Floor Loading in Singapore

Who sets the numbers, how they're calculated, and where SCDF actually fits in

A practical engineer's guide to BCA, JTC and SCDF floor-load requirements — with the maths, the diagrams, and the citations.

1. The single most-misquoted fact about Singapore floor loading

If you read tenant fit-out brochures or industrial-property listings, you will see lines like "SCDF requires 7.5 kN/m² floor loading." That sentence is almost always wrong.

SCDF does not regulate general floor loading. SCDF regulates fire-specific loads only: the slabs of a Civil Defence Storey Shelter[1], a fire-engine accessway[2], and the live-load arithmetic of an Area of Refuge[3].

Everything else — the office at 2.5 kN/m², the warehouse at 15 kN/m², the gym mezzanine at 5 kN/m² — is set by BCA via the Eurocodes and (for industrial estates) by JTC.

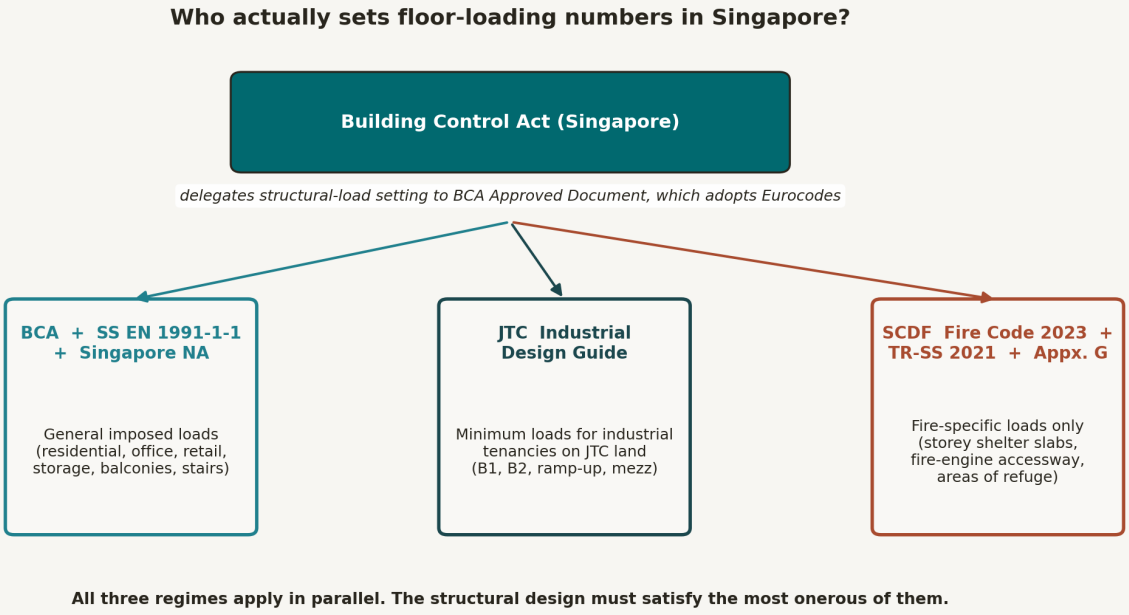


Figure 1. Authority hierarchy — three regimes apply in parallel.

The Building Control Act delegates structural-load setting to BCA's Approved Document, which has formally adopted the Eurocodes since 2013[4]. For industrial buildings on JTC land, JTC's tenancy and design-guide minimums layer on top of BCA. SCDF's fire-specific loads layer on top of both. All three apply in parallel — the structural design must satisfy the most onerous of them.

1. SCDF TR-SS 2021, Cl. 2.3 — wall and slab thickness
2. SCDF Fire Code, Appendix G — fire-engine accessway loading
3. SCDF Fire Code 2023, Cl. 9.2 — Purpose Group II occupancy
4. BCA Approved Document — adoption of Eurocodes
5. EN 1991-1-1 §6.3 — imposed loads on buildings
6. SS EN 1991-1-1 + Singapore NA — Table NA.3
7. Singapore NA + A1:2017 to SS EN 1991-1-1 — Tables NA.3 & NA.5

2. How a floor load is actually specified — UDL vs point load

Engineers don't pick a single "floor load" number. Eurocode 1 specifies imposed loads as two simultaneous values[5]:

Symbol	Name	Units	What it represents
q_k	Characteristic UDL	kN/m²	Smeared load across the whole floor — used for global effects (deflection, span moments, column loads)
Q_k	Characteristic point load	kN	Concentrated load on a 50 × 50 mm footprint — used for local effects (punching shear, slab top reinforcement, finishes)

Both must be considered, but never simultaneously on the same element — whichever produces the worst effect governs.

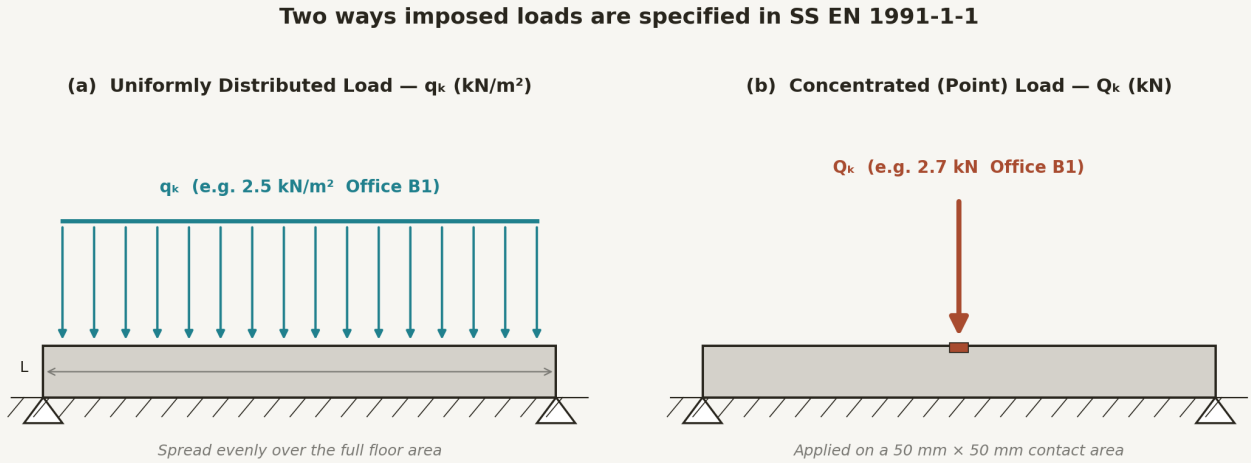


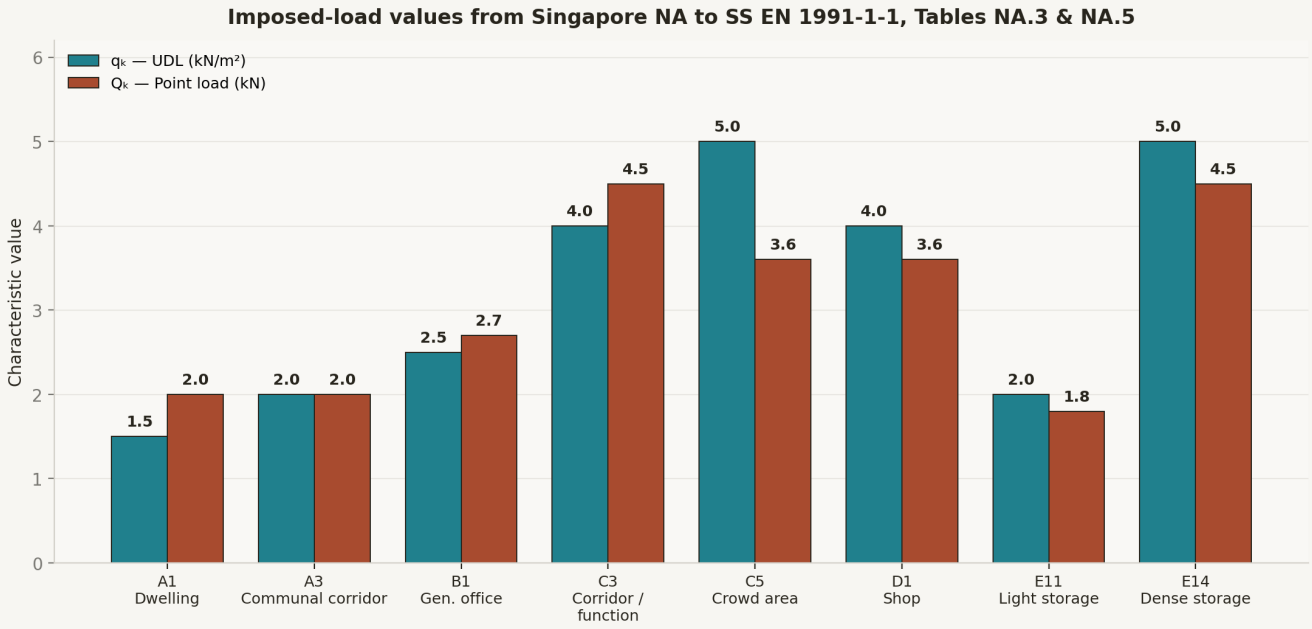
Figure 2. UDL governs global effects; point load governs local effects.

Why two numbers?

Because a real floor sees both kinds of load at once. An office suite at 2.5 kN/m² UDL also has to take a single 2.7 kN load from a server cabinet wheel[6]. The UDL says "the slab won't deflect"; the point load says "the slab won't punch through where the wheel sits."

3. The general regime — Singapore NA to SS EN 1991–1–1

Within SS EN 1991-1-1 the recommended European values are bracketed ranges (e.g. Cat A floors q_k 1.5 – 2.0 kN/m²). Singapore's National Annex (NA + A1:2017) closes the brackets and adds local sub-categories. The values you must use in Singapore are in Table NA.3 (residential / office / public / shop) and Table NA.5 (storage)[7].



Sources: Singapore National Annex NA.3 (residential, office, public) and NA.5 (storage). Industrial Cat E2 has no fixed value — it is agreed with the client.

Figure 3. Selected sub-category values from Singapore NA Tables NA.3 & NA.5.

Sub-cat	Use	q_k (kN/m²)	Q_k (kN)
A1	Self-contained dwelling unit	1.5	2.0
A2	Communal areas in flats with limited use	1.5	2.0
A3	Communal corridor (general blocks of flats)	2.0	2.0
A5	Balconies in dwellings	2.5	2.0
B1	General office	2.5	2.7
C3	Corridor / function rooms	4.0	4.5
C5	Areas susceptible to overcrowding	5.0	3.6
D1	Shop floor — general retail	4.0	3.6
E11	Light storage	2.0	1.8
E13	Bulk storage	2.4 / m height	7.0
E14	Dense storage / cold-store	5.0	4.5

Equipment & pump rooms. The Singapore NA explicitly notes that for equipment and pump rooms imposed loads should be 5 kN/m² or higher, set by client / authority[8].

Industrial Cat E2. SS EN 1991-1-1 deliberately leaves Cat E2 (industrial use) without a fixed value — it must be agreed with the client and/or relevant authority. This is precisely where JTC steps in.

4. JTC's industrial minimums — the regime that fills Cat E2

JTC publishes minimum superimposed live-load values that its tenants must design or verify against. These are higher than Eurocode defaults precisely because Eurocode E2 is open-ended.

JTC space type	Typical superimposed live load	Source
B1 flatted factory	7.5 – 15 kN/m² (ground floor higher)	Warehouse Rental SG[9]
B2 industrial / general industry	15 – 20 kN/m² (ground), 5 kN/m² mezzanine	SpaceLookUp[10]
JTC investor benchmark (heavy equipment ready)	≥ 12.5 kN/m²	Proptiply[11]
Tier-3 data centre (white space)	7.5 – 12 kN/m²	Strateq · Digital Realty[12][13]

Why ground floors are higher than upper floors

The ground slab sits on engineered fill or piles and only has to take its own dead load plus the live load — there is no upper-storey self-weight or cumulative column-load limit. Upper floors are limited by what the columns and the slab itself can carry without deflection.

5. Worked example — battery rack on a 7.5 kN/m² slab

A client wants to install a 2,500 kg battery rack in a B1 flatted factory unit advertised at 7.5 kN/m². The rack footprint is 2.0 m × 0.8 m.

Step 1 — Total weight as a force

$W = 2{,}500\ \text{kg} \times 9.81\ \text{m/s}^2 = 24{,}525\ \text{N} \approx 24.5\ \text{kN}$

Step 2 — Effective UDL

$q_{eff} = W / A = 24.5 / (2.0 \times 0.8) = 24.5 / 1.6 = 15.3\ \text{kN/m}^2$

Step 3 — Compare to slab capacity

$15.3\ \text{kN/m}^2 > 7.5\ \text{kN/m}^2 \Rightarrow$ direct placement fails.

Step 4 — Required spreader-plate area

$A_{req} = W / q_{slab} = 24.5 / 7.5 = 3.27\ \text{m}^2$

Result

A 2.0 m × 1.8 m steel base plate (3.6 m²) gives ≈ 6.8 kN/m² — comfortably below the 7.5 kN/m² limit. The PE will also check the point-load limit (Q_k) at each rack foot.

Same logic applies to a Diesel rotary UPS, a transformer, an Aggreko genset, or a server rack — only the numbers change.

6. SCDF — the three places it actually sets a load

6.1 Storey-Shelter slabs (TR-SS 2021, Cl. 2.3)

Storey shelters are designed to resist blast and ground-shock. SCDF prescribes slab thicknesses, concrete grade and rebar grade rather than a kN/m² UDL — because the governing action is impulsive, not static[14].

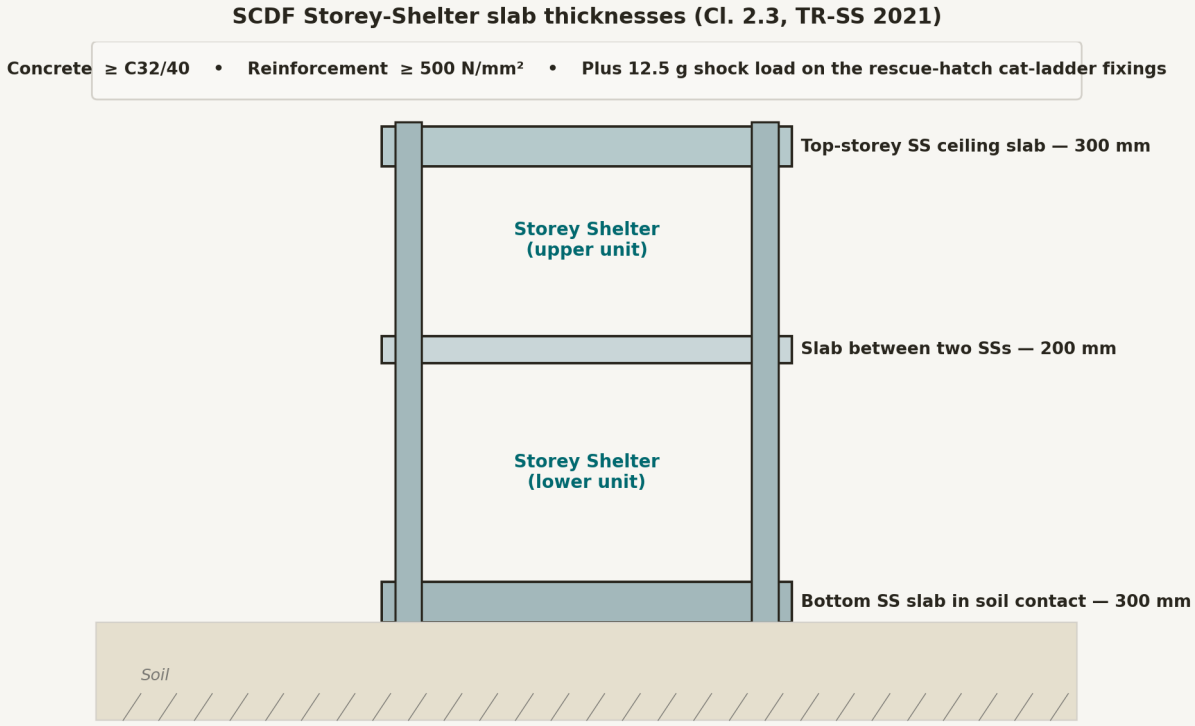


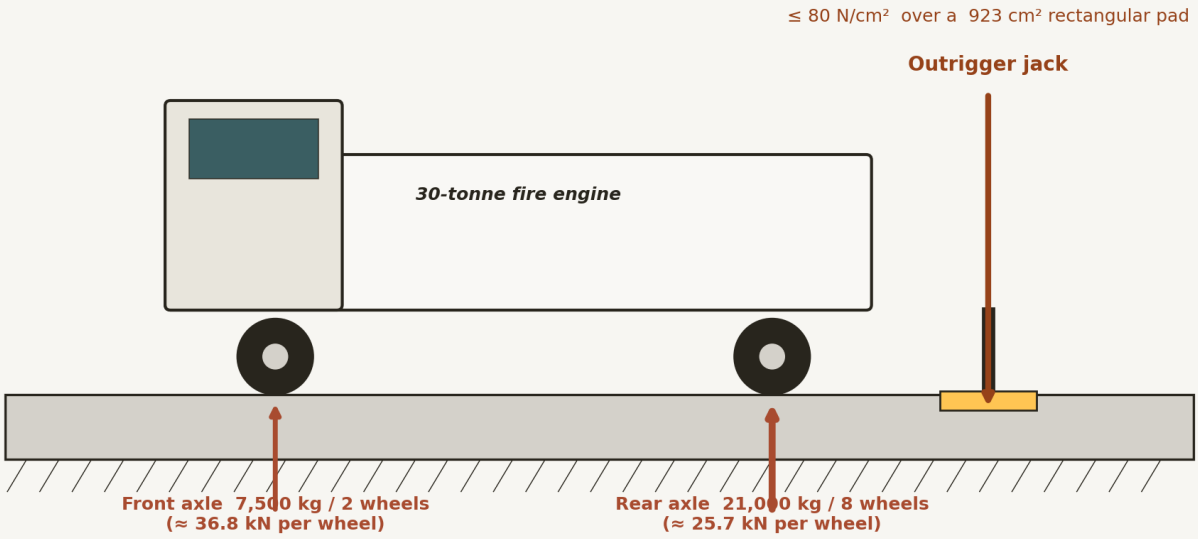
Figure 4. SCDF Storey Shelter slab thicknesses (Cl. 2.3, TR-SS 2021).

The 12.5 g shock-load rule (Cl. 2.11.2) applies only to the cat-ladder fixings inside the shelter that lead to the rescue-hatch opening — not to general roof-access cat ladders. This 12.5 × g requirement is for the embedment and bracketry, not the floor slab itself.

6.2 Fire-engine accessway loads (Fire Code Appendix G)

The accessway is the strip of pavement / podium / driveway that the fire appliance drives over to reach the riser. SCDF specifies the vehicle reference load[15]:

SCDF fire-engine accessway — wheel, axle and outrigger-jack loads



Plus: minimum surcharge load 10 kN/m² on the accessway slab (SCDF Fire Code, Appendix G).

Figure 5. 30-tonne reference fire engine — wheel and outrigger-jack loads.

Item	Value
Reference vehicle	30-tonne fire engine
Front axle	7,500 kg / 2 wheels (≈ 36.8 kN per wheel)
Rear axle	21,000 kg / 8 wheels (≈ 25.7 kN per wheel)
Outrigger jack	≤ 80 N/cm² over a 923 cm² rectangular pad
Surcharge UDL (general slab)	10 kN/m² minimum

The 80 N/cm² figure converts to 800 kPa — that is the local bearing pressure under the jack, and it is what governs the design of any podium deck or basement transfer slab the appliance has to operate on. A normal car-park slab designed to EN 1991-1-1 Cat F (≈ 2.5 kN/m²) is two orders of magnitude below this — which is why fire-engine accessways are a separate structural exercise.

6.3 Areas of Refuge / refuge floors (Fire Code 2023, Cl. 9.2.2)

For super-high-rise residential (Purpose Group II) buildings, SCDF requires a refuge floor every 20 storeys or fewer, sized at 0.3 m² per person with at least 50 % of the floor as holding area, and a 2-hour fire-resistance rating[16].

The structural live load on a refuge floor is taken at C5 (5.0 kN/m²) because it is, by design, an area liable to overcrowding[17]. Note that the load value still comes from the Eurocode — what SCDF specifies is the occupancy density, not the kN/m².

7. Checklist for design submissions

1. Identify the use — match it to the closest sub-category in Singapore NA Table NA.3 / NA.5.

2. Check the Eurocode UDL and point load — both numbers, not just q_k.

3. If on JTC land — verify the lease minimum (often 7.5 – 20 kN/m²) and apply the higher of {Eurocode, JTC}.

4. If equipment > slab UDL — design a load-spreader, get a PE endorsement, or relocate.

5. If a Storey Shelter is involved — slab thickness is fixed by Cl. 2.3; concrete C32/40 and high-tensile rebar are non-negotiable.

6. If a fire-engine accessway is involved — design for the 30-tonne reference vehicle plus 80 N/cm² jack pressure plus 10 kN/m² surcharge.

7. If a refuge floor is involved — design at Cat C5 (5.0 kN/m²) and verify floor area against 0.3 m²/person.

> Clean rule of thumb: BCA tells you the structural number, JTC tells you the industrial minimum, SCDF tells you the fire-specific number. The slab has to satisfy whichever is highest.

8. Common myths to avoid

Myth	Reality
"SCDF requires 7.5 kN/m² floor loading."	False. SCDF only specifies fire-specific loads. The 7.5 kN/m² figure is a JTC B1 floor-loading minimum, not an SCDF rule.
"Eurocode and Singapore values are the same."	No. The Singapore NA closes Eurocode brackets — e.g. Cat A floor q_k = 1.5 kN/m² in Singapore (NA.3) but a recommended 2.0 kN/m² in the EN default.
"Industrial floors don't need a code value."	The slab still must be designed — Cat E2 is open-ended in EN 1991-1-1 precisely because the client must specify it. JTC fills that gap on JTC land.
"The 12.5 g shock load applies to all cat ladders."	No. It applies only to the cat-ladder fixings inside a Storey Shelter that access the rescue hatch.

Compiled for engineering teams in Singapore — David Wee, Ezzogenics — April 2026. Verified against SS EN 1991-1-1:2008 + Singapore NA + A1:2017, SCDF Fire Code 2023, SCDF TR-SS 2021, BCA Approved Document, and JTC tenancy reference data.