BATH

Office Loading Design



Assembly Loading Design



Comparison

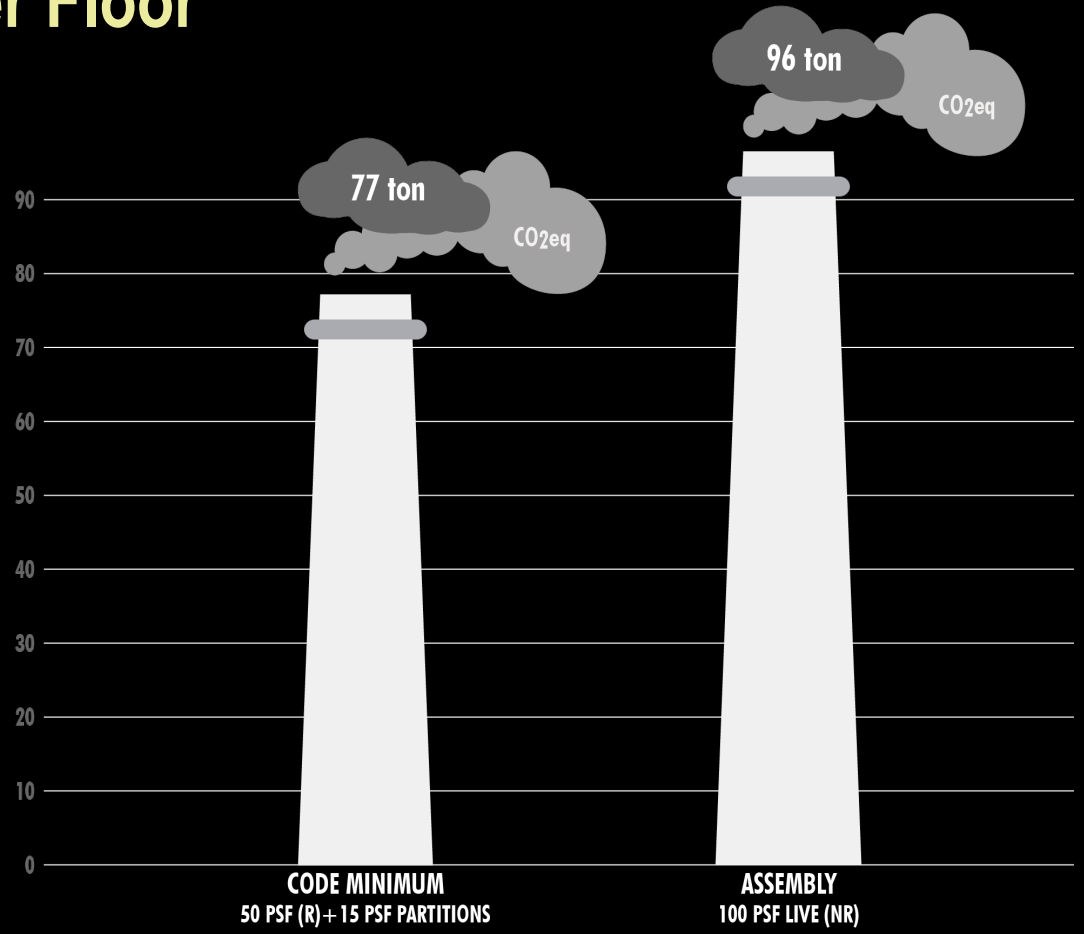
Load Level	Tons per Floor	ΔTons per Floor	GWP per Floor	ΔGWP per Floor
Code Minimum 50psf Live (R) + 15psf Partitions	85 tons	--	77 ton CO2eq	--
Assembly 100psf Live (NR)	106 tons	21 tons	96 ton CO2eq	19 ton CO2eg

GWP = Global Warming Potential

R = Reducible

NR = Non-reducible

GWP Per Floor



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