

# PRODUCT DESCRIPTION RC BEAMS & COLUMNS DESIGN

## EN1992 - NEN-NA- BRL 0207

EN 1992-1-1 NEN-NA

### DOCUMENT

This document is the elaboration of BRL 0207: 2014 chapter 4 Product description.

### IDENTIFICATION

RC Beam and column BRL 2014 V4.0/19

### CERTIFICATE

BRL 0207:2014-Rekensoftware voor betonconstructies

Version 06/03/2014

<http://www.kiwa.nl/upload/certificate/00090880.pdf>

Certificate No.



### SUPPLIER

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### PROGRAM

SCIA Engineer  
Release 19.1  
10/2019  
Modules: sencd.01.X

### CODES

Main standard: NEN-EN 1992-1-1 + C2: 2011 en - Eurocode 2: Design of concrete structures - Part 1-1: General rules and rules for buildings (Published on 01-11-2011)

Corrections: NEN-EN 1992-1-1 + C2: 2011 en - Eurocode 2: Design of concrete structures - Part 1-1: General rules and rules for buildings (published 01-11-2011)

National Appendix: NEN EN 1992-1-1+C2:2011/NB:2016 / NB: 2011 en - National Annex to EN 1992-1-1 + C2 Eurocode 2: Design of concrete structures - Part 1-1: General rules and rules for buildings (published 01-11-2016)

### GENERAL

This product description is the elaboration of BRL 0207: 2014 chapter 4 Product Description.

It indicates which parts of the software are certified according to BRL 0207:2014 Annex I - Functionality.

Also you can check the Concrete Design - new 1D Solution for EN 1992-1-1 on the link below

[https://resources.scia.net/en/articles/concrete/16.1/new\\_development\\_in\\_the\\_design\\_of\\_1d\\_member\\_se\\_16\\_1.htm](https://resources.scia.net/en/articles/concrete/16.1/new_development_in_the_design_of_1d_member_se_16_1.htm)

[https://resources.scia.net/en/articles/concrete/new\\_development\\_in\\_the\\_design\\_of\\_1d\\_member\\_se\\_16\\_0.htm](https://resources.scia.net/en/articles/concrete/new_development_in_the_design_of_1d_member_se_16_0.htm)

<https://resources.scia.net/en/articles/concrete/newconcrete1dsolution.htm>

### IDENTIFICATION AND MARKING

The product description (this document) is available directly at page <https://resources.scia.net/en/benchmarks/KOMO- ECEN- NEN- NA- for- SE.htm> or can be downloaded as a PDF from <https://resources.scia.net/download/en/qa/KOMO- RC- Beams- Columns- EN1992-NEN-NA-BRL-0207.pdf>

The accompanying KOMO product certificate can be accessed directly via page [https://resources.scia.net/download/en/qa/KOMO- RC- Beams- Columns- EN1992-NEN-NA-BRL-0207\\_Certificate.pdf](https://resources.scia.net/download/en/qa/KOMO- RC- Beams- Columns- EN1992-NEN-NA-BRL-0207_Certificate.pdf)

## FUNCTIONALITY DESCRIPTION

This module is a software program for design and checks of reinforced concrete beams and columns according to EN 1992-1-1 with Dutch National Annex.

For the installation and operation of the program refer to the Installation Guide and Reference manual. This is provided in:

- Online Help system accessible at <https://help.scia.net/webhelplatest/en/>
- HTML Help format in file esa.chm (installed with the program itself)
- PDF format via multiple files downloadable from <https://help.scia.net/webhelplatest/en/#rou/download.htm>

## FUNCTIONALITY SCOPE

The functionality of this Scope does not cover the whole standard as described in 'BRL 0207: 2014 Annex I – Functionality'.

This scope covers these functionality:

### Geometric imperfections - Chapter 5.2

- Geometric imperfections represented by an inclination
- Effects on isolated members and bracing system
- Geometric imperfections as eccentricity

### Idealisation of the structure - Chapter 5.3

- Classification of a element of a structure

### Analysis of second order effects with axial load - Chapter 5.8

- Ignoring of second order effects if slenderness is below limit value
- Check of slenderness criterion for each direction
- Slenderness ratio
- Design bending moment
- Calculation of factor K for calculation of curvature
- Calculation of factor  $K_r$  for calculation of curvature
- Nominal second order moment
- Calculation of curvature for members with symmetrical cross section
- Definition of effective length for isolated members with constant cross section
- Calculation of slenderness with Beta factor
- Determination of c factor
- Definition of effective height depending on distribution of reinforcement
- Equivalent first order end moment
- Conditions for slenderness ratios and for ratios of relative eccentricities

### Bending with axial force - chapter 6.1

- Check - verification of cross section subjected to  $N+My+Mz$
- Design - design of reinforcement area for cross section subjected to  $N+My+Mz$

### Shear - chapter 6.2

- Check - verification of cross section subjected to  $Vy+Vz$
- Design - design of reinforcement area for cross section subjected to  $Vy+Vz$

### Torsion - chapter 6.3

- Check - verification of cross section subjected to  $Vy+Vz + T$
- Design - design of reinforcement area for cross-sections subjected to  $Vy+Vz + T$  Serviceability limit state control -

### Serviceability limit state control - chapter 7

- Check-for Stress limitation, crack control and deflection control

### Detailing of members and particular rules - chapter 9

- Check - check of reinforcement based on detailing provision
- Design - design of reinforcement based on detailing provision

## SUPPORTED CROSS-SECTIONS

For the certified part, the cross sections are limited to :

- Rectangular and T section for **beams**
- Rectangular and Circular sections for **columns**.

Reference	Function type	Cross-section			
		Beam		Column	
		Rect.	T	Rect.	Circ.
Chapter 6.1 – Bending with or without axial force	Check	✓	✓	✓	✓
	Design	✓	✓	✓	✓
Chapter 6.2 – Shear	Check	✓	✓	✓	✓
	Design	✓	✓	✓	✓
Chapter 6.3 - Torsion	Check	✓	✓	✓	✓
	Design	✓	✓	✓	✓
Chapter 7- Serviceability limit state control	Check	✓	✓	✓	✓
Chapter 9 - Detailing of members and particular rules	Check	✓	✓	✓	✓
	Design	✓	✓	✓	✓

The following parts of 'BRL 0207: 2014 Annex I – Functionality' are considered:

Fully Supported ✓

Not Supported ✗

Partly Supported -

Status	Chapter/Article	Chapter / Comment
	<b>NEN-EN 1992-1-1+NB(NL)</b>	
	<b>5</b>	<b>STRUCTURAL ANALYSIS</b>
	<b>5.2</b>	<b>Geometric imperfections</b>
✓	(5)	
✓	(6)	
✓	(7)	
	<b>5.3</b>	<b>Idealisation of the structure</b>
	<b>5.3.1</b>	<b>Structural models for overall analysis</b>
✓	(1)	Classification of a element of a structure
	<b>5.8</b>	<b>Analysis of second order effects with axial load</b>
	<b>5.8.3</b>	<b>Simplified criteria for second order effects</b>
	<b>5.8.3.1</b>	<b>Slenderness criterion for isolated members</b>
✓	(1)	
✓	(2)	
	<b>5.8.3.2</b>	<b>Slenderness and effective length of isolated members</b>
✓	(1)	
✓	(2)	
✓	(7)	
	<b>5.8.8</b>	<b>Method based on nominal curvature</b>
	<b>5.8.8.2</b>	<b>Bending moments</b>
✓	(1)	
✓	(2)	
✓	(3)	
✓	(4)	
	<b>5.8.8.3</b>	<b>Curvature</b>
✓	(1)	
✓	(2)	
✓	(3)	
✓	(4)	
	<b>5.8.9</b>	<b>biaxial bending</b>
✓	(3)	
	<b>6</b>	<b>ULTIMATE LIMIT STATES (ULS)</b>
	<b>6.1</b>	<b>Bending with or without axial force</b>
✓	(1)	<ul style="list-style-type: none"> <li>For 1D elements (beams and columns)</li> <li>Check according to 6.5 is not applied</li> </ul>
✓	(2)	
✓	(3)	<ul style="list-style-type: none"> <li>There is option to select between the parabola or the bilinear stress-strain diagram.</li> <li>For reinforcement steel, the diagram with the inclined top branch is applied.</li> </ul>
✓	(4)	
✓	(5)	Automatically by iterative method searching for plane of equilibrium.

Status	Chapter/Article	Chapter / Comment
✓	(6)	
✓	(9)NB(NL)	Two cases are supported for beams only: <ul style="list-style-type: none"> <li>• When <math>N_{ed} &gt; N_{lim}</math> (<math>N_{lim} = 0,1A_c \cdot f_{cd}</math>), the calculation of <math>X_u</math> will be aborted and the user will be informed</li> <li>• <math>N_{ed} &lt; N_{lim}</math> (<math>N_{lim} = 0,1A_c \cdot f_{cd}</math>), the calculation will be performed</li> <li>• The compression zone can be calculated based on <math>M_{Ed}</math>, <math>M_{Rd}</math>, or can be ignored.</li> </ul>
✗	(10) NB(NL)	
	<b>6.2</b>	<b>Shear</b>
	6.2.2	<b>Members not requiring design shear reinforcement</b>
✓	(1)	
✓	(4)	
-	(5)	<i>The shift rule of 9.2.1.3.(2) is applied.</i>
-	(6)	<ul style="list-style-type: none"> <li>• <i>The value <math>\beta</math> is not used.</i></li> <li>• <i>The formula (6.5) is applied in all cases.</i></li> </ul>
	<b>6.2.3</b>	<b>Members requiring design shear reinforcement</b>
✓	(1)	
✓	(2)	
✓	(3)	
✗	(4)	<i>Inclined shear reinforcement is not implemented.</i>
-	(7)	<i>The shift rule of 9.2.1.3.(2) is applied.</i>
✗	(8)	
	<b>6.3</b>	<b>Torsion Design procedure</b>
	<b>6.3.2</b>	<b>Design procedure</b>
✓	(1)	<i>The value <math>V_{ed,l}</math> is not used</i>
✓	(2)	<i>Automatic calculation of angle theta.</i>
✓	(3)	
✓	(4)	
✓	(5)	
	<b>7.</b>	<b>SERVICEABILITY LIMIT STATES (SLS)</b>
	<b>7.1.</b>	<b>General</b>
✓	(2)	
	<b>7.2.</b>	<b>Stress limitation</b>
✓	(2)	
✓	(3)	
✓	(5)	<i>Conditions for k4 and k5 are not applied.</i>
		<b>Crack Control</b>
		<b>d</b> is calculated from the plane of equilibrium.
	<b>7.3.</b>	<i>in case that the plane of equilibrium is not found then the calculation of "d" will assumed as a percentage of the total height of the cross section (<math>d = \text{coff.} \cdot h</math>). Coff = 0.9</i>
	<b>7.3.1.</b>	<b>General considerations</b>
✓	(5)	
	<b>7.3.4.</b>	<b>Calculation of crack widths</b>
✓	(1)	
✓	(2)	
✓	(3)	
	<b>7.4.</b>	<b>Deflection control</b>
	<b>7.4.1.</b>	<b>General considerations</b>

Status	Chapter/Article	Chapter / Comment
✓	(4)	
✓	(5)	
	<b>7.4.3.</b>	<b>Checking deflections by calculations</b>
✓	(3)	
✓	(5)	
	<b>9</b>	<b>DETAILING OF MEMBERS AND PARTICULAR RULES</b>
	<b>9.2</b>	<b>Beams</b>
	<b>9.2.1.</b>	<b>Longitudinal reinforcement</b>
	<b>9.2.1.1</b>	<b>Minimum and maximum reinforcement areas</b>
-	(1)	<ul style="list-style-type: none"> <li>• Standard EN1992 regulations are supported.</li> <li>• The application of the NEN NA is under construction.</li> </ul>
✓	(3)	The limitation on $A_{s,max}$ is applied in all cases.
	<b>9.2.2.</b>	<b>Shear reinforcement</b>
✓	(1)	
✓	(5)	
✓	(6)	
✓	(8)	
	<b>9.2.3.</b>	<b>Torsion reinforcement</b>
✓	(2)	
✓	(3)	
✓	(4)	
	<b>9.5.</b>	<b>Columns</b>
	<b>9.5.2.</b>	<b>Longitudinal reinforcement</b>
✓	(1)	
✓	(2)	
✓	(3)	
✓	(4)	
	<b>9.5.3.</b>	<b>Transverse reinforcement</b>
✓	(1)	
✓	(3)	

## USABILITY

SCIA Engineer program can be run on the following minimum hardware:

Minimum hardware requirement	
Processor Minimum	Intel Core 2Duo or AMD equivalent Advised: Intel Core-i5 or AMD equivalent
RAM	2 GB (Advised: > 4 GB)
Graphics Controller	256 MB, supporting OpenGL
Free disk space	5GB
resolution	1280 x 800

### Specific knowledge for use of the software:

1. College or university degree, or civil engineering (construction) direction, or equivalent.
2. Good knowledge of the Eurocode building standards relevant to computations,
3. Minimum of 2 years of practical experience with calculations according to the EN 199x series (EN 1992 for concrete),
4. Ability to make independent (concrete) calculations and / or verify,
5. Adequate knowledge of the specifications and operation of SCIA Engineer.

## MAINTAINABILITY

SCIA Engineer is a modular system and each user can select his/her own configuration. An example of a combination of base modelling module (sen.00), static linear calculation module (sens.00), practical reinforcement module (sencdt.01) and EN1992 code design module (sencd.01.01).

## WARRANTY

- SCIA guarantees that software will function in accordance with the written specifications, properties and functions as delivered to the client. Based on this guarantee, SCIA will detect and repair, free of charge, possible mistakes or failures in the program, which occur within the guarantee period of 6 months after delivery and which have been clearly announced in writing to SCIA within one month after discovery of them and this within the briefest possible delay.
- Should it be the case that, after investigation by SCIA, the cause of the failure, mentioned in the previous item, lies in the computer system or otherwise with the client, than the client will have to pay to SCIA all expenses linked to this investigation.
- SCIA is not responsible for the whole, hardware and software, for installations, in which the hardware has not been delivered by SCIA, unless extensive tests have been executed and unless a reasonable compensation for potential hidden hardware defects have been agreed to.
- The guarantee, mentioned in this item, terminates if the client, without written consent of SCIA, which will not be denied to the client on good grounds, makes alterations to the program or have alterations introduced by third parties.
- The activities of SCIA, performed on request of the client, which are not included in the delivery and/or maintenance contract, e.g. testing the software or hardware of third parties, literature search, support for operating systems, etc., can be charged at fixed rates.

## LICENSE

The software is protected and can only be used with a valid license key. After purchasing the program and possible extra modules the license is recorded and the user is given a choice of hardware or software license key.

## MAINTENANCE CONTRACT

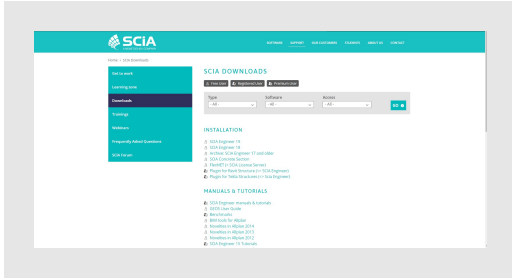
When purchasing the software the user can sign also a maintenance contract. The maintenance contract gives the user the right to obtain free new versions (updates or patches) and to contact freely the helpdesk for questions and assistance in using the software.

From the moment when the maintenance contract is terminated, the user is no longer entitled to obtain free new version and continues to use the latest released version available prior to the termination date. The user also loses the right to contact the helpdesk for support.

# COMMUNICATIONS

The software can be downloaded from SCIA website(<https://www.scia.net/nl/support/downloads>).

As shown in this images



# CUSTOMER SERVICE

<b>Message about new updates</b>	Notification about a new versions of the software is made directly in the SCIA Engineer GUI.
<b>Installing Updates</b>	SCIA Engineer "new versions", "updates" and "patches" are always released as "complete setup".

# PORTABILITY

<b>Supported Windows OS</b>	Windows 7 32/64 bit Windows 8 32/64 bit Windows 10 32/64 bit
<b>Supported Macintosh OS</b>	You must run a virtualized version of Windows on OS X. We recommend Parallels Desktop (version 7 or higher). With this software you can install windows as a virtual machine on which you can run Windows application such as SCIA Engineer.
<b>API link with Revit</b>	SCIA Engineer 19.1 is compatible with: Revit 2019, 2020
<b>API link with Tekla</b>	SCIA Engineer 19.1 is compatible with: Tekla Structures 2019
<b>IFC</b>	SCIA Engineer 19.1 is compatible with: IFC version 2x3, IFC4
<b>SDNF</b>	SCIA Engineer 19.1 is compatible with: SDNF version 2.0, SDNF version 3.0



# DEPENDENCIES

## Standalone protection

The dongle must be accompanied with LIC file and in some cases also E2C file. Dongle itself is not sufficient for starting the SCIA Engineer.

To simplify as much as possible updating of dongles, working with dongle on more computers and other similar use cases it is possible to download LIC and E2C files online from the SCIA server.

## Floating protection

SCIA Floating protection is based on FLEXnet technology of Flexera Software Company. This type of licensing stores commercial modules in "Trusted storage" on the Licence server. Those modules can be used (Checked out) by SCIA application online or borrowed (offline using of modules from licence server).

FLEXnet based protection fully replaces FlexLM based protection from version 2010.0.

## Trial, Student and Viewer modes

It is also possible to run SCIA Engineer without protection as SCIA Viewer. In this case SCIA Engineer has limited functionality. It is intended to be used for viewing of calculated structures only. The user can also use "TRIAL" or "STUDENT" modules which are also free but still require some modules.

### Student version

- User can use majority of all SCIA Engineer functionality.
- User can edit and calculate a project
- Projects can be saved as \*.esad only
- Available for free for registered users (students) only
- The license is cloud based protected.

### Trial version

- User can use functionality listed in his licence file only
- User can edit and calculate a project
- Projects are saved into \*.esa
- Provided by SCIA dealers to prospect customers
- The license is cloud based protected.

### SCIA Viewer version

Available from version 2011

- User can view existing model and document only
- User cannot edit nor calculate a project
- If the project is saved with results then user can view pre calculated checks
- Projects cannot be saved neither exported to any file format
- Available to anybody without any protection

# PRODUCT CERTIFICATE

The version of SCIA Engineer which the KOMO product certificate has been granted to can be seen on the cover page.

## Required modules

**sencd.01.x**  
**sen.00**

## References and related reading

Analysis of second order effect in concrete (*Technical article*)

Wizard for reinforcement schemes (*Technical article*)

