SIMBI REBAR
REBAR DETAILING SOFTWARE

STANDARDS & METHODOLOGY

Simbi Rebar Standards & Methodology

The design and detailing basis behind Simbi Rebar — the standards applied, how each element is reinforced, and how the output is verified.

STANDARDS BASIS

SANS 10100-1 · SANS 51992-1 · SANS 10144:2010 · SANS 282 · SANS 10160-4 · EN 1992-1-1

PLANNED FOR A FUTURE RELEASE

BS 8666:2020 · ACI 318

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1.1

Contents

1. Purpose & scope

This document sets out the standards Simbi Rebar works to, and the detailing methodology it applies to each structural element. It is written for the structural engineer who signs off the reinforcement, so that the tool's output can be understood, checked and defended.

Simbi Rebar automates the modelling and scheduling of reinforcement. It applies recognised detailing rules and reports the governing clause for the checks it performs. It does **not** perform structural analysis or replace design: bar sizes, spacings and arrangements are chosen by the engineer, and the tool details them consistently and schedules them to standard.

READ THIS FIRST

Everything Simbi Rebar produces must be verified by the responsible engineer against the project specification and the applicable codes before it is issued or built. Simbi Rebar is a detailing and scheduling aid, not a substitute for engineering judgement.

2. Standards basis

Simbi Rebar currently details and schedules to the South African standards below, and to Eurocode 2 directly:

Standard	Role
SANS 10100-1	The structural use of concrete. Governs bar limits, spacing, anchorage, laps and curtailment applied during detailing.
SANS 51992-1	Design of concrete structures — the South African adoption of Eurocode 2. Basis for detailing provisions such as tension-steel and curtailment rules.
SANS 10144:2010	Detailing of steel reinforcement for concrete. Governs the format and content of the Bar Bending Schedule.
SANS 282	Bending dimensions and scheduling of steel reinforcement. Defines the shape codes, the dimensions shown on the schedule, and the calculated cutting lengths.
SANS 10160-4	Seismic actions. Basis for confinement of wall boundary elements.
EN 1992-1-1	Eurocode 2. Supported and selectable directly as the detailing basis, for projects worked to Eurocode rather than SANS.

EUROCODE ALIGNMENT

Because SANS 51992-1 is the South African implementation of Eurocode 2, Simbi Rebar's detailing provisions align with EN 1992-1-1. EN 1992-1-1 can also be selected directly in the project settings. Simbi Rebar cites the clause it applies in each dialog and schedule.

BS 8666 AND ACI 318 ARE NOT YET SUPPORTED

Support for **BS 8666:2020** and **ACI 318** is planned for a future release (Section 10). Until then, do not use Simbi Rebar to produce BS- or ACI-based detailing or schedules. All current shape codes and bending dimensions follow SANS 282.

3. How Simbi Rebar applies the codes

Across all tools, Simbi Rebar applies the codes in four consistent ways:

Minimum-steel auto-sizing

Where a bar count is left at zero, Simbi Rebar sizes the reinforcement to the minimum area required by the governing clause for that element, and reports it. A manual entry always overrides the automatic value.

Detailing limits

Bar counts, link spacings and covers are constrained to the code limits — for example, maximum link spacing and minimum bar counts — with the governing clause shown.

Anchorage, laps and curtailment

Anchorage lengths, lap lengths and lap locations, and curtailment of top and bottom steel, are set from the provisions of the selected code for each element, so bars are anchored at supports and lapped away from peak-moment regions.

Live clause citation and audit

Each dialog and the post-propagation summary cite the clause applied. The **Calc Audit** tool on the ribbon lets you review the basis of the detailing for verification.

USE THE ON-SCREEN CHECKS AS FIRST-PASS QA

The bar summary flags reinforcement ratios and status against the governing clause the moment reinforcement is placed — a fast sanity check before you schedule.

Crank, hook or kink at the top of a lift

At the top of a lift, main bars are adjusted to suit the column above. A bar whose required lateral step is **100 mm or less cranks** across to meet it; a bar requiring more **hooks off** and does not lap. Where the column above rakes, main bars are placed as **SC-62 kinked bars** whose tail runs parallel to the axis above for the lap length. The rule is the angle between the two axes, so it applies equally to a raked column beneath a vertical one; two columns raked identically need no kink.

Kink-zone links (mark LK)

Three additional links at 75 mm centres are placed immediately below any bend in the main bars — both the SC-41 crank and the SC-62 kink — satisfying the requirement for transverse reinforcement at laps of SANS 51992-1 Cl. 8.7.4.1. They are generated as a copy of the column's own outer link, so shape, size and cutting length match the links already scheduled.

A bar carrying tensile force F and bent through angle θ develops a transverse deviation force $\mathbf{2 \cdot F \cdot \sin(\theta/2)}$ at the bend, acting on every bar at the same level:

Bend	Typical source	Force as a fraction of F
5,6°	SC-41 crank, 20 mm step over a 205 mm diagonal	9,8 %
11,2°	SC-62 into a raked column	19,5 %
14,1°	SC-62 into a raked circular column	24,5 %

THESE LINKS ARE NOT SIZED AGAINST THE DEVIATION FORCE

The provision is three links at 75 mm centres of the same size as the column's existing links — a detailing convention, not the result of a calculation. The computed force is reported in the output notes. Above a kink of 1:4 (14,0°) the notes recommend couplers or separately anchored bars in place of a bent lap. Verification is the engineer's.

QUANTITY IMPACT

Because the provision applies wherever top bars crank — the normal condition at the top of a lift — enabling **Follow geometry above** adds three links to essentially every column in a model. Schedules produced before this provision was introduced will not match a re-run.

4.3 Starter bars into slabs

Where a main bar receives **no lapping bar from the column below**, a starter is provided into the slab at the base: an SC-37 L-bar with its horizontal leg 50 mm above the soffit, turned outward, and its vertical leg lapping into the column.

No lapping bar means the nearest bar below lies beyond the 100 mm crank limit — the same threshold the crank/hook decision uses — or terminates without crossing the joint. No slab at the base means no starters; no column below means every main bar receives one.

READ FROM THE MODEL, NOT RECONSTRUCTED

Both sides of this test are read from the bars actually present in the model. Columns are processed bottom-up so that the level below is always complete when the level above is assessed.

4. Element methodologies

The reinforcement arrangement and the governing clauses applied to each element type. Clause references below are to SANS; the equivalent Eurocode provisions apply when EN 1992-1-1 is selected.

4.1 Foundations

Pad, strip, stepped footings and pile caps are reinforced with orthogonal bottom and top mats, starter bars to the element above, and perimeter ties where required. For strip footings, the footing is linked to the wall above so reinforcement aligns correctly, including at corners.

Item	Basis
Bottom & top mats	Orthogonal mats (B1/B2, T1/T2) at the specified size and spacing.
Starters	Dowels developed into the element above per SANS 10100-1 anchorage provisions.
Cover	Set by the engineer to suit the exposure and specification.

4.2 Columns

Rectangular and circular columns are reinforced with longitudinal bars and links or a helix. Longitudinal steel can be auto-sized to the minimum area; links are spaced to the code maximum; multi-lift columns lap or splice between lifts.

Provision	Governing clause
Minimum longitudinal steel (auto-size)	SANS 10100-1 Cl. 4.11.4 — min 4 bars rectangular, 6 circular
Maximum link spacing	SANS 10100-1 Cl. 4.11.4.7 — min(12ø, b, 12·dia_link)
Top bar condition	SANS 10100-1 Cl. 4.11.6 — continuous crank (lap into column above) or hook into roof slab
Reinforcement ratio	SANS 10100-1 Cl. 4.11.4 — 0.4%–6.0% (A_s/A_c)

HELICAL REINFORCEMENT

For circular columns, a continuous helix can be used in place of separate links; the helix pitch is set on the same code basis as link spacing.

4.4 Walls

Shear, retaining and single-layer walls are reinforced with vertical and horizontal bars. Simbi Rebar detects walls that pass through structural slabs and constructs them as separate lifts.

Condition	Handling
Bottom lift	Sits on the foundation; starter bars (hook detail) developed from the foundation.
Intermediate lifts	Bars cranked and lapped at each slab level.
Top lift	Main bars hooked into the roof slab for anchorage.

LIFT DETECTION

Lifts are detected from the structural floor slabs intersecting the wall. Drop panels, sloped slabs, parapets and openings can occasionally affect detection, so each lift's elevation should be reviewed before propagating.

4.5 Beams

Beams — including continuous, multi-span runs — are reinforced with bottom tension steel, top steel over supports and continuous top bars, side/face bars in deeper beams, and closed links with closure clips. Bottom bars are spliced away from peak-moment regions, and top bars are curtailed over supports.

Provision	Governing clause
Anchorage at supports	SANS 10100-1 Cl. 4.11.6.5
Tension lap location (away from peak moment)	SANS 10100-1 Cl. 4.11.6.7
Bottom tension steel	SANS 51992-1 Cl. 9.2.1.1 (EN 1992-1-1 Cl. 9.2.1.1)
Top bar curtailment	SANS 51992-1 Cl. 9.2.1.2 (EN 1992-1-1 Cl. 9.2.1.2)
Tension reinforcement ratio	SANS 10100-1 Cl. 4.11.4 — min 0.15%, max 4.0%

5. Anchorage & lap lengths

Anchorage and lap lengths derive from the design bond stress, per SANS 51992-1 Cl. 8.4.2:

$$f_{bd} = 2{,}25 \cdot \eta_1 \cdot \eta_2 \cdot f_{ctd}$$
$$f_{ctd} = f_{ctk,0.05} / \gamma_c = 0{,}7 \cdot f_{ctm} / 1{,}5$$

WHY THE 0,7 FACTOR MATTERS

$f_{ctk,0.05}$ is the 5 % fractile of the tensile strength, not the mean. Omitting the factor and using f_{ctm} / 1,5 overstates the bond stress and makes every anchorage and lap length approximately **30 % short**, in the unconservative direction. Simbi Rebar applies the 5 % fractile.

Situation	Length applied
Column bar lapping into the column above	l_0
Kinked (SC-62) lap into a raked column above	l_0, measured along the upper axis
Starter bar vertical leg into the column above	l_0
Starter bar horizontal leg anchoring into the slab	max(0,7 · l_{bd}, 150 mm)

The starter's horizontal leg is an **anchorage**, not a lap — there is no bar below it to lap with — so l_{bd} with the bent-bar factor α_1 = 0,7 (Cl. 8.4.4, Table 8.2) applies rather than l_0. Using a lap length there would roughly double the leg.

6. Reinforcement density & ratio checks

After reinforcement is placed, Simbi Rebar reports the steel quantity and checks the reinforcement ratio against the code limits for the element. This is provided both in the post-propagation summary and via the **Density** tool.

Reported value	Basis
Reinforcement density (kg/m³)	Total steel mass divided by concrete volume, flagged against a typical range for the element type.
Reinforcement ratio (A_s/A_c)	Provided longitudinal steel against the code minimum and maximum.
Status & clause	Pass/fail against the governing clause — e.g. SANS 10100-1 Cl. 4.11.4 (0.4–6.0% columns; 0.15–4.0% beam tension steel).

DENSITY RANGE VS CODE RATIO

The **density** figure (kg/m³) is a practical guide against typical ranges and is not itself a code limit. The **ratio** check (A_s/A_c) is the code compliance check, with the governing clause cited.

7. Shape codes & the Bar Bending Schedule

The Bar Bending Schedule follows **SANS 10144:2010** for format and **SANS 282** for shape codes, bending dimensions and calculated lengths. Each bar group carries a shape code, a bending diagram, its bending dimensions (A–E), a scheduling bend radius (r), a cut length and a mass. Bars are grouped by member with a subtotal per member.

Example shape codes used

Shape code	Typical use
SC-37	Hooked bar / starter anchored into a slab.
SC-38	Closure clip / cranked closer bar.
SC-41	Cranked (offset) bar lapping into the element above.
SC-60	Closed link / stirrup.
SC-86	Helix for circular columns.

> **BAR TYPE NOTATION**
>
> Bar types are scheduled in the standard South African notation (for example, Y for high-yield ribbed reinforcement) with the diameter in millimetres, e.g. Y16.

8. Units, notation & conventions

Quantity	Convention
Length / dimension	Millimetres (mm).
Bar diameter	Millimetres, prefixed by bar type (e.g. Y16 = 16 mm high-yield).
Mass	Kilograms (kg); density in kg/m³.
Cover	Millimetres, set by the engineer per exposure and specification.
Spacing	Centre-to-centre in millimetres (e.g. ø12@200).

9. Verification, limitations & responsibility

What Simbi Rebar does

It models reinforcement to your inputs, applies the detailing limits of the selected code, cites the governing clauses, checks reinforcement ratios, and schedules to SANS 10144:2010.

What it does not do

- It does not perform structural analysis or member design.
- It does not select bar sizes or spacings for you — these are engineering decisions.
- It does not yet support BS 8666:2020 or ACI 318 (Section 9).

Engineer's responsibility

The responsible engineer must verify all reinforcement and schedules against the project specification and applicable codes before issue or construction. The on-screen clause citations and the Calc Audit tool support this review but do not transfer responsibility.

10. Roadmap: BS 8666 and ACI 318

The following standards are planned for a future release and are **not available today**:

Standard	Planned scope
BS 8666:2020	UK/other-market shape codes and scheduling for the Bar Bending Schedule.
ACI 318	US detailing provisions.

UNTIL THEN

Simbi Rebar details and schedules to SANS 10100-1, SANS 51992-1, SANS 10144:2010 and EN 1992-1-1. Any statement of BS 8666 or ACI 318 compliance would be premature until these are released and verified.

Questions on methodology: **info@simbi-rebar.com**.